PORT OF LOS ANGELES
INVENTORY OF AIR EMISSIONS - 2006

THE PORT
OF LOS ANGELES

Addendum
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Prepared by:
STARCREST CONSULTING GROUP, LLC

ADDENDUM

THE PORT OF LOS ANGELES INVENTORY OF AIR EMISSIONS FOR CALENDAR YEAR 2006

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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 2006 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.

Table 1 summarizes the overall changes in emission estimates resulting from the review and improvement processes.

Table 1: 2006 Port-wide Published vs. Revised Emissions Comparison, tpy

2006 Published	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC	CO_2	N_2O	CH_4
Ocean-going vessels	644	515	546	6,614	5,711	601	279	406,440	23	3
Harbor craft	52	48	52	1,265	1	345	84	87,746	3	2
Cargo handling equipment	52	49	51	1,853	2	977	95	285,708	5	7
Rail locomotives	72	65	72	2,081	131	320	115	116,210	10	3
Heavy-duty vehicles	404	372	404	8,579	40	2,808	599	699,326	92	28
Total	**1,224**	**1,048**	**1,126**	**20,392**	**5,886**	**5,052**	**1,170**	**1,595,430**	**133**	**42**
2006 Revised										
Ocean-going vessels	700	560	603	6,760	6,401	612	279	406,334	23	6
Harbor craft	51	47	51	1,245	1	339	82	61,676	3	1
Cargo handling equipment	51	47	50	1,826	2	970	94	202,076	5	6
Rail locomotives	72	65	72	2,081	131	320	115	116,210	3	10
Heavy-duty vehicles	362	333	362	7,672	40	2,518	437	624,888	82	25
Total	**1,236**	**1,053**	**1,138**	**19,585**	**6,575**	**4,760**	**1,006**	**1,411,184**	**116**	**47**
Difference										
Ocean-going vessels	56	45	56	147	690	10	1	-106	0	3
Harbor craft	-1	-1	-1	-20	0	-6	-2	-26,070	0	-1
Cargo handling equipment	-1	-1	-1	-28	0	-7	-1	-83,632	0	-1
Rail locomotives	0	0	0	0	0	0	0	0	0	7
Heavy-duty vehicles	-42	-39	-42	-907	0	-290	-162	-74,438	-10	-3
Difference	**12**	**5**	**12**	**-807**	**689**	**-292**	**-164**	**-184,246**	**-17**	**5**
% Difference										
Ocean-going vessels	9%	9%	10%	2%	12%	2%	0%	0%	2%	92%
Harbor craft	-2%	-2%	-2%	-2%	-2%	-2%	-2%	-30%	-8%	-30%
Cargo handling equipment	-2%	-2%	-2%	-1%	-2%	-1%	-1%	-29%	-9%	-19%
Rail locomotives	0%	0%	0%	0%	0%	0%	0%	0%	-69%	218%
Heavy-duty vehicles	-10%	-10%	-10%	-11%	-1%	-10%	-27%	-11%	-11%	-10%
% Difference	**1%**	**0%**	**1%**	**-4%**	**12%**	**-6%**	**-14%**	**-12%**	**-13%**	**13%**

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 2 (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. Medium impact is considered a 15-30% change in emissions.

Table 2: Discrepancy Resolutions – 2006 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	Standardized fuel switching hierarchy	Low	Varies	PM. NO_x, SO_x, N_2O	Prop & Aux
OGV	Changed operator query from MarEx to Lloyd's for fuel switching	Low	Increase	PM. NO_x, SO_x, N_2O	Prop & Aux
OGV	Changed start of Maersk vessel ME fuel switch from 1/1/06 to 7/1	Low	Increase	PM. NO_x, SO_x, N_2O	Propulsion
OGV	Applied 95% shore power reduction instead of 100%	Low	Increase	All	Auxilliary
OGV	Corrected low load adjustment factors	Low	Decrease	HC, CH_4	Propulsion
OGV	Corrected miscalcuated hoteling times	Low	Increase	All	Aux & boilers
HC	Removed deterioration rates for GHGs	Medium	Decrease	CO_2, N_2O, CH_4	Prop & Aux
CHE	Removed deterioration rates for GHGs	Medium	Decrease	CO_2, N_2O, CH_4	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 2006 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 2006 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 2006 EI report and the methodology in the routines of the new OGV calculation system. The inconsistencies are listed in Table 2 and are described in detail below. Tables 3 and 4 illustrate the overall differences between the OGV emission estimates published in the 2006 EI report and the emissions estimated by the new database calculation system which include the changes listed in Table 2.

