FINAL

PORT OF OAKLAND

2005 SEAPORT CONSTRUCTION AIR EMISSIONS INVENTORY

Prepared for

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INTRODUCTION

This report contains an estimate of air emissions associated with construction activities at the Port of Oakland (Port) Seaport in 2005. Included in this report is the methodology used for calculating emissions from off-road construction equipment and from on-road trucks associated with construction activities at different marine terminals at the Port. This report also includes the methodology used to calculate emission from channel deepening and deepening of berths in 2005. Emissions estimated include Reactive Organic Gases (ROG), Carbon Monoxide (CO), Oxides of Nitrogen (NOx), Sulfur Dioxide (SO_2) and Diesel Particulate Matter (DPM). To the extent that the information was available, the emissions were estimated based on the quantity of materials listed in contract quantity variances, final construction payment authorizations, or other activity data provided by the Port of Oakland. All assumptions used to calculate emissions are identified in this report. The annual air emissions for all construction projects are provided in Table 10 in the Results section.

SUMMARY

A summary of total 2005 emissions from each construction project at the Port of Oakland is shown in Table 1. Emissions are broken down by construction activities at various marine terminals, as well as for deepening dredging activities. Detailed emissions summaries from off-road equipment, on-road trucks, tug boats and from deepening dredging and disposal of dredged materials are provided in the Table 9 of Results section. The activity assumptions and methodology used to generate emissions from each project is discussed in the following sections.

Table 1. 2005 Construction at the Port of Oakland Seaport - Summary of annual emissions (tons/yr) from each project.

Location	Emissions (tons/yr)				
	ROG	CO	NOx	SO_2	DPM
1. Berth 22 Wharf	0.32	1.19	4.24	0.03	0.15
2. Berth 23 (WESP)	0.05	0.14	0.30	0.00	0.02
3. Berths 32-33 Wharf	0.10	0.32	0.75	0.00	0.05
4. B59 Yard Extension - Demo of Build.D-833	0.60	2.10	4.10	0.02	0.13
B59 Yard Extension - Paving 7 acres	0.08	0.25	0.71	0.01	0.03
5. Berth 30 terminal expansion - Phase 1	0.20	0.70	1.91	0.01	0.08
Berth 30 terminal exp. Phase 2 -4 acres	0.26	0.87	2.51	0.02	0.10
6. Yard at former UP roundhouse site	1.47	5.30	12.33	0.09	0.49
7. Dredging	0.08	0.46	3.02	0.03	0.07
Dredged Material Disposal I	0.17	0.79	4.22	0.04	0.09
Total	**3.33**	**12.12**	**34.09**	**0.25**	**1.21**

GENERAL ACTIVITY ASSUMPTIONS AND METHODOLOGY

The general activity assumptions and methodology for generating emission from off-road equipment and on-road trucks are described below for construction projects that occurred at different marine terminals in 2005. However for dredging activities and for the container yard expansions at Berth 30 and at the former UP roundhouse site, a different approach was used and is described in the next section.

The following activity assumptions were used to calculate emissions:

Off-road Equipment

- The Port staff provided the estimated data for the Off-road equipment used to perform the activities, including the type of equipment and their hours of operation.
- The load factors for each piece of equipment were obtained from CEQA handbook[1].
- Equipment size (HP) was based on typical construction projects with similar activities.
- All equipment was assumed to be operated with diesel fuel.

On-road Trucks

- The Port provided the truck type, estimated number of trucks and estimated total construction-related trips in 2005.
- Assumptions were made for idling time of trucks at the Port based on typical construction projects.
- The on-road truck travel distance was limited to travel within the Port boundaries[2].

Methodology

Emission factors from off-road equipment for all criteria pollutants were generated using the Air Resources Board's (ARB's) OFFROAD 2007 model for the calendar year 2005 and for Alameda County. The following equation was used to generate emissions in tons per year from off-road equipment used for the calendar year 2005.

