Appendix G1
Air Quality - Construction Emissions

G1-1 Construction Emission Tables
G1-2 Construction Emission Tables (with Mitigation Measures)

AVAILABLE ON CD ONLY

Appendix G1-1

Construction Emission Tables

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Table 1
Summary of Construction Emissions
Cabrillo Port LNG Deepwater Port

EMISSIONS BY ACTIVITY

Construction Activity	Daily Emissions (lb/day)						Total Emissions (tons)					
	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Mooring/FSRU Installation	4,474	3	5,512	259	259	648	27.4	0.019	33.8	1.6	1.6	4.0
Offshore Pipeline Installation	5,725	4	7,050	332	332	830	97.0	0.068	119.5	5.6	5.6	14.1
Shore Crossing Construction	1,140	1	1,029	94	63	191	30.5	0.027	23.5	2.5	1.6	5.5
Onshore Pipeline Installation - Trenching	193	0.3	179	21	14	43	17.4	0.025	16.1	1.9	1.2	3.8
Onshore Pipeline Installation - Pipelay	187	1	979	143	43	60	13.7	0.10	75.3	11.6	3.5	4.5
Onshore Pipeline Installation - Boring	260	0.3	146	53	21	53	3.9	0.0040	2.2	0.79	0.32	0.79
Onshore Pipeline Installation - Drilling	616	1	347	65	34	125	9.2	0.009	5.2	1.0	0.5	1.9
Worker Commuting	14	2	212	4	4	7	0.95	0.12	14.0	0.25	0.25	0.4
TOTAL	-	-	-	-	-	-	**200**	**0.37**	**290**	**25**	**15**	**35**

EMISSIONS BY LOCATION

Construction Activity	Daily Emissions (lb/day)						Total Emissions (tons)					
	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Federal Waters												
Mooring/FSRU Installation	4,474	3.1	5,512	259	259	648	27.4	0.02	33.8	1.6	1.6	4.0
Offshore Pipeline Installation	5,725	4.0	7,050	332	332	830	82.4	0.06	101.5	4.8	4.8	11.9
Subtotal							**109.8**	**0.08**	**135.3**	**6.4**	**6.4**	**15.9**
Ventura County												
Offshore Pipeline Installation	5,725	4.0	7,050	332	332	830	14.5	0.010	17.9	0.8	0.8	2.1
Shore Crossing Construction	1,140	0.9	1,029	94	63	191	30.5	0.027	23.5	2.5	1.6	5.5
Onshore Pipeline Installation - Trenching	193	0.3	179	21	14	43	11.6	0.017	10.7	1.3	0.8	2.6
Onshore Pipeline Installation - Pipelay	187	1.3	979	143	43	60	9.2	0.066	50.2	7.8	2.3	3.0
Onshore Pipeline Installation - Boring	260	0.3	146	53	21	53	3.9	0.004	2.2	0.8	0.3	0.8
Worker Commuting	11	1.4	160.8	2.9	2.9	5.1	0.54	0.067	7.9	0.14	0.14	0.25
Subtotal							**70.3**	**0.19**	**112.5**	**13.3**	**6.0**	**14.1**
Los Angeles County												
Onshore Pipeline Installation - Trenching	193	0.28	179	21	14	43	5.8	0.0084	5.4	0.64	0.41	1.3
Onshore Pipeline Installation - Pipelay	187	1.3	979	143	43	60	4.6	0.033	25.1	3.9	1.2	1.5
Onshore Pipeline Installation - Drilling	616	0.62	347	65	34	125	9.2	0.0092	5.2	1.0	0.51	1.9
Worker Commuting	3	0	51	1	1	2	0.41	0.0514	6.1	0.11	0.11	0.19
Subtotal							**20.0**	**0.10**	**41.8**	**5.6**	**2.2**	**4.8**
TOTAL	-	-	-	-	-	-	**200**	**0.37**	**290**	**25**	**15**	**35**

Table 2
Emissions from Mooring/FSRU Installation
Cabrillo Port LNG Deepwater Port

Equipment Type	No. of Devices	Engine Rating per Device (bhp)	Fuel Type	Daily Operation per Device (hrs/day)	Average Load	Total Working Days[d]	Engine Output (bhp-hr/day)	Daily Emissions (lb/day)						Total Emissions (tons)					
								NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
AHTS[a]	2	15,000	diesel	24	10%	20	72,000	1,095	0.8	1,349	63	63	159	11.0	0.0077	13.5	0.63	0.63	1.6
Crew Boat	1	1,500	diesel	16	23%	20	5,520	84	0.06	103	5	5	12	0.8	0.0006	1.0	0.05	0.05	0.12
Construction Barge[b]	1	8,000	diesel	24	43%	20	82,560	1,256	0.9	1,547	73	73	182	12.6	0.0088	15.5	0.73	0.73	1.8
Tug[c]	1	6,500	diesel	24	9%	20	14,040	214	0.1	263	12	12	31	2.1	0.0015	2.6	0.12	0.12	0.31
Ocean Going Tug	1	25,000	diesel	24	20%	1	120,000	1,825	1.3	2,249	106	106	265	0.9	0.0006	1.1	0.05	0.05	0.13
TOTAL								**4,474**	**3**	**5,512**	**259**	**259**	**648**	**27.4**	**0.019**	**33.8**	**1.6**	**1.6**	**4.0**

Notes:
a. AHTS also handles risers
b. Barge used to transport anchors and equipment
c. Tug boat used as riser installation vessel.
d. Total vessel-days equivalent to task estimates, multiple vessels used in some tasks, composite daily estimate is conservative for planned activities due to vessel overlap

Table 3
Emissions from Offshore Pipeline Installation
Cabrillo Port LNG Deepwater Port

Equipment Type[a]	No. of Devices	Engine Rating per Device (bhp)	Daily Operation per Device (hrs/day)	Mileage per Day (mile/day)	Avg Load	Total Working Days	Engine Output (bhp-hr/day)	Daily Emissions (lb/day)						Total Emissions (tons)					
								NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Pipe Laying Vessel	1	25,000	24	-	47%	35	282,000	4,290	3	5,285	249	249	622	75.1	0.053	92.5	4.4	4.4	10.9
AHTS[b]	2	15,000	24	-	10%	35	72,000	1,095	1	1,349	63	63	159	19.2	0.013	23.6	1.1	1.1	2.8
Crew Boat	1	1,500	16	-	23%	35	5,520	84	0.06	103	5	5	12	1.5	0.0010	1.8	0.09	0.09	0.2
Tug Boat & Barge[c]	1	4,000	16	-	26%	10	16,640	253	0.2	312	15	15	37	1.3	0.0009	1.6	0.07	0.07	0.2
Dock Crane (35 ton)	1	130	1	-	80%	8	104	1	0.001	1	0.1	0.1	0.2	0.005	0.000004	0.004	0.0006	0.0006	0.0009
Delivery Truck	1	-	-	60	-	5	-	2	0.006	0.1	0.02	0.02	0.03	0.005	0.00002	0.0003	0.00004	0.00004	0.0001
TOTAL								**5,725**	**4**	**7,050**	**332**	**332**	**830**	**97.0**	**0.068**	**119**	**5.6**	**5.6**	**14.1**

Notes:
a. All equipment is diesel-fueled.
b. AHTS also provides welding power when needed.
c. Barge used to transport pipe and material off-shore (not powered) and tug boat pulls pipe barge.

Table 4
Emissions from Shore Crossing Construction
Cabrillo Port LNG Deepwater Port

EQUIPMENT EXHAUST EMISSIONS

Equipment Type	No. of Devices	Engine Rating per Device (bhp)	Fuel Type	Daily Operation per Device (hrs/day)	Daily Mileage per Device (mi/day)	Average Load	Total Working Days	Engine Output (bhp-hr/day)	Daily Emissions (lb/day)						Total Emissions (tons)					
									NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
In-hole head drive unit	1	400	diesel	6	-	100%	88	2,400	25	0.03	14	0.8	0.8	5	1.1	0.0011	0.6	0.03	0.03	0.23
Mud pumps	2	400	diesel	9	-	100%	88	7,200	76	0.08	41	2	2	16	3.4	0.0034	1.8	0.10	0.10	0.70
Solids control unit	1	500	diesel	9	-	100%	88	4,500	48	0.05	26	1.5	1.5	10	2.1	0.0021	1.1	0.07	0.07	0.44
Thrusting apparatus	1	300	diesel	6	-	100%	88	1,800	19	0.02	10	0.6	0.6	4	0.8	0.0008	0.5	0.03	0.03	0.17
Electrical generator	1	400	diesel	24	-	80%	85	7,680	81	0.08	44	3	3	17	3.5	0.0035	1.9	0.11	0.11	0.72
All Terrain Forklift	1	100	diesel	12	-	30%	60	360	4	0.004	3	0.2	0.2	1	0.1	0.0001	0.1	0.01	0.01	0.02
Mobile crane	1	400	diesel	7.2	-	80%	85	2,304	24	0.02	13	0.8	0.8	5	1.0	0.0010	0.6	0.03	0.03	0.22
Welding machines	3	100	diesel	12	-	80%	85	2,880	30	0.03	17	1	1	6	1.3	0.0013	0.7	0.04	0.04	0.27
Exit Hole Barge Tug	1	4,000	diesel	24	-	5%	35	4,800	73	0.05	90	4	4	11	1.3	0.0009	1.6	0.07	0.07	0.19
AHTS	1	15,000	diesel	24	-	10%	35	36,000	548	0.38	675	32	32	79	9.6	0.0067	11.8	0.56	0.56	1.4
Contingency	1	700	diesel	24	-	100%	60	16,800	207	0.18	96	6	6	37	6.2	0.0054	2.9	0.17	0.17	1.1
18 Wheeler Truck	2	-	diesel	-	60	-	60	-	4	0.01	0.21	0.03	0.03	0.06	0.1	0.0004	0.01	0.001	0.001	0.002
Subtotal									**1,140**	**0.9**	**1,029**	**51**	**51**	**191**	**30.5**	**0.027**	**23.5**	**1.2**	**1.2**	**5.5**

FUGITIVE DUST EMISSIONS FROM PAVED AND UNPAVED ROADS IN CONSTRUCTION ZONE

Equipment Type	No. of Devices	Daily Mileage per Device (mi/day)	Daily Mileage per Device on Paved Roads (mi/day)	Daily Mileage per Device on Unpaved Roads (mi/day)	Total Working Days	Daily Emissions (lb/day)						Total Emissions (tons)					
						NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
All Terrain Forklift	1	1.6	0	1.6	60	-	-	-	0.58	0.09	-	-	-	-	0.017	0.003	-
18 Wheeler Truck	2	1.2	0.6	0.6	60	-	-	-	0.82	0.16	-	-	-	-	0.02	0.005	-
Subtotal						**-**	**-**	**-**	**1.4**	**0.25**	**-**	**-**	**-**	**-**	**0.04**	**0.008**	**-**

FUGITIVE DUST EMISSIONS FROM PAVED ROADS OUTSIDE CONSTRUCTION ZONE

Equipment Type	No. of Devices	Daily Mileage per Device (mi/day)	Daily Mileage per Device on Paved Roads (mi/day)	Daily Mileage per Device on Unpaved Roads (mi/day)	Total Working Days	Daily Emissions (lb/day)						Total Emissions (tons)					
						NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
18 Wheeler Truck	2	58.8	58.8	0	60	-	-	-	37.4	9.3	-	-	-	-	1.12	0.28	-
Subtotal						**-**	**-**	**-**	**37.4**	**9.3**	**-**	**-**	**-**	**-**	**1.12**	**0.28**	**-**

FUGITIVE DUST EMISSIONS FROM EARTHMOVING

Equipment Type	No. of Devices	Daily Operation per Device (hrs/day)	Total Working Days	Daily Emissions (lb/day)						Total Emissions (tons)					
				NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Track Backhoe	1	12	60	-	-	-	4.3	2.4	-	-	-	-	0.13	0.07	-
Subtotal				**-**	**-**	**-**	**4.3**	**2.4**	**-**	**-**	**-**	**-**	**0.13**	**0.07**	**-**

TOTAL EMISSIONS

Daily Emissions (lb/day)						Total Emissions (tons)					
NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
1,140	**0.9**	**1,029**	**94**	**63**	**191**	**30.5**	**0.027**	**23.5**	**2.5**	**1.6**	**5.5**

Table 5
Emissions from Onshore Pipeline Installation - Trenching
Cabrillo Port LNG Deepwater Port

EQUIPMENT EXHAUST EMISSIONS

Equipment Type	No. of Devices	Engine Rating per Device (bhp)	Fuel Type	Daily Operation per Device (hrs/day)	Daily Mileage per Device (mi/day)	Average Load	Total Working Days	Engine Output (bhp-hr/day)	Daily Emissions (lb/day)						Total Emissions (tons)					
									NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Trenching Machine	1	1,000	diesel	12	-	80%	180	9,600	102	0.10	55	3	3	21	9.1	0.0092	5.0	0.29	0.29	1.9
Track Backhoe	1	500	diesel	12	-	80%	180	4,800	51	0.05	28	2	2	11	4.6	0.0046	2.5	0.14	0.14	0.95
Front Loader	1	200	diesel	12	-	50%	180	1,200	13	0.01	7	0.4	0.4	3	1.2	0.0012	0.6	0.04	0.04	0.24
Bulldozer	1	200	diesel	12	-	50%	180	1,200	13	0.01	7	0.4	0.4	3	1.2	0.0012	0.6	0.04	0.04	0.24
Dragline	1	200	diesel	12	-	50%	180	1,200	13	0.01	7	0.4	0.4	3	1.2	0.0012	0.6	0.04	0.04	0.24
Concrete Saw	1	50	gasoline	12	-	50%	180	300	2	0.09	76	0.1	0.1	3	0.2	0.0078	6.8	0.01	0.01	0.26
Subtotal									**193**	**0.3**	**179**	**6**	**6**	**43**	**17.4**	**0.025**	**16.1**	**0.5**	**0.5**	**3.8**

FUGITIVE DUST EMISSIONS FROM UNPAVED ROADS

Equipment Type	No. of Devices	Daily Mileage per Device (mi/day)	Daily Mileage per Device on Paved Roads (mi/day)	Daily Mileage per Device on Unpaved Roads (mi/day)	Total Working Days	Daily Emissions (lb/day)						Total Emissions (tons)					
						NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Front Loader	1	6.1	0	6.1	180	-	-	-	1.9	0.29	-	-	-	-	0.173	0.026	-
Subtotal						**-**	**-**	**-**	**1.9**	**0.29**	**-**	**-**	**-**	**-**	**0.17**	**0.03**	**-**

FUGITIVE DUST EMISSIONS FROM EARTHMOVING

Equipment Type	No. of Devices	Daily Operation per Device (hrs/day)	Total Working Days	Daily Emissions (lb/day)						Total Emissions (tons)					
				NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Track Backhoe	1	12	180	-	-	-	4.3	2.4	-	-	-	-	0.39	0.22	-
Bulldozer	1	12	180	-	-	-	4.3	2.4	-	-	-	-	0.39	0.22	-
Dragline	1	12	180	-	-	-	4.3	2.4	-	-	-	-	0.39	0.22	-
Subtotal				**-**	**-**	**-**	**13.0**	**7.2**	**-**	**-**	**-**	**-**	**1.17**	**0.65**	**-**

FUGITIVE DUST EMISSIONS FROM TERTIARY CRUSHING AND MATERIAL CONVEYING

Equipment Type	Pipe Diameter (ft)	Excavated Area (ft^2/ft)	Advance Rate (ft/hr)	Excavated Volume (ft^3/hr)	Soil Density (lb/ft^3)	Excavated Soil Weight (ton/hr)	Daily Operation per Device (hrs/day)	Total Working Days	Daily Emissions (lb/day)						Total Emissions (tons)					
									NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Trenching Machine[a]	3	20.93	53.78	1126	100	56.3	12	180	-	-	-	0.43	0.09	-	-	-	-	0.04	0.008	-

Notes:
a. Trenching includes two conveyor points.

TOTAL EMISSIONS

Daily Emissions (lb/day)						Total Emissions (tons)					
NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
193	**0.28**	**179**	**21**	**14**	**43**	**17.4**	**0.025**	**16.1**	**1.9**	**1.2**	**3.8**

Table 6
Emissions from Onshore Pipeline Installation - Pipelay
Cabrillo Port LNG Deepwater Port
(Page 1 of 2)

EQUIPMENT EXHAUST EMISSIONS

Equipment Type	No. of Devices	Engine Rating per Device (bhp)	Fuel Type	Daily Operation per Device (hrs/day)	Daily Mileage per Device	Average Load	Total Working Days	Engine Output (bhp-hr/day)	Daily Emissions (lb/day)						Total Emissions (tons)					
									NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Heavy Fork Lift	1	200	diesel	12	-	50%	180	1,200	13	0.01	7	0.4	0.4	3	1.2	0.0012	0.6	0.04	0.04	0.24
Sideboom Tractor	2	200	diesel	12	-	50%	180	2,400	26	0.03	14	0.8	0.8	5	2.3	0.0023	1.2	0.07	0.07	0.48
Mobile Crane	1	200	diesel	12	-	50%	180	1,200	13	0.01	7	0.4	0.4	3	1.2	0.0012	0.6	0.04	0.04	0.24
Pipe Bending Machine	1	100	diesel	12	-	50%	90	600	6	0.006	5	0.3	0.3	1	0.3	0.0003	0.2	0.01	0.01	0.06
Hydrostatic Test Pump	1	200	diesel	12	-	50%	30	1,200	13	0.01	7	0.4	0.4	3	0.2	0.0002	0.1	0.01	0.01	0.04
Fill Dirt Screener	1	200	diesel	12	-	50%	180	1,200	13	0.01	7	0.4	0.4	3	1.2	0.0012	0.6	0.04	0.04	0.24
Sheepsfoot Compactor	1	200	diesel	12	-	50%	180	1,200	13	0.01	7	0.4	0.4	3	1.2	0.0012	0.6	0.04	0.04	0.24
Cement Pump	1	100	diesel	12	-	50%	90	600	6	0.006	5	0.3	0.3	1	0.3	0.0003	0.2	0.01	0.01	0.06
Asphalt Paving Machine	1	200	diesel	12	-	50%	90	1,200	13	0.01	7	0.4	0.4	3	0.6	0.0006	0.3	0.02	0.02	0.12
Asphalt Roller	1	100	diesel	12	-	50%	90	600	6	0.006	5	0.3	0.3	1	0.3	0.0003	0.2	0.01	0.01	0.06
Welding Generator	2	50	gasoline	12	-	50%	180	600	4	0.2	151	0.2	0.2	6	0.4	0.0156	13.6	0.02	0.02	0.52
Utility Generator	2	50	gasoline	12	-	50%	180	600	4	0.2	151	0.2	0.2	6	0.4	0.0156	13.6	0.02	0.02	0.52
Air Compressor	2	50	gasoline	12	-	50%	180	600	4	0.2	151	0.2	0.2	6	0.4	0.0156	13.6	0.02	0.02	0.52
Dewatering Pump	2	50	gasoline	12	-	50%	30	600	4	0.2	151	0.2	0.2	6	0.1	0.0026	2.3	0.00	0.00	0.09
Vibratory Roller	2	50	gasoline	12	-	50%	180	600	4	0.2	151	0.2	0.2	6	0.4	0.0156	13.6	0.02	0.02	0.52
Hydraulic Tamper	2	50	gasoline	12	-	50%	180	600	4	0.2	151	0.2	0.2	6	0.4	0.0156	13.6	0.02	0.02	0.52
Dump Truck	2	-	diesel	-	60	-	180	-	4	0.01	0.21	0.03	0.03	0.06	0.4	0.0012	0.02	0.003	0.003	0.005
Water Truck	2	-	diesel	-	60	-	180	-	4	0.01	0.21	0.03	0.03	0.06	0.4	0.0012	0.02	0.003	0.003	0.005
Utility Truck	2	-	diesel	-	60	-	180	-	4	0.01	0.21	0.03	0.03	0.06	0.4	0.0012	0.02	0.003	0.003	0.005
Lowboy Truck	4	-	diesel	-	120	-	180	-	16	0.05	0.83	0.13	0.13	0.24	1.4	0.0046	0.07	0.011	0.011	0.022
Pipe Stringing Truck	2	-	diesel	-	60	-	180	-	4	0.01	0.21	0.03	0.03	0.06	0.4	0.0012	0.02	0.003	0.003	0.005
Cement Truck	2	-	diesel	-	60	-	90	-	4	0.01	0.21	0.03	0.03	0.06	0.2	0.0006	0.01	0.001	0.001	0.003
Asphalt Truck	2	-	diesel	-	60	-	90	-	4	0.01	0.21	0.03	0.03	0.06	0.2	0.0006	0.01	0.001	0.001	0.003
Subtotal									**187**	**1.3**	**979**	**5**	**5**	**60**	**13.7**	**0.10**	**75.3**	**0.4**	**0.4**	**4.5**

