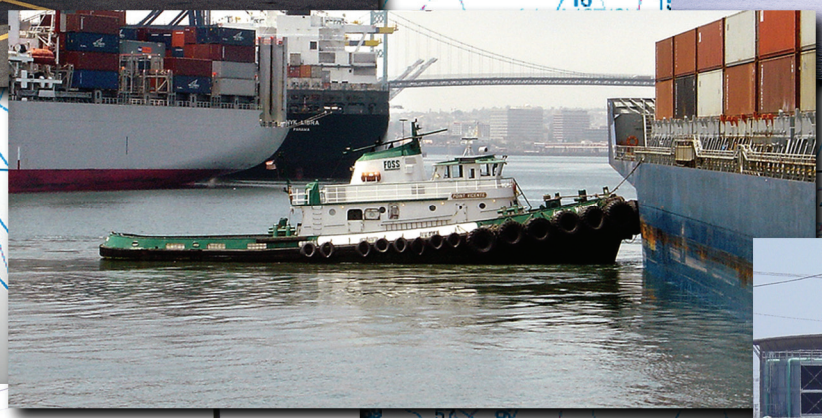
PORT OF LOS ANGELES
INVENTORY OF AIR EMISSIONS
2005

Centennial
THE PORT OF LOS ANGELES
1907 2007



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Addendum
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Prepared by:
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ADDENDUM

THE PORT OF LOS ANGELES INVENTORY OF AIR EMISSIONS FOR CALENDAR YEAR 2005

Prepared for:

THE PORT OF LOS ANGELES

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SECTION 1 INTRODUCTION

The emission estimates presented in the Port's emissions inventory reports are prepared from a diverse collection of data sources using the calculation methods detailed in the individual reports. The datasets are maintained within a database system developed by the Port; the database system also performs the calculations that produce the emission estimates. The calculation methods are updated and improved from year to year as new information becomes available and as improvements are made to the "state of the science" of developing emissions inventories. A major improvement was made between the 2007 and 2008 inventory reports to the portion of the database calculation system that estimates emissions from ocean-going vessels (OGVs) to support tracking of the fuel switch reimbursement and vessel speed reduction incentive programs.

As part of a continuous process of quality control/quality assurance, the data files and calculation routines used to estimate emissions are reviewed to identify and resolve differences that may exist between the published Inventory of Air Emissions for a given year and the latest database emissions and activity estimates for that year. Additional review has been conducted as a part of the evaluation of the new OGV calculation system to ensure that it properly accounts for the many variables and assumptions that are part of the OGV emission calculation methodology. In the course of these reviews several inconsistencies were identified between the calculation methodology undertaken for the 2005 EI report and the methodology in the routines of the new OGV calculation system.

This Addendum will be used to highlight and explain the nature of the differences in emission estimates that have been caused by resolving the inconsistencies. As noted above, most of the changes relate to the OGV emission estimates, but the source categories of harbor craft, cargo handling equipment, and heavy-duty trucks are also discussed.

Although GHG emissions were not estimated for the 2005 EI report, they are summarized in Table 1 by source category for completeness.

Table 1: 2005 Port-wide GHG Emissions, metric tons

2005	CO_2	CO_2 Equivalent	N_2O	CH_4
Ocean-going vessels	339,840	333,990	19	2
Harbor craft	79,214	78,133	3	0
Cargo handling equipment	196,096	194,528	5	6
Rail locomotives	79,686	78,897	2	6
Heavy-duty vehicles	504,276	483,757	65	20
Total	**1,199,111**	**1,169,306**	**94**	**35**

Table 2 summarizes the overall changes in emission estimates resulting from the review and improvement processes.