E = Efs* LF * HP * (Hr/yr) * 1/907185 (g/ton)
Where,
E = Emissions from off-road equipment (tons/yr)
Efs = Emission factors from ARB's OFFROAD2007 (g/bhp-hr)
LF = Load Factor
HP = Horse Power of particular equipment
Hr/yr = Annual hours of operation (hr/yr)

Emission factors for all criteria pollutants from heavy heavy duty trucks used to haul materials were obtained by running ARB's EMFAC2007 model for the calendar year 2005 and for the Alameda County. The onsite emissions were generated using following equation.

$E_{exhaust} = Ef_{exhaust}$*distance*TripPY*1/907185 (g/ton)
$E_{idle} = Ef_{idle}$ * IH * 1/907185 (g/ton)
Where,
$E_{exhaust}$ = Exhaust emissions (tons/yr)
$Ef_{exhaust}$ = Exhaust emission factors (g/mile)
Distance = On-road truck travel distance from the port site to the nearest highway intersections (mile/trip)
TripPY = Total trips per year (trip/year)
Ef_{idle} = Idling emission factors (g/hr)
IH = Idling hours On-road per trip (hr/trip)

The emissions from each of construction activities are provided in the Table 10 in the Results section.

2005 CONSTRUCTION PROJECTS

This section describes construction projects that occurred at various marine terminals at the Port of Oakland in 2005.

1. Berth 22 Wharf Reconstruction Project

The Berth 22 Wharf Reconstruction project started in December 2003 and was completed in mid 2005. Air emissions generated from the construction activities at the Berth 22 marine terminal in 2005 included driving of concrete piles to support the wharf, installation of the rock dike and rip rap on the embankment slopes, construction of the wharf deck and cut-off wall, placement of engineered fill and aggregate base behind the cut-off walls (landside of the wharf), and Asphalt Concrete (AC) Paving. Off-road construction equipment and on-road trucks as well as tugboats associated with the reconstruction of the Berth 22 Wharf are shown in Table 2.

Table 2. Summary of activity data in 2005 for the Berth 22 Wharf Reconstruction Project.

Equipment	No. of Equipment	Fuel	Hp	Load Factor (%)	Hours of Operation (hrs/yr)
Pile Driving of Wharf Construction					
Crane -on land[a]	1	D	175	43	121
Pile Driver Crane on a barge	1	D	175	43	121
Diesel Hammer	1	D	120	43	121
Transport of Rock for Rock Dike and Rip Rap installation on the Embankment Slopes					
Crane	1	D	175	43	88
Long Reach Backhoe	1	D	120	46.5	88
Loader	1	D	500	46.5	88
Wharf Deck Construction					
Crane	2	D	175	43	94
Crane	1	D	175	43	39
Hydro Crane	1	D	175	43	133
Placement of Engineered Fill, Aggregate Base, Fine Grading and AC Paving					
Crushing Equipment[a]	1	D	250	78	88
Filling and Compacting earth					
Excavator	1	D	250	58	72
Loader	2	D	500	46.5	64
Vibratory Sheep's Foot Roller	1	D	250	57.5	32
Placing Base Rock					
Motorized Scraper	1	D	175	66	16
Blade (Motor Grade)	1	D	500	57.5	56
Loader	1	D	120	46.5	40
Vibratory steel wheel roller	1	D	250	57.5	40
Skip Loader	1	D	500	46.5	40
Paving					
Asphalt Pavers	1	D	175	59	24
Steel wheel roller	1	D	250	57.5	24
Vibratory steel wheel roller	1	D	500	57.5	15
Loader	1	D	500	46.5	6
Sweeper	1	D	175	68	2
Construction of Underground Utility Trenches					
Excavator	1	D	250	58	72
On-road Truck Activities					
Activity	**Truck Type**	**Number of Trucks**	**Idling Time [hr/Trip]**	**Round Trip Distance of Onsite Route [mi/Trip][c]**	**Total No. Trips**
Wharf Deck Construction	Dump Trucks	6	0.17	0.732	1632
Asphalt Concrete	Double bottom dump trucks	3	0.17	0.732	230
AC paving	Dump Trucks	3	0.17	0.732	461
Tug-boat activities used to transport rock and rip-rap to the Port					
Material	**Tug Main or Aux HP**	**Volume [b] (cy)**	**Travel Time per trip (hrs/trip)**	**Nbr. Trips (trips/yr)**	
Rock	1200	102,947	4.9	102.95	
	110		0.0	102.95	
Rip-rap	1200	5,282	4.9	5.282	
	110		0.0	5.282	

[a] The hours of operations for the crane used to install piles and crushing equipment used to prepare aggregate base onsite were assumed based on typical construction projects with similar activities.