FUGITIVE DUST EMISSIONS FROM PAVED AND UNPAVED ROADS IN CONSTRUCTION ZONE

Equipment Type	No. of Devices	Daily Mileage per Device (mi/day)	Daily Mileage per Device on Paved Roads (mi/day)	Daily Mileage per Device on Unpaved Roads (mi/day)	Total Working Days	Daily Emissions (lb/day)						Total Emissions (tons)					
						NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Mobile Crane	1	0.1	0	0.1	180	-	-	-	0.03	0.005	-	-	-	-	0.0028	0.0004	-
Heavy Forklift	1	3.1	0	3.1	180	-	-	-	0.97	0.15	-	-	-	-	0.088	0.013	-
Dump Truck	2	1.2	0.6	0.6	180	-	-	-	0.50	0.09	-	-	-	-	0.04	0.01	-
Water Truck	2	1.2	0.6	0.6	180				0.50	0.09					0.04	0.01	
Utility Truck	2	1.2	0.6	0.6	180				0.50	0.09					0.04	0.01	
Lowboy Truck	4	2.4	1.2	1.2	180				1.99	0.35					0.18	0.03	
Pipe Stringing Truck	2	1.2	0.6	0.6	180				0.50	0.09					0.04	0.01	
Cement Truck	2	1.2	0.6	0.6	90				0.50	0.09					0.02	0.00	
Asphalt Truck	2	1.2	0.6	0.6	90				0.50	0.09					0.02	0.00	
Subtotal						**-**	**-**	**-**	**6.0**	**1.0**	**-**	**-**	**-**	**-**	**0.49**	**0.08**	**-**

Table 6
Emissions from Onshore Pipeline Installation - Pipelay
Cabrillo Port LNG Deepwater Port
(Page 2 of 2)

FUGITIVE DUST EMISSIONS FROM PAVED ROADS OUTSIDE CONSTRUCTION ZONE

Equipment Type	No. of Devices	Daily Mileage per Device (mi/day)	Daily Mileage per Device on Paved Roads (mi/day)	Daily Mileage per Device on Unpaved Roads (mi/day)	Total Working Days	Daily Emissions (lb/day)						Total Emissions (tons)					
						NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Dump Truck	2	58.8	58.8	0	180	-	-	-	11.8	2.9	-	-	-	-	1.06	0.26	-
Water Truck	2	58.8	58.8	0	180				11.8	2.9					1.06	0.26	
Utility Truck	2	58.8	58.8	0	180				11.8	2.9					1.06	0.26	
Lowboy Truck	4	117.6	117.6	0	180				47.1	11.7					4.24	1.05	
Pipe Stringing Truck	2	58.8	58.8	0	180				11.8	2.9					1.06	0.26	
Cement Truck	2	58.8	58.8	0	90				11.8	2.9					0.53	0.13	
Asphalt Truck	2	58.8	58.8	0	90				11.8	2.9					0.53	0.13	
Subtotal						**-**	**-**	**-**	**117.8**	**29.2**	**-**	**-**	**-**	**-**	**9.54**	**2.36**	**-**

FUGITIVE DUST EMISSIONS FROM EARTHMOVING

Equipment Type	No. of Devices	Daily Operation per Device (hrs/day)	Total Working Days	Daily Emissions (lb/day)						Total Emissions (tons)					
				NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Sideboom Tractor	2	12	180	-	-	-	8.6	4.8	-	-	-	-	0.78	0.43	-
Sheepsfoot Compactor	1	12	180	-	-	-	4.3	2.4	-	-	-	-	0.39	0.22	-
Subtotal				**-**	**-**	**-**	**13.0**	**7.2**	**-**	**-**	**-**	**-**	**1.17**	**0.65**	**-**

FUGITIVE DUST EMISSIONS FROM TERTIARY CRUSHING AND MATERIAL CONVEYING

Equipment Type	Pipe Dia. (ft)	Excavated Area (ft^2/ft)	Advance Rate (ft/hr)	Excavated Volume (ft^3/hr)	Soil Density (lb/ft^3)	Excavated Soil Weight (ton/hr)	Daily Operation per Device (hrs/day)	Total Working Days	Daily Emissions (lb/day)						Total Emissions (tons)					
									NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Fill Dirt Screener	3	20.93	53.78	1126	100	56.3	12	180	-	-	-	0.50	0.03	-	-	-	-	0.04	0.003	-

TOTAL EMISSIONS

Daily Emissions (lb/day)						Total Emissions (tons)					
NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
187	**1.3**	**979**	**143**	**43**	**60**	**13.7**	**0.10**	**75.3**	**11.6**	**3.5**	**4.5**

Table 7
Emissions from Onshore Pipeline Installation - Boring
Cabrillo Port LNG Deepwater Port

EQUIPMENT EXHAUST EMISSIONS

Equipment Type	No. of Devices	Engine Rating per Device (bhp)	Fuel Type	Daily Operation per Device (hrs/day)	Daily Mileage per Device (mi/day)	Average Load	Total Working Days	Engine Output (bhp-hr/day)	Daily Emissions (lb/day)						Total Emissions (tons)					
									NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Horizontal Boring Rig	1	1,000	diesel	24	-	80%	30	19,200	203	0.20	110	6	6	42	3.0	0.0031	1.7	0.10	0.10	0.63
Track Backhoe	1	200	diesel	12	-	50%	30	1,200	13	0.01	7	0.4	0.4	3	0.2	0.0002	0.1	0.01	0.01	0.04
All Terrain Forklift	1	100	diesel	12	-	50%	30	600	6	0.01	5	0.3	0.3	1	0.1	0.0001	0.1	0.00	0.00	0.02
Light Towers	6	20	diesel	12	-	100%	30	1,440	18	0.02	16	2	2	3	0.3	0.0002	0.2	0.03	0.03	0.05
Heavy Lift Crane	1	500	diesel	6	-	50%	30	1,500	16	0.02	9	0.5	0.5	3	0.2	0.0002	0.1	0.01	0.01	0.05
18 Wheeler Truck	2	-	diesel	-	60	-	30	-	4	0.01	0.21	0.03	0.03	0.06	0.1	0.0002	0.00	0.000	0.000	0.001
Subtotal									**260**	**0.3**	**146**	**9**	**9**	**53**	**3.9**	**0.004**	**2.2**	**0.1**	**0.1**	**0.8**

FUGITIVE DUST EMISSIONS FROM PAVED AND UNPAVED ROADS IN CONSTRUCTION ZONE

Equipment Type	No. of Devices	Daily Mileage per Device (mi/day)	Daily Mileage per Device on Paved Roads (mi/day)	Daily Mileage per Device on Unpaved Roads (mi/day)	Total Working Days	Daily Emissions (lb/day)						Total Emissions (tons)					
						NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
All Terrain Forklift	1	1.6	0	1.6	30	-	-	-	0.58	0.09	-	-	-	-	0.009	0.001	-
18 Wheeler Truck	2	1.2	0.6	0.6	30	-	-	-	0.82	0.16	-	-	-	-	0.01	0.00	-
Subtotal						**-**	**-**	**-**	**1.4**	**0.3**	**-**	**-**	**-**	**-**	**0.02**	**0.00**	**-**

FUGITIVE DUST EMISSIONS FROM PAVED ROADS OUTSIDE CONSTRUCTION ZONE

Equipment Type	No. of Devices	Daily Mileage per Device (mi/day)	Daily Mileage per Device on Paved Roads (mi/day)	Daily Mileage per Device on Unpaved Roads (mi/day)	Total Working Days	Daily Emissions (lb/day)						Total Emissions (tons)					
						NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
18 Wheeler Truck	2	58.8	58.8	0	30	-	-	-	37.4	9.33	-	-	-	-	0.56	0.14	-
Subtotal						**-**	**-**	**-**	**37.4**	**9.3**	**-**	**-**	**-**	**-**	**0.56**	**0.14**	**-**

FUGITIVE DUST EMISSIONS FROM EARTHMOVING

Equipment Type	No. of Devices	Daily Operation per Device (hrs/day)	Total Working Days	Daily Emissions (lb/day)						Total Emissions (tons)					
				NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Track Backhoe	1	12	30	-	-	-	4.3	2.4	-	-	-	-	0.06	0.04	-
Subtotal				**-**	**-**	**-**	**4.3**	**2.4**	**-**	**-**	**-**	**-**	**0.06**	**0.04**	**-**

TOTAL EMISSIONS

Daily Emissions (lb/day)						Total Emissions (tons)					
NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
260	**0.27**	**146**	**53**	**21**	**53**	**3.9**	**0.0040**	**2.2**	**0.79**	**0.32**	**0.79**

Table 8
Emissions from Onshore Pipeline Installation - Drilling
Cabrillo Port LNG Deepwater Port

EQUIPMENT EXHAUST EMISSIONS

Equipment Type	No. of Devices	Engine Rating per Device (bhp)	Fuel Type	Daily Operation per Device (hrs/day)	Daily Mileage per Device (mi/day)	Average Load	Total Working Days	Engine Output (bhp-hr/day)	Daily Emissions (lb/day)						Total Emissions (tons)					
									NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Large Drilling Rig (HDD)	2	500	diesel	24	-	80%	30	19,200	203	0.20	110	6	6	42	3.0	0.0031	1.7	0.10	0.10	0.63
Mud Cleaner Generator	1	400	diesel	24		80%	30	7,680	81	0.08	44	3	3	17	1.2	0.0012	0.7	0.04	0.04	0.25
Mud Pumps	2	500	diesel	24		80%	30	19,200	203	0.20	110	6	6	42	3.0	0.0031	1.7	0.10	0.10	0.63
Fluid Handling Pumps	4	75	diesel	24		80%	30	5,760	71	0.06	47	4	4	13	1.1	0.0009	0.7	0.06	0.06	0.19
Track Backhoe	1	200	diesel	12	-	50%	30	1,200	13	0.01	7	0	0	3	0.2	0.0002	0.1	0.01	0.01	0.04
All Terrain Forklift	1	100	diesel	12	-	50%	30	600	6	0.01	5	0	0	1	0.1	0.0001	0.1	0.00	0.00	0.02
Light Towers	6	20	diesel	12	-	100%	30	1,440	18	0.02	16	2	2	3	0.3	0.0002	0.2	0.03	0.03	0.05
Heavy Lift Crane	1	500	diesel	6	-	50%	30	1,500	16	0.02	9	0	0	3	0.2	0.0002	0.1	0.01	0.01	0.05
18 Wheeler Truck	2	-	diesel	-	60	-	30	-	4	0.01	0.21	0.03	0.03	0.06	0.1	0.0002	0.00	0.000	0.000	0.001
Subtotal									**616**	**0.6**	**347**	**22**	**22**	**125**	**9.2**	**0.009**	**5.2**	**0.3**	**0.3**	**1.9**

FUGITIVE DUST EMISSIONS FROM PAVED AND UNPAVED ROADS IN CONSTRUCTION ZONE

Equipment Type	No. of Devices	Daily Mileage per Device (mi/day)	Daily Mileage per Device on Paved Roads (mi/day)	Daily Mileage per Device on Unpaved Roads (mi/day)	Total Working Days	Daily Emissions (lb/day)						Total Emissions (tons)					
						NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
All Terrain Forklift	1	1.6	0	1.6	30	-	-	-	0.58	0.09	-	-	-	-	0.009	0.001	-
18 Wheeler Truck	2	1.2	0.6	0.6	30	-	-	-	0.82	0.16	-	-	-	-	0.01	0.002	-
Subtotal						**-**	**-**	**-**	**1.4**	**0.3**	**-**	**-**	**-**	**-**	**0.02**	**0.004**	**-**

FUGITIVE DUST EMISSIONS FROM PAVED ROADS OUTSIDE CONSTRUCTION ZONE

Equipment Type	No. of Devices	Daily Mileage per Device (mi/day)	Daily Mileage per Device on Paved Roads (mi/day)	Daily Mileage per Device on Unpaved Roads (mi/day)	Total Working Days	Daily Emissions (lb/day)						Total Emissions (tons)					
						NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
18 Wheeler Truck	2	58.8	58.8	0	30	-	-	-	37.4	9.3	-	-	-	-	0.56	0.14	-
Subtotal						**-**	**-**	**-**	**37.4**	**9.3**	**-**	**-**	**-**	**-**	**0.56**	**0.14**	**-**

FUGITIVE DUST EMISSIONS FROM EARTHMOVING

Equipment Type	No. of Devices	Daily Operation per Device (hrs/day)	Total Working Days	Daily Emissions (lb/day)						Total Emissions (tons)					
				NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Track Backhoe	1	12	30	-	-	-	4.3	2.4	-	-	-	-	0.06	0.04	-
Subtotal				**-**	**-**	**-**	**4.3**	**2.4**	**-**	**-**	**-**	**-**	**0.06**	**0.04**	**-**

TOTAL EMISSIONS

	Daily Emissions (lb/day)						Total Emissions (tons)					
	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
	616	**0.62**	**347**	**65**	**34**	**125**	**9.2**	**0.009**	**5.2**	**1.0**	**0.5**	**1.9**

Table 9
Emission Factors for Construction
Cabrillo Port LNG Deepwater Port

Source Type	Emission Factors						Units	Reference	Assumptions
	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC			
Diesel Off-Road Equipment (11 ≤ hp < 25)	5.6	0.0048	4.9	0.6	0.6	1.0	g/hp-hr	40 CFR 89.112, URBEMIS2002	See Table 13
Diesel Off-Road Equipment (25 ≤ hp < 50)	5.6	0.0048	4.1	0.45	0.45	1.0	g/hp-hr	40 CFR 89.112, URBEMIS2002	See Table 13
Diesel Off-Road Equipment (50 ≤ hp < 100)	5.6	0.0048	3.7	0.3	0.3	1.0	g/hp-hr	40 CFR 89.112, URBEMIS2002	See Table 13
Diesel Off-Road Equipment (100 ≤ hp < 175)	4.9	0.0048	3.7	0.22	0.22	1.0	g/hp-hr	40 CFR 89.112, URBEMIS2002	See Table 13
Diesel Off-Road Equipment (175 ≤ hp < 300)	4.9	0.0048	2.6	0.15	0.15	1.0	g/hp-hr	40 CFR 89.112, URBEMIS2002	See Table 13
Diesel Off-Road Equipment (300 ≤ hp)	4.8	0.0048	2.6	0.15	0.15	1.0	g/hp-hr	40 CFR 89.112, URBEMIS2002	See Table 13
Diesel Offshore Vessel Equipment	6.900	0.005	8.500	0.400	0.400	1.000	g/BHP-hr	URBEMIS2002, Appendix H	See Table 13
Gasoline Off-Road Equipment	3.0	0.131	114	0.131	0.131	4.326	g/BHP-hr	SCAQMD CEQA Air Quality Handbook, Table A9-3-A	See Table 13
Diesel Heavy Heavy Duty Truck	15.104	0.048	0.781	0.119	0.119	0.226	g/mi	EMFAC2002	See Table 13
Paved Roads (Shore Crossing Activities)	-	-	-	0.318	0.0794	-	lb/mi (lb/VMT)	AP-42, Section 13.2.1	See Table 14
Paved Roads (Onshore Pipeline Installation)	-	-	-	0.100	0.0248	-	lb/mi (lb/VMT)	AP-42, Section 13.2.1	See Table 14
Unpaved Roads (Shore Crossing Activities)	-	-	-	0.36	0.056	-	lb/mi (lb/VMT)	AP-42, Section 13.2.2	See Table 14
Unpaved Roads (Onshore Pipeline Installation)	-	-	-	0.31	0.048	-	lb/mi (lb/VMT)	AP-42, Section 13.2.2	See Table 14
Earth Moving (with Track and Non-wheeled Equipment)	-	-	-	0.36	0.20	-	lb/hr	AP-42, Section 11.9, Table 11.9-1	Bulldozing overburden; silt content = 8.5% (see Table 5); moisture content after wetting = 16.8% (AP-42 Table 11.9-3, upper bound for overburden).
Tertiary Crushing (Trenching Machine)	-	-	-	0.00054	0.00010	-	lb/ton	AP-42, Section 11.19, Table 11.19-2	Emission factors for source controlled with water supression
Conveyor Transfer Points (Trenching Machine)	-	-	-	0.000046	0.000013	-	lb/ton	AP-42, Section 11.19, Table 11.19-2	Emission factors for source controlled with water supression
Soil Screening (Fill Dirt Screener)	-	-	-	0.00074	0.000050	-	lb/ton	AP-42, Section 11.19, Table 11.19-2	Emission factors for source controlled with water supression

Table 10
Assumptions for Emission Factors - Vessels and Equipment
Cabrillo Port LNG Deepwater Port