Table 2: 2005 Port-wide Published vs. Revised Emissions Comparison, tpy

2005 Published	**PM_{10}**	**$PM_{2.5}$**	**DPM**	**NO_x**	**SO_x**	**CO**	**HC**
Ocean-going vessels	634	507	552	6,206	5,609	540	247
Harbor craft	38	35	38	1,259	7	297	26
Cargo handling equipment	63	58	63	2,037	14	1,010	153
Rail locomotives	57	53	57	1,783	97	244	100
Heavy-duty vehicles	280	257	280	6,104	43	2,226	469
Total	**1,072**	**910**	**990**	**17,389**	**5,770**	**4,317**	**995**
2005 Revised							
Ocean-going vessels	644	515	559	6,151	5,861	541	245
Harbor craft	38	35	38	1,259	7	297	26
Cargo handling equipment	61	56	60	2,021	14	982	100
Rail locomotives	57	53	57	1,712	97	237	89
Heavy-duty vehicles	311	286	311	6,715	48	2,185	386
Total	**1,111**	**946**	**1,024**	**17,859**	**6,027**	**4,242**	**846**
Difference							
Ocean-going vessels	10	8	7	-54	252	1	-2
Harbor craft	0	0	0	0	0	0	0
Cargo handling equipment	-2	-2	-3	-16	0	-28	-53
Rail locomotives	0	0	0	-71	0	-7	-11
Heavy-duty vehicles	31	29	31	611	5	-41	-83
Difference	**39**	**36**	**34**	**470**	**257**	**-75**	**-148**
% Difference							
Ocean-going vessels	2%	2%	1%	-1%	4%	0%	-1%
Harbor craft	1%	1%	1%	0%	1%	0%	0%
Cargo handling equipment	-3%	-3%	-5%	-1%	0%	-3%	-34%
Rail locomotives	-1%	0%	-1%	-4%	0%	-3%	-11%
Heavy-duty vehicles	11%	11%	11%	10%	12%	-2%	-18%
% Difference	**4%**	**4%**	**3%**	**3%**	**4%**	**-2%**	**-15%**

SECTION 2 RESOLUTION OF DISCREPANCIES

This section details the inconsistencies between methodology and calculations that were identified and have been resolved as part of the detailed reviews discussed above. For each source category, a subsection will present the overall differences between the estimates

Table 3 (on the following page) summarizes the resolution of inconsistencies by source category; lists the qualitative magnitude and direction of the impact on estimated emissions; and lists which pollutants and (for OGVs and harbor craft) which engine types are impacted by the change. Low impact is considered less than 15% change in emissions.

Table 3: Discrepancy Resolutions - 2005 Inventory

Source Category	Item	Impact on Emissions	Increase/ Decrease	Pollutants Impacted	Engine Type Impacted
OGV	Changed vessel type classification rules	Low	Varies	All	All
OGV	Improved vessel activity allocation to port	Low	Increase	All	All
OGV	Some departures assigned to anchorage instead of port	Low	Increase	All	All
OGV	Limited activty data to calendar year (no carryover)	Low	Decrease	All	All
OGV	Minimum main engine load factor of 2%	Low	Increase	All	Propulsion
OGV	Changed operator query from MarEx to Lloyd's for fuel switching	Low	Increase	PM. NO_x, SO_x, N_2O	Prop & Aux
OGV	Corrected low load adjustment factors	Low	Decrease	HC, CH_4	Propulsion
OGV	Maximum main engine load factor cap of 100%	Low	Decrease	All	Propulsion
OGV	Made assumption that boilers are on when main engine load <20%, all zones	Low	Increase	All	Boilers
OGV	Changed method of assigment of missing speeds	Medium	Decrease	All	Propulsion
OGV	Implemented averaging of MarEx speeds to estimate zone speeds	Low	Decrease	All	Propulsion
OGV	Updated zone distances	Low	Increase	All	All
OGV	Changed assumption of slide valve use from 2005 build year to 2004	Low	Decrease	PM. NO_x	Propulsion
OGV	Changed maneuvering load calc to vessel by vessel basis	Low	Varies	All	All
OGV	Changed maneuvering time assumptions from vessel type to berth location	Low	Varies	All	All
OGV	Implemented assumption that D/E cruise ships do not use their fired boilers	Low	Decrease	All	Boilers
HC	Improved logic for defaults in cases of reported zero activity	Medium	Decrease	All	Prop & Aux
CHE	Improved logic for defaults in cases of reported zero activity	Medium	Decrease	All	All
HDV	Corrected minor calculation errors (SO_2 calc, # truck trips)	Low	Decrease	All	All
HDV	Corrected reported emissions from ROG to THC	Medium	Decrease	HC	All

2.1 2005 OGV Revisions

Part of the review and validation of the new OGV calculation system was a comparison between the estimates produced by the two systems using 2005 activity data. In reviewing the reasons for the differences between the two sets of emission estimates, inconsistencies were discovered between the calculation methodology undertaken for the 2005 EI report and the methodology in the routines of the new OGV calculation system. The inconsistencies are listed in Table 3 and are described in detail below. Table 4 illustrates the overall differences between the OGV emission estimates published in the 2005 EI report and the emissions estimated by the new database calculation system which include the changes listed in Table 3.