Table 3 shows that the re-calculated 2006 criteria pollutant emissions from the new calculation system are 0 to 12% higher than those in the published report

Table 3: 2006 OGV Emission Differences due to Revisions, tpy

2006 OGV	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
2006 Report	644	515	546	6,614	5,711	601	279
2006 Revised	700	560	603	6,760	6,401	612	279
Difference	**56**	**45**	**56**	**147**	**690**	**10**	**1**
% Difference	**9%**	**9%**	**10%**	**2%**	**12%**	**2%**	**0%**

Tables 4 shows the 2006 greenhouse gas emissions differences as estimated by the revised calculation system used in preparing those estimates as compared to the published greenhouse gas emissions. The 67% difference for CH_4 is mainly due to the low load adjustment factor correction and the percentage is high due to the low emissions value, but the impact on the CO_2 equivalent is negligible.

Table 4: 2006 GHG OGV Emission Differences due to Revisions, metric tons per year

2006 OGV	CO_2 Equivalent	CO_2	N_2O	CH_4
2006 Report	375,977	369,491	21	3
2006 Revised	376,035	369,398	21	5
Difference	**58**	**-93**	**0**	**2**
% Difference	**0%**	**0%**	**0%**	**69%**

The issues listed in Table 2 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. Three changes have been made regarding the process of allocating activities and emissions to the correct port or berth:

- For the published 2006 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.

- A limited amount of double counting of activity was found to exist in the 2006 EI OGV data import file and an adjustment was made in the database to delete this extraneous vessel arrival and departure activity.

- Four anchorages were not included in the berth list used to associate berths for the 2006 inventory, thus some activity associated with the Port and these anchorages was not allocated to the Port. In addition, some departures were assigned to Anchorage instead of the Port.

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

The data file for the 2006 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: Vessel Type Classification
Affected Source Category: OGV
Affected Pollutants: All
Impact on Emissions: Minor

In the 2006 EI reportthe 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 2006 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 2006 numbers of OGV movements. Arrivals did not change greatly while the number of departures had increased by 6% and shift decreased by 3% for a total 2% difference in total movements.

Table 5: Comparison of Total OGV Movements for 2006

	Arrival	Departure	Shift	Total
2006 Report	2,708	2,511	1,206	6,425
2006 Revised	2,701	2,656	1,169	6,526
Difference	**-7**	**145**	**-37**	**101**
% Difference	**0%**	**6%**	**-3%**	**2%**

Table 6 (Table 3.5 in the 2006 EI) shows the revised 2006 OGV movements table, which takes into account the various vessel activity changes, calendar year definition, and vessel type classification.

Table 6: OGV Movements for 2006

Category	Arrivals	Departures	Shifts	Total
Auto Carrier	71	71	9	151
Bulk	177	168	168	513
Bulk - Heavy Load	5	3	8	16
Bulk - Self Discharging	1	1	0	2
Bulk Wood Chips	2	1	3	6
Container1000	218	216	49	483
Container2000	149	149	20	318
Container3000	201	200	30	431
Container4000	515	511	83	1,109
Container5000	289	282	23	594
Container6000	181	181	19	381
Container7000	78	79	3	160
Container8000	1	2	2	5
Cruise	261	261	0	522
General Cargo	126	116	142	384
ITB	53	47	53	153
MISC	1	1	0	2
Reefer	33	34	47	114
RoRo	2	1	1	4
Tanker - Aframax	4	5	11	20
Tanker - Chemical	172	162	251	585
Tanker - Handyboat	96	101	153	350
Tanker - Panamax	65	64	94	223
Total	**2,701**	**2,656**	**1,169**	**6,526**

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 2006 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: Operator Query for Company Policy on Fuel Switching
Affected Source Category: OGV
Affected Pollutants: PM, NO_x, SO_x, N_2O
Impact on Emissions: Minor

In processing the OGV activity data, the Marine Exchange "operator" field was used to determine which vessels switched fuels due to a company policy. The Lloyd's "operator" designation is considered to be a more complete source of vessel operator information, as some vessels operated by a company with a fuel switch policy were not identified in the Marine Exchange data field. The fuel switching activity assumptions were revised based on Lloyd's as the data source rather than the Marine Exchange data. This resulted in a minor decrease in estimated emissions because of the additional vessels that were identified.