Source Type	Pollutant(s)	Reference	Assumptions
Diesel Off-Road Equipment	NO_x	40 CFR 89.112, Tier 2 Emission Standards	NO_x emission factor equal to Tier 2 emission standard for NOx+NMHC
	SO_2	URBEMIS2002, Appendix H	Year 2000; 37.1% efficiency; diesel sulfur content of 15 ppm
	CO	41 CFR 89.112, Tier 2 Emission Standards	
	PM_{10}, $PM_{2.5}$	42 CFR 89.112, Tier 2 Emission Standards	PM_{10} and $PM_{2.5}$ emission factors equal to Tier 2 emission standard for PM
	ROC	40 CFR 89.112, Tier 1 Emission Standards	ROC emission factor equal to Tier 1 emission standard for NMHC (engines > 175 hp)
Diesel Offshore Vessel Equipment	All	URBEMIS2002, Appendix H	Year 2000; 37.1% efficiency; diesel sulfur content of 15 ppm; $PM_{2.5}$ assumed equal to PM_{10}
Gasoline Off-Road Equipment	All	SCAQMD CEQA Air Quality Handbook, Table A9-3-A	34.6% efficiency; $PM_{2.5}$ assumed equal to PM_{10}
Gasoline Off-Road Equipment (Mitigation Measure)	SO_2, PM_{10}, $PM_{2.5}$	SCAQMD CEQA Air Quality Handbook, Table A9-3-A	34.6% efficiency; $PM_{2.5}$ assumed equal to PM_{10}
	CO, NO_x, ROC	13 CCR 2433, Exhaust Standards - Off-Road Large Spark Ingition Engines	
Diesel Heavy Heavy Duty Truck	All	EMFAC2002	HHD Trucks; T7; Summer; VCAPCD; Year 2000 with 100,000 miles; I/M; 37.1% efficiency; diesel sulfur content of 15 ppm; $PM_{2.5}$ assumed equal to PM_{10}

Table 11
Assumptions for Emission Factors - Paved and Unpaved Roads
Cabrillo Port LNG Deepwater Port

Paved Roads

Emission Factor = $[k (sL/2)^{0.65} (W/3)^{1.5} - C] [1 - (P/4N)]$

AP-42, Section 13.2.1, Equation (2)

Particulate Size Multiplier	k (for PM_{10})	0.016 lb/VMT	AP-42, Section 13.2.1, Table 13.2.1-1
	k (for $PM_{2.5}$)	0.004 lb/VMT	AP-42, Section 13.2.1, Table 13.2.1-1
Road Surface Silt Loading	sL	1.02 g/m^2	Based on silt loading of 0.03 oz/yd^2 for collector streets (SCAQMD CEQA Air Quality Handbook Table A9-9-C-1)
Average Weight of Vehicles	W	see below	
Emission Factor for Exhaust, Brake Wear, and Tire Wear	C (for PM_{10})	0.00047 lb/VMT	AP-42, Section 13.2.1, Table 13.2.1-2
	C (for PM2.5)	0.00036 lb/VMT	AP-42, Section 13.2.1, Table 13.2.1-2
Number of "Wet Days" in Period	P	17 days	=34 days (180 days/365 days) { 34 days is the average number of annual "wet days" in the South Coast Air Basin [SCAQMD CEQA Air Quality Handbook Table A9-9-C-1] }
Number of Days in Period	N	180 days	Length of construction period

Unpaved Roads

Emission Factor = $[k (s/12)^a (W/3)^b] * [1\text{-Control}]$

AP-42, Section 13.2.2, Equation (1a) modified to account for water control measures

Constants for Equation 1a	k (for PM_{10})	1.5 lb/VMT	AP-42, Section 13.2.2, Table 13.2.2-2
	k (for $PM_{2.5}$)	0.23 lb/VMT	AP-42, Section 13.2.2, Table 13.2.2-2
	a	0.9	AP-42, Section 13.2.2, Table 13.2.2-2
	b	0.45	AP-42, Section 13.2.2, Table 13.2.2-2
Surface Material Silt Content	s	8.5 %	AP-42, Section 13.2.2, Table 13.2.2-1
Average Weight of Vehicles	W	see below	
Water Control Effectiveness	Control	85%	AP-42, Section 13.2.2, Figure 13.2.2-2

Average Weight of Vehicles (W) During Shore Crossing Activities

Equipment	Loaded Weight (tons)	Vehicle Weight (tons)	Mean Weight (tons)	
All Terrain Forklift	5.5	3.5	4.5	
18 Wheeler Truck	40	20	30.0	
Average for Vehicles on Paved Roads[1]			30.00	W for Paved Roads
Average on Unpaved Roads[2]			17.25	W for Unpaved Roads

Notes:
1. Only 18-Wheeler Truck.
2. All vehicles

Average Weight of Vehicles (W) During Onshore Pipeline Installation

Equipment	Loaded Weight (tons)	Vehicle Weight (tons)	Mean Weight (tons)	
Front End Loader	6.5	4.5	5.5	
Dump Truck	16	6	11.0	
Water Truck	10	6	8.0	
Utility Truck	2.5	2.5	2.5	
Heavy Fork Lift	5.5	3.5	4.5	
Low Boy Truck	10.5	6	8.3	
Pipe Stringing Truck	16	6	11.0	
Mobile Crane	25	25	25.0	
Cement Truck	40	19	29.5	
Asphalt Truck	16	6	11.0	
All Terrain Forklift	5.5	3.5	4.5	
18 Wheeler Truck	40	20	30.0	
Average for Vehicles on Paved Roads[1]			13.91	W for Paved Roads
Average on Unpaved Roads[2]			12.56	W for Unpaved Roads

Notes:
1. All vehicles except front end loader, heavy fork lift, mobile crane, and all-terrain forklift
2. All vehicles

Table 12
Emissions from Worker Commuting
Cabrillo Port LNG Deepwater Port

Parameter	Units	Value	Comments
Average One-Way Trip Length	miles/trip	16.2	Average Trip Length (Reference 1, Section 2.3)
Average Roundtrip Distance	miles/roundtrip	32.4	= Average Trip Length x 2

Vehicle Operation	Units	Emission Factor[a,b,c,d]					
		NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Running Exhaust & Evaporative	g/mile	0.29	0.05	2.75	0.005	0.005	0.06
Tire Wear	g/mile				0.10	0.10	
Cold Start	g/trip	1.21		47.65			1.30
Hot Start	g/trip	0.58		3.76			0.23
Diurnal	g/vehicle-day						0.54

References:
1. Southern California Association of Governments. July 2000. 1999 State of the Commute Report
2. South Coast Air Quality Management District. April 1993. CEQA Air Quality Handbook

Notes:
a. Emission factors, except SO_2, from Reference 2, Table A9-5-J-10.
b. NO_x and CO emission factors reported for AREA2; running exhaust & evaporative emission factors based on 20 mph. Speed used in emission factor selection based on AM Peak Speed for Los Angeles County (21 mph) from Reference 2, Table A9-5-F.
c. ROC emission factors reported for AREA2; running exhaust & evaporative emission factors based on 35 mph. Speed used in emission factor selection based on Off Peak Speed for Los Angeles County (33 mph) from Reference 2, Table A9-5-F.
d. SO_2 emission factor from Reference 2, Table A9-5-L for AREA2 in 2009.

Onshore Pipeline Construction (Ventura and Los Angeles Counties)

Number of Worker Roundtrips	roundtrips/day	120	
Daily Mileage for All Vehicles	miles/day	3888	Average Roundtrip Distance x Number of Worker Roundtrips
Days with Roundtrips	days	240	

Vehicle Operation	Emission Units	Emissions					
		NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Exhaust & Evaporative, and Tire Wear	Daily (lb/day)	2.5	0.43	23.6	0.900	0.900	0.5
Cold Start, Hot Start, and Diurnal	Daily (lb/day)	0.95		27.2			1.10
All	**Daily (lb/day)**	**3.4**	**0.43**	**50.8**	**0.90**	**0.90**	**1.6**
All	**Total (tons)**	**0.41**	**0.05**	**6.1**	**0.11**	**0.11**	**0.19**

Shore Crossing Construction (Ventura County)

Number of Worker Roundtrips	roundtrips/day	60	
Daily Mileage for All Vehicles	miles/day	1944	Average Roundtrip Distance x Number of Worker Roundtrips
Days with Roundtrips	days	108	

Vehicle Operation	Emission Units	Emissions					
		NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Exhaust & Evaporative, and Tire Wear	Daily (lb/day)	1.2	0.21	11.8	0.450	0.450	0.3
Cold Start, Hot Start, and Diurnal	Daily (lb/day)	0.47		13.6			0.55
All	**Daily (lb/day)**	**1.7**	**0.21**	**25.4**	**0.45**	**0.45**	**0.8**
All	**Total (tons)**	**0.09**	**0.012**	**1.4**	**0.02**	**0.02**	**0.04**

Offshore Pipeline Construction and FSRU/Mooring Installation (Ventura County)

Number of Worker Roundtrips	roundtrips/day	200	
Daily Mileage for All Vehicles	miles/day	6480	Average Roundtrip Distance x Number of Worker Roundtrips
Days with Roundtrips	days	11	Workers stay onboard during duration of offshore construction

Vehicle Operation	Emission Units	Emissions					
		NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Exhaust & Evaporative, and Tire Wear	Daily (lb/day)	4.1	0.71	39.3	1.500	1.500	0.9
Cold Start, Hot Start, and Diurnal	Daily (lb/day)	1.58		45.3			1.83
All	**Daily (lb/day)**	**5.7**	**0.71**	**84.6**	**1.50**	**1.50**	**2.7**
All	**Total (tons)**	0.0315	0.0039	0.47	0.008	0.008	0.015

TOTAL PER COUNTY

	Emission Units	Emissions					
		NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Ventura County	Daily (lb/day)	10.9	1.36	161	2.9	2.9	5.1
Los Angeles County	Daily (lb/day)	3.4	0.43	51	0.90	0.90	1.6
TOTAL	**Daily (lb/day)**	**14**	**1.8**	**212**	**3.8**	**3.8**	**6.7**
Ventura County	Total (tons)	0.54	0.07	7.9	0.14	0.14	0.25
Los Angeles County	Total (tons)	0.41	0.05	6.1	0.11	0.11	0.19
TOTAL	**Total (tons)**	**0.95**	**0.12**	**14.0**	**0.25**	**0.25**	**0.4**

Table 13
Summary of CO_2 Emissions from Construction
Cabrillo Port LNG Deepwater Port

Construction Activity	Source Type	Total Energy Output (bhp-hr)	Vehicles Miles Traveled (mi)	CO_2 Emission Factor[a,b]	CO_2 Emission Factor Units	CO_2 Emissions (lbs)	CO_2 Emissions (tons)
Mooring/FSRU Installation	Equipment	3,602,400	-	1.16	lb/hp-hr	4,178,784	2,089
Offshore Pipeline Installation	Equipment	12,750,432	-	1.16	lb/hp-hr	14,790,501	7,395
Shore Crossing Construction	Equipment	4,950,240	-	1.16	lb/hp-hr	5,742,278	2,871
	Trucks	-	3,600	2.4	lb/mi	8,640	4
Onshore Pipeline Installation - Trenching	Equipment	3,294,000	-	1.16	lb/hp-hr	3,821,040	1,911
Onshore Pipeline Installation - Pipelay	Equipment	2,160,000	-	1.16	lb/hp-hr	2,505,600	1,253
	Trucks	-	75,600	2.4	lb/mi	181,440	91
Onshore Pipeline Installation - Boring	Equipment	718,200	-	1.16	lb/hp-hr	833,112	417
	Trucks	-	1,800	2.4	lb/mi	4,320	2
Onshore Pipeline Installation - Drilling	Equipment	1,697,400	-	1.16	lb/hp-hr	1,968,984	984
	Trucks	-	1,800	2.4	lb/mi	4,320	2
TOTAL	-	-	-	-		-	**17,020**

Notes:

a. Emission factor for "Equipment" based in diesel internal combustion engines (from AP-42, Section 3.4, Table 3.4-1).

b. Emission factor for "Trucks" based in trucks getting approximately 7.7 miles per gallon (from EPA-420F-97-037: Annual Emissions and Fuel Consumption).

Table 14
Exhaust Parameters for Mooring/FSRU Installation
Cabrillo Port LNG Deepwater Port

Equipment Type	No.	Maximum Emission Rate [Each Unit] (lb/hr)					Maximum Emission Rate [Each Unit] (g/s)					24-Hour Average Emission Rate [Each Unit] (lb/hr)					24-Hour Average Emission Rate [Each Unit] (g/s)					Stack Dia. (m)	Stack Height (m)	Stack Temp (K)	Exhaust Flow [Each Unit] (m^3/s)	Exit Velocity (m/s)
		NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$					
AHTS	2	22.8	0.0160	28.1	1.32	1.32	2.88	0.00202	3.54	0.167	0.167	22.8	0.016	28.1	1.32	1.32	2.88	0.00202	3.54	0.167	0.167	0.923	7.000	700	4.69	7.01
Crew Boat	1	5.25	0.0037	6.47	0.304	0.304	0.661	0.00046	0.815	0.0383	0.0383	3.5	0.002	4.31	0.20	0.20	0.441	0.00031	0.543	0.0256	0.0256	0.292	7.000	700	1.08	16.1
Construction Barge	1	52.3	0.0367	64.5	3.03	3.03	6.59	0.00462	8.12	0.382	0.382	52.3	0.037	64.5	3.03	3.03	6.59	0.00462	8.12	0.382	0.382	0.674	7.000	700	10.7	30.1
Tug	1	8.90	0.0062	11.0	0.516	0.516	1.12	0.00079	1.38	0.065	0.065	8.9	0.006	11.0	0.52	0.52	1.12	0.00079	1.38	0.065	0.065	0.607	7.000	700	1.83	6.32
Ocean Going Tug	1	76.1	0.0533	93.7	4.41	4.41	9.58	0.00672	11.81	0.556	0.556	76.1	0.053	93.7	4.41	4.41	9.58	0.00672	11.81	0.556	0.556	1.191	7.000	700	15.6	14.0

Table 15
Exhaust Parameters for Offshore Pipeline Installation
Cabrillo Port LNG Deepwater Port

Equipment Type	No.	Maximum Emission Rate [Each Unit] (lb/hr)					Maximum Emission Rate [Each Unit] (g/s)					24-Hour Average Emission Rate [Each Unit] (lb/hr)					24-Hour Average Emission Rate [Each Unit] (g/s)					Stack Dia. (m)	Stack Height (m)	Stack Temp (K)	Exhaust Flow [Each Unit] (m^3/s)	Exit Velocity (m/s)
		NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$					
Pipe Laying Vessel	1	179	0.125	220	10.4	10.4	22.5	0.0158	27.7	1.31	1.31	179	0.1253	220	10.36	10.36	22.5	0.0158	27.7	1.31	1.31	1.191	7.000	700	36.7	33.0
AHTS	2	22.8	0.0160	28.1	1.32	1.32	2.88	0.00202	3.54	0.167	0.167	22.8	0.0160	28	1.32	1.32	2.88	0.00202	3.54	0.167	0.167	0.923	7.000	700	4.69	7.01
Crew Boat	1	5.25	0.0037	6.47	0.304	0.304	0.661	0.00046	0.815	0.0383	0.0383	3.50	0.0025	4.3	0.20	0.20	0.441	0.00031	0.543	0.0256	0.0256	0.292	7.000	700	1.08	16.1
Tug Boat & Barge	1	15.8	0.0111	19.5	0.917	0.917	1.99	0.00140	2.46	0.116	0.116	10.5	0.0074	13	0.61	0.61	1.33	0.00093	1.64	0.077	0.077	0.476	7.000	700	3.25	18.3

Table 16
Exhaust Parameters for Shore Crossing Construction
Cabrillo Port LNG Deepwater Port

Equipment Type	No.	Maximum Emission Rate [Each Unit] (lb/hr) NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	Maximum Emission Rate [Each Unit] (g/s) NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	24-Hour Average Emission Rate [Each Unit] (lb/hr) NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	24-Hour Average Emission Rate [Each Unit] (g/s) NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	Stack Dia. (m)	Stack Height (m)	Stack Temp (K)	Exhaust Flow [Each Unit] (m^3/s)	Exit Velocity (m/s)
Onshore Equipment																										
In-hole head drive unit	1	4.23	0.00427	2.29	0.1323	0.1323	0.533	0.00054	0.289	0.0167	0.0167	1.06	0.00107	0.57	0.0331	0.0331	0.133	0.000134	0.072	0.00417	0.00417	0.238	4.000	700	1.250	28.1
Mud pumps	2	4.23	0.00427	2.29	0.1323	0.1323	0.533	0.00054	0.289	0.0167	0.0167	1.59	0.0015995	0.86	0.0496	0.0496	0.200	0.000202	0.108	0.00625	0.00625	0.168	4.000	700	1.250	56.4
Solids control unit	1	5.29	0.00533	2.87	0.1653	0.1653	0.667	0.00067	0.361	0.0208	0.0208	1.98	0.00200	1.07	0.0620	0.0620	0.250	0.000252	0.135	0.00781	0.00781	0.238	4.000	700	1.562	35.1
Thrusting apparatus	1	3.17	0.0032	1.7196	0.0992	0.0992	0.400	0.00040	0.217	0.0125	0.0125	0.79	0.0007998	0.43	0.0248	0.0248	0.100	0.000101	0.054	0.00313	0.00313	0.238	4.000	700	0.937	21.1
Electrical generator	1	3.39	0.00341	1.83	0.1058	0.1058	0.427	0.00043	0.231	0.0133	0.0133	3.39	0.00341	1.83	0.1058	0.1058	0.427	0.000430	0.231	0.01333	0.01333	0.151	4.000	700	1.000	55.9
All Terrain Forklift	1	0.324	0.00032	0.2447	0.0146	0.0146	0.0408	0.00004	0.031	0.0018	0.0018	0.16	0.00016	0.12	0.0073	0.0073	0.020	0.000020	0.015	0.00092	0.00092	0.075	4.000	700	0.094	21.2
Mobile crane	1	3.39	0.00341	1.83	0.1058	0.1058	0.427	0.00043	0.231	0.0133	0.0133	1.02	0.00102	0.55	0.0317	0.0317	0.128	0.000129	0.069	0.00400	0.00400	0.238	4.000	700	1.000	22.5
Welding machines	3	0.847	0.00085	0.4586	0.0265	0.0265	0.107	0.00011	0.058	0.0033	0.0033	0.42	0.0004265	0.23	0.0132	0.0132	0.053	0.000054	0.029	0.00167	0.00167	0.151	4.000	700	0.250	14.0
Contingency	1	8.64	0.00746	4.01	0.2315	0.2315	1.09	0.00094	0.506	0.0292	0.0292	8.64	0.00746	4.01	0.2315	0.2315	1.089	0.000941	0.506	0.029	0.029	0.305	4.000	700	2.187	30.0
18 Wheeler Truck[a]	2	1.00	0.0032	0.0517	0.0079	0.0079	0.126	0.00040	0.0065	0.0010	0.0010	0.08	0.0002666	0.00	0.00066	0.00066	0.0105	0.000034	0.00054	0.000083	0.000083	0.185	4.000	700	0.625	23.3
Offshore Equipment																										
Exit Hole Barge Tug	1	3.04	0.00213	3.7479	0.1764	0.1764	0.38	0.00027	0.47	0.0222	0.0222	3.04	0.00213	3.75	0.176	0.176	0.383	0.00027	0.472	0.022	0.022	0.476	7.000	700	0.6	3.5
AHTS	1	22.8	0.016	28.109	1.3228	1.3228	2.88	0.0020	3.54	0.167	0.167	22.82	0.0160	28.1	1.323	1.323	2.875	0.00202	3.542	0.167	0.167	0.923	7.000	700	4.7	7.0

Notes:

a. Emission rates based on 2 hr/day operation and exhaust flow assumes 400 hp engine operating at 50% load.