[b] The total quantity of rocks and rip-rap used for project, total travel time required for the transportation using tug boats, HPs and the capacity of barges were provided by the Port or by the construction contractor (Manson)

[c] From Port of Oakland 2005 Seaport Air Emission Inventory[2]

Emissions from tug boats used to transport rip-rap and rocks to the site were generated using average emission factors for tug boats used for Operations and Maintenance (O&M) dredged material disposal used in the Port of Oakland 2005 Seaport Air Emission Inventory.

Annual emissions (tpy) from off-road equipment and on-road trucks and from tug boat associated with the Berth 22 wharf reconstruction are provided in Table 10 of the Results section.

2. Wharf and Embankment Strengthening Project (WESP)

The activities performed under this project in 2005 included installation of a sheet pile wall at Outer Harbor (along Berth 23), cutting openings on the existing wharf deck, driving concrete piles, and constructing reinforcements to the crane rail girders. Off-road construction equipment and on-road trucks used to conduct these activities are listed in Table 3.

Table 3. Summary of activity data in 2005 for the WESP Project.

Equipment	No. of Equipment	Fuel	Hp	Load Factor (%)	Hours of Operation (hrs/yr)
Pile Driver Crane	1	D	175	43	47.6
Diesel Hammer	1	D	120	43	47.6
Generator	1	D	120	74	168
Air Compressor	1	D	120	48	170
On-road Truck Activities					
Truck Type	**Number of Trucks**	**Idling Time [hr/Trip]**	**Round Trip Distance of Onsite Route [mi/Trip]**	**Total No. Trips**	
Dump Trucks	3	0.17	1.01	125	

3. Construction of Berths 32/33 Wharf Rehabilitation Project

This project consisted of constructing a new wharf structure to fill-in the 240-foot gap between Berth 32 and Berth 30, extending the Berths 32/33 Wharf to align with the face of adjacent Berth 30, retrofitting the wharf to support 100-foot gage cranes, dredging, relocating associated utilities and constructing an electrical substation. Work conducted in 2005 included installation of a sheet pile wall approximately 900 feet long, driving 58 concrete piles, constructing the wharf deck, placing AC pavement, and deepening dredging of the berth. Dredging assumptions and emissions calculation are discussed in Section 7 below. Off-road construction equipment and on-road trucks used to conduct these activities are listed in Table 4.

Table 4. Summary of activity data in 2005 for the Berths 32-33 Wharf Rehabilitation Project.

Equipment	No. of Equipment	Fuel	Hp	Load Factor (%)	Hours of Operation (hrs/yr)
Crane	1	D	175	43	371.03
Diesel Hammer for Sheet Piles	1	D	120	43	348.53
Diesel Hammer for Concrete Piles	1	D	120	43	22.5
On-road Truck Activities					
Activity	**Truck Type**	**Number of Trucks**	**Idling Time [hr/Trip]**	**Round Trip Distance of Onsite Route [mi/Trip]**	**Total No. Trips**
Concrete used at Construction work	Dump trucks	3	0.17	2.40	876.94
Asphalt concrete hauled	Dump trucks	3	0.17	2.40	504.16

4. Berth 59 Expansion

a) Demolition of Building D-833

Demolition of building D-833 located adjacent to the Berth 59 container yard occurred in 2004. The activities conducted in 2005 under this construction contract included demolishing and removing AC and Portland Cement Concrete (PCC) pavement from an area of 88,400 square feet; crushing and stockpiling 18,512 tons of AC and PCC from demolition; backfilling and compacting fill in an area of 176,800 sq ft, and importing, placing and compacting 8,120 cubic yards of Port-furnished sand. After the demolition of building D-833 was completed, another construction contractor was responsible for paving that area to be used as an extension to the Berth 59 container yard. Emissions associated with paving 7 acres are discussed in the following subsection. Off-road construction equipment and on-road trucks used for the demolition activities are listed in Table 5.

