APPENDIX E

AIR QUALITY EMISSIONS CALCULATIONS

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Table 1. Emission Source Data for Construction of LWI - Pile-Supported Pier

Construction Activity/Equipment Type	*Max HP Rating*	*Ave. Daily Load Factor*	*Number Active*	*Estimated Avg HP*	*Hours/ Day*	*Daily Hp-Hrs*	*Work Days*	*Total Hp-Hrs*
Construction (1) (10)								
Crane Hoist	564	0.25	1	141	4.0	564	80.0	45,120
Generator - Pile Hammer	190	0.60	1	114	8.0	912	80.0	72,960
Tugboat	1,200	0.25	1	300	1.0	300	50.0	15,000
Barge Equipment	195	0.50	1	98	12.0	1,170	50.0	58,500
Tugboat - Material Deliveries (2) (3)	1,200	0.50	1	600	9.7	5,797	16.0	92,754
Backhoe	160	0.50	1	80	4.0	320	8.0	2,560
Bulldozer - D6	165	0.50	1	83	8.0	660	12.0	7,920
Compactive Roller (4)	165	0.50	1	83	8.0	660	8.0	5,280
Fugitive Dust (5)	NA	NA	1	NA	NA	NA	12.0	6
Grader	180	0.50	1	90	8.0	720	8.0	5,760
Haul Truck - Soil (6) (7)	NA	NA	34	NA	20.0	680	95.0	64,600
Other Construction Truck Traffic (6) (8)	NA	NA	20	NA	8.0	160	540.0	86,400
Other Construction Traffic (6) (8)	NA	NA	20	NA	30.0	600	540.0	324,000
Loader	215	0.50	1	108	8.0	860	8.0	6,880
Paving Machine	200	0.50	1	100	8.0	800	8.0	6,400
Water Truck - 5,000 Gallons	175	0.40	1	70	6.0	420	12.0	5,040
Phase 2 Grate/Mesh Installation (9)								
Tugboat	1,200	0.25	1	300	1	300	260.0	78,000
Barge Equipment	195	0.50	1	98	12	1,170	260.0	304,200
Derrick Barge Crane Hoist	564	0.25	1	141	4	564	260.0	146,640

Notes: (1) Pile driving equipment usage estimates based on 80 days.

(2) Hours per day = Hours per trip, Daily HP Hours = HP hours per trip, and Work Days = # of trips

(3) Assuming that the materials are 50 miles away and the tug travels at a speed of 9 knots

(4) Number Active is acres to be paved.

(5) Number Active = acres disturbed per day, Total Hp-Hrs = total acre-days.

(6) Number Active = miles/roundtrip, Hours/Day = daily truck trips, Daily Hp-Hrs = daily miles, and Total Hp-Hrs = total miles.

(7) Assuming that concrete comes from Bremerton, WA, a round trip distance of 34 miles.

(8) Average round trip for construction related truck or vehicle trip estimated at 20 miles.

(9) Phase 2 will be the remaining days, 260, of the over-water construction period.

(10) Phase 1 construction activity data based on an acreage comparison of POLA Berths 136-147 Container Terminal Project, FEIS/FEIR December 2007 and the SCAQMD construction survey.

Table 2. Emission Source Data for Construction of LWI - PSB Modifications

Construction Activity/Equipment Type	*Max HP Rating*	*Ave. Daily Load Factor*	*Number Active*	*Estimated Avg HP*	*Hours/ Day*	*Daily Hp-Hrs*	*Work Days*	*Total Hp-Hrs*
Construction (1) (9)								
Crane Hoist	564	0.25	1	141	4.0	564	30.0	16,920
Generator - Pile Hammer	190	0.60	1	114	8.0	912	30.0	27,360
Tugboat	1,200	0.25	1	300	1.0	300	30.0	9,000
Barge Equipment	195	0.50	1	98	12.0	1,170	30.0	35,100
Tugboat - Material Deliveries (2) (3)	1,200	0.50	1	600	9.7	5,797	3.0	17,391
Backhoe	160	0.50	1	80	4.0	320	8.0	2,560
Bulldozer - D6	165	0.50	1	83	8.0	660	12.0	7,920
Compactive Roller (4)	165	0.50	1	83	8.0	660	8.0	5,280
Fugitive Dust (5)	NA	NA	0.5	NA	NA	NA	12.0	6
Grader	180	0.50	1	90	8.0	720	8.0	5,760
Haul Truck - Soil (6) (7)	NA	NA	34	NA	20.0	680	95.0	64,600
Other Construction Truck Traffic (6) (8)	NA	NA	20	NA	8.0	160	540.0	86,400
Other Construction Traffic (6) (8)	NA	NA	20	NA	30.0	600	540.0	324,000
Loader	215	0.50	1	108	8.0	860	8.0	6,880
Paving Machine	200	0.50	1	100	8.0	800	8.0	6,400
Semi Truck (6) (8)	NA	NA	93	NA	2.0	186	8.0	1,488
Water Truck - 5,000 Gallons	175	0.40	1	70	6.0	420	12.0	5,040

Notes: (1) Pile driving equipment usage estimates based on 30 days.