Table 4 shows that the re-calculated 2005 criteria pollutant emissions from new calculation system are 2 to 8% lower than those in the published report.

Table 4: 2005 OGV Emission Differences due to Revisions, tpy

2005 OGV	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
2005 Report	634	507	552	6,206	5,609	540	247
2005 Revised	644	515	559	6,151	5,861	541	245
Difference	**10**	**8**	**7**	**-54**	**252**	**1**	**-2**
% Difference	**2%**	**2%**	**1%**	**-1%**	**4%**	**0%**	**-1%**

The issues listed in Table 3 are further discussed and explained below for the OGV source category.

Issue: Vessel Activity Estimates
Affected Source Category: OGV
Affected Pollutants: All
Impact on Emissions: Minor

The vessel activity data that is the primary basis of the OGV emission estimates is obtained from the Marine Exchange and consists of records of vessel arrivals and departures. The processing of this Marine Exchange data includes determining when and from where a vessel arrives at a berth (for example, directly from sea or in a shift from an anchorage berth), how long it stays at each location, when it departs, and to what destination it is headed (for example, to a Port of Long Beach berth, or back out to sea). Many vessels do not arrive at a berth directly from sea. Some vessels arrive at anchorage and move from one anchorage area to another prior to entering the port. Still others come into San Pedro Bay to refuel, be inspected, clean their holds, change crews, receive orders to go to a different port, lighter, take on provisions, undergo repairs, or may even be quarantined without ever reaching a terminal. In instances such as these, the task of assigning specific OGV activity to a port, terminal and/or berth can become complicated.

The OGV activity data provided by the Marine Exchange consists of a series of records describing a single vessel movement such as an arrival, a shift (movement within the San Pedro Bay system of berths and anchorages), or a departure. Vessel activity related to both San Pedro Bay Ports is included and is not differentiated by the Marine Exchange. The emissions resulting from these activities are estimated on a row-by-row basis, so it is necessary to allocate the activities and emissions to one of the Ports or, if a vessel never actually berthed at either port, to a "port surrogate" designated "Anchorage" (this might occur in the case of vessels that call at an anchorage to take on fuel, for example). Because of the row-by-row nature of the Marine Exchange data, the methodology for allocating vessel activity and the associated emission to a port, terminal or berth requires tracing a vessel's movements back a number of steps. The following changes have been made regarding the process of allocating activities and emissions to the correct port or berth:

- For the published 2005 EI report, the number of previous movements that were analyzed to assign an activity to a port or berth was not sufficient to correctly allocate all activities to the appropriate port or berth. The methodology in the new OGV calculation system has been improved such that the 2008 EI methodology traces a ship's movements back an indefinite number of steps, so all activities can be appropriately allocated. The prior system was designed to "look back" three records for the 2007 and 2006 estimates, and only two records for the 2005 estimates. This allowed a misallocation of a small number of vessel activities to the wrong port or to Anchorage.

- In addition, some departures may have been assigned to anchorage instead of port.

Issue: Calendar Year Definition for Vessel Activity
Affected Source Category: OGV
Affected Pollutants: All
Impact on Emissions: Minor

The data file for the 2005 calendar year contained data on activities that occurred in the following year. The new OGV calculation system has been designed to limit this activity analysis strictly to the calendar year of study (1 January to 31 December).

Issue: Minimum 2% Cap for low loads
Affected Source Category: OGV
Affected Pollutants: All
Impact on Emissions: Minor

The established methodology includes the assumption that main engines do not operate below 2% load. The calculations behind the published 2005 EI report did not include a provision for setting a minimum load of 2% for the transiting zones, so some main engine loads were estimated below 2%. The low load adjustment factors were implemented for loads between 2% and 20%, so the emissions calculated for loads below 2% were not assigned a low load adjustment factor. The impact of this was minor because few loads were calculated below 2%.

Issue: Vessel Type Classification
Affected Source Category: OGV
Affected Pollutants: All
Impact on Emissions: Minor

In the 2005 EI report, the vessel type classification was based on vessel types as reported by the Marine Exchange in the activity source data. Lloyd's vessel type classification system is believed to be a more consistent source of vessel-specific information. The new OGV calculation system uses the Lloyd's vessel type classification (based on IMO number) to classify the vessel types and subtypes. In addition, the tanker subtypes were re-assigned so that all tankers, with the exception of chemical tankers, were assigned to the Aframax, Handyboat, Panamax, or Suezmax classification. In the 2005 EI report, only tankers that were exclusively crude oil tankers were assigned to these tanker subtypes.