Table 5. Summary of activity data in 2005 for demolition of Building D-833 contract.

Equipment	No. of Equipment	Fuel	Hp	Load Factor (%)	Hours of Operation (hrs/yr)
Sheep Foot	1	D	250	57.5	67.54
Crawler or Dozer	1	D	310	59	67.54
Crawler or Mudcat	1	D	310	59	67.54
Excavator	2	D	250	58	67.54
Blader	1	D	500	57.5	151.96
Crusher	1	D	120	46.5	67.54
On-road Truck Activities					
Activity	**Truck Type**	**Number of Trucks**	**Idling Time [hr/Trip]**	**Round Trip Distance of Onsite Route [mi/Trip]**	**Total No. Trips**
Sand hauled	Dump trucks	3	10	1.48	902.22
Metal Scarp	Dump trucks	1	10	1.48	20
Wood	Dump trucks	1	10	1.48	20
Trash	Dump trucks	1	10	1.48	20

Annual emissions (tpy) from off-road equipments and on-road trucks associated with the demolition project are provided in Table 10 of the Results section.

b) Paving of Area Formerly Occupied by Building D-833 (7 acres)

As described above, the area formerly occupied by building D-833 was paved by a separate contractor and became an expansion to the Berth 59 yard. The main activity that occurred in 2005 under this contract was to place the 18,512 tons of crushed material onto the 7 acres to raise the grade, followed by the placement of 14,356 tons of asphalt concrete onto the area. Off-road construction equipment and on-road trucks used to conduct these activities are listed in Table 6.

Table 6. Summary of activity data in 2005 for paving 7 acres at the Berth 59 yard.

Equipment	No. of Equipment	Fuel	Hp	Load Factor (%)	Hours of Operation[c] (hrs/yr)
Paving Machine	1	D	175	59	30.16
Steel wheel Roller	1	D	250	57.5	30.16
Loader	1	D	500	57.5	18.85
On-road Truck Activities					
Truck Type	**Number of Trucks**	**Idling Time [hr/Trip]**	**Round Trip Distance of Onsite Route [mi/Trip]**	**Total No. Trips**	
Dump Trucks	3	0.17	2	1196.33	

[c] The hours of operation for the equipment used at Berth 59 was based on the same equipment-activity combination used at Berth 22. The ratio of the acreage paved at Berth 59 to that of Berth 22 was applied to obtain the actual hours of operation for each equipment used on Berth 59.

Annual emissions (tpy) from off-road equipment and on-road trucks associated with the paving of 7 acres at the Berth 59 yard are provided in the Table 10 of the Results section.

5. Berth 30 Terminal Expansion Project

This construction activity is divided into two activities; a) the sub-grade preparation and grading and b) the activity associated with the Berth 30 expansion project (4 acres).

a) Berth 30 Terminal Pavement Activities: Pavement activities included sub-grade preparation and grading that was conducted in 2005. The equipment used for this activity and other associated information related to this activity was not available. Therefore, emissions were generated by scaling emissions from the Filling and Compacting earth, Placing Base Rock and Paving activities that occurred at Berth 22. The emissions were scaled by applying the ratio of the quantity of material used at Berth 30 to that used at Berth 22 for AC pavement, and aggregate base rock. The total quantity of engineered fill, asphalt concrete and aggregate base provided is summarized in Table 7.

Table 7. Summary of the quantity of material at Berth 30 and Berth 22.