(2) Hours per day = Hours per trip, Daily HP Hours = HP hours per trip, and Work Days = # of trips

(3) Assuming that the materials are 50 miles away and the tug travels at a speed of 9 knots

(4) Number Active is acres to be paved.

(5) Number Active = acres disturbed per day, Total Hp-Hrs = total acre-days.

(6) Number Active = miles/roundtrip, Hours/Day = daily truck trips, Daily Hp-Hrs = daily miles, and Total Hp-Hrs = total miles.

(7) Assuming that concrete comes from Bremerton, WA, a round trip distance of 34 miles.

(8) Average round trip for construction related truck or vehicle trip estimated at 20 miles.

(9) Data for construction activity taking place on land based on an acreage comparison of POLA Berths 136-147 Container Terminal Project, FEIS/FEIR December 2007 and the SCAQMD construction survey.

Table 3. Emission Source Data for Construction of SPE - Short Pier

Construction Activity/Equipment Type	Max HP Rating	Ave. Daily Load Factor	Number Active	Estimated Avg HP	Hours/ Day	Daily Hp-Hrs	Work Days	Total Hp-Hrs
Over Water Construction (1)								
Crane Hoist	564	0.25	1	141	4.0	564	161.0	90,804
Generator - Pile Hammer	190	0.60	1	114	8.0	912	161.0	146,832
Tugboat	1,200	0.25	1	300	1.0	300	161.0	48,300
Barge Equipment	195	0.50	1	98	12.0	1,170	161.0	188,370
Tugboat - Material Deliveries (2) (3)	1,200	0.50	1	600	9.7	5,797	144.0	834,783
Pier Services and Compressor Bldg (7)								
Air Compressor - 100 CFM	50	0.60	1	30	6.0	180	3.6	648
Concrete/Industrial Saw	84	0.73	1	61	6.0	368	3.6	1,325
Crane	190	0.30	1	57	6.0	342	3.6	1,231
Forklift	94	0.48	1	45	6.0	268	3.6	964
Generator	45	0.60	1	27	8.0	216	3.6	778
Fugitive Dust (6)	NA	NA	0.05	NA	8.0	NA	0.9	1.0
Waterfront Ship Support Building (7)								
Air Compressor - 100 CFM	50	0.60	1	30	6.0	180	90.0	16,200
Concrete/Industrial Saw	84	0.73	1	61	6.0	368	90.0	33,113
Crane	190	0.30	1	57	6.0	342	90.0	30,780
Forklift	94	0.48	1	45	6.0	268	90.0	24,111
Generator	45	0.60	1	27	8.0	216	90.0	19,440
Fugitive Dust (6)	NA	NA	1.1	NA	8.0	NA	21.8	25
Parking Lot (7)								
Paving Machine	200	0.50	1	100	8.0	800	4.0	3,200
Water Truck - 5,000 Gallons	175	0.40	1	70	8.0	560	5.7	3,200
Compactive Roller	165	0.50	2	165	8.0	1,320	2.3	3,093
Scraper	195	0.50	2	195	8.0	1,560	4.0	6,240
Grader	180	0.50	1	90	8.0	720	5.0	3,600
Loader	215	0.50	1	108	8.0	860	5.0	4,300
Backhoe	160	0.50	1	80	8.0	640	4.0	2,560
Bulldozer - D6	165	0.50	1	83	8.0	660	4.0	2,640
Fugitive Dust (6)	NA	NA	3	NA	8.0	NA	5.7	17
Construction Truck and Vehicle Trips								
Construction Truck Traffic (4) (5)	NA	NA	20	NA	18.0	360	400	144,000
Construction Vehicle Traffic (4) (5)	NA	NA	20	NA	70.0	1,400	400	560,000

Notes: (1) Pile driving equipment usage estimates based on 161 days.

(2) Hours per day = Hours per trip, Daily HP Hours = HP hours per trip, and Work Days = # of trips

(3) Assuming that the materials are 50 miles away and the tug travels at a speed of 9 knots

(4) Number Active = miles/roundtrip, Hours/Day = daily truck trips, Daily Hp-Hrs = daily miles, and Total Hp-Hrs = total miles.

(5) Average round trip for construction related truck or vehicle trip estimated at 20 miles.

(6) Number Active = acres disturbed per day, Total Hp-Hrs = total acre-days.

(7) Construction is based on a acreage comparison of POLA Berths 136-147 Container Terminal Project, FEIS/FEIR December 2007, the SCAQMD construction survey and data provided by the US Navy in a 3/20/2013 email.