Table 5 compares the total revised versus the total published 2005 OGV movements. Arrivals and departures increased by 7%, shifts increased by 31%. There was a 10% increase in total movements.

Table 5: Comparison of Total OGV Movements for 2005

	Arrival	Departure	Shift	Total
2005 Report	2,341	2,312	777	5,430
2005 Revised	2,500	2,463	1,018	5,987
Difference	**159**	**151**	**241**	**557**
% Difference	**7%**	**7%**	**31%**	**10%**

Table 6 (Table 2.4 in the 2005 EI) shows the revised 2005 OGV movements table, which takes into account the various vessel activity changes, calendar year definition, and vessel type classification.

Table 6: OGV Movements for 2005

Category	Arrivals	Departures	Shifts	Total
Auto Carrier	68	68	8	144
Bulk	150	159	152	461
Bulk - Heavy Load	2	2	1	5
Bulk Wood Chips	3	3	3	9
Container1000	201	202	32	435
Container2000	184	187	30	401
Container3000	296	296	58	650
Container4000	398	400	38	836
Container5000	215	205	38	458
Container6000	131	129	7	267
Container7000	52	52	5	109
Container8000	0	2	2	4
Cruise	272	271	2	545
General Cargo	97	93	94	284
ITB	60	39	58	157
MISC	3	3	2	8
Reefer	62	65	61	188
Tanker - Aframax	6	6	13	25
Tanker - Chemical	140	136	199	475
Tanker - Handyboat	91	84	121	296
Tanker - Panamax	69	67	94	230
Total	**2,500**	**2,469**	**1,018**	**5,987**

2.2 2005 Harbor Craft and Cargo Handling Equipment Revisions

Issue: Erroneous Adjustment for Zero (0) Activity
Affected Source Category: HC, CHE
Affected Pollutants: All
Impact on Emissions: Minor

When information necessary to estimate emissions is missing, the logic in the emissions calculation system calls for the use of defaults or averages derived from similar equipment. Although this is the considered the proper procedure for missing values, in the published 2005 EI report this algorithm was also being used when the database encountered zeros in the engine or equipment activity field (which indicate no activity or zero hours of operation). This resulted in emissions being estimated for equipment that had not been used. This issue has since been resolved in the new database system by discriminating between zeros and missing values. The impact on emissions estimates in the published 2005 EI report is minimal for CHE. Although the same issue existed with harbor craft, the emission estimates for this source category were not affected.

Table 7 shows the effect on the cargo handling equipment emission estimates.

Table 7: 2005 Cargo Handling Equipment Emissions Differences

2005 CHE	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
2005 Report	63	58	63	2,037	14	1,010	153
2005 Revised	61	56	60	2,021	14	982	100
Difference	**-2**	**-2**	**-3**	**-16**	**0**	**-28**	**-53**
% Difference	**-3%**	**-3%**	**-5%**	**-1%**	**0%**	**-3%**	**-34%**

2.3 2005 HDV Emissions

The 2005 HDV emission estimates were prepared using a system of spreadsheet calculations prior to the development of the database calculation system for this source category. While the methodologies used in the spreadsheet and database systems are conceptually the same, there are differences in various components of the calculations that make the final results different. In addition, review of the spreadsheet calculations revealed minor cell reference errors and an underestimation of regional VMT, which lowered the reported emission estimates. In addition, the reporting of the group of organic compounds designated "hydrocarbons" (HC) was based on estimates of the group of compounds termed "reactive organic gases" (ROG) whereas the reporting of "total hydrocarbons" (THC) would have been more consistent with reporting of similar emissions from the other source categories. The HDV emission estimates have been changed to reflect estimates of THC rather than ROG. The net result of these differences was an underestimate of all emissions except CO and HC, which were overestimated. Table 8 shows the difference in emission estimates between the 2005 report and the revised calculations.

Table 8: 2005 HDV Emissions Differences

2005 HDV	**PM_{10}**	**$PM_{2.5}$**	**DPM**	**NO_x**	**SO_x**	**CO**	**HC**
2005 Report	280	257	280	6,104	43	2,226	469
2005 Revised	311	286	311	6,715	48	2,185	386
Difference	**31**	**29**	**31**	**611**	**5**	**-41**	**-83**
% Difference	**11%**	**11%**	**11%**	**10%**	**12%**	**-2%**	**-18%**

SECTION 3 NEW REPORT TABLES

The following is a list of published report table numbers that are affected due to the changes listed in the addendum.