Fugitive Dust Emissions (in Construction Zone)[a]

Equipment Type	No.	Emission Rate (lb/hr) PM_{10}	$PM_{2.5}$	Emission Rate (g/s) PM_{10}	$PM_{2.5}$
All Terrain Forklift	1	0.024	0.00371	0.0030	0.0005
18 Wheeler Truck	2	0.034	0.00675	0.0043	0.0009
Track Backhoe	1	0.18	0.10	0.0227	0.0126
TOTAL		**0.24**	**0.11**	**0.030**	**0.014**

Notes:

a. Average emission rates for 24 hr-period.

Table 17
Exhaust Parameters for Onshore Pipeline Installation - Trenching
Cabrillo Port LNG Deepwater Port

Equipment Type	No.	Maximum Emission Rate [Each Unit] (lb/hr)					Maximum Emission Rate [Each Unit] (g/s)					24-Hour Average Emission Rate [Each Unit] (lb/hr)					24-Hour Average Emission Rate [Each Unit] (g/s)					Stack Dia. (m)	Stack Height (m)	Stack Temp (K)	Exhaust Flow [Each Unit] (m^3/s)	Exit Velocity (m/s)
		NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$					
Trenching Machine	1	8.47	0.00853	4.59	0.2646	0.2646	1.07	0.0011	0.578	0.0333	0.0333	4.23	0.0043	2.29	0.132	0.132	0.53	0.0005	0.289	0.0167	0.0167	0.300	2.500	700	2.50	35.4
Track Backhoe	1	4.23	0.00427	2.29	0.1323	0.1323	0.533	0.00054	0.289	0.0167	0.0167	2.12	0.0021	1.15	0.066	0.066	0.267	0.00027	0.144	0.0083	0.0083	0.200	2.500	700	1.25	39.8
Front Loader	1	1.0803	0.00107	0.5732	0.0331	0.0331	0.136	0.00013	0.0722	0.0042	0.0042	0.54	0.0005	0.29	0.017	0.017	0.068	0.000067	0.0361	0.0021	0.0021	0.100	2.500	700	0.312	39.8
Bulldozer	1	1.0803	0.00107	0.5732	0.0331	0.0331	0.136	0.00013	0.0722	0.0042	0.0042	0.54	0.0005	0.29	0.017	0.017	0.068	0.000067	0.0361	0.0021	0.0021	0.100	2.500	700	0.312	39.8
Dragline	1	1.0803	0.00107	0.5732	0.0331	0.0331	0.136	0.00013	0.0722	0.0042	0.0042	0.54	0.0005	0.29	0.017	0.017	0.068	0.000067	0.0361	0.0021	0.0021	0.100	2.500	700	0.312	39.8
Concrete Saw	1	0.1662	0.00723	6.30	0.0072	0.0072	0.0209	0.00091	0.794	0.0009	0.0009	0.083	0.0036	3.15	0.0036	0.0036	0.0105	0.00046	0.397	0.00046	0.00046	0.050	2.500	700	0.078	39.8

Fugitive Dust Emissions (in Construction Zone)[a]

Equipment Type	No.	Emission Rate (lb/hr)		Emission Rate (g/s)	
		PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Front Loader	1	0.08	0.012	0.010	0.002
Track Backhoe	1	0.18	0.10	0.023	0.013
Bulldozer	1	0.18	0.10	0.023	0.013
Dragline	1	0.18	0.10	0.023	0.013
Trenching Machine	3	0.0178	0.00355	0.002	0.000
TOTAL		**0.64**	**0.32**	**0.080**	**0.040**

Notes:
a. Average emission rates over a 24 hr-period (including periods of inactivity).

Table 18
Exhaust Parameters for Onshore Pipeline Installation - Pipelay
Cabrillo Port LNG Deepwater Port

		Maximum Emission Rate [Each Unit]										24-Hour Average Emission Rate [Each Unit]													
		(lb/hr)					(g/s)					(lb/hr)					(g/s)								
Equipment Type	**No.**	**NO_X**	**SO_2**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**NO_X**	**SO_2**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**NO_X**	**SO_2**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**NO_X**	**SO_2**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**Stack Dia. (m)**	**Stack Height (m)**	**Stack Temp (K)**	**Exhaust Flow [Each Unit] (m^3/s)**	**Exit Velocity (m/s)**
Heavy Fork Lift	1	1.08	0.001066	0.573	0.0331	0.0331	0.136	0.000134	0.0722	0.00417	0.0042	0.54	0.00053	0.287	0.0165	0.0165	0.068	0.000067	0.0361	0.00208	0.0021	0.107	2.500	700	0.312	34.8
Sideboom Tractor	2	1.08	0.001066	0.573	0.0331	0.0331	0.136	0.000134	0.0722	0.00417	0.0042	0.54	0.00053	0.287	0.0165	0.0165	0.068	0.000067	0.0361	0.00208	0.0021	0.151	2.500	700	0.312	17.5
Mobile Crane	1	1.08	0.001066	0.573	0.0331	0.0331	0.136	0.000134	0.0722	0.00417	0.0042	0.54	0.00053	0.287	0.0165	0.0165	0.068	0.000067	0.0361	0.00208	0.0021	0.107	2.500	700	0.312	34.8
Pipe Bending Machine	1	0.540	0.000533	0.408	0.0243	0.0243	0.068	0.000067	0.0514	0.00306	0.0031	0.27	0.00027	0.204	0.0121	0.0121	0.034	0.000034	0.0257	0.00153	0.0015	0.075	2.500	700	0.156	35.4
Hydrostatic Test Pump	1	1.08	0.001066	0.573	0.0331	0.0331	0.136	0.000134	0.0722	0.00417	0.0042	0.54	0.00053	0.287	0.0165	0.0165	0.068	0.000067	0.0361	0.00208	0.0021	0.107	2.500	700	0.312	34.8
Fill Dirt Screener	1	1.08	0.001066	0.573	0.0331	0.0331	0.136	0.000134	0.0722	0.00417	0.0042	0.54	0.00053	0.287	0.0165	0.0165	0.068	0.000067	0.0361	0.00208	0.0021	0.107	2.500	700	0.312	34.8
Sheepsfoot Compactor	1	1.08	0.001066	0.573	0.0331	0.0331	0.136	0.000134	0.0722	0.00417	0.0042	0.54	0.00053	0.287	0.0165	0.0165	0.068	0.000067	0.0361	0.00208	0.0021	0.107	2.500	700	0.312	34.8
Cement Pump	1	0.540	0.000533	0.408	0.0243	0.0243	0.068	0.000067	0.0514	0.00306	0.0031	0.27	0.00027	0.204	0.0121	0.0121	0.034	0.000034	0.0257	0.00153	0.0015	0.075	2.500	700	0.156	35.4
Asphalt Paving Machine	1	1.08	0.001066	0.573	0.0331	0.0331	0.136	0.000134	0.0722	0.00417	0.0042	0.54	0.00053	0.287	0.0165	0.0165	0.068	0.000067	0.0361	0.00208	0.0021	0.107	2.500	700	0.312	34.8
Asphalt Roller	1	0.540	0.000533	0.408	0.0243	0.0243	0.0681	0.000067	0.0514	0.00306	0.0031	0.27	0.00027	0.204	0.0121	0.0121	0.0340	0.000034	0.0257	0.00153	0.0015	0.075	2.500	700	0.156	35.4
Welding Generator	2	0.166	0.007225	6.30	0.00723	0.00723	0.0209	0.000910	0.794	0.000910	0.00091	0.08	0.00361	3.150	0.0036	0.0036	0.0105	0.000455	0.397	0.000455	0.00046	0.075	2.500	700	0.078	17.7
Utility Generator	2	0.166	0.007225	6.30	0.00723	0.00723	0.0209	0.000910	0.794	0.000910	0.00091	0.08	0.00361	3.150	0.0036	0.0036	0.0105	0.000455	0.397	0.000455	0.00046	0.075	2.500	700	0.078	17.7
Air Compressor	2	0.166	0.007225	6.30	0.00723	0.00723	0.0209	0.000910	0.794	0.000910	0.00091	0.08	0.00361	3.150	0.0036	0.0036	0.0105	0.000455	0.397	0.000455	0.00046	0.075	2.500	700	0.078	17.7
Dewatering Pump	2	0.166	0.007225	6.30	0.00723	0.00723	0.0209	0.000910	0.794	0.000910	0.00091	0.08	0.00361	3.150	0.0036	0.0036	0.0105	0.000455	0.397	0.000455	0.00046	0.075	2.500	700	0.078	17.7
Vibratory Roller	2	0.166	0.007225	6.30	0.00723	0.00723	0.0209	0.000910	0.794	0.000910	0.00091	0.08	0.00361	3.150	0.0036	0.0036	0.0105	0.000455	0.397	0.000455	0.00046	0.075	2.500	700	0.078	17.7
Hydraulic Tamper	2	0.166	0.007225	6.30	0.00723	0.00723	0.0209	0.000910	0.794	0.000910	0.00091	0.08	0.00361	3.150	0.0036	0.0036	0.0105	0.000455	0.397	0.000455	0.00046	0.075	2.500	700	0.078	17.7
Dump Truck[a]	2	0.999	0.00320	0.0517	0.00787	0.00787	0.126	0.000403	0.00651	0.00099	0.00099	0.08	0.00027	0.004	0.0007	0.0007	0.010	0.000034	0.00054	0.000083	0.000083	0.185	4.000	700	0.625	23.3
Water Truck[a]	2	0.999	0.00320	0.0517	0.00787	0.00787	0.126	0.000403	0.00651	0.00099	0.00099	0.08	0.00027	0.004	0.0007	0.0007	0.010	0.000034	0.00054	0.000083	0.000083	0.185	4.000	700	0.625	23.3
Utility Truck[a]	2	0.999	0.00320	0.0517	0.00787	0.00787	0.126	0.000403	0.00651	0.00099	0.00099	0.08	0.00027	0.004	0.0007	0.0007	0.010	0.000034	0.00054	0.000083	0.000083	0.185	4.000	700	0.625	23.3
Lowboy Truck[a]	4	0.999	0.00320	0.0517	0.00787	0.00787	0.126	0.000403	0.00651	0.00099	0.00099	0.17	0.00053	0.009	0.0013	0.0013	0.021	0.000067	0.00108	0.00017	0.00017	0.185	4.000	700	0.625	23.3
Pipe Stringing Truck[a]	2	0.999	0.00320	0.0517	0.00787	0.00787	0.126	0.000403	0.00651	0.00099	0.00099	0.08	0.00027	0.004	0.0007	0.0007	0.010	0.000034	0.00054	0.000083	0.000083	0.185	4.000	700	0.625	23.3
Cement Truck[a]	2	0.999	0.00320	0.0517	0.00787	0.00787	0.126	0.000403	0.00651	0.00099	0.00099	0.08	0.00027	0.004	0.0007	0.0007	0.010	0.000034	0.00054	0.000083	0.000083	0.185	4.000	700	0.625	23.3
Asphalt Truck[a]	2	0.999	0.00320	0.0517	0.00787	0.00787	0.126	0.000403	0.00651	0.00099	0.00099	0.08	0.00027	0.004	0.0007	0.0007	0.010	0.000034	0.00054	0.000083	0.000083	0.185	4.000	700	0.625	23.3

Notes:

a. Emission rates based on 2 hr/day operation and exhaust flow assumes 400 hp engine operating at 50% load.

Fugitive Dust Emissions (in Construction Zone)[a]

		(lb/hr)		(g/s)	
Equipment Type	**No.**	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Mobile Crane	1	0.0013	0.00020	0.00016	0.00003
Heavy Forklift	1	0.0406	0.00622	0.005	0.0008
Trucks	16	0.19	0.033	0.023	0.0041
Sideboom Tractor	2	0.36	0.20	0.045	0.025
Sheepsfoot Compactor	1	0.18	0.10	0.023	0.013
Fill Dirt Screener	3	0.021	0.0014	0.003	0.00018
TOTAL		**0.79**	**0.34**	**0.10**	**0.043**

Notes:

a. Average emission rates over a 24 hr-period (including periods of inactivity).

Table 19
Exhaust Parameters for Onshore Pipeline Installation - Boring
Cabrillo Port LNG Deepwater Port

Equipment Type	No.	Maximum Emission Rate [Each Unit] (lb/hr)					Maximum Emission Rate [Each Unit] (g/s)					24-Hour Average Emission Rate [Each Unit] (lb/hr)					24-Hour Average Emission Rate [Each Unit] (g/s)					Stack Dia. (m)	Stack Height (m)	Stack Temp (K)	Exhaust Flow [Each Unit] (m^3/s)	Exit Velocity (m/s)
		NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$					
Horizontal Boring Rig	1	8.47	0.00853	4.59	0.2646	0.2646	1.07	0.00107	0.578	0.0333	0.0333	8.47	0.00853	4.59	0.264556	0.264556	1.07	0.00107	0.578	0.0333	0.0333	0.238	4.000	700	2.50	56.2
Track Backhoe	1	1.0803	0.00107	0.5732	0.0331	0.0331	0.136	0.00013	0.0722	0.0042	0.0042	0.54	0.00053	0.29	0.016535	0.016535	0.068	0.00007	0.0361	0.0021	0.0021	0.107	4.000	700	0.312	34.8
All Terrain Forklift	1	0.540	0.00053	0.4079	0.0243	0.0243	0.0681	0.00007	0.0514	0.0031	0.0031	0.27	0.00027	0.20	0.012125	0.012125	0.0340	0.00003	0.0257	0.0015	0.0015	0.075	4.000	700	0.156	35.4
Light Towers	6	0.2469	0.00021	0.2161	0.0265	0.0265	0.0311	0.00003	0.0272	0.0033	0.0033	0.12	0.00011	0.11	0.013228	0.013228	0.0156	0.00001	0.0136	0.0017	0.0017	0.051	2.500	700	0.0625	30.6
Heavy Lift Crane	1	2.65	0.00267	1.43	0.0827	0.0827	0.333	0.00034	0.181	0.0104	0.0104	0.66	0.00067	0.36	0.020668	0.020668	0.083	0.00008	0.045	0.0026	0.0026	0.168	4.000	700	0.781	35.3
18 Wheeler Truck[a]	2	1.00	0.00320	0.0517	0.0079	0.0079	0.126	0.00040	0.0065	0.0010	0.0010	0.08	0.00027	0.00	0.000656	0.000656	0.010	0.00003	0.0005	0.0001	0.0001	0.185	4.000	700	0.625	23.3

Notes:

a. Emission rates based on 2 hr/day operation and exhaust flow assumes 400 hp engine operating at 50% load.

Fugitive Dust Emissions (in Construction Zone)[a]

Equipment Type	No.	(lb/hr)		(g/s)	
		PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
All Terrain Forklift	1	0.024	0.0037	0.0030	0.0005
18 Wheeler Truck	2	0.034	0.0067	0.0043	0.0009
Track Backhoe	1	0.18	0.10	0.023	0.013
TOTAL		**0.24**	**0.11**	**0.030**	**0.014**

Notes:

a. Average emission rates over a 24 hr-period (including periods of inactivity).

Table 20
Exhaust Parameters for Onshore Pipeline Installation - Drilling
Cabrillo Port LNG Deepwater Port

		Maximum Emission Rate [Each Unit]										24-Hour Average Emission Rate [Each Unit]										Stack Dia. (m)	Stack Height (m)	Stack Temp (K)	Exhaust Flow [Each Unit] (m^3/s)	Exit Velocity (m/s)
		(lb/hr)					(g/s)					(lb/hr)					(g/s)									
Equipment Type	**No.**	**NO_X**	**SO_2**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**NO_X**	**SO_2**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**NO_X**	**SO_2**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**NO_X**	**SO_2**	**CO**	**PM_{10}**	**$PM_{2.5}$**					
Large Drilling Rig (HDD)	2	4.23	0.00427	2.29	0.1323	0.1323	0.533	0.00054	0.289	0.0167	0.0167	4.23	0.00427	2.29	0.132278	0.132278	0.533	0.00054	0.289	0.0167	0.0167	0.238	4.000	700	1.250	28.1
Mud Cleaner Generator	1	3.39	0.00341	1.83	0.1058	0.1058	0.427	0.00043	0.231	0.0133	0.0133	3.39	0.00341	1.83	0.105822	0.105822	0.427	0.00043	0.231	0.0133	0.0133	0.151	4.000	700	1.000	55.9
Mud Pumps	2	4.23	0.00427	2.29	0.1323	0.1323	0.533	0.00054	0.289	0.0167	0.0167	4.23	0.00427	2.29	0.132278	0.132278	0.533	0.00054	0.289	0.0167	0.0167	0.238	4.000	700	1.250	28.1
Fluid Handling Pumps	4	0.7408	0.00064	0.4894	0.0397	0.0397	0.093	0.00008	0.062	0.0050	0.0050	0.74	0.00064	0.49	0.039683	0.039683	0.093	0.00008	0.062	0.0050	0.0050	0.130	4.000	700	0.187	14.1
Track Backhoe	1	1.0803	0.00107	0.5732	0.0331	0.0331	0.136	0.00013	0.072	0.0042	0.0042	0.54	0.00053	0.29	0.016535	0.016535	0.068	0.00007	0.036	0.0021	0.0021	0.107	4.000	700	0.312	34.8
All Terrain Forklift	1	0.540	0.00053	0.4079	0.0243	0.0243	0.068	0.00007	0.051	0.0031	0.0031	0.27	0.00027	0.20	0.012125	0.012125	0.034	0.00003	0.026	0.0015	0.0015	0.075	4.000	700	0.156	35.4
Light Towers	6	0.2469	0.00021	0.2161	0.0265	0.0265	0.031	0.00003	0.027	0.0033	0.0033	0.12	0.00011	0.11	0.013228	0.013228	0.016	0.00001	0.014	0.0017	0.0017	0.050	2.500	700	0.0625	31.8
Heavy Lift Crane	1	2.65	0.00267	1.43	0.0827	0.0827	0.333	0.00034	0.181	0.0104	0.0104	0.66	0.00067	0.36	0.020668	0.020668	0.083	0.00008	0.045	0.0026	0.0026	0.168	4.000	700	0.781	35.3
18 Wheeler Truck	2	1.00	0.00320	0.0517	0.0079	0.0079	0.126	0.00040	0.0065	0.0010	0.0010	0.08	0.00027	0.00	0.000656	0.000656	0.010	0.00003	0.0005	0.00008	0.00008	0.185	4.000	700	0.625	23.3

Fugitive Dust Emissions (in Construction Zone)[a]

		(lb/hr)		(g/s)	
Equipment Type	**No.**	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
All Terrain Forklift	1	0.024	0.0037	0.0030	0.0005
18 Wheeler Truck	2	0.034	0.0067	0.0043	0.0009
Track Backhoe	1	0.18	0.10	0.023	0.013
TOTAL		**0.24**	**0.11**	**0.030**	**0.014**

Notes:

a. Average emission rates over a 24 hr-period (including periods of inactivity).