Table 4. Emission Source Data for Construction of SPE - Long Pier

Construction Activity/Equipment Type	*Max HP Rating*	*Ave. Daily Load Factor*	*Number Active*	*Estimated Avg HP*	*Hours/ Day*	*Daily Hp-Hrs*	*Work Days*	*Total Hp-Hrs*
Over Water Construction (1)								
Crane Hoist	564	0.25	1	141	4.0	564	205.0	115,620
Generator - Pile Hammer	190	0.60	1	114	8.0	912	205.0	186,960
Tugboat	1,200	0.25	1	300	1.0	300	205.0	61,500
Barge Equipment	195	0.50	1	98	12.0	1,170	205.0	239,850
Tugboat - Material Deliveries (2) (3)	1,200	0.50	1	600	9.7	5,797	252.0	1,460,870
Pier Services and Compressor Bldg (7)								
Air Compressor - 100 CFM	50	0.60	1	30	6.0	180	3.6	648
Concrete/Industrial Saw	84	0.73	1	61	6.0	368	3.6	1,325
Crane	190	0.30	1	57	6.0	342	3.6	1,231
Forklift	94	0.48	1	45	6.0	268	3.6	964
Generator	45	0.60	1	27	8.0	216	400.0	86,400
Fugitive Dust (6)	NA	NA	0.05	NA	8.0	NA	4.0	0
Waterfront Ship Support Building (7)								
Air Compressor - 100 CFM	50	0.60	1	30	6.0	180	90.0	16,200
Concrete/Industrial Saw	84	0.73	1	61	6.0	368	90.0	33,113
Crane	190	0.30	1	57	6.0	342	90.0	30,780
Forklift	94	0.48	1	45	6.0	268	90.0	24,111
Generator	45	0.60	1	27	8.0	216	90.0	19,440
Fugitive Dust (6)	NA	NA	1	NA	8.0	NA	21.8	25
Parking Lot (7)								
Paving Machine	200	0.50	1	100	8.0	800	4.0	3,200
Water Truck - 5,000 Gallons	175	0.40	1	70	8.0	560	5.7	3,200
Compactive Roller	165	0.50	2	165	8.0	1,320	2.3	3,093
Scraper	195	0.50	2	195	8.0	1,560	4.0	6,240
Grader	180	0.50	1	90	8.0	720	5.0	3,600
Loader	215	0.50	1	108	8.0	860	5.0	4,300
Backhoe	160	0.50	1	80	8.0	640	4.0	2,560
Bulldozer - D6	165	0.50	1	83	8.0	660	4.0	2,640
Fugitive Dust (6)	NA	NA	3	NA	8.0	NA	5.7	17
Construction Truck and Vehicle Trips								
Construction Truck Traffic (4) (5)	NA	NA	20	NA	18.0	360	400.0	144,000
Construction Vehicle Traffic (4) (5)	NA	NA	20	NA	70.0	1,400	400.0	560,000

Notes: (1) Pile driving equipment usage estimates based on 205 days.

(2) Hours per day = Hours per trip, Daily HP Hours = HP hours per trip, and Work Days = # of trips

(3) Assuming that the materials are 50 miles away and the tug travels at a speed of 9 knots

(4) Number Active = miles/roundtrip, Hours/Day = daily truck trips, Daily Hp-Hrs = daily miles, and Total Hp-Hrs = total miles.

(5) Average round trip for construction related truck or vehicle trip estimated at 20 miles.

(6) Number Active = acres disturbed per day, Total Hp-Hrs = total acre-days.

(7) Construction is based on a acreage comparison of POLA Berths 136-147 Container Terminal Project, FEIS/FEIR December 2007, the SCAQMD construction survey and data provided by the US Navy in a 3/20/2013 email.