Table ES.1: TEUs per vessel call in 2005
Table ES.3: 2005 Port-related Emissions by Category, tpy
Figure ES.7: Distribution of 2005 Port-related Emissions by Category
Table 2.4: OGV Movements for 2005
Table 2.16: 2005 Ocean-Going Vessel Emissions by Vessel Type, tpy
Table 2.17: 2005 Ocean-Going Vessel Emissions by Engine Type, tpy
Table 2.18: 2005 Ocean-Going Vessel Emissions by Mode, tpy
Table 3.10: 2005 Commercial Harbor Craft Emissions by Engine Type, tpy
Table 4.13: 2005 CHE Emissions by Terminal Type, tpy
Table 4.14: 2005 CHE Emissions by Equipment Type, tpy
Table 5.18: Port-Related Locomotive Operations Estimated Emissions
Table 6.11: Summary of HDV Emissions, tpy
Table 6.12: Summary of HDV Emissions Associated with Container Terminals, tpy
Table 6.13: Summary of HDV Emissions Associated with Other Port Terminals, tpy
Table 7.2: 2005 Port-related Emissions by Category, tpy
Figure 7.8: Distribution of 2005 Port-related Emissions by Category

Table ES.1: TEUs per vessel call in 2005

EI Year	All Calls	Containership Calls	TEUs	Average TEUs/Call
2005	2,500	1,477	7,484,625	5,067

Table ES.3: 2005 Port-related Emissions by Category, tpy

2005 Revised	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
Ocean-going vessels	644	515	559	6,151	5,861	541	245
Harbor craft	38	35	38	1,259	7	297	26
Cargo handling equipment	61	56	60	2,021	14	982	100
Rail locomotives	57	53	57	1,712	97	237	89
Heavy-duty vehicles	311	286	311	6,715	48	2,185	386
Total	**1,111**	**946**	**1,024**	**17,859**	**6,027**	**4,242**	**846**

Figure ES.7: 2005 Port-related Emissions by Category

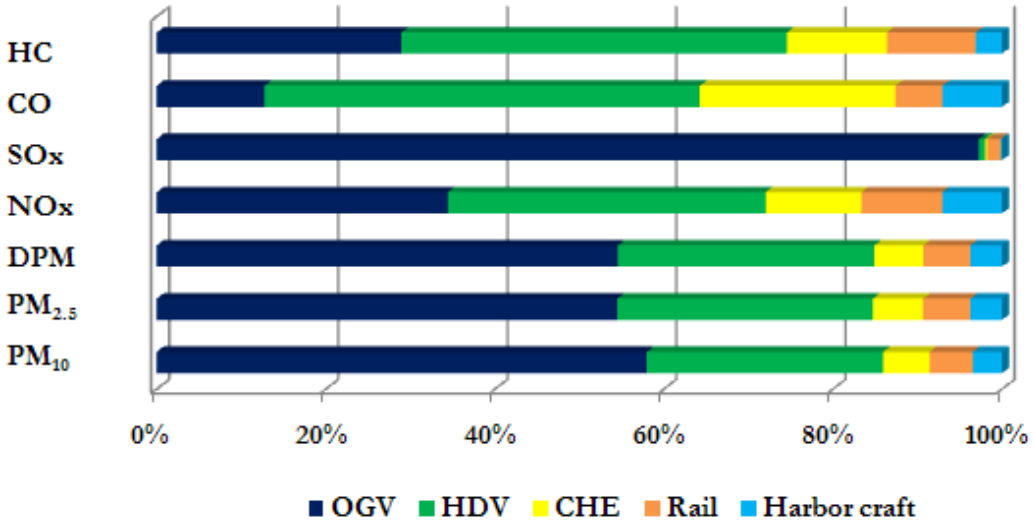

Table 2.4: OGV Movements for 2005

Category	Arrivals	Departures	Shifts	Total
Auto Carrier	68	68	8	144
Bulk	150	159	152	461
Bulk - Heavy Load	2	2	1	5
Bulk Wood Chips	3	3	3	9
Container1000	201	202	32	435
Container2000	184	187	30	401
Container3000	296	296	58	650
Container4000	398	400	38	836
Container5000	215	205	38	458
Container6000	131	129	7	267
Container7000	52	52	5	109
Container8000	0	2	2	4
Cruise	272	271	2	545
General Cargo	97	93	94	284
ITB	60	39	58	157
MISC	3	3	2	8
Reefer	62	65	61	188
Tanker - Aframax	6	6	13	25
Tanker - Chemical	140	136	199	475
Tanker - Handyboat	91	84	121	296
Tanker - Panamax	69	67	94	230
Total	**2,500**	**2,469**	**1,018**	**5,987**