Appendix G1-2
Construction Emission Tables (With Mitigation Measures)

Table No.	Table Name
Table M1	Summary of Construction Emissions
Table M2	Emissions from Mooring/FSRU Installation
Table M3	Emissions from Offshore Pipeline Installation
Table M4	Emissions from Shore Crossing Construction
Table M5	Emissions from Onshore Pipeline Installation - Trenching
Table M6	Emissions from Onshore Pipeline Installation - Pipelay
Table M7	Emissions from Onshore Pipeline Installation - Boring
Table M8	Emissions from Onshore Pipeline Installation - Drilling
Table M9	Emission Factors for Construction
Table M10	Assumptions for Emission Factors - Vessels and Equipment
Table M11	Assumptions for Emission Factors - Paved and Unpaved Roads
Table M12	Emissions from Worker Commuting
Table M13	Exhaust Parameters for Mooring/FSRU Installation
Table M14	Exhaust Parameters for Offshore Pipeline Installation
Table M15	Exhaust Parameters for Shore Crossing Construction
Table M16	Exhaust Parameters for Onshore Pipeline Installation - Trenching (with Mitigation Measures)
Table M17	Exhaust Parameters for Onshore Pipeline Installation - Pipelay (with Mitigation Measures)
Table M18	Exhaust Parameters for Onshore Pipeline Installation - Boring
Table M19	Exhaust Parameters for Onshore Pipeline Installation - Drilling

Table M1
Summary of Construction Emissions
Cabrillo Port LNG Deepwater Port

EMISSIONS BY ACTIVITY

Construction Activity	Daily Emissions (lb/day)						Total Emissions (tons)					
	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Mooring/FSRU Installation	4,474	3	5,512	259	259	648	27.4	0.019	33.8	1.6	1.6	4.0
Offshore Pipeline Installation	5,725	4	7,050	332	332	830	97.0	0.068	119.5	5.6	5.6	14.1
Shore Crossing Construction	928	1	1,029	94	63	153	22.6	0.027	23.5	2.5	1.6	3.8
Onshore Pipeline Installation - Trenching	159	0.3	128	21	14	31	14.3	0.025	11.5	1.9	1.2	2.8
Onshore Pipeline Installation - Pipelay	139	1	365	143	43	34	10.4	0.10	27.7	11.6	3.5	2.6
Onshore Pipeline Installation - Boring	247	0.3	146	53	21	48	3.7	0.0040	2.2	0.79	0.32	0.73
Onshore Pipeline Installation - Drilling	419	1	347	65	34	59	6.3	0.009	5.2	1.0	0.5	0.9
Worker Commuting	14	2	212	4	4	7	0.95	0.12	14.0	0.25	0.25	0.4
TOTAL	-	-	-	-	-	-	**183**	**0.37**	**237**	**25**	**15**	**29**

EMISSIONS BY LOCATION

Construction Activity	Daily Emissions (lb/day)						Total Emissions (tons)					
	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Federal Waters												
Mooring/FSRU Installation	4,474	3.1	5,512	259	259	648	27.4	0.02	33.8	1.6	1.6	4.0
Offshore Pipeline Installation	5,725	4.0	7,050	332	332	830	82.4	0.06	101.5	4.8	4.8	11.9
Subtotal							**109.8**	**0.08**	**135.3**	**6.4**	**6.4**	**15.9**
Ventura County												
Offshore Pipeline Installation	5,725	4.0	7,050	332	332	830	14.5	0.010	17.9	0.8	0.8	2.1
Shore Crossing Construction	928	0.9	1,029	94	63	153	22.6	0.027	23.5	2.5	1.6	3.8
Onshore Pipeline Installation - Trenching	159	0.3	128	21	14	31	9.5	0.017	7.7	1.3	0.8	1.8
Onshore Pipeline Installation - Pipelay	139	1.3	365	143	43	34	6.9	0.066	18.5	7.8	2.3	1.7
Onshore Pipeline Installation - Boring	247	0.3	146	53	21	48	3.7	0.004	2.2	0.8	0.3	0.7
Worker Commuting	11	1.4	160.8	2.9	2.9	5.1	0.54	0.067	7.9	0.14	0.14	0.25
Subtotal							**57.9**	**0.19**	**77.7**	**13.3**	**6.0**	**10.4**
Los Angeles County												
Onshore Pipeline Installation - Trenching	159	0.28	128	21	14	31	4.8	0.0084	3.8	0.64	0.41	0.9
Onshore Pipeline Installation - Pipelay	139	1.3	365	143	43	34	3.5	0.033	9.2	3.9	1.2	0.9
Onshore Pipeline Installation - Drilling	419	0.62	347	65	34	59	6.3	0.0092	5.2	1.0	0.51	0.9
Worker Commuting	3	0	51	1	1	2	0.41	0.0514	6.1	0.11	0.11	0.19
Subtotal							**14.9**	**0.10**	**24.4**	**5.6**	**2.2**	**2.9**
TOTAL	-	-	-	-	-	-	**183**	**0.37**	**237**	**25**	**15**	**29**

Table M2
Emissions from Mooring/FSRU Installation
Cabrillo Port LNG Deepwater Port

Equipment Type	No. of Devices	Engine Rating per Device (bhp)	Fuel Type	Daily Operation per Device (hrs/day)	Average Load	Total Working Days[d]	Engine Output (bhp-hr/day)	Daily Emissions (lb/day)						Total Emissions (tons)					
								NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
AHTS[a]	2	15,000	diesel	24	10%	20	72,000	1,095	0.8	1,349	63	63	159	11.0	0.0077	13.5	0.63	0.63	1.6
Crew Boat	1	1,500	diesel	16	23%	20	5,520	84	0.06	103	5	5	12	0.8	0.0006	1.0	0.05	0.05	0.12
Construction Barge[b]	1	8,000	diesel	24	43%	20	82,560	1,256	0.9	1,547	73	73	182	12.6	0.0088	15.5	0.73	0.73	1.8
Tug[c]	1	6,500	diesel	24	9%	20	14,040	214	0.1	263	12	12	31	2.1	0.0015	2.6	0.12	0.12	0.31
Ocean Going Tug	1	25,000	diesel	24	20%	1	120,000	1,825	1.3	2,249	106	106	265	0.9	0.0006	1.1	0.05	0.05	0.13
TOTAL								**4,474**	**3**	**5,512**	**259**	**259**	**648**	**27.4**	**0.019**	**33.8**	**1.6**	**1.6**	**4.0**

Notes:
a. AHTS also handles risers
b. Barge used to transport anchors and equipment
c. Tug boat used as riser installation vessel.
d. Total vessel-days equivalent to task estimates, multiple vessels used in some tasks, composite daily estimate is conservative for planned activities due to vessel overlap

Table M3
Emissions from Offshore Pipeline Installation
Cabrillo Port LNG Deepwater Port

Equipment Type[a]	No. of Devices	Engine Rating per Device (bhp)	Daily Operation per Device (hrs/day)	Mileage per Day (mile/day)	Avg Load	Total Working Days	Engine Output (bhp-hr/day)	Daily Emissions (lb/day)						Total Emissions (tons)					
								NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Pipe Laying Vessel	1	25,000	24	-	47%	35	282,000	4,290	3	5,285	249	249	622	75.1	0.053	92.5	4.4	4.4	10.9
AHTS[b]	2	15,000	24	-	10%	35	72,000	1,095	1	1,349	63	63	159	19.2	0.013	23.6	1.1	1.1	2.8
Crew Boat	1	1,500	16	-	23%	35	5,520	84	0.06	103	5	5	12	1.5	0.0010	1.8	0.09	0.09	0.2
Tug Boat & Barge[c]	1	4,000	16	-	26%	10	16,640	253	0.2	312	15	15	37	1.3	0.0009	1.6	0.07	0.07	0.2
Dock Crane (35 ton)	1	130	1	-	80%	8	104	1	0.001	1	0.1	0.1	0.2	0.005	0.000004	0.004	0.0006	0.0006	0.0009
Delivery Truck	1	-	-	60	-	5	-	2	0.006	0.1	0.02	0.02	0.03	0.005	0.00002	0.0003	0.00004	0.00004	0.0001
TOTAL								**5,725**	**4**	**7,050**	**332**	**332**	**830**	**97.0**	**0.068**	**119**	**5.6**	**5.6**	**14.1**

Notes:
a. All equipment is diesel-fueled.
b. AHTS also provides welding power when needed.
c. Barge used to transport pipe and material off-shore (not powered) and tug boat pulls pipe barge.

Table M4
Emissions from Shore Crossing Construction
Cabrillo Port LNG Deepwater Port

EQUIPMENT EXHAUST EMISSIONS

Equipment Type	No. of Devices	Engine Rating per Device (bhp)	Fuel Type	Daily Operation per Device (hrs/day)	Daily Mileage per Device (mi/day)	Average Load	Total Working Days	Engine Output (bhp-hr/day)	Daily Emissions (lb/day)						Total Emissions (tons)					
									NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
In-hole head drive unit	1	400	diesel	6	-	100%	88	2,400	16	0.03	14	0.8	0.8	2	0.7	0.0011	0.6	0.03	0.03	0.09
Mud pumps	2	400	diesel	9	-	100%	88	7,200	48	0.08	41	2	2	6	2.1	0.0034	1.8	0.10	0.10	0.28
Solids control unit	1	500	diesel	9	-	100%	88	4,500	30	0.05	26	1.5	1.5	4	1.3	0.0021	1.1	0.07	0.07	0.17
Thrusting apparatus	1	300	diesel	6	-	100%	88	1,800	12	0.02	10	0.6	0.6	2	0.5	0.0008	0.5	0.03	0.03	0.07
Electrical generator	1	400	diesel	24	-	80%	85	7,680	51	0.08	44	3	3	7	2.2	0.0035	1.9	0.11	0.11	0.29
All Terrain Forklift	1	100	diesel	12	-	30%	60	360	2	0.004	3	0.2	0.2	0	0.1	0.0001	0.1	0.01	0.01	0.01
Mobile crane	1	400	diesel	7.2	-	80%	85	2,304	15	0.02	13	0.8	0.8	2	0.6	0.0010	0.6	0.03	0.03	0.09
Welding machines	3	100	diesel	12	-	80%	85	2,880	19	0.03	17	1	1	3	0.8	0.0013	0.7	0.04	0.04	0.11
Exit Hole Barge Tug	1	4,000	diesel	24	-	5%	35	4,800	73	0.05	90	4	4	11	1.3	0.0009	1.6	0.07	0.07	0.19
AHTS	1	15,000	diesel	24	-	10%	35	36,000	548	0.38	675	32	32	79	9.6	0.0067	11.8	0.56	0.56	1.4
Contingency	1	700	diesel	24	-	100%	60	16,800	111	0.18	96	6	6	37	3.3	0.0054	2.9	0.17	0.17	1.1
18 Wheeler Truck	2	-	diesel	-	60	-	60	-	4	0.01	0.21	0.03	0.03	0.06	0.1	0.0004	0.01	0.001	0.001	0.002
Subtotal									**928**	**0.9**	**1,029**	**51**	**51**	**153**	**22.6**	**0.027**	**23.5**	**1.2**	**1.2**	**3.8**

FUGITIVE DUST EMISSIONS FROM PAVED AND UNPAVED ROADS IN CONSTRUCTION ZONE

Equipment Type	No. of Devices	Daily Mileage per Device (mi/day)	Daily Mileage per Device on Paved Roads (mi/day)	Daily Mileage per Device on Unpaved Roads (mi/day)	Total Working Days	Daily Emissions (lb/day)						Total Emissions (tons)					
						NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
All Terrain Forklift	1	1.6	0	1.6	60	-	-	-	0.58	0.09	-	-	-	-	0.017	0.003	-
18 Wheeler Truck	2	1.2	0.6	0.6	60	-	-	-	0.82	0.16	-	-	-	-	0.02	0.005	-
Subtotal						**-**	**-**	**-**	**1.4**	**0.25**	**-**	**-**	**-**	**-**	**0.04**	**0.008**	**-**

FUGITIVE DUST EMISSIONS FROM PAVED ROADS OUTSIDE CONSTRUCTION ZONE

Equipment Type	No. of Devices	Daily Mileage per Device (mi/day)	Daily Mileage per Device on Paved Roads (mi/day)	Daily Mileage per Device on Unpaved Roads (mi/day)	Total Working Days	Daily Emissions (lb/day)						Total Emissions (tons)					
						NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
18 Wheeler Truck	2	58.8	58.8	0	60	-	-	-	37.4	9.3	-	-	-	-	1.12	0.28	-
Subtotal						**-**	**-**	**-**	**37.4**	**9.3**	**-**	**-**	**-**	**-**	**1.12**	**0.28**	**-**

FUGITIVE DUST EMISSIONS FROM EARTHMOVING

Equipment Type	No. of Devices	Daily Operation per Device (hrs/day)	Total Working Days	Daily Emissions (lb/day)						Total Emissions (tons)					
				NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Track Backhoe	1	12	60	-	-	-	4.3	2.4	-	-	-	-	0.13	0.07	-
Subtotal				**-**	**-**	**-**	**4.3**	**2.4**	**-**	**-**	**-**	**-**	**0.13**	**0.07**	**-**

TOTAL EMISSIONS

Daily Emissions (lb/day)						Total Emissions (tons)					
NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
928	**0.9**	**1,029**	**94**	**63**	**153**	**22.6**	**0.027**	**23.5**	**2.5**	**1.6**	**3.8**

Table M5
Emissions from Onshore Pipeline Installation - Trenching
Cabrillo Port LNG Deepwater Port

EQUIPMENT EXHAUST EMISSIONS

Equipment Type	No. of Devices	Engine Rating per Device (bhp)	Fuel Type	Daily Operation per Device (hrs/day)	Daily Mileage per Device (mi/day)	Average Load	Total Working Days	Engine Output (bhp-hr/day)	Daily Emissions (lb/day)						Total Emissions (tons)					
									NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Trenching Machine	1	1,000	diesel	12	-	80%	180	9,600	102	0.10	55	3	3	21	9.1	0.0092	5.0	0.29	0.29	1.9
Track Backhoe	1	500	diesel	12	-	80%	180	4,800	32	0.05	28	2	2	4	2.9	0.0046	2.5	0.14	0.14	0.38
Front Loader	1	200	diesel	12	-	50%	180	1,200	8	0.01	7	0.4	0.4	1	0.7	0.0012	0.6	0.04	0.04	0.10
Bulldozer	1	200	diesel	12	-	50%	180	1,200	8	0.01	7	0.4	0.4	1	0.7	0.0012	0.6	0.04	0.04	0.10
Dragline	1	200	diesel	12	-	50%	180	1,200	8	0.01	7	0.4	0.4	1	0.7	0.0012	0.6	0.04	0.04	0.10
Concrete Saw	1	50	gasoline	12	-	50%	180	300	2	0.09	24	0.1	0.1	2	0.2	0.0078	2.2	0.01	0.01	0.18
Subtotal									**159**	**0.3**	**128**	**6**	**6**	**31**	**14.3**	**0.025**	**11.5**	**0.5**	**0.5**	**2.8**

FUGITIVE DUST EMISSIONS FROM UNPAVED ROADS

Equipment Type	No. of Devices	Daily Mileage per Device (mi/day)	Daily Mileage per Device on Paved Roads (mi/day)	Daily Mileage per Device on Unpaved Roads (mi/day)	Total Working Days	Daily Emissions (lb/day)						Total Emissions (tons)					
						NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Front Loader	1	6.1	0	6.1	180	-	-	-	1.9	0.29	-	-	-	-	0.173	0.026	-
Subtotal						**-**	**-**	**-**	**1.9**	**0.29**	**-**	**-**	**-**	**-**	**0.17**	**0.03**	**-**

FUGITIVE DUST EMISSIONS FROM EARTHMOVING

Equipment Type	No. of Devices	Daily Operation per Device (hrs/day)	Total Working Days	Daily Emissions (lb/day)						Total Emissions (tons)					
				NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Track Backhoe	1	12	180	-	-	-	4.3	2.4	-	-	-	-	0.39	0.22	-
Bulldozer	1	12	180	-	-	-	4.3	2.4	-	-	-	-	0.39	0.22	-
Dragline	1	12	180	-	-	-	4.3	2.4	-	-	-	-	0.39	0.22	-
Subtotal				**-**	**-**	**-**	**13.0**	**7.2**	**-**	**-**	**-**	**-**	**1.17**	**0.65**	**-**

FUGITIVE DUST EMISSIONS FROM TERTIARY CRUSHING AND MATERIAL CONVEYING

Equipment Type	Pipe Diameter (ft)	Excavated Area (ft^2/ft)	Advance Rate (ft/hr)	Excavated Volume (ft^3/hr)	Soil Density (lb/ft^3)	Excavated Soil Weight (ton/hr)	Daily Operation per Device (hrs/day)	Total Working Days	Daily Emissions (lb/day)						Total Emissions (tons)					
									NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Trenching Machine[a]	3	20.93	53.78	1126	100	56.3	12	180	-	-	-	0.43	0.09	-	-	-	-	0.04	0.008	-

Notes:
a. Trenching includes two conveyor points.