Issue: Low Load Adjustment
Affected Source Category: OGV
Affected Pollutants: HC, CH_4
Impact on Emissions: Minor

The hydrocarbon low load adjustment was wrong in published 2006 EI report due to the fact that the wrong intercept was used for hydrocarbon (0.36 in 2006 vs. 0.3859 in 2008). This had a minor impact on overall vessel emission estimates.

Issue: Implemented 95% reduction for shore power rather than 100%
Affected Source Category: OGV
Affected Pollutants: All
Impact on Emissions: Minor

The use of shore power eliminates auxiliary engine emissions at berth once the auxiliary engines are shut down. For vessel calls known to have been shore powered, the methodology assumes a control effectiveness of 95%. This is less than 100% control to account for the time it takes to connect and disconnect the shore power apparatus on arrival or departure. In developing the emission estimates for the 2006 EI report, this aspect of the calculation methodology was not implemented as specified. The impact of this discrepancy on the total emission estimates is minor, because only 5% of auxiliary engine emissions at berth were erroneously removed for the few vessel calls that shore powered in 2006.

2.2 2006 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 2006 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 the published 2006 EI report is minimal for harbor craft and cargo handling equipment.

Issue: Erroneous Deterioration Rates for Greenhouse Gases
Affected Source Category: HC, CHE
Affected Pollutants: CO_2, CH_4, N_2O
Impact on Emissions: Significant

The deterioration rate is the increase in emissions due to wear as equipment ages through use. In the emissions inventory, criteria pollutant emission deterioration rates increase as the cumulative hours of activity increase. In the development of the greenhouse gas emission calculation component of the 2006 EI report, these compounds were thought to increase as related criteria pollutants increased. That is, emissions of methane were modeled to increase as hydrocarbons increased and emissions of nitrous oxide were modeled to increase as emission of oxides of nitrogen increased. However, because there are currently no data sources available on greenhouse gas deterioration rates, this assumption should not have been made. Additionally, in the 2006 EI report, deterioration rates were inadvertently applied to the CO_2 emission estimates. In removing the estimates of deterioration from the calculation of these pollutants, the greenhouse gases emission estimates were reduced significantly.

Table 7 shows the cumulative effect on the harbor craft emission estimates due to the erroneous adjustment for zero activity and to the removal of GHG deterioration rates.

Table 7: 2006 Harbor Craft Emissions Differences, tpy and %

2006 Harbor Craft	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC	CO_2	N_2O	CH_4
2006 Report	52	48	52	1,265	1	345	84	87,746	3	2
2006 Revised	51	47	51	1,245	1	339	82	61,676	3	1
Difference	**-1**	**-1**	**-1**	**-20**	**0**	**-6**	**-2**	**-26,070**	**-0.2**	**-1**
% Difference	**-2%**	**-2%**	**-2%**	**-2%**	**0%**	**-2%**	**-2%**	**-30%**	**-8%**	**-30%**

Table 8 shows the effect on the cargo handling equipment emission estimates due to the change in the GHG deterioration rates.