Table 2.16: 2005 Ocean-Going Vessel Emissions by Vessel Type, tpy

2005 OGV	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
Auto Carrier	8	6	7	77	64	6	3
Bulk	22	18	21	218	192	18	7
Bulk - Heavy Load	0	0	0	2	2	0	0
Bulk Wood Chips	0	0	0	4	4	0	0
Container - 1000	23	19	18	205	246	17	8
Container - 2000	36	29	31	350	327	29	13
Container - 3000	70	56	63	752	568	63	28
Container - 4000	113	91	105	1,166	900	107	52
Container - 5000	79	64	71	815	667	80	39
Container - 6000	58	46	54	586	451	55	26
Container - 7000	23	18	21	218	200	21	10
Container - 8000	1	0	1	5	5	1	0
Cruise	107	86	104	979	919	77	31
General Cargo	14	11	13	144	115	12	5
ITB	1	1	1	26	1	2	1
MISC	1	0	0	5	7	0	0
Reefer	12	10	11	114	116	9	4
Tanker - Aframax	3	2	2	21	35	2	1
Tanker - Chemical	30	24	15	194	422	17	8
Tanker - Handyboat	20	16	9	126	317	10	5
Tanker - Panamax	22	18	12	145	304	13	6
Total	**644**	**515**	**559**	**6,151**	**5,861**	**541**	**245**

Table 2.17: 2005 Ocean-Going Vessel Emissions by Engine Type, tpy

2005 OGV	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
Auxiliary Engine	277	221	277	2,842	2,166	227	82
Auxiliary Boiler	81	65	0	213	1,674	20	10
Main Engine	286	229	282	3,097	2,021	294	153
Total	**644**	**515**	**559**	**6,151**	**5,861**	**541**	**245**

Table 2.18: 2005 Ocean-Going Vessel Emissions by Mode, tpy

Mode	Engine Type	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
Transit	Aux	34	27	34	334	275	26	10
Transit	Auxiliary Boiler	0	0	0	0	0	0	0
Transit	Main	266	213	262	2,928	1,963	264	124
Total Transit		**300**	**240**	**296**	**3,262**	**2,238**	**291**	**134**
Maneuvering	Aux	24	19	24	242	186	19	7
Maneuvering	Auxiliary Boiler	2	2	0	6	45	1	0
Maneuvering	Main	20	16	20	169	58	30	28
Total Maneuvering		**46**	**37**	**44**	**417**	**290**	**50**	**35**
Hotelling - Berth	Aux	208	166	208	2,164	1,618	173	63
Hotelling - Berth	Auxiliary Boiler	76	60	0	198	1,558	19	9
Hotelling - Berth	Main	0	0	0	0	0	0	0
Total Hotelling - Berth		**284**	**227**	**208**	**2,362**	**3,175**	**192**	**72**
Hotelling - Anchorage	Aux	11	9	11	101	87	8	3
Hotelling - Anchorage	Auxiliary Boiler	3	3	0	9	71	1	0
Hotelling - Anchorage	Main	0	0	0	0	0	0	0
Total Hotelling - Anchorage		**14**	**11**	**11**	**110**	**158**	**9**	**3**
Total		**644**	**515**	**559**	**6,151**	**5,861**	**541**	**245**

Table 4.13: 2005 CHE Emissions by Terminal Type, tpy

Terminal Type	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
Auto	0	0	0	0	0	2	0
Break-Bulk	11	10	11	259	0	113	19
Container	42	39	42	1,509	12	580	55
Cruise	0	0	0	8	0	13	2
Dry Bulk	1	1	1	16	0	6	1
Liquid	0	0	0	2	0	3	0
Other	7	6	6	225	2	264	23
Total	**61**	**56**	**60**	**2,021**	**14**	**982**	**100**