TOTAL EMISSIONS

Daily Emissions (lb/day)						Total Emissions (tons)					
NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
159	**0.28**	**128**	**21**	**14**	**31**	**14.3**	**0.025**	**11.5**	**1.9**	**1.2**	**2.8**

Table M6
Emissions from Onshore Pipeline Installation - Pipelay
Cabrillo Port LNG Deepwater Port
(Page 1 of 2)

EQUIPMENT EXHAUST EMISSIONS

Equipment Type	No. of Devices	Engine Rating per Device (bhp)	Fuel Type	Daily Operation per Device (hrs/day)	Daily Mileage per Device	Average Load	Total Working Days	Engine Output (bhp-hr/day)	Daily Emissions (lb/day)						Total Emissions (tons)					
									NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Heavy Fork Lift	1	200	diesel	12	-	50%	180	1,200	8	0.01	7	0.4	0.4	1	0.7	0.0012	0.6	0.04	0.04	0.10
Sideboom Tractor	2	200	diesel	12	-	50%	180	2,400	16	0.03	14	0.8	0.8	2	1.4	0.0023	1.2	0.07	0.07	0.19
Mobile Crane	1	200	diesel	12	-	50%	180	1,200	8	0.01	7	0.4	0.4	1	0.7	0.0012	0.6	0.04	0.04	0.10
Pipe Bending Machine	1	100	diesel	12	-	50%	90	600	4	0.006	5	0.3	0.3	1	0.2	0.0003	0.2	0.01	0.01	0.02
Hydrostatic Test Pump	1	200	diesel	12	-	50%	30	1,200	8	0.01	7	0.4	0.4	1	0.1	0.0002	0.1	0.01	0.01	0.02
Fill Dirt Screener	1	200	diesel	12	-	50%	180	1,200	8	0.01	7	0.4	0.4	1	0.7	0.0012	0.6	0.04	0.04	0.10
Sheepsfoot Compactor	1	200	diesel	12	-	50%	180	1,200	8	0.01	7	0.4	0.4	1	0.7	0.0012	0.6	0.04	0.04	0.10
Cement Pump	1	100	diesel	12	-	50%	90	600	4	0.006	5	0.3	0.3	1	0.2	0.0003	0.2	0.01	0.01	0.02
Asphalt Paving Machine	1	200	diesel	12	-	50%	90	1,200	8	0.01	7	0.4	0.4	1	0.4	0.0006	0.3	0.02	0.02	0.05
Asphalt Roller	1	100	diesel	12	-	50%	90	600	4	0.006	5	0.3	0.3	1	0.2	0.0003	0.2	0.01	0.01	0.02
Welding Generator	2	50	gasoline	12	-	50%	180	600	4	0.2	49	0.2	0.2	4	0.4	0.0156	4.4	0.02	0.02	0.36
Utility Generator	2	50	gasoline	12	-	50%	180	600	4	0.2	49	0.2	0.2	4	0.4	0.0156	4.4	0.02	0.02	0.36
Air Compressor	2	50	gasoline	12	-	50%	180	600	4	0.2	49	0.2	0.2	4	0.4	0.0156	4.4	0.02	0.02	0.36
Dewatering Pump	2	50	gasoline	12	-	50%	30	600	4	0.2	49	0.2	0.2	4	0.1	0.0026	0.7	0.00	0.00	0.06
Vibratory Roller	2	50	gasoline	12	-	50%	180	600	4	0.2	49	0.2	0.2	4	0.4	0.0156	4.4	0.02	0.02	0.36
Hydraulic Tamper	2	50	gasoline	12	-	50%	180	600	4	0.2	49	0.2	0.2	4	0.4	0.0156	4.4	0.02	0.02	0.36
Dump Truck	2	-	diesel	-	60	-	180	-	4	0.01	0.21	0.03	0.03	0.06	0.4	0.0012	0.02	0.003	0.003	0.005
Water Truck	2	-	diesel	-	60	-	180	-	4	0.01	0.21	0.03	0.03	0.06	0.4	0.0012	0.02	0.003	0.003	0.005
Utility Truck	2	-	diesel	-	60	-	180	-	4	0.01	0.21	0.03	0.03	0.06	0.4	0.0012	0.02	0.003	0.003	0.005
Lowboy Truck	4	-	diesel	-	120	-	180	-	16	0.05	0.83	0.13	0.13	0.24	1.4	0.0046	0.07	0.011	0.011	0.022
Pipe Stringing Truck	2	-	diesel	-	60	-	180	-	4	0.01	0.21	0.03	0.03	0.06	0.4	0.0012	0.02	0.003	0.003	0.005
Cement Truck	2	-	diesel	-	60	-	90	-	4	0.01	0.21	0.03	0.03	0.06	0.2	0.0006	0.01	0.001	0.001	0.003
Asphalt Truck	2	-	diesel	-	60	-	90	-	4	0.01	0.21	0.03	0.03	0.06	0.2	0.0006	0.01	0.001	0.001	0.003
Subtotal									**139**	**1.3**	**365**	**5**	**5**	**34**	**10.4**	**0.10**	**27.7**	**0.4**	**0.4**	**2.6**

FUGITIVE DUST EMISSIONS FROM PAVED AND UNPAVED ROADS IN CONSTRUCTION ZONE

Equipment Type	No. of Devices	Daily Mileage per Device (mi/day)	Daily Mileage per Device on Paved Roads (mi/day)	Daily Mileage per Device on Unpaved Roads (mi/day)	Total Working Days	Daily Emissions (lb/day)						Total Emissions (tons)					
						NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Mobile Crane	1	0.1	0	0.1	180	-	-	-	0.03	0.005	-	-	-	-	0.0028	0.0004	-
Heavy Forklift	1	3.1	0	3.1	180	-	-	-	0.97	0.15	-	-	-	-	0.088	0.013	-
Dump Truck	2	1.2	0.6	0.6	180	-	-	-	0.50	0.09	-	-	-	-	0.04	0.01	-
Water Truck	2	1.2	0.6	0.6	180				0.50	0.09					0.04	0.01	
Utility Truck	2	1.2	0.6	0.6	180				0.50	0.09					0.04	0.01	
Lowboy Truck	4	2.4	1.2	1.2	180				1.99	0.35					0.18	0.03	
Pipe Stringing Truck	2	1.2	0.6	0.6	180				0.50	0.09					0.04	0.01	
Cement Truck	2	1.2	0.6	0.6	90				0.50	0.09					0.02	0.00	
Asphalt Truck	2	1.2	0.6	0.6	90				0.50	0.09					0.02	0.00	
Subtotal						**-**	**-**	**-**	**6.0**	**1.0**	**-**	**-**	**-**	**-**	**0.49**	**0.08**	**-**

Table M6
Emissions from Onshore Pipeline Installation - Pipelay (with Mitigation Measures)
Cabrillo Port LNG Deepwater Port
(Page 2 of 2)

FUGITIVE DUST EMISSIONS FROM PAVED ROADS OUTSIDE CONSTRUCTION ZONE

Equipment Type	No. of Devices	Daily Mileage per Device (mi/day)	Daily Mileage per Device on Paved Roads (mi/day)	Daily Mileage per Device on Unpaved Roads (mi/day)	Total Working Days	Daily Emissions (lb/day)						Total Emissions (tons)					
						NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Dump Truck	2	58.8	58.8	0	180	-	-	-	11.8	2.9	-	-	-	-	1.06	0.26	-
Water Truck	2	58.8	58.8	0	180				11.8	2.9					1.06	0.26	
Utility Truck	2	58.8	58.8	0	180				11.8	2.9					1.06	0.26	
Lowboy Truck	4	117.6	117.6	0	180				47.1	11.7					4.24	1.05	
Pipe Stringing Truck	2	58.8	58.8	0	180				11.8	2.9					1.06	0.26	
Cement Truck	2	58.8	58.8	0	90				11.8	2.9					0.53	0.13	
Asphalt Truck	2	58.8	58.8	0	90				11.8	2.9					0.53	0.13	
Subtotal						**-**	**-**	**-**	**117.8**	**29.2**	**-**	**-**	**-**	**-**	**9.54**	**2.36**	**-**

FUGITIVE DUST EMISSIONS FROM EARTHMOVING

Equipment Type	No. of Devices	Daily Operation per Device (hrs/day)	Total Working Days	Daily Emissions (lb/day)						Total Emissions (tons)					
				NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Sideboom Tractor	2	12	180	-	-	-	8.6	4.8	-	-	-	-	0.78	0.43	-
Sheepsfoot Compactor	1	12	180	-	-	-	4.3	2.4	-	-	-	-	0.39	0.22	-
Subtotal				**-**	**-**	**-**	**13.0**	**7.2**	**-**	**-**	**-**	**-**	**1.17**	**0.65**	**-**

FUGITIVE DUST EMISSIONS FROM TERTIARY CRUSHING AND MATERIAL CONVEYING

Equipment Type	Pipe Dia. (ft)	Excavated Area (ft^2/ft)	Advance Rate (ft/hr)	Excavated Volume (ft^3/hr)	Soil Density (lb/ft^3)	Excavated Soil Weight (ton/hr)	Daily Operation per Device (hrs/day)	Total Working Days	Daily Emissions (lb/day)						Total Emissions (tons)					
									NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Fill Dirt Screener	3	20.93	53.78	1126	100	56.3	12	180	-	-	-	0.50	0.03	-	-	-	-	0.04	0.003	-

TOTAL EMISSIONS

Daily Emissions (lb/day)						Total Emissions (tons)					
NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
139	**1.3**	**365**	**143**	**43**	**34**	**10.4**	**0.10**	**27.7**	**11.6**	**3.5**	**2.6**

Table M7
Emissions from Onshore Pipeline Installation - Boring
Cabrillo Port LNG Deepwater Port

EQUIPMENT EXHAUST EMISSIONS

Equipment Type	No. of Devices	Engine Rating per Device (bhp)	Fuel Type	Daily Operation per Device (hrs/day)	Daily Mileage per Device (mi/day)	Average Load	Total Working Days	Engine Output (bhp-hr/day)	Daily Emissions (lb/day)						Total Emissions (tons)					
									NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Horizontal Boring Rig	1	1,000	diesel	24	-	80%	30	19,200	203	0.20	110	6	6	42	3.0	0.0031	1.7	0.10	0.10	0.63
Track Backhoe	1	200	diesel	12	-	50%	30	1,200	8	0.01	7	0.4	0.4	1	0.1	0.0002	0.1	0.01	0.01	0.02
All Terrain Forklift	1	100	diesel	12	-	50%	30	600	4	0.01	5	0.3	0.3	1	0.1	0.0001	0.1	0.00	0.00	0.01
Light Towers	6	20	diesel	12	-	100%	30	1,440	18	0.02	16	2	2	3	0.3	0.0002	0.2	0.03	0.03	0.05
Heavy Lift Crane	1	500	diesel	6	-	50%	30	1,500	10	0.02	9	0.5	0.5	1	0.1	0.0002	0.1	0.01	0.01	0.02
18 Wheeler Truck	2	-	diesel	-	60	-	30	-	4	0.01	0.21	0.03	0.03	0.06	0.1	0.0002	0.00	0.000	0.000	0.001
Subtotal									**247**	**0.3**	**146**	**9**	**9**	**48**	**3.7**	**0.004**	**2.2**	**0.1**	**0.1**	**0.7**

FUGITIVE DUST EMISSIONS FROM PAVED AND UNPAVED ROADS IN CONSTRUCTION ZONE

Equipment Type	No. of Devices	Daily Mileage per Device (mi/day)	Daily Mileage per Device on Paved Roads (mi/day)	Daily Mileage per Device on Unpaved Roads (mi/day)	Total Working Days	Daily Emissions (lb/day)						Total Emissions (tons)					
						NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
All Terrain Forklift	1	1.6	0	1.6	30	-	-	-	0.58	0.09	-	-	-	-	0.009	0.001	-
18 Wheeler Truck	2	1.2	0.6	0.6	30	-	-	-	0.82	0.16	-	-	-	-	0.01	0.00	-
Subtotal						**-**	**-**	**-**	**1.4**	**0.3**	**-**	**-**	**-**	**-**	**0.02**	**0.00**	**-**

FUGITIVE DUST EMISSIONS FROM PAVED ROADS OUTSIDE CONSTRUCTION ZONE

Equipment Type	No. of Devices	Daily Mileage per Device (mi/day)	Daily Mileage per Device on Paved Roads (mi/day)	Daily Mileage per Device on Unpaved Roads (mi/day)	Total Working Days	Daily Emissions (lb/day)						Total Emissions (tons)					
						NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
18 Wheeler Truck	2	58.8	58.8	0	30	-	-	-	37.4	9.33	-	-	-	-	0.56	0.14	-
Subtotal						**-**	**-**	**-**	**37.4**	**9.3**	**-**	**-**	**-**	**-**	**0.56**	**0.14**	**-**

FUGITIVE DUST EMISSIONS FROM EARTHMOVING

Equipment Type	No. of Devices	Daily Operation per Device (hrs/day)	Total Working Days	Daily Emissions (lb/day)						Total Emissions (tons)					
				NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Track Backhoe	1	12	30	-	-	-	4.3	2.4	-	-	-	-	0.06	0.04	-
Subtotal				**-**	**-**	**-**	**4.3**	**2.4**	**-**	**-**	**-**	**-**	**0.06**	**0.04**	**-**

TOTAL EMISSIONS

Daily Emissions (lb/day)						Total Emissions (tons)					
NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
247	**0.27**	**146**	**53**	**21**	**48**	**3.7**	**0.0040**	**2.2**	**0.79**	**0.32**	**0.73**

Table M8
Emissions from Onshore Pipeline Installation - Drilling
Cabrillo Port LNG Deepwater Port

EQUIPMENT EXHAUST EMISSIONS

Equipment Type	No. of Devices	Engine Rating per Device (bhp)	Fuel Type	Daily Operation per Device (hrs/day)	Daily Mileage per Device (mi/day)	Average Load	Total Working Days	Engine Output (bhp-hr/day)	Daily Emissions (lb/day)						Total Emissions (tons)					
									NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Large Drilling Rig (HDD)	2	500	diesel	24	-	80%	30	19,200	127	0.20	110	6	6	17	1.9	0.0031	1.7	0.10	0.10	0.25
Mud Cleaner Generator	1	400	diesel	24		80%	30	7,680	51	0.08	44	3	3	7	0.8	0.0012	0.7	0.04	0.04	0.10
Mud Pumps	2	500	diesel	24		80%	30	19,200	127	0.20	110	6	6	17	1.9	0.0031	1.7	0.10	0.10	0.25
Fluid Handling Pumps	4	75	diesel	24		80%	30	5,760	71	0.06	47	4	4	13	1.1	0.0009	0.7	0.06	0.06	0.19
Track Backhoe	1	200	diesel	12	-	50%	30	1,200	8	0.01	7	0	0	1	0.1	0.0002	0.1	0.01	0.01	0.02
All Terrain Forklift	1	100	diesel	12	-	50%	30	600	4	0.01	5	0	0	1	0.1	0.0001	0.1	0.00	0.00	0.01
Light Towers	6	20	diesel	12	-	100%	30	1,440	18	0.02	16	2	2	3	0.3	0.0002	0.2	0.03	0.03	0.05
Heavy Lift Crane	1	500	diesel	6	-	50%	30	1,500	10	0.02	9	0	0	1	0.1	0.0002	0.1	0.01	0.01	0.02
18 Wheeler Truck	2	-	diesel	-	60	-	30	-	4	0.01	0.21	0.03	0.03	0.06	0.1	0.0002	0.00	0.000	0.000	0.001
Subtotal									**419**	**0.6**	**347**	**22**	**22**	**59**	**6.3**	**0.009**	**5.2**	**0.3**	**0.3**	**0.9**

FUGITIVE DUST EMISSIONS FROM PAVED AND UNPAVED ROADS IN CONSTRUCTION ZONE

Equipment Type	No. of Devices	Daily Mileage per Device (mi/day)	Daily Mileage per Device on Paved Roads (mi/day)	Daily Mileage per Device on Unpaved Roads (mi/day)	Total Working Days	Daily Emissions (lb/day)						Total Emissions (tons)					
						NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
All Terrain Forklift	1	1.6	0	1.6	30	-	-	-	0.58	0.09	-	-	-	-	0.009	0.001	-
18 Wheeler Truck	2	1.2	0.6	0.6	30	-	-	-	0.82	0.16	-	-	-	-	0.01	0.002	-
Subtotal						**-**	**-**	**-**	**1.4**	**0.3**	**-**	**-**	**-**	**-**	**0.02**	**0.004**	**-**

FUGITIVE DUST EMISSIONS FROM PAVED ROADS OUTSIDE CONSTRUCTION ZONE

Equipment Type	No. of Devices	Daily Mileage per Device (mi/day)	Daily Mileage per Device on Paved Roads (mi/day)	Daily Mileage per Device on Unpaved Roads (mi/day)	Total Working Days	Daily Emissions (lb/day)						Total Emissions (tons)					
						NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
18 Wheeler Truck	2	58.8	58.8	0	30	-	-	-	37.4	9.3	-	-	-	-	0.56	0.14	-
Subtotal						**-**	**-**	**-**	**37.4**	**9.3**	**-**	**-**	**-**	**-**	**0.56**	**0.14**	**-**

FUGITIVE DUST EMISSIONS FROM EARTHMOVING

Equipment Type	No. of Devices	Daily Operation per Device (hrs/day)	Total Working Days	Daily Emissions (lb/day)						Total Emissions (tons)					
				NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
Track Backhoe	1	12	30	-	-	-	4.3	2.4	-	-	-	-	0.06	0.04	-
Subtotal				**-**	**-**	**-**	**4.3**	**2.4**	**-**	**-**	**-**	**-**	**0.06**	**0.04**	**-**

TOTAL EMISSIONS

Daily Emissions (lb/day)						Total Emissions (tons)					
NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC
419	**0.62**	**347**	**65**	**34**	**59**	**6.3**	**0.009**	**5.2**	**1.0**	**0.5**	**0.9**

Table M9
Emission Factors for Construction
Cabrillo Port LNG Deepwater Port

Source Type	Emission Factors						Units	Reference	Assumptions
	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	ROC			
Diesel Off-Road Equipment (11 ≤ hp < 25)	5.6	0.0048	4.9	0.6	0.6	1.0	g/hp-hr	40 CFR 89.112, URBEMIS2002	See Table 13
Diesel Off-Road Equipment (25 ≤ hp < 50)	5.6	0.0048	4.1	0.45	0.45	1.0	g/hp-hr	40 CFR 89.112, URBEMIS2002	See Table 13
Diesel Off-Road Equipment (50 ≤ hp < 100)	5.6	0.0048	3.7	0.3	0.3	1.0	g/hp-hr	40 CFR 89.112, URBEMIS2002	See Table 13
Diesel Off-Road Equipment (100 ≤ hp < 175)	3.0	0.0048	3.7	0.22	0.22	0.40	g/hp-hr	40 CFR 89.112 (Tier 3), URBEMIS2002	See Table 13
Diesel Off-Road Equipment (175 ≤ hp < 300)	3.0	0.0048	2.6	0.15	0.15	0.40	g/hp-hr	40 CFR 89.112 (Tier 3), URBEMIS2002	See Table 13
Diesel Off-Road Equipment (300 ≤ hp < 750)	3.0	0.0048	2.6	0.15	0.15	0.40	g/hp-hr	40 CFR 89.112 (Tier 3), URBEMIS2002	See Table 13
Diesel Off-Road Equipment (750 ≤ hp)	4.8	0.0048	2.6	0.15	0.15	1.0	g/hp-hr	40 CFR 89.112, URBEMIS2002	See Table 13
Diesel Offshore Vessel Equipment	6.900	0.005	8.500	0.400	0.400	1.000	g/BHP-hr	URBEMIS2002, Appendix H	See Table 13
Gasoline Off-Road Equipment	3.0	0.131	37	0.131	0.131	3.0	g/BHP-hr	SCAQMD CEQA Air Quality Handbook, 13 CCR 2433	See Table 13
Diesel Heavy Heavy Duty Truck	15.104	0.048	0.781	0.119	0.119	0.226	g/mi	EMFAC2002	See Table 13
Paved Roads (Shore Crossing Activities)	-	-	-	0.318	0.0794	-	lb/mi (lb/VMT)	AP-42, Section 13.2.1	See Table 14
Paved Roads (Onshore Pipeline Installation)	-	-	-	0.100	0.0248	-	lb/mi (lb/VMT)	AP-42, Section 13.2.1	See Table 14
Unpaved Roads (Shore Crossing Activities)	-	-	-	0.36	0.056	-	lb/mi (lb/VMT)	AP-42, Section 13.2.2	See Table 14
Unpaved Roads (Onshore Pipeline Installation)	-	-	-	0.31	0.048	-	lb/mi (lb/VMT)	AP-42, Section 13.2.2	See Table 14
Earth Moving (with Track and Non-wheeled Equipment)	-	-	-	0.36	0.20	-	lb/hr	AP-42, Section 11.9, Table 11.9-1	Bulldozing overburden; silt content = 8.5% (see Table 5); moisture content after wetting = 16.8% (AP-42 Table 11.9-3, upper bound for overburden).
Tertiary Crushing (Trenching Machine)	-	-	-	0.00054	0.00010	-	lb/ton	AP-42, Section 11.19, Table 11.19-2	Emission factors for source controlled with water supression
Conveyor Transfer Points (Trenching Machine)	-	-	-	0.000046	0.000013	-	lb/ton	AP-42, Section 11.19, Table 11.19-2	Emission factors for source controlled with water supression
Soil Screening (Fill Dirt Screener)	-	-	-	0.00074	0.000050	-	lb/ton	AP-42, Section 11.19, Table 11.19-2	Emission factors for source controlled with water supression