Activity	Quantity	Unit
Quantity of material at Berth 30[1]		
Exc. & Compact Exist, Subgrade	12,503.00	CY
Quantity of aggregate base	16,529.11	CY
Quantity of asphalt concrete	12,180.48	Tons
Quantity of material at Berth 22[2]		
Quantity of engineered fill	17,236	CY
Quantity of aggregate base	3,554	CY
Quantity of asphalt concrete	5,905	Tons

[1] Data from the Cost Summary for Berth 30 Terminal Expansion Contract
[2] Data from the Berth 22 Wharf Construction Contract Quantity Variances

b) Berth 30 Terminal Expansion (Four Acres):

The activity data for off-road equipment usage and trucks required to haul material for this activity were not available. Therefore, emissions from the activities associated with the four acre terminal expansion at Berth 30 in 2005 were generated by scaling emissions from the Filling and Compacting earth, Placing Base Rock and Paving activities that occurred at Berth 22. Emissions were scaled up by applying the ratio of the acreage paved at Berth 30 to that at Berth 22. The acreage that was paved at B22 yard was 1.26 acres. The estimated annual emissions are included in the results section.

The Results section includes emissions from off-road equipment and on-road trucks for this project.

6. Yard at Former UP Roundhouse Site

The Roundhouse project at the former Union Pacific site included asphalt removal, re-grading and repaving, abandoning existing utilities, constructing a new storm drain system, a new water and fire system (including hydrants), and installing ductbanks and other structures for future electrical and telecommunication facilities, and installing light poles. The Roundhouse project took place in 2005, mostly during the summer. The project included demolition of a 3,000 square foot warehouse. Demolition included only the roof and walls. The foundation remained in place. This project also included removal of an asphalt cover on 36.6 acres. The bulk of the asphalt removal work took approximately 2 weeks, though the work was interrupted for approximately 1 week due to change in method of removing AC. The original plan was to grind in place and stockpile, but this was found to be not practical due to the unanticipated existence of old rail lines buried just beneath the surface.

The onsite construction equipment used for this activity and other associated information related to this activity were not available. Therefore, emissions from construction equipment were scaled from the Demolition of Building D-833 by using a ratio for the size of these respective projects (36.6 acres vs. 7 acres). However, the truck activities were nearly identical so on road truck emissions from demolition of Building D-833 and Berth 59 were used for this project. Lastly, the AC paving was scaled to the AC paving from Berth 22 emissions for placing base rock using the total tons of base rock installed (38,600 vs. 5282 tons).

The total quantity of engineered fill, asphalt concrete and aggregate base provided is summarized in Table 8.

Table 8. Summary of quantity of material and activities at old UP Roundhouse.

Activity	Quantity	Unit
Demolition of Warehouse	3,000	Square Feet
Remove Asphalt Cover	36.6	Acres
Excavate Trenches	5 to 6	Depth in Feet
Import Sand	1,200	Yards
Import Concrete	1,000	Yards
Import Base Rock	4,900	Tons
Double Bottom Dump Trucks	2,158	Truck Trips
Install Base Rock	38,600	Tons
AC Paving (paving machine, wheel roller, Loader	18	Days
Diesel Operated Crusher	33,700	Tons

7. Dredging and Dredged Material Disposal

Deepening dredging at the Port of Oakland in 2005 included the deepening of Berth 22, Berths 32-33, and dredging related to deepening the Oakland Navigational Channel to -50 Feet. Dredged material was disposed of at the Montezuma Wetlands Project, the San Francisco Deep Ocean Disposal Site (SF-DODS), the San Francisco Channel Bar Ocean Dredged Material Disposal Site (SF-8), and at the Middle Harbor Enhancement Area within the Port. Channel deepening material excavated with an electric cutter head dredge was placed hydraulically at the Middle Harbor Habitat Enhancement Area in the Port area, and thus no air emissions were generated by this activity. All other dredged materials were excavated using electric clamshell dredges and placed in scows. Table 9 summarizes activity data used to estimate 2005 emissions from tug boats hauling the scows to disposal sites. Unloading of scows at SF-8, SF-DODS and MHEA was done by bottom dump.

Table 9. Summary of activity data in 2005 for dredging and dredged material disposal.