Table 8: 2006 Cargo Handling Equipment Emissions Differences, tpy and %

2006 CHE	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC	CO_2	N_2O	CH_4
2006 Report	52	49	51	1,853	2	977	95	285,708	5	7
2006 Revised	51	47	50	1,826	2	970	94	202,076	5	6
Difference	**-1**	**-1**	**-1**	**-28**	**0**	**-7**	**-1**	**-83,632**	**-0.5**	**-1**
% Difference	**-2%**	**-2%**	**-2%**	**-1%**	**-2%**	**-1%**	**-1%**	**-29%**	**-9%**	**-15%**

2.3 2006 HDV Revisions

The database calculation structure review resulted in changes that caused the results to differ from the published HDV emission estimates. The major change was to the way truck miles were allocated among terminals. The regional modeling on which the emission estimates are based estimates mileage for all trucks, those serving container terminals as well as those serving other types of terminals. In order to estimate the mileage associated with each terminal, the total miles are allocated among the terminals according to the number of truck trips to and from each terminal. The allocation to container terminals had been based on the total number of trips to and from the container terminals rather than the total to and from all terminals - this increased the percentage of miles allocated to each container terminal, which in turn caused an overestimate of emissions of all pollutants. Changing the basis of the allocation from container terminal trips to all trips reduced the estimates relative to the reported emissions.

An additional change was made to the SO_x calculations to resolve an underestimate of SO_x emissions. The underestimate occurred because the equation that calculated SO_x emissions in each direction of travel (on each roadway segment) was incorrectly written for one of the directions. This resulted in a lower estimate of emissions for that direction and, therefore, a lower overall emission estimate than should have been the case. Changing the equation so that both directions are calculated the same way increased the SO_x estimates relative to the reported emissions.

In a third change, 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 changes is a reduction in the estimates of all emissions except for SO_x, for which the issues cancelled, resulting in virtually no net change in estimated SO_x emissions. Tables 9 and 10 show the differences in emission estimates between the 2007 report and the revised calculations.

Table 9: 2006 HDV Emissions Differences

2005 HDV	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
2006 Report	404	372	404	8,579	40	2,808	599
2006 Revised	362	333	362	7,672	40	2,518	437
Difference	**-42**	**-39**	**-42**	**-907**	**0**	**-290**	**-162**
% Difference	**-10%**	**-10%**	**-10%**	**-11%**	**-1%**	**-10%**	**-27%**

Table 10: 2006 HDV GHG Emissions Differences

2006 HDV	CO_2 Equivalent	CO_2	N_2O	CH_4
2006 Report	662,276	635,751	84	25
2006 Revised	591,757	568,085	75	23
Difference	**-70,519**	**-67,666**	**-9**	**-2**
% Difference	**-11%**	**-11%**	**-11%**	**-8%**

SECTION 3 REPORT TABLES AND FIGURES AFFECTED

The following is a list of published report table and figure numbers that are affected due to the changes listed in the addendum. In this Addendum, the GHG tables are provided in metric tons per year instead of short tons per year which were the units used in the published report. Additionally, since the published 2005 EI report values have changed with an addendum to that report, all the comparison tables in Chapter 9 had to be revised. In order to be consistent with 2007 and 2008 EI reports, a positive value in the emissions efficiency comparison tables and figures mean an improvement for emissions efficiency. This is different from the 2006 EI report.

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Table ES.1: TEUs and Vessel Call Comparison, %

EI Year	All Calls	Containership Calls	TEUs	Average TEUs/Call
2006	2,701	1,632	8,469,853	5,190
2005	2,500	1,477	7,484,625	5,067
2006-2005	**8%**	**10%**	**13%**	**2%**