Table 4.14: 2005 CHE Emissions by Equipment Type, tpy

Port Equipment	Engine Type	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
Bulldozer	Diesel	1	1	1	19	0	6	1
Crane	Diesel	1	1	1	20	0	8	1
Dump Truck	Diesel	3	3	3	62	0	25	5
Excavator	Diesel	2	2	2	55	0	12	3
Forklift	Gasoline	0	0	0	8	0	20	1
Forklift	Diesel	2	2	2	45	0	18	3
Forklift	Propane	0	0	0	77	0	218	19
Fuel Truck	Diesel	0	0	0	2	0	1	0
Loader	Diesel	1	1	1	39	0	8	2
Man Lift	Diesel	0	0	0	3	0	1	0
Propane Truck	Diesel	0	0	0	1	0	0	0
Rail Pusher	Diesel	0	0	0	5	0	2	0
Roller	Diesel	0	0	0	0	0	0	0
Rub-trd Gantry Crane	Diesel	4	3	4	118	1	34	6
Side pick	Diesel	2	1	2	44	0	12	2
Skid Steer Loader	Diesel	0	0	0	1	0	1	0
Sweeper	Gasoline	0	0	0	2	0	6	0
Sweeper	Diesel	0	0	0	3	0	1	0
Top handler	Diesel	6	6	6	240	2	47	9
Truck	Diesel	0	0	0	0	0	0	0
Utility	Diesel	0	0	0	0	0	0	0
Vacuum Truck	Diesel	0	0	0	0	0	0	0
Water Truck	Diesel	1	1	1	12	0	4	1
Yard tractor	Diesel	36	33	36	1,226	11	264	36
Yard tractor	Propane	1	1	0	39	0	294	8
Total		**61**	**56**	**60**	**2,021**	**14**	**982**	**100**

Table 5.18: Port-Related Locomotive Operations Estimated Emissions

	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_2	CO	HC
On-Port Emissions, tons per year							
Switching	4.5	4.2	4.5	210.0	1.1	21.8	10.4
Line Haul	16.5	15.4	16.5	468.8	31.4	68.0	24.5
On-Port Subtotal	**21.0**	**19.6**	**21.0**	**678.8**	**32.4**	**89.9**	**34.8**
Off-Port (regional) Emissions, tons per year							
Switching	1.8	1.7	1.8	71.2	0.4	7.5	4.1
Line Haul	33.8	31.6	33.8	961.6	64.3	139.6	50.2
Off-Port Subtotal	**35.6**	**33.3**	**35.6**	**1,032.8**	**64.7**	**147.0**	**54.3**
Switching Subtotal	6.3	5.9	6.3	281.2	1.5	29.3	14.5
Line Haul Subtotal	50.3	47.0	50.3	1,430.5	95.7	207.6	74.6
Total	**56.6**	**52.9**	**56.6**	**1,711.6**	**97.2**	**236.9**	**89.1**

Table 6.11: Summary of HDV Emissions, tpy

Activity Location	VMT	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
On-Terminal	6,564,657	30	28	30	514	1	228	90
On-Road	259,870,104	281	258	281	6,201	47	1,957	296
Total	**266,434,761**	**311**	**286**	**311**	**6,715**	**48**	**2,185**	**386**

Table 6.12: Summary of HDV Emissions Associated with Container Terminals, tpy

Activity Location	VMT	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
On-Terminal	5,188,764	24	22	24	402	1	181	72
On-Road	234,469,989	254	233	254	5,595	42	1,767	267
Total	**239,658,753**	**278**	**256**	**278**	**5,998**	**43**	**1,948**	**339**

Table 6.13: Summary of HDV Emissions Associated with Other Port Terminals, tpy

Activity Location	VMT	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
On-Terminal	1,375,894	6	5	6	112	0	47	18
On-Road	25,400,115	27	25	27	606	5	190	29
Total	**26,776,008**	**33**	**30**	**33**	**718**	**5**	**237**	**47**

Table 7.2: 2005 Port-related Emissions by Category, tpy

2005 Revised	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
Ocean-going vessels	644	515	559	6,151	5,861	541	245
Harbor craft	38	35	38	1,259	7	297	26
Cargo handling equipment	61	56	60	2,021	14	982	100
Rail locomotives	57	53	57	1,712	97	237	89
Heavy-duty vehicles	311	286	311	6,715	48	2,185	386
Total	**1,111**	**946**	**1,024**	**17,859**	**6,027**	**4,242**	**846**

Figure 7.8: Distribution of 2005 Port-related Emissions by Category