Table 5. Emission Factors for Construction of LWI

Project Year/Source Type	*Fuel Type*	*Emission Factors* VOC	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$	N_2O	CH_4	CO_2	Units	*References*
Year 2014												
Off-Road Equipment - 25-39 Hp	D	0.38	1.65	4.20	0.76	0.66	0.64	0.09	0.01	609.7	g/hp-hr	(1), (6)
Off-Road Equipment - 40-49 Hp	D	0.36	1.58	4.14	0.76	0.67	0.65	0.09	0.01	611.0	g/hp-hr	(1), (6)
Off-Road Equipment - 50-74 Hp	D	0.43	2.80	4.07	0.79	0.65	0.63	0.09	0.01	607.5	g/hp-hr	(1), (6)
Off-Road Equipment - 75-99 Hp	D	0.44	3.02	3.47	0.77	0.78	0.75	0.09	0.01	608.1	g/hp-hr	(1), (6)
Off-Road Equipment - 100-174 Hp	D	0.32	1.26	3.00	0.69	0.59	0.57	0.09	0.01	546.5	g/hp-hr	(1), (6)
Off-Road Equipment - 175-299 Hp	D	0.24	0.81	2.56	0.66	0.55	0.53	0.09	0.01	538.7	g/hp-hr	(1), (6)
Off-Road Equipment - 300-599 Hp	D	0.22	1.19	3.13	0.67	0.49	0.47	0.08	0.01	534.6	g/hp-hr	(1), (6)
Off-Road Equipment - 600-749 Hp	D	0.21	1.50	3.12	0.67	0.49	0.48	0.08	0.01	534.3	g/hp-hr	(1), (6)
Off-Road Equipment - 750-999 Hp	D	0.32	1.15	4.48	0.67	0.53	0.51	0.08	0.01	534.0	g/hp-hr	(1), (6)
Off-Road Equipment - 1000-1199 Hp	D	0.32	1.09	4.39	0.67	0.53	0.52	0.08	0.01	534.2	g/hp-hr	(1), (6)
Off-Road Equipment - 1200-1999 Hp	D	0.33	1.24	4.45	0.67	0.54	0.53	0.00	0.01	534.8	g/hp-hr	(1), (6)
On-Road Truck - 10 mph		0.28	0.92	3.87	0.65	0.56	0.54	0.00	0.01	535.7	g/mi	(2)
On-Road Truck - 25 mph		0.47	1.43	4.34	0.01	0.14	0.11	0.00	0.01	19.5	g/mi	(2)
On-Road Truck - 55 mph		0.34	0.94	3.87	0.01	0.14	0.11	0.00	0.01	19.5	g/mi	(2)
On-Road Trucks - Composite		0.36	1.03	3.96	0.05	0.16	0.13	0.00	0.01	45.3	g/mi	(3)
On-Road Vehicles - Composite		1.65	14.06	8.47	0.01	0.44	0.44	0.02	0.07	1,189.22	g/mi	(2)
All Years												
Tugboat	D	0.53	1.10	13.20	0.81	0.72	0.67	0.08	0.06	146.9	g/hp-hr	(4)
Small Harbor Craft	D	0.16	1.27	7.46	0.47	0.30	0.28	0.09	0.01	668.2	g/hp-hr	(1)
Fugitive Dust	---	---	---	---	---	27.50	13.45	---	---	---	lbs/acre-day	(5)

Notes: (1) Composite emission factors in [g/bhp-hr] developed from the USEPA NONROAD emissions model CY2014 assume two years before construction. USEPA. 2009. NONROAD Model Core Model ver. 2008a, posted July 6, 2009. http://www.epa.gov/otaq/nonrdmdl.htm.

(2) CY2014 HHDV On-road emissions factors in [g/mi] developed from the USEPA MOVES emissions model (http://www.epa.gov/otaq/models/moves/moves-docum.htm). [g/hr or g/mi]

(3) Composite factors based on a round trip of 75% at 55 mph, 20% at 25 mph, and 5% at 5 mph. Units in grams/mile.

(4) Entec UK Ltd. 2002. European Commission Quantification of emissions from ships associated with ship movements between ports in the European Community. Final Report. Northwich, Cheshire, UK. July 2002.

(5) Units in lbs/acre-day; USEPA. 1995. Heavy Construction Operations (Section 13.2.3). In Compilation of air pollutant emission factors. Washington, DC: U. S. Environmental Protection Agency. http://www.epa.gov/ttn/chief/ap42/ch13/final/c13s02-3.pdf.

(6) N_2O and CH_4 EFs are from the GHG Emission Factors from The Climate Registry GHG Reporting Protocol (www.theclimateregistry.org).