Figure ES.3: TEUs and Vessel Call Comparison, %

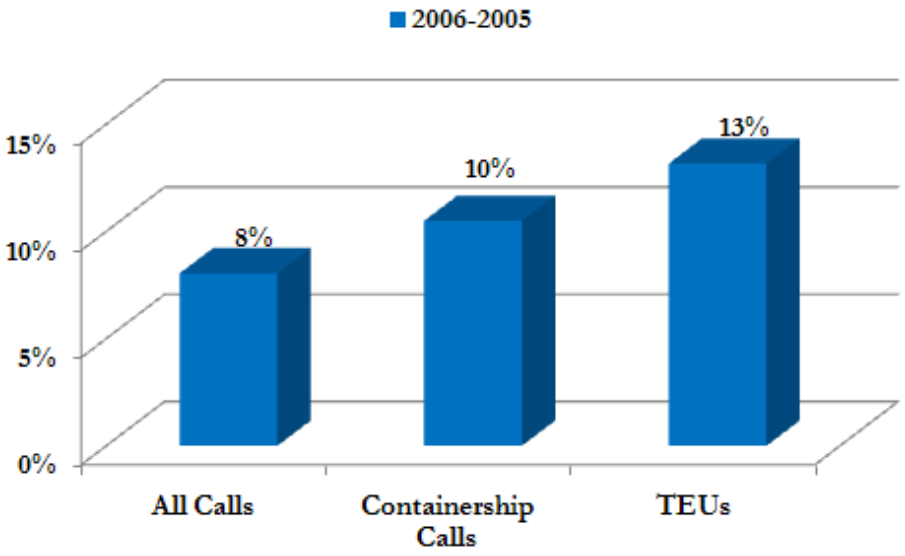

Table ES.8: 2006 Port-related Emissions by Category, tpy

Category	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
Ocean-going vessels	700	560	603	6,760	6,401	612	279
Harbor craft	51	47	51	1,245	1	339	82
Cargo handling equipment	51	47	50	1,826	2	970	94
Rail locomotives	72	65	72	2,081	131	320	115
Heavy-duty vehicles	362	333	362	7,672	40	2,518	437
Total	**1,236**	**1,053**	**1,138**	**19,585**	**6,575**	**4,760**	**1,006**

Table ES.9: 2006 Port-related GHG Emissions by Category, metric tons per year

Category	CO_2	CO_2 Equivalent	N_2O	CH_4
Ocean-going vessels	376,035	369,398	21	5
Harbor craft	56,878	56,070	3	1
Cargo handling equipment	185,102	183,708	4	5
Rail locomotives	106,703	105,647	3	9
Heavy-duty vehicles	591,757	568,085	75	23
Total	**1,316,474**	**1,282,908**	**105**	**43**

Figure ES.8: 2006 Port-related Emissions by Category, %

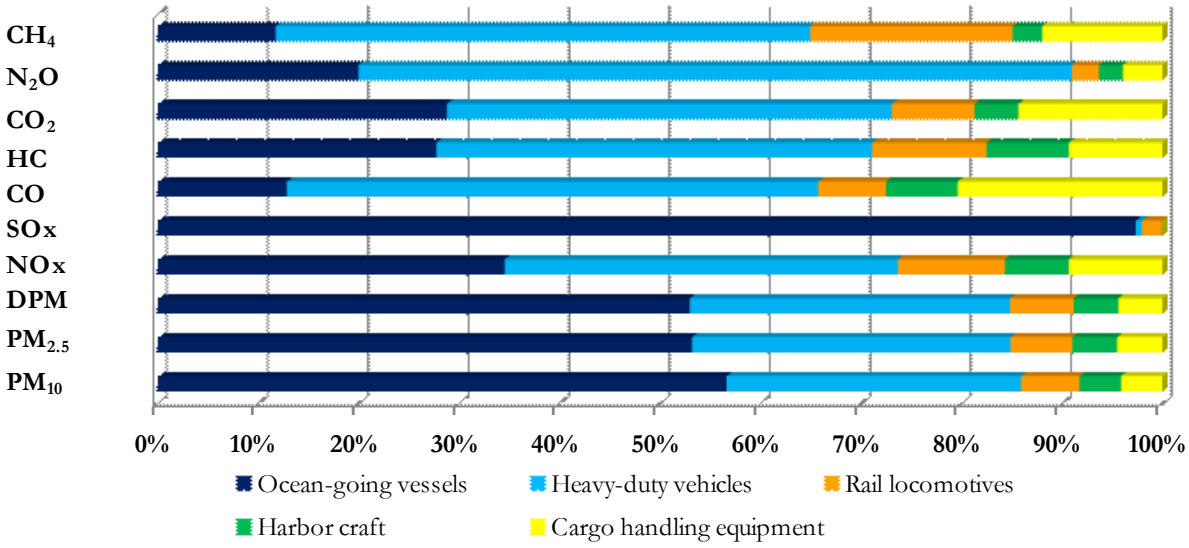

Figure ES.11: 2006 SO_x Emissions in the South Coast Air Basin, %