Location	Tug Main or Aux HP	Volume (cy)	Travel Time per trip (hrs/trip)	Nbr. Trips (trips/yr)
Berth 22 to SF-8	1200	29,041	4.0	10.00
	110		0.0	10.00
Berth 32-33 to SFDODS	1200	99,863	16.0	35.00
	110		0.0	35.00
Berth 32-33 to SF8	1200	16,222	4.0	5.00
	110		0.0	5.00
Channel Deepening Material Hydraulically Placed at the Port of Oakland Middle Harbor Habitat Enhancement Project (MHEA)	None	165,750	NA	NA
	None		NA	NA
Channel Deepening Material Clamshell Dredged and Hauled to MHEA Using Scows and Tugboats	1200	354,750	1	64.50
	110		0.0	64.50
To Montezuma - only 50% of emissions attributed to the Port	1200	350,600	12.2	63.75
	110		0.0	63.75

Emissions from Deepening Dredging Projects

Activity Assumptions:

- The Port staff provided the quantity of total dredging material at different project sites and horse power ratings for tender and crew boats.
- Except for the channel deepening conducted by an electric cutter head dredge, most of the dredging in 2005 was conducted by an electrically-powered clamshell dredge and diesel-powered auxiliary engine, accompanied by a tender, and supported by a boat
- An auxiliary diesel-powered engine and tender were assumed to be operated a maximum of 2 hours a day while crew boats operated a maximum of 1 hour a day.

Methodology:

Emission factors and methodology are based on the Port of Oakland 2005 Seaport Air Emission Inventory[2] for O&M dredging and disposal of dredged materials. The results are provided in the Table 10 of the Results section. The basic equation used to calculate emissions from each of the engines involved in dredging is:

Equip Emiss = EF x Time hrs x Engine bhp x LF x 1/(453.6 x 2000)

Where:

Equip Emiss = The engine's emissions in tons per year,
EF = The engine emission factor in grams per brake horsepower-hour,
Time hrs = The annual operating hours,
Engine Bhp = The brake horsepower rating of the engine,
LF wt = The time weighted load factor, based on different engine operating modes during a round trip, stated as a ratio of 1, and
1/(453.6 x 2000) = The conversion of annual grams to annual tons.

Emissions from Dredged Materials Disposal

Activity Assumptions:

- It was assumed that an auxiliary engine was not used during the disposal transportation.
- The Port provided total travel time per trip and total trips per year, except the total travel time for Montezuma and Middle Harbor sites were obtained from O&M dredging and disposal of materials in the Port of Oakland 2005 Seaport Air Emission Inventory. The total trips to the disposal Montezuma and Middle Harbor sites in 2005 were calculated assuming scow load capacity of 5000-6000 CY/trip.

Methodology:

Emissions from tug boats used to transport dredged material to disposal sites were generated using average emission factors for tug boats used for O&M dredging and disposal of materials in the Port of Oakland 2005 Seaport Air Emission Inventory. Only half of the total emissions from hauling dredged material to Montezuma were assigned to the Port, the other half is attributed to the Montezuma re-use site. The results are provided in the Table 10 of results section. The basic equation used to calculate main propulsion and auxiliary engine emissions from the tug is:

Tugemiss = EF x Engine Bhp x Time hours x LF wt x Trips x 1/(453.6 x 2000)

Where,

Tug_{emiss} = The tug emissions in tons per year,
EF = The tug main propulsion or auxiliary engine emission factor in grams per brake horsepower-hour,
Engine Bhp = The combined brake horsepower rating of a tug's main propulsion engines and the brake horsepower rating of one of the auxiliary engines,
Time = The tug operating time per round trip in hours,
Trips = The annual number of round trips per tug,
LF wt = the time weighted load factor, based on different engine operating modes during a round trip, stated as a ratio of 1, and the load factor for the auxiliary engine stated as a ratio of 1, and
1/(453.6 x 2000) = The conversion of annual grams to annual tons

RESULTS

This section presents the total annual emissions (ton/yr) from all construction projects at the Port of Oakland in 2005. As shown in Table 10, emissions from off-road equipment, on-road trucks and tugboats are identified for each construction activity.

Table 10. Total construction emissions (tons/year) at the Port of Oakland in 2005.