Table 6. Total Emissions for Construction of LWI - Pile-Supported Pier

Construction Activity/Equipment Type	*Tons*								
	VOC	**CO**	**NO_X**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**	**N_2O**	**CH_4**	**CO_2**
Construction									
Crane Hoist	0.01	0.06	0.16	0.03	0.02	0.02	0.00	0.00	26.6
Generator - Pile Hammer	0.02	0.07	0.21	0.05	0.04	0.04	0.01	0.00	43.3
Tugboat	0.01	0.02	0.22	0.01	0.01	0.01	0.00	0.00	2.4
Barge Equipment	0.02	0.05	0.16	0.04	0.04	0.03	0.01	0.00	34.7
Tugboat - Pile Deliveries	0.05	0.11	1.35	0.08	0.07	0.07	0.01	0.01	15.0
Backhoe	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.0
Bulldozer - D6	0.00	0.01	0.03	0.01	0.01	0.00	0.00	0.00	0.0
Compactive Roller	0.00	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.0
Fugitive Dust	-	-	-	-	0.08	0.04	-	-	-
Grader	0.00	0.01	0.02	0.00	0.00	0.00	0.00	0.00	3.4
Haul Truck - Soil	0.03	0.07	0.28	0.00	0.01	0.01	0.00	0.00	3.3
Other Construction Truck Traffic	0.03	0.10	0.38	0.00	0.02	0.01	0.00	0.00	4.5
Other Construction Traffic	0.59	5.02	3.03	0.01	0.16	0.16	0.01	0.03	425.5
Loader	0.00	0.01	0.02	0.00	0.00	0.00	0.00	0.00	4.1
Paving Machine	0.00	0.01	0.02	0.00	0.00	0.00	0.00	0.00	3.8
Water Truck	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	3.0
Subtotal	**0.77**	**5.55**	**5.91**	**0.27**	**0.48**	**0.42**	**0.04**	**0.03**	**447.7**
Phase 2 - Grate Installation									
Tugboat	0.05	0.09	1.13	0.07	0.06	0.06	0.01	0.00	12.63
Barge Equipment	0.08	0.27	0.86	0.22	0.18	0.18	0.03	0.00	180.65
Derrick Barge Crane Hoist	0.03	0.19	0.51	0.11	0.08	0.08	0.01	0.00	86.42
Subtotal	**0.16**	**0.56**	**2.50**	**0.40**	**0.33**	**0.31**	**0.05**	**0.01**	**279.69**

Table 7. Total Emissions for Construction of LWI - PSB Modifications

Construction Activity/Equipment Type	*Tons*								
	VOC	**CO**	**NO_X**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**	**N_2O**	**CH_4**	**CO_2**
Construction									
Crane Hoist	0.00	0.02	0.06	0.01	0.01	0.01	0.00	0.00	10.0
Generator - Pile Hammer	0.01	0.02	0.08	0.02	0.02	0.02	0.00	0.00	16.2
Tugboat	0.01	0.01	0.13	0.01	0.01	0.01	0.00	0.00	1.5
Barge Equipment	0.01	0.03	0.10	0.03	0.02	0.02	0.00	0.00	20.8
Tugboat - Pile Deliveries	0.01	0.02	0.25	0.02	0.01	0.01	0.00	0.00	2.8
Backhoe	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	1.5
Bulldozer - D6	0.00	0.01	0.03	0.01	0.01	0.00	0.00	0.00	4.8
Compactive Roller	0.00	0.01	0.02	0.00	0.00	0.00	0.00	0.00	3.2
Fugitive Dust	-	-	-	-	0.08	0.04	-	-	-
Grader	0.00	0.01	0.02	0.00	0.00	0.00	0.00	0.00	3.4
Haul Truck - Soil	0.03	0.07	0.28	0.00	0.01	0.01	0.00	0.00	3.3
Other Construction Truck Traffic	0.03	0.10	0.38	0.00	0.02	0.01	0.00	0.00	4.5
Other Construction Traffic	0.59	5.02	3.03	0.01	0.16	0.16	0.01	0.03	425.5
Loader	0.00	0.01	0.02	0.00	0.00	0.00	0.00	0.00	4.1
Paving Machine	0.00	0.01	0.02	0.00	0.00	0.00	0.00	0.00	3.8
Semi Truck	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.1
Water Truck	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	3.0
Subtotal	**0.66**	**5.24**	**3.82**	**0.04**	**0.29**	**0.24**	**0.02**	**0.03**	**457.2**