Table M10
Assumptions for Emission Factors - Vessels and Equipment
Cabrillo Port LNG Deepwater Port

Source Type	Pollutant(s)	Reference	Assumptions
Diesel Off-Road Equipment	NO_x	40 CFR 89.112, Tier 2 Emission Standards	NO_x emission factor equal to Tier 2 emission standard for NOx+NMHC
		40 CFR 89.112, Tier 3 Emission Standards	NO_x emission factor equal to Tier 3 emission standard for NOx+NMHC
	SO_2	URBEMIS2002, Appendix H	Year 2000; 37.1% efficiency; diesel sulfur content of 15 ppm
	CO	41 CFR 89.112, Tier 2/3 Emission Standards	
	PM_{10}, $PM_{2.5}$	42 CFR 89.112, Tier 2/3 Emission Standards	PM_{10} and $PM_{2.5}$ emission factors equal to Tier 2/3 emission standard for PM
	ROC	40 CFR 89.112, Tier 1 Emission Standards	For Tier 2 engines: ROC emission factor equal to Tier 1 emission standard for NMHC (engines > 175 hp)
		Draft Regulatory Impact Analysis: Control of Emissions from Nonroad Engines (USEPA)	For Tier 3 engines: ROC emission factor based on value twice the ROC estimated certification level for Tier 3 engines in Table 5-5 of reference.
Diesel Offshore Vessel Equipment	All	URBEMIS2002, Appendix H	Year 2000; 37.1% efficiency; diesel sulfur content of 15 ppm; $PM_{2.5}$ assumed equal to PM_{10}
Gasoline Off-Road Equipment	All	SCAQMD CEQA Air Quality Handbook, Table A9-3-A	34.6% efficiency; $PM_{2.5}$ assumed equal to PM_{10}
Gasoline Off-Road Equipment (Mitigation Measure)	SO_2, PM_{10}, $PM_{2.5}$	SCAQMD CEQA Air Quality Handbook, Table A9-3-A	34.6% efficiency; $PM_{2.5}$ assumed equal to PM_{10}
	CO, NO_x, ROC	13 CCR 2433, Exhaust Standards - Off-Road Large Spark Ingition Engines	
Diesel Heavy Heavy Duty Truck	All	EMFAC2002	HHD Trucks; T7; Summer; VCAPCD; Year 2000 with 100,000 miles; I/M; 37.1% efficiency; diesel sulfur content of 15 ppm; $PM_{2.5}$ assumed equal to PM_{10}

Table M11
Assumptions for Emission Factors - Paved and Unpaved Roads
Cabrillo Port LNG Deepwater Port

Paved Roads

Emission Factor = $[k (sL/2)^{0.65} (W/3)^{1.5} - C] [1 - (P/4N)]$

AP-42, Section 13.2.1, Equation (2)

Particulate Size Multiplier	k (for PM_{10})	0.016 lb/VMT	AP-42, Section 13.2.1, Table 13.2.1-1
	k (for $PM_{2.5}$)	0.004 lb/VMT	AP-42, Section 13.2.1, Table 13.2.1-1
Road Surface Silt Loading	sL	1.02 g/m^2	Based on silt loading of 0.03 oz/yd^2 for collector streets (SCAQMD CEQA Air Quality Handbook Table A9-9-C-1)
Average Weight of Vehicles	W	see below	
Emission Factor for Exhaust, Brake Wear, and Tire Wear	C (for PM_{10})	0.00047 lb/VMT	AP-42, Section 13.2.1, Table 13.2.1-2
	C (for PM2.5)	0.00036 lb/VMT	AP-42, Section 13.2.1, Table 13.2.1-2
Number of "Wet Days" in Period	P	17 days	=34 days (180 days/365 days) { 34 days is the average number of annual "wet days" in the South Coast Air Basin [SCAQMD CEQA Air Quality Handbook Table A9-9-C-1] }
Number of Days in Period	N	180 days	Length of construction period

Unpaved Roads

Emission Factor = $[k (s/12)^a (W/3)^b] * [1\text{-Control}]$

AP-42, Section 13.2.2, Equation (1a) modified to account for water control measures

Constants for Equation 1a	k (for PM_{10})	1.5 lb/VMT	AP-42, Section 13.2.2, Table 13.2.2-2
	k (for $PM_{2.5}$)	0.23 lb/VMT	AP-42, Section 13.2.2, Table 13.2.2-2
	a	0.9	AP-42, Section 13.2.2, Table 13.2.2-2
	b	0.45	AP-42, Section 13.2.2, Table 13.2.2-2
Surface Material Silt Content	s	8.5 %	AP-42, Section 13.2.2, Table 13.2.2-1
Average Weight of Vehicles	W	see below	
Water Control Effectiveness	Control	85%	AP-42, Section 13.2.2, Figure 13.2.2-2

Average Weight of Vehicles (W) During Shore Crossing Activities

Equipment	Loaded Weight (tons)	Vehicle Weight (tons)	Mean Weight (tons)	
All Terrain Forklift	5.5	3.5	4.5	
18 Wheeler Truck	40	20	30.0	
Average for Vehicles on Paved Roads[1]			30.00	W for Paved Roads
Average on Unpaved Roads[2]			17.25	W for Unpaved Roads

Notes:
1. Only 18-Wheeler Truck.
2. All vehicles

Average Weight of Vehicles (W) During Onshore Pipeline Installation

Equipment	Loaded Weight (tons)	Vehicle Weight (tons)	Mean Weight (tons)	
Front End Loader	6.5	4.5	5.5	
Dump Truck	16	6	11.0	
Water Truck	10	6	8.0	
Utility Truck	2.5	2.5	2.5	
Heavy Fork Lift	5.5	3.5	4.5	
Low Boy Truck	10.5	6	8.3	
Pipe Stringing Truck	16	6	11.0	
Mobile Crane	25	25	25.0	
Cement Truck	40	19	29.5	
Asphalt Truck	16	6	11.0	
All Terrain Forklift	5.5	3.5	4.5	
18 Wheeler Truck	40	20	30.0	
Average for Vehicles on Paved Roads[1]			13.91	W for Paved Roads
Average on Unpaved Roads[2]			12.56	W for Unpaved Roads

Notes:
1. All vehicles except front end loader, heavy fork lift, mobile crane, and all-terrain forklift
2. All vehicles

Table M12
Emissions from Worker Commuting
Cabrillo Port LNG Deepwater Port

Parameter	Units	Value	Comments
Average One-Way Trip Length	miles/trip	16.2	Average Trip Length (Reference 1, Section 2.3)
Average Roundtrip Distance	miles/roundtrip	32.4	= Average Trip Length x 2

		Emission Factor[a,b,c,d]					
Vehicle Operation	**Units**	**NO_X**	**SO_2**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**ROC**
Running Exhaust & Evaporative	g/mile	0.29	0.05	2.75	0.005	0.005	0.06
Tire Wear	g/mile				0.10	0.10	
Cold Start	g/trip	1.21		47.65			1.30
Hot Start	g/trip	0.58		3.76			0.23
Diurnal	g/vehicle-day						0.54

References:
1. Southern California Association of Governments. July 2000. 1999 State of the Commute Report
2. South Coast Air Quality Management District. April 1993. CEQA Air Quality Handbook

Notes:
a. Emission factors, except SO_2, from Reference 2, Table A9-5-J-10.
b. NO_x and CO emission factors reported for AREA2; running exhaust & evaporative emission factors based on 20 mph. Speed used in emission factor selection based on AM Peak Speed for Los Angeles County (21 mph) from Reference 2, Table A9-5-F.
c. ROC emission factors reported for AREA2; running exhaust & evaporative emission factors based on 35 mph. Speed used in emission factor selection based on Off Peak Speed for Los Angeles County (33 mph) from Reference 2, Table A9-5-F.
d. SO_2 emission factor from Reference 2, Table A9-5-L for AREA2 in 2009.

Onshore Pipeline Construction (Ventura and Los Angeles Counties)

Number of Worker Roundtrips	roundtrips/day	120	
Daily Mileage for All Vehicles	miles/day	3888	Average Roundtrip Distance x Number of Worker Roundtrips
Days with Roundtrips	days	240	

	Emission	Emissions					
Vehicle Operation	**Units**	**NO_X**	**SO_2**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**ROC**
Exhaust & Evaporative, and Tire Wear	Daily (lb/day)	2.5	0.43	23.6	0.900	0.900	0.5
Cold Start, Hot Start, and Diurnal	Daily (lb/day)	0.95		27.2			1.10
All	**Daily (lb/day)**	**3.4**	**0.43**	**50.8**	**0.90**	**0.90**	**1.6**
All	**Total (tons)**	**0.41**	**0.05**	**6.1**	**0.11**	**0.11**	**0.19**

Shore Crossing Construction (Ventura County)

Number of Worker Roundtrips	roundtrips/day	60	
Daily Mileage for All Vehicles	miles/day	1944	Average Roundtrip Distance x Number of Worker Roundtrips
Days with Roundtrips	days	108	

	Emission	Emissions					
Vehicle Operation	**Units**	**NO_X**	**SO_2**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**ROC**
Exhaust & Evaporative, and Tire Wear	Daily (lb/day)	1.2	0.21	11.8	0.450	0.450	0.3
Cold Start, Hot Start, and Diurnal	Daily (lb/day)	0.47		13.6			0.55
All	**Daily (lb/day)**	**1.7**	**0.21**	**25.4**	**0.45**	**0.45**	**0.8**
All	**Total (tons)**	**0.09**	**0.012**	**1.4**	**0.02**	**0.02**	**0.04**

Offshore Pipeline Construction and FSRU/Mooring Installation (Ventura County)

Number of Worker Roundtrips	roundtrips/day	200	
Daily Mileage for All Vehicles	miles/day	6480	Average Roundtrip Distance x Number of Worker Roundtrips
Days with Roundtrips	days	11	Workers stay onboard during duration of offshore construction

	Emission	Emissions					
Vehicle Operation	**Units**	**NO_X**	**SO_2**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**ROC**
Exhaust & Evaporative, and Tire Wear	Daily (lb/day)	4.1	0.71	39.3	1.500	1.500	0.9
Cold Start, Hot Start, and Diurnal	Daily (lb/day)	1.58		45.3			1.83
All	**Daily (lb/day)**	**5.7**	**0.71**	**84.6**	**1.50**	**1.50**	**2.7**
All	**Total (tons)**	0.0315	0.0039	0.47	0.008	0.008	0.015

TOTAL PER COUNTY

	Emission	Emissions					
	Units	**NO_X**	**SO_2**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**ROC**
Ventura County	Daily (lb/day)	10.9	1.36	161	2.9	2.9	5.1
Los Angeles County	Daily (lb/day)	3.4	0.43	51	0.90	0.90	1.6
TOTAL	**Daily (lb/day)**	**14**	**1.8**	**212**	**3.8**	**3.8**	**6.7**
Ventura County	Total (tons)	0.54	0.07	7.9	0.14	0.14	0.25
Los Angeles County	Total (tons)	0.41	0.05	6.1	0.11	0.11	0.19
TOTAL	**Total (tons)**	**0.95**	**0.12**	**14.0**	**0.25**	**0.25**	**0.4**

Table M13
Exhaust Parameters for Mooring/FSRU Installation
Cabrillo Port LNG Deepwater Port

Equipment Type	No.	Maximum Emission Rate [Each Unit] (lb/hr)					Maximum Emission Rate [Each Unit] (g/s)					24-Hour Average Emission Rate [Each Unit] (lb/hr)					24-Hour Average Emission Rate [Each Unit] (g/s)					Stack Dia. (m)	Stack Height (m)	Stack Temp (K)	Exhaust Flow [Each Unit] (m^3/s)	Exit Velocity (m/s)
		NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$					
AHTS	2	22.8	0.0160	28.1	1.32	1.32	2.88	0.00202	3.54	0.167	0.167	22.8	0.016	28.1	1.32	1.32	2.88	0.00202	3.54	0.167	0.167	0.923	7.000	700	4.69	7.01
Crew Boat	1	5.25	0.0037	6.47	0.304	0.304	0.661	0.00046	0.815	0.0383	0.0383	3.5	0.002	4.31	0.20	0.20	0.441	0.00031	0.543	0.0256	0.0256	0.292	7.000	700	1.08	16.1
Construction Barge	1	52.3	0.0367	64.5	3.03	3.03	6.59	0.00462	8.12	0.382	0.382	52.3	0.037	64.5	3.03	3.03	6.59	0.00462	8.12	0.382	0.382	0.674	7.000	700	10.7	30.1
Tug	1	8.90	0.0062	11.0	0.516	0.516	1.12	0.00079	1.38	0.065	0.065	8.9	0.006	11.0	0.52	0.52	1.12	0.00079	1.38	0.065	0.065	0.607	7.000	700	1.83	6.32
Ocean Going Tug	1	76.1	0.0533	93.7	4.41	4.41	9.58	0.00672	11.81	0.556	0.556	76.1	0.053	93.7	4.41	4.41	9.58	0.00672	11.81	0.556	0.556	1.191	7.000	700	15.6	14.0

Table M14
Exhaust Parameters for Offshore Pipeline Installation
Cabrillo Port LNG Deepwater Port

Equipment Type	No.	Maximum Emission Rate [Each Unit] (lb/hr)					Maximum Emission Rate [Each Unit] (g/s)					24-Hour Average Emission Rate [Each Unit] (lb/hr)					24-Hour Average Emission Rate [Each Unit] (g/s)					Stack Dia. (m)	Stack Height (m)	Stack Temp (K)	Exhaust Flow [Each Unit] (m^3/s)	Exit Velocity (m/s)
		NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$					
Pipe Laying Vessel	1	179	0.125	220	10.4	10.4	22.5	0.0158	27.7	1.31	1.31	179	0.1253	220	10.36	10.36	22.5	0.0158	27.7	1.31	1.31	1.191	7.000	700	36.7	33.0
AHTS	2	22.8	0.0160	28.1	1.32	1.32	2.88	0.00202	3.54	0.167	0.167	22.8	0.0160	28	1.32	1.32	2.88	0.00202	3.54	0.167	0.167	0.923	7.000	700	4.69	7.01
Crew Boat	1	5.25	0.0037	6.47	0.304	0.304	0.661	0.00046	0.815	0.0383	0.0383	3.50	0.0025	4.3	0.20	0.20	0.441	0.00031	0.543	0.0256	0.0256	0.292	7.000	700	1.08	16.1
Tug Boat & Barge	1	15.8	0.0111	19.5	0.917	0.917	1.99	0.00140	2.46	0.116	0.116	10.5	0.0074	13	0.61	0.61	1.33	0.00093	1.64	0.077	0.077	0.476	7.000	700	3.25	18.3

Table M15
Exhaust Parameters for Shore Crossing Construction
Cabrillo Port LNG Deepwater Port

Equipment Type	No.	Maximum Emission Rate [Each Unit] (lb/hr) NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	Maximum Emission Rate [Each Unit] (g/s) NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	24-Hour Average Emission Rate [Each Unit] (lb/hr) NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	24-Hour Average Emission Rate [Each Unit] (g/s) NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	Stack Dia. (m)	Stack Height (m)	Stack Temp (K)	Exhaust Flow [Each Unit] (m^3/s)	Exit Velocity (m/s)
Onshore Equipment																										
In-hole head drive unit	1	2.65	0.00427	2.29	0.1323	0.1323	0.333	0.00054	0.289	0.0167	0.0167	0.66	0.00107	0.57	0.0331	0.0331	0.083	0.000134	0.072	0.00417	0.00417	0.238	4.000	700	1.250	28.1
Mud pumps	2	2.65	0.00427	2.29	0.1323	0.1323	0.333	0.00054	0.289	0.0167	0.0167	0.99	0.0015995	0.86	0.0496	0.0496	0.125	0.000202	0.108	0.00625	0.00625	0.168	4.000	700	1.250	56.4
Solids control unit	1	3.31	0.00533	2.87	0.1653	0.1653	0.417	0.00067	0.361	0.0208	0.0208	1.24	0.00200	1.07	0.0620	0.0620	0.156	0.000252	0.135	0.00781	0.00781	0.238	4.000	700	1.562	35.1
Thrusting apparatus	1	1.98	0.0032	1.7196	0.0992	0.0992	0.250	0.00040	0.217	0.0125	0.0125	0.50	0.0007998	0.43	0.0248	0.0248	0.063	0.000101	0.054	0.00313	0.00313	0.238	4.000	700	0.937	21.1
Electrical generator	1	2.12	0.00341	1.83	0.1058	0.1058	0.267	0.00043	0.231	0.0133	0.0133	2.12	0.00341	1.83	0.1058	0.1058	0.267	0.000430	0.231	0.01333	0.01333	0.151	4.000	700	1.000	55.9
All Terrain Forklift	1	0.198	0.00032	0.2447	0.0146	0.0146	0.0250	0.00004	0.031	0.0018	0.0018	0.10	0.00016	0.12	0.0073	0.0073	0.013	0.000020	0.015	0.00092	0.00092	0.075	4.000	700	0.094	21.2
Mobile crane	1	2.12	0.00341	1.83	0.1058	0.1058	0.267	0.00043	0.231	0.0133	0.0133	0.63	0.00102	0.55	0.0317	0.0317	0.080	0.000129	0.069	0.00400	0.00400	0.238	4.000	700	1.000	22.5
Welding machines	3	0.529	0.00085	0.4586	0.0265	0.0265	0.067	0.00011	0.058	0.0033	0.0033	0.26	0.0004265	0.23	0.0132	0.0132	0.033	0.000054	0.029	0.00167	0.00167	0.151	4.000	700	0.250	14.0
Contingency	1	4.63	0.00746	4.01	0.2315	0.2315	0.58	0.00094	0.506	0.0292	0.0292	4.63	0.00746	4.01	0.2315	0.2315	0.583	0.000941	0.506	0.029	0.029	0.305	4.000	700	2.187	30.0
18 Wheeler Truck[a]	2	1.00	0.0032	0.0517	0.0079	0.0079	0.126	0.00040	0.0065	0.0010	0.0010	0.08	0.0002666	0.00	0.00066	0.00066	0.0105	0.000034	0.00054	0.000083	0.000083	0.185	4.000	700	0.625	23.3
Offshore Equipment																										
Exit Hole Barge Tug	1	3.04	0.00213	3.7479	0.1764	0.1764	0.38	0.00027	0.47	0.0222	0.0222	3.04	0.00213	3.75	0.176	0.176	0.383	0.00027	0.472	0.022	0.022	0.476	7.000	700	0.6	3.5
AHTS	1	22.8	0.016	28.109	1.3228	1.3228	2.88	0.0020	3.54	0.167	0.167	22.82	0.0160	28.1	1.323	1.323	2.875	0.00202	3.542	0.167	0.167	0.923	7.000	700	4.7	7.0

Notes:

a. Emission rates based on 2 hr/day operation and exhaust flow assumes 400 hp engine operating at 50% load.