Location		Emissions (tons/yr)				
		ROG	CO	NOx	SO_2	DPM
1. Berth 22 Wharf	Off-road equipment	0.1878	0.6033	1.6827	0.0132	0.0807
	On-road Trucks	0.0537	0.1902	0.4251	0.0030	0.0167
	Tug boats	0.0777	0.4011	2.1372	0.0180	0.0480
	Subtotal	0.3192	1.1946	4.2449	0.0342	0.1454
2. Berth 23 (WESP)	Off-road equipment	0.0464	0.1343	0.2808	0.0021	0.0229
	On-road Trucks	0.0019	0.0068	0.0159	0.0001	0.0006
	Subtotal	0.0483	0.1411	0.2967	0.0022	0.0235
3. Berths 32-33 Wharf	Off-road equipment	0.0658	0.1999	0.4387	0.0031	0.0320
	On-road Trucks	0.0332	0.1208	0.3138	0.0024	0.0140
	Subtotal	0.0989	0.3207	0.7525	0.0055	0.0459
4. Berth 59 Yard Expansion – Demo of Building D-833	Off-road equipment	0.0891	0.3640	0.8575	0.0061	0.0365
	On-road Trucks	0.5073	1.7364	3.1378	0.0186	0.0943
	Subtotal	0.5965	2.1004	3.9952	0.0247	0.1309
Berth 59 Yard Expansion – Paving 7 Acres	Off-road equipment	0.0493	0.1568	0.4705	0.0037	0.0204
	On-road Trucks	0.0257	0.0934	0.2375	0.0018	0.0104
	Subtotal	0.0750	0.2502	0.7080	0.0055	0.0308
5. Berth 30 Terminal Expansion – Phase 1	Off-road equipment	0.1809	0.6364	1.7576	0.0139	0.0756
	On-road Trucks	0.0194	0.0685	0.1532	0.0011	0.0060
	Subtotal	0.2003	0.7049	1.9108	0.0149	0.0816
Berth 30 Terminal Expansion – Phase 2 Paving 4 acres	Off-road equipment	0.2259	0.7658	2.2804	0.0187	0.0926
	On-road Trucks	0.0298	0.1055	0.2358	0.0017	0.0092
	Subtotal	0.2557	0.8713	2.5161	0.0203	0.1018
6. Yard at former UP roundhouse site	Off-road equipment	0.9338	3.4722	8.9557	0.0672	0.3863
	On-road Trucks	0.5331	1.8298	3.3752	0.0204	0.1047
	Subtotal	1.4669	5.3020	12.3309	0.0876	0.4910
7. Dredging	Berth 22	0.0035	0.0196	0.1300	0.0012	0.0030
	Berths 32-33	0.0140	0.0785	0.5196	0.0049	0.0119
	Dredge Federal Channel with electric cutterhead	0.0000	0.0000	0.0000	0.0000	0.0000
	Federal channel with electric clamshell dredge – disposed at MHEA	0.0429	0.2400	1.5880	0.0150	0.0362
	Federal channel with electric clamshell dredge – disposed at Montezuma	0.0212	0.1186	0.7847	0.0074	0.0179
	Subtotal	0.0816	0.4568	3.0223	0.0286	0.0690
Dredging Disposal Emissions	Berth 22	0.0058	0.0301	0.1602	0.0013	0.0036
	Berths 32-33 to SFDODS	0.0966	0.4228	2.2437	0.0206	0.0504
	Federal Channel deepening with hydraulic placement at MHEA	0.0000	0.0000	0.0000	0.0000	0.0000
	Channel deepening material placed at MHEA with scows	0.0094	0.0485	0.2583	0.0022	0.0058
	Channel Deepening material disposed at Montezuma with scows	0.0566	0.2923	1.5575	0.0131	0.0350
	Subtotal	0.1684	0.7936	4.2197	0.0372	0.0948
Total		**3.3108**	**12.1356**	**33.9971**	**0.2607**	**1.2147**

REFERENCES

[1]The South Coast Air Quality Management District - CEQA Handbook, Table A9-8-D.

[2] ENVIRON, W. Sylte and Sierra Nevada, 2007. Port of Oakland, 2005 Seaport Air Emissions Inventory.