Table 8. Total Emissions for Construction of SPE - Short Pier

	Tons								
Construction Activity/Equipment Type	**VOC**	**CO**	**NO_X**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**	**N_2O**	**CH_4**	**CO_2**
Over Water Construction									
Derrick Barge Crane Hoist	0.02	0.12	0.31	0.07	0.05	0.05	0.01	0.00	53.5
Generator - Pile Hammer	0.04	0.13	0.41	0.11	0.09	0.09	0.02	0.00	87.2
Tugboat	0.02	0.07	0.24	0.04	0.03	0.03	0.00	0.00	28.5
Barge Equipment	0.05	0.17	0.53	0.14	0.11	0.11	0.02	0.00	111.9
Tugboat - Pile Deliveries	0.48	1.01	12.15	0.75	0.66	0.62	0.08	0.05	135.1
Subtotal	**0.61**	**1.50**	**13.64**	**1.09**	**0.94**	**0.89**	**0.12**	**0.06**	**416.2**
Pier Services and Compressor Bldg									
Air Compressor - 100 CFM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.4
Concrete/Industrial Saw	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.9
Crane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.7
Forklift	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.6
Generator	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.5
Fugitive Dust	-	-	-	-	0.00	0.00	-	-	-
Subtotal	**0.00**	**0.01**	**0.02**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**3.2**
Waterfront Ship Support Building									
Air Compressor - 100 CFM	0.01	0.05	0.07	0.01	0.01	0.01	0.00	0.00	10.8
Concrete/Industrial Saw	0.02	0.11	0.13	0.03	0.03	0.03	0.00	0.00	22.2
Crane	0.01	0.03	0.09	0.02	0.02	0.02	0.00	0.00	18.3
Forklift	0.01	0.08	0.09	0.02	0.02	0.02	0.00	0.00	16.2
Generator	0.01	0.03	0.09	0.02	0.01	0.01	0.00	0.00	13.1
Fugitive Dust	-	-	-	-	0.01	0.00	-	-	-
Subtotal	**0.05**	**0.30**	**0.47**	**0.10**	**0.10**	**0.09**	**0.01**	**0.00**	**80.6**
Parking Lot									
Paving Machine	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	1.9
Water Truck - 5,000 Gallons	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	1.9
Compactive Roller	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	1.9
Scraper	0.00	0.01	0.02	0.00	0.00	0.00	0.00	0.00	3.7
Grader	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	2.1
Loader	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	2.6
Backhoe	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	1.5
Bulldozer - D6	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	1.6
Fugitive Dust	-	-	-	-	0.00	0.00	-	-	-
Subtotal	**0.01**	**0.03**	**0.09**	**0.02**	**0.02**	**0.02**	**0.00**	**0.00**	**17.2**
Construction Truck and Vehicle Trips									
Construction Truck Traffic	0.06	0.16	0.63	0.01	0.03	0.02	0.00	0.00	7.54
Construction Vehicle Traffic	1.02	8.68	5.24	0.01	0.27	0.27	0.01	0.04	735.47
Subtotal	**1.08**	**8.84**	**5.87**	**0.02**	**0.30**	**0.29**	**0.01**	**0.04**	**743.02**

Table 9. Total Emissions for Construction of SPE - Long Pier

	Tons								
Construction Activity/Equipment Type	**VOC**	**CO**	**NO_X**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**	**N_2O**	**CH_4**	**CO_2**
Over Water Construction									
Derrick Barge Crane Hoist	0.03	0.15	0.40	0.09	0.06	0.06	0.01	0.00	68.1
Generator - Pile Hammer	0.05	0.17	0.53	0.14	0.11	0.11	0.02	0.00	111.0
Tugboat	0.02	0.08	0.30	0.05	0.04	0.04	0.00	0.00	36.3
Barge Equipment	0.06	0.22	0.68	0.17	0.15	0.14	0.02	0.00	142.4
Tugboat - Pile Deliveries	0.85	1.77	21.26	1.30	1.16	1.09	0.13	0.09	236.5
Subtotal	**1.01**	**2.39**	**23.16**	**1.74**	**1.52**	**1.43**	**0.19**	**0.10**	**594.3**
Pier Services and Compressor Bldg									
Air Compressor - 100 CFM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.4
Concrete/Industrial Saw	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.9
Crane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.7
Forklift	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.6
Generator	0.03	0.15	0.39	0.07	0.06	0.06	0.01	0.00	58.2
Fugitive Dust	-	-	-	-	0.00	0.00	-	-	-
Subtotal	**0.04**	**0.16**	**0.41**	**0.08**	**0.07**	**0.07**	**0.01**	**0.00**	**60.9**
Waterfront Ship Support Building									
Air Compressor - 100 CFM	0.01	0.05	0.07	0.01	0.01	0.01	0.00	0.00	10.8
Concrete/Industrial Saw	0.02	0.11	0.13	0.03	0.03	0.03	0.00	0.00	22.2
Crane	0.01	0.03	0.09	0.02	0.02	0.02	0.00	0.00	18.3
Forklift	0.01	0.08	0.09	0.02	0.02	0.02	0.00	0.00	16.2
Generator	0.01	0.03	0.09	0.02	0.01	0.01	0.00	0.00	13.1
Fugitive Dust	-	-	-	-	0.01	0.00	-	-	-
Subtotal	**0.05**	**0.30**	**0.47**	**0.10**	**0.10**	**0.09**	**0.01**	**0.00**	**80.6**
Parking Lot									
Paving Machine	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	1.9
Water Truck - 5,000 Gallons	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	1.9
Compactive Roller	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	1.9
Scraper	0.00	0.01	0.02	0.00	0.00	0.00	0.00	0.00	3.7
Grader	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	2.1
Loader	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	2.6
Backhoe	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	1.5
Bulldozer - D6	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	1.6
Fugitive Dust	-	-	-	-	0.00	0.00	-	-	-
Subtotal	**0.01**	**0.03**	**0.09**	**0.02**	**0.02**	**0.02**	**0.00**	**0.00**	**17.2**
Construction Truck and Vehicle Trips									
Construction Truck Traffic	0.06	0.16	0.63	0.01	0.03	0.02	0.00	0.00	7.54
Construction Vehicle Traffic	1.02	8.68	5.24	0.01	0.27	0.27	0.01	0.04	735.47
Subtotal	**1.08**	**8.84**	**5.87**	**0.02**	**0.30**	**0.29**	**0.01**	**0.04**	**743.02**