Fugitive Dust Emissions (in Construction Zone)[a]

Equipment Type	No.	Emission Rate (lb/hr) PM_{10}	$PM_{2.5}$	Emission Rate (g/s) PM_{10}	$PM_{2.5}$
All Terrain Forklift	1	0.024	0.00371	0.0030	0.0005
18 Wheeler Truck	2	0.034	0.00675	0.0043	0.0009
Track Backhoe	1	0.18	0.10	0.0227	0.0126
TOTAL		**0.24**	**0.11**	**0.030**	**0.014**

Notes:

a. Average emission rates for 24 hr-period.

Table M16
Exhaust Parameters for Onshore Pipeline Installation - Trenching (with Mitigation Measures)
Cabrillo Port LNG Deepwater Port

Equipment Type	No.	Maximum Emission Rate [Each Unit] (lb/hr)					Maximum Emission Rate [Each Unit] (g/s)					24-Hour Average Emission Rate [Each Unit] (lb/hr)					24-Hour Average Emission Rate [Each Unit] (g/s)					Stack Dia. (m)	Stack Height (m)	Stack Temp (K)	Exhaust Flow [Each Unit] (m^3/s)	Exit Velocity (m/s)
		NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$					
Trenching Machine	1	8.47	0.00853	4.59	0.2646	0.2646	1.07	0.0011	0.578	0.0333	0.0333	4.23	0.004265	2.29	0.13228	0.1323	0.53	0.0005	0.289	0.0167	0.0167	0.300	2.500	700	2.50	35.4
Track Backhoe	1	2.65	0.00427	2.29	0.1323	0.1323	0.333	0.00054	0.289	0.0167	0.0167	1.32	0.002133	1.15	0.06614	0.0661	0.167	0.00027	0.144	0.0083	0.0083	0.200	2.500	700	1.25	39.8
Front Loader	1	0.66	0.00107	0.57	0.0331	0.0331	0.083	0.00013	0.0722	0.0042	0.0042	0.33	0.000533	0.29	0.01653	0.0165	0.042	0.00007	0.0361	0.0021	0.0021	0.100	2.500	700	0.312	39.8
Bulldozer	1	0.66	0.00107	0.57	0.0331	0.0331	0.083	0.00013	0.0722	0.0042	0.0042	0.33	0.000533	0.29	0.01653	0.0165	0.042	0.00007	0.0361	0.0021	0.0021	0.100	2.500	700	0.312	39.8
Dragline	1	0.66	0.00107	0.57	0.0331	0.0331	0.083	0.00013	0.0722	0.0042	0.0042	0.33	0.000533	0.29	0.01653	0.0165	0.042	0.00007	0.0361	0.0021	0.0021	0.100	2.500	700	0.312	39.8
Concrete Saw	1	0.165	0.00723	2.04	0.0072	0.0072	0.0208	0.00091	0.257	0.0009	0.0009	0.08	0.003613	1.02	0.00361	0.00361	0.0104	0.00046	0.128	0.00046	0.00046	0.050	2.500	700	0.0781	39.8

Fugitive Dust Emissions (in Construction Zone)[a]

Equipment Type	No.	Emission Rate (lb/hr)		Emission Rate (g/s)	
		PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Front Loader	1	0.08	0.012	0.010	0.002
Track Backhoe	1	0.18	0.10	0.023	0.013
Bulldozer	1	0.18	0.10	0.023	0.013
Dragline	1	0.18	0.10	0.023	0.013
Trenching Machine	3	0.0178	0.00355	0.002	0.000
TOTAL		**0.64**	**0.32**	**0.080**	**0.040**

Notes:
a. Average emission rates over a 24 hr-period (including periods of inactivity).

Table M17
Exhaust Parameters for Onshore Pipeline Installation - Pipelay (with Mitigation Measures)
Cabrillo Port LNG Deepwater Port

		Maximum Emission Rate [Each Unit]										24-Hour Average Emission Rate [Each Unit]														
		(lb/hr)					(g/s)					(lb/hr)					(g/s)									
Equipment Type	**No.**	**NO_X**	**SO_2**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**NO_X**	**SO_2**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**NO_X**	**SO_2**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**NO_X**	**SO_2**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**Stack Dia. (m)**	**Stack Height (m)**	**Stack Temp (K)**	**Exhaust Flow [Each Unit] (m^3/s)**	**Exit Velocity (m/s)**
Heavy Fork Lift	1	0.66	0.001066	0.573	0.0331	0.0331	0.083	0.000134	0.0722	0.00417	0.0042	0.33	0.00053	0.287	0.0165	0.0165	0.042	0.000067	0.0361	0.00208	0.0021	0.107	2.500	700	0.312	34.8
Sideboom Tractor	2	0.66	0.001066	0.573	0.0331	0.0331	0.083	0.000134	0.0722	0.00417	0.0042	0.33	0.00053	0.287	0.0165	0.0165	0.042	0.000067	0.0361	0.00208	0.0021	0.151	2.500	700	0.312	17.5
Mobile Crane	1	0.66	0.001066	0.573	0.0331	0.0331	0.083	0.000134	0.0722	0.00417	0.0042	0.33	0.00053	0.287	0.0165	0.0165	0.042	0.000067	0.0361	0.00208	0.0021	0.107	2.500	700	0.312	34.8
Pipe Bending Machine	1	0.33	0.000533	0.408	0.0243	0.0243	0.042	0.000067	0.0514	0.00306	0.0031	0.17	0.00027	0.204	0.0121	0.0121	0.021	0.000034	0.0257	0.00153	0.0015	0.075	2.500	700	0.156	35.4
Hydrostatic Test Pump	1	0.66	0.001066	0.573	0.0331	0.0331	0.083	0.000134	0.0722	0.00417	0.0042	0.33	0.00053	0.287	0.0165	0.0165	0.042	0.000067	0.0361	0.00208	0.0021	0.107	2.500	700	0.312	34.8
Fill Dirt Screener	1	0.66	0.001066	0.573	0.0331	0.0331	0.083	0.000134	0.0722	0.00417	0.0042	0.33	0.00053	0.287	0.0165	0.0165	0.042	0.000067	0.0361	0.00208	0.0021	0.107	2.500	700	0.312	34.8
Sheepsfoot Compactor	1	0.66	0.001066	0.573	0.0331	0.0331	0.083	0.000134	0.0722	0.00417	0.0042	0.33	0.00053	0.287	0.0165	0.0165	0.042	0.000067	0.0361	0.00208	0.0021	0.107	2.500	700	0.312	34.8
Cement Pump	1	0.33	0.000533	0.408	0.0243	0.0243	0.042	0.000067	0.0514	0.00306	0.0031	0.17	0.00027	0.204	0.0121	0.0121	0.021	0.000034	0.0257	0.00153	0.0015	0.075	2.500	700	0.156	35.4
Asphalt Paving Machine	1	0.66	0.001066	0.573	0.0331	0.0331	0.083	0.000134	0.0722	0.00417	0.0042	0.33	0.00053	0.287	0.0165	0.0165	0.042	0.000067	0.0361	0.00208	0.0021	0.107	2.500	700	0.312	34.8
Asphalt Roller	1	0.33	0.000533	0.408	0.0243	0.0243	0.0417	0.000067	0.0514	0.00306	0.0031	0.17	0.00027	0.204	0.0121	0.0121	0.0208	0.000034	0.0257	0.00153	0.0015	0.075	2.500	700	0.156	35.4
Welding Generator	2	0.17	0.007225	2.039	0.0072	0.0072	0.0208	0.000910	0.257	0.000910	0.00091	0.08	0.00361	1.020	0.0036	0.0036	0.0104	0.000455	0.128	0.000455	0.00046	0.075	2.500	700	0.078	17.7
Utility Generator	2	0.17	0.007225	2.039	0.0072	0.0072	0.0208	0.000910	0.257	0.000910	0.00091	0.08	0.00361	1.020	0.0036	0.0036	0.0104	0.000455	0.128	0.000455	0.00046	0.075	2.500	700	0.078	17.7
Air Compressor	2	0.17	0.007225	2.039	0.0072	0.0072	0.0208	0.000910	0.257	0.000910	0.00091	0.08	0.00361	1.020	0.0036	0.0036	0.0104	0.000455	0.128	0.000455	0.00046	0.075	2.500	700	0.078	17.7
Dewatering Pump	2	0.17	0.007225	2.039	0.0072	0.0072	0.0208	0.000910	0.257	0.000910	0.00091	0.08	0.00361	1.020	0.0036	0.0036	0.0104	0.000455	0.128	0.000455	0.00046	0.075	2.500	700	0.078	17.7
Vibratory Roller	2	0.17	0.007225	2.039	0.0072	0.0072	0.0208	0.000910	0.257	0.000910	0.00091	0.08	0.00361	1.020	0.0036	0.0036	0.0104	0.000455	0.128	0.000455	0.00046	0.075	2.500	700	0.078	17.7
Hydraulic Tamper	2	0.17	0.007225	2.039	0.0072	0.0072	0.0208	0.000910	0.257	0.000910	0.00091	0.08	0.00361	1.020	0.0036	0.0036	0.0104	0.000455	0.128	0.000455	0.00046	0.075	2.500	700	0.078	17.7
Dump Truck[a]	2	0.999	0.00320	0.0517	0.00787	0.00787	0.126	0.000403	0.00651	0.00099	0.00099	0.08	0.00027	0.004	0.0007	0.0007	0.010	0.000034	0.00054	0.00008	0.00008	0.185	4.000	700	0.625	23.3
Water Truck[a]	2	0.999	0.00320	0.0517	0.00787	0.00787	0.126	0.000403	0.00651	0.00099	0.00099	0.08	0.00027	0.004	0.0007	0.0007	0.010	0.000034	0.00054	0.00008	0.00008	0.185	4.000	700	0.625	23.3
Utility Truck[a]	2	0.999	0.00320	0.0517	0.00787	0.00787	0.126	0.000403	0.00651	0.00099	0.00099	0.08	0.00027	0.004	0.0007	0.0007	0.010	0.000034	0.00054	0.00008	0.00008	0.185	4.000	700	0.625	23.3
Lowboy Truck[a]	4	1.998	0.00640	0.1033	0.01574	0.01574	0.252	0.000806	0.01302	0.00198	0.00198	0.17	0.00053	0.009	0.0013	0.0013	0.021	0.000067	0.00108	0.00017	0.00017	0.185	4.000	700	0.625	23.3
Pipe Stringing Truck[a]	2	0.999	0.00320	0.0517	0.00787	0.00787	0.126	0.000403	0.00651	0.00099	0.00099	0.08	0.00027	0.004	0.0007	0.0007	0.010	0.000034	0.00054	0.00008	0.00008	0.185	4.000	700	0.625	23.3
Cement Truck[a]	2	0.999	0.00320	0.0517	0.00787	0.00787	0.126	0.000403	0.00651	0.00099	0.00099	0.08	0.00027	0.004	0.0007	0.0007	0.010	0.000034	0.00054	0.00008	0.00008	0.185	4.000	700	0.625	23.3
Asphalt Truck[a]	2	0.999	0.00320	0.0517	0.00787	0.00787	0.126	0.000403	0.00651	0.00099	0.00099	0.08	0.00027	0.004	0.0007	0.0007	0.010	0.000034	0.00054	0.00008	0.00008	0.185	4.000	700	0.625	23.3

Notes:

a. Emission rates based on 2 hr/day operation and exhaust flow assumes 400 hp engine operating at 50% load.

Fugitive Dust Emissions (in Construction Zone)[a]

		(lb/hr)		(g/s)	
Equipment Type	**No.**	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Mobile Crane	1	0.0013	0.00020	0.00016	0.00003
Heavy Forklift	1	0.0406	0.00622	0.005	0.0008
Trucks	16	0.19	0.033	0.023	0.0041
Sideboom Tractor	2	0.36	0.20	0.045	0.025
Sheepsfoot Compactor	1	0.18	0.10	0.023	0.013
Fill Dirt Screener	3	0.021	0.0014	0.003	0.00018
TOTAL		**0.79**	**0.34**	**0.10**	**0.043**

Notes:

a. Average emission rates over a 24 hr-period (including periods of inactivity).

Table M18
Exhaust Parameters for Onshore Pipeline Installation - Boring
Cabrillo Port LNG Deepwater Port

Equipment Type	No.	Maximum Emission Rate [Each Unit] (lb/hr)					Maximum Emission Rate [Each Unit] (g/s)					24-Hour Average Emission Rate [Each Unit] (lb/hr)					24-Hour Average Emission Rate [Each Unit] (g/s)					Stack Dia. (m)	Stack Height (m)	Stack Temp (K)	Exhaust Flow [Each Unit] (m^3/s)	Exit Velocity (m/s)
		NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$					
Horizontal Boring Rig	1	8.47	0.00853	4.59	0.2646	0.2646	1.07	0.00107	0.578	0.0333	0.0333	8.47	0.00853	4.59	0.264556	0.264556	1.07	0.00107	0.578	0.0333	0.0333	0.238	4.000	700	2.50	56.2
Track Backhoe	1	0.6614	0.00107	0.5732	0.0331	0.0331	0.083	0.00013	0.0722	0.0042	0.0042	0.33	0.00053	0.29	0.016535	0.016535	0.042	0.00007	0.0361	0.0021	0.0021	0.107	4.000	700	0.312	34.8
All Terrain Forklift	1	0.331	0.00053	0.4079	0.0243	0.0243	0.0417	0.00007	0.0514	0.0031	0.0031	0.17	0.00027	0.20	0.012125	0.012125	0.0208	0.00003	0.0257	0.0015	0.0015	0.075	4.000	700	0.156	35.4
Light Towers	6	0.2469	0.00021	0.2161	0.0265	0.0265	0.0311	0.00003	0.0272	0.0033	0.0033	0.12	0.00011	0.11	0.013228	0.013228	0.0156	0.00001	0.0136	0.0017	0.0017	0.051	2.500	700	0.0625	30.6
Heavy Lift Crane	1	1.65	0.00267	1.43	0.0827	0.0827	0.208	0.00034	0.181	0.0104	0.0104	0.41	0.00067	0.36	0.020668	0.020668	0.052	0.00008	0.045	0.0026	0.0026	0.168	4.000	700	0.781	35.3
18 Wheeler Truck[a]	2	1.00	0.00320	0.0517	0.0079	0.0079	0.126	0.00040	0.0065	0.0010	0.0010	0.08	0.00027	0.00	0.000656	0.000656	0.010	0.00003	0.0005	0.0001	0.0001	0.185	4.000	700	0.625	23.3

Notes:

a. Emission rates based on 2 hr/day operation and exhaust flow assumes 400 hp engine operating at 50% load.

Fugitive Dust Emissions (in Construction Zone)[a]

Equipment Type	No.	(lb/hr)		(g/s)	
		PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
All Terrain Forklift	1	0.024	0.0037	0.0030	0.0005
18 Wheeler Truck	2	0.034	0.0067	0.0043	0.0009
Track Backhoe	1	0.18	0.10	0.023	0.013
TOTAL		**0.24**	**0.11**	**0.030**	**0.014**

Notes:

a. Average emission rates over a 24 hr-period (including periods of inactivity).

Table M19
Exhaust Parameters for Onshore Pipeline Installation - Drilling
Cabrillo Port LNG Deepwater Port

		Maximum Emission Rate [Each Unit]										24-Hour Average Emission Rate [Each Unit]										Stack Dia. (m)	Stack Height (m)	Stack Temp (K)	Exhaust Flow [Each Unit] (m^3/s)	Exit Velocity (m/s)
		(lb/hr)					(g/s)					(lb/hr)					(g/s)									
Equipment Type	**No.**	**NO_X**	**SO_2**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**NO_X**	**SO_2**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**NO_X**	**SO_2**	**CO**	**PM_{10}**	**$PM_{2.5}$**	**NO_X**	**SO_2**	**CO**	**PM_{10}**	**$PM_{2.5}$**					
Large Drilling Rig (HDD)	2	2.65	0.00427	2.29	0.1323	0.1323	0.333	0.00054	0.289	0.0167	0.0167	2.65	0.00427	2.29	0.132278	0.132278	0.333	0.00054	0.289	0.0167	0.0167	0.238	4.000	700	1.250	28.1
Mud Cleaner Generator	1	2.12	0.00341	1.83	0.1058	0.1058	0.267	0.00043	0.231	0.0133	0.0133	2.12	0.00341	1.83	0.105822	0.105822	0.267	0.00043	0.231	0.0133	0.0133	0.151	4.000	700	1.000	55.9
Mud Pumps	2	2.65	0.00427	2.29	0.1323	0.1323	0.333	0.00054	0.289	0.0167	0.0167	2.65	0.00427	2.29	0.132278	0.132278	0.333	0.00054	0.289	0.0167	0.0167	0.238	4.000	700	1.250	28.1
Fluid Handling Pumps	4	0.7408	0.00064	0.4894	0.0397	0.0397	0.093	0.00008	0.062	0.0050	0.0050	0.74	0.00064	0.49	0.039683	0.039683	0.093	0.00008	0.062	0.0050	0.0050	0.130	4.000	700	0.187	14.1
Track Backhoe	1	0.6614	0.00107	0.5732	0.0331	0.0331	0.083	0.00013	0.072	0.0042	0.0042	0.33	0.00053	0.29	0.016535	0.016535	0.042	0.00007	0.036	0.0021	0.0021	0.107	4.000	700	0.312	34.8
All Terrain Forklift	1	0.331	0.00053	0.4079	0.0243	0.0243	0.042	0.00007	0.051	0.0031	0.0031	0.17	0.00027	0.20	0.012125	0.012125	0.021	0.00003	0.026	0.0015	0.0015	0.075	4.000	700	0.156	35.4
Light Towers	6	0.2469	0.00021	0.2161	0.0265	0.0265	0.031	0.00003	0.027	0.0033	0.0033	0.12	0.00011	0.11	0.013228	0.013228	0.016	0.00001	0.014	0.0017	0.0017	0.050	2.500	700	0.0625	31.8
Heavy Lift Crane	1	1.65	0.00267	1.43	0.0827	0.0827	0.208	0.00034	0.181	0.0104	0.0104	0.41	0.00067	0.36	0.020668	0.020668	0.052	0.00008	0.045	0.0026	0.0026	0.168	4.000	700	0.781	35.3
18 Wheeler Truck	2	1.00	0.00320	0.0517	0.0079	0.0079	0.126	0.00040	0.0065	0.0010	0.0010	0.08	0.00027	0.00	0.000656	0.000656	0.010	0.00003	0.0005	0.00008	0.00008	0.185	4.000	700	0.625	23.3

Fugitive Dust Emissions (in Construction Zone)[a]

		(lb/hr)		(g/s)	
Equipment Type	**No.**	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
All Terrain Forklift	1	0.024	0.0037	0.0030	0.0005
18 Wheeler Truck	2	0.034	0.0067	0.0043	0.0009
Track Backhoe	1	0.18	0.10	0.023	0.013
TOTAL		**0.24**	**0.11**	**0.030**	**0.014**

Notes:

a. Average emission rates over a 24 hr-period (including periods of inactivity).