Table 10. Air Emissions for LWI - Pile-Supported Pier

	Tons									
Construction Activity	**VOC**	**CO**	**NO_X**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**	**N_2O**	**CH_4**	**CO_2**	**CO_2e**
Construction Activity	0.77	5.55	5.91	0.27	0.48	0.42	0.03	0.03	406.1	417.6
Phase 2 - Grate/Mesh	0.16	0.56	2.50	0.40	0.33	0.31	0.05	0.01	253.7	268.5
Commuters	1.96	16.73	10.08	0.01	0.52	0.01	0.02	0.08	1,284.3	1,291.5
Total	**2.89**	**22.84**	**18.49**	**0.68**	**1.33**	**0.75**	**0.10**	**0.11**	**1,944.2**	**1,977.5**

N_2O, CH_4, CO_2, and CO_2e are in Metric Tons

Table 11. Air Emissions for LWI - PSB Modifications

	Tons									
Construction Activity	**VOC**	**CO**	**NO_X**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**	**N_2O**	**CH_4**	**CO_2**	**CO_2e**
Construction Activity	0.66	5.24	3.82	0.04	0.29	0.24	0.02	0.02	414.8	420.7
Commuters	1.96	16.73	10.08	0.01	0.52	0.01	0.02	0.08	1,284.3	1,291.5
Total	**2.63**	**21.97**	**13.90**	**0.06**	**0.81**	**0.26**	**0.04**	**0.10**	**1,699.1**	**1,712.2**

N_2O, CH_4, CO_2, and CO_2e are in Metric Tons

Table 12. Air Emissions for SPE - Short Pier

	Tons									
Construction Activity	**VOC**	**CO**	**NO_X**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**	**N_2O**	**CH_4**	**CO_2**	**CO_2e**
Over Water Construction	0.61	1.50	13.64	1.09	0.94	0.89	0.11	0.05	377.5	412.0
Pier Services and Compressor Bldg.	0.00	0.01	0.02	0.00	0.00	0.00	0.00	0.00	2.9	3.1
Waterfront Ship Support Building	0.05	0.30	0.47	0.10	0.10	0.09	0.01	0.00	73.1	76.7
Parking Lot	0.01	0.03	0.09	0.02	0.02	0.02	0.00	0.00	15.6	16.4
Bldg. Operations	0.07	0.37	0.07	-	-	-	-	-	-	-
Construction Truck and Vehicle Trips	1.08	8.84	5.87	0.02	0.30	0.29	0.01	0.04	743.02	747.4
Commuters	1.02	8.68	5.23	0.01	0.27	0.01	0.01	0.04	666.0	669.7
Total (Construction)	**2.77**	**19.36**	**25.31**	**1.24**	**1.63**	**1.31**	**0.14**	**0.14**	**1,878.13**	**1,925.31**
Total	**2.84**	**19.74**	**25.38**	**1.24**	**1.63**	**1.31**	**0.14**	**0.14**	**1,878.13**	**1,925.31**

N_2O, CH_4, CO_2, and CO_2e are in Metric Tons

Table 13. Air Emissions for SPE - Long Pier

	Tons									
Construction Activity	**VOC**	**CO**	**NO_X**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**	**N_2O**	**CH_4**	**CO_2**	**CO_2e**
Over Water Construction	1.01	2.39	23.16	1.74	1.52	1.43	0.17	0.09	539.2	593.6
Pier Services and Compressor Bldg.	0.04	0.16	0.41	0.08	0.07	0.07	0.06	0.01	0.0	18.5
Waterfront Ship Support Building	0.05	0.30	0.47	0.10	0.09	0.10	0.08	0.01	0.0	26.5
Parking Lot	0.01	0.03	0.09	0.02	0.02	0.02	0.02	0.00	0.0	5.1
Bldg. Operations	0.07	0.37	0.07	-	-	-	-	-	-	-
Construction Truck and Vehicle Trips	1.08	8.84	5.87	0.02	0.30	0.29	0.01	0.04	743.02	747.4
Commuters	1.02	8.68	5.23	0.01	0.27	0.01	0.01	0.04	666.0	669.7
Total (Construction)	**3.20**	**20.40**	**35.22**	**1.97**	**2.26**	**1.92**	**0.35**	**0.19**	**1,948.14**	**2,060.85**
Total	**3.27**	**20.78**	**35.29**	**1.97**	**2.26**	**1.92**	**0.35**	**0.19**	**1,948.14**	**2,060.85**

N_2O, CH_4, CO_2, and CO_2e are in Metric Tons

Table 14. Construction Worker Activity

LWI - Pile-Supported Pier				
Number of Workers	***Workers***	***Miles/Day***	***# of Days***	***Total Activity***
Upland Construction	100	20	540	1,080,000
LWI - PSB Modifications				
Number of Workers	***Workers***	***Miles/Day***	***# of Days***	***Total Activity***
Upland Construction	100	20	540	1,080,000
Service Pier Extension - Either Alternative				
Number of Workers	***Workers***	***Miles/Day***	***# of Days***	***Total Activity***
Upland Construction	70	20	400	560,000

Table 15. Emission Factors for Construction Commuter Vehicles

	grams/mile									
Project Year/Source Type	**VOC**	**CO**	**NO_X**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**	**N_2O**	**CH_4**	**CO_2**	***Notes***
Year 2014										
On-Road Vehicles - Composite	1.65	14.06	8.47	0.01	0.44	0.01	0.02	0.07	1189.22	(1)

Note: 1. Emission factors from MOVES - CY2014

Table 16. Air Emissions for Construction Commuter Vehicles

	Tons									
Personnel Activity	**VOC**	**CO**	**NO_X**	**SO_2**	**PM10**	**$PM_{2.5}$**	**N_2O**	**CH_4**	**CO_2**	**CO_2e**
LWI Pile-Supported Pier										
Construction Commuters	1.96	16.73	10.08	0.01	0.52	0.01	0.02	0.08	1415.7	1423.6
Total	***1.96***	***16.73***	***10.08***	***0.01***	***0.52***	***0.01***	***0.02***	***0.08***	***1415.7***	***1423.6***
LWI - PSB Modifications										
Construction Commuters	1.96	16.73	10.08	0.01	0.52	0.01	0.02	0.08	1415.7	1423.6
Total	***1.96***	***16.73***	***10.08***	***0.01***	***0.52***	***0.01***	***0.02***	***0.08***	***1415.7***	***1423.6***
Service Pier Extension - Either Alternative										
Construction Commuters	1.02	8.68	5.23	0.01	0.27	0.01	0.01	0.04	734.1	738.2
Total	***1.02***	***8.68***	***5.23***	***0.01***	***0.27***	***0.01***	***0.01***	***0.04***	***734.1***	***738.2***

Table 17. Operational Emissions for SPE - Support Buildings (tons per year)

	VOC	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$
SPE	0.07	0.37	0.07	0.00	0.00	0.00

Notes:

Based on 52,000 square feet of the 2 new facilities using Urbemis 2007

Estimated Natural gas usage of 2.0 feet^3 / sq. ft/month

Emissions Factors from SCAQMD. 1993. CEQA Air Quality Handbook. Diamond Bar, C.

Table 18. Comparison of Air Emissions Total Impacts for LWI and SPE Project Alternatives

	Total Tons									
Alternatives	VOC	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$	N_2O	CH_4	CO_2	CO_2e
LWI - Pile-Supported Pier	*2.89*	*22.84*	*18.49*	*0.68*	*1.33*	*0.75*	*0.10*	*0.11*	*1944.2*	*1977.5*
LWI - PSB modifications	*2.63*	*21.97*	*13.90*	*0.06*	*0.81*	*0.26*	*0.04*	*0.10*	*1699.1*	*1712.2*
Short Pier	*2.77*	*19.36*	*25.31*	*1.24*	*1.63*	*1.31*	*0.14*	*0.14*	*1878.1*	*1925.3*
Long Pier	3.20	20.40	35.22	1.97	2.26	1.92	0.35	0.19	1948.1	2060.9

N_2O, CH_4, CO_2, and CO_2e are in Metric Tons

Table 19. Comparison of Construction-Related Air Emissions for LWI Project Alternatives

	Tons/Year									
Alternatives	VOC	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$	N_2O	CH_4	CO_2	CO_2e
LWI - Pile-Supported Pier	*2.89*	*22.84*	*18.49*	*0.68*	*1.33*	*0.75*	*0.10*	*0.11*	*1944.19*	*1977.54*
LWI - PSB modifications	*2.63*	*21.97*	*13.90*	*0.06*	*0.81*	*0.26*	*0.04*	*0.10*	*1699.14*	*1712.19*

N_2O, CH_4, CO_2, and CO_2e are in Metric Tons

Table 20. Comparison of Construction-Related Air Emissions for SPE Project Alternatives

	Tons/Year									
Alternatives	VOC	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$	N_2O	CH_4	CO_2	CO_2e
Short Pier	*2.77*	*19.36*	*25.31*	*1.24*	*1.63*	*1.31*	*0.14*	*0.14*	*1878.1*	*1925.3*
Long Pier	*3.20*	*20.40*	*35.22*	*1.97*	*2.26*	*1.92*	*0.35*	*0.19*	*1948.1*	*2060.9*

N_2O, CH_4, CO_2, and CO_2e are in Metric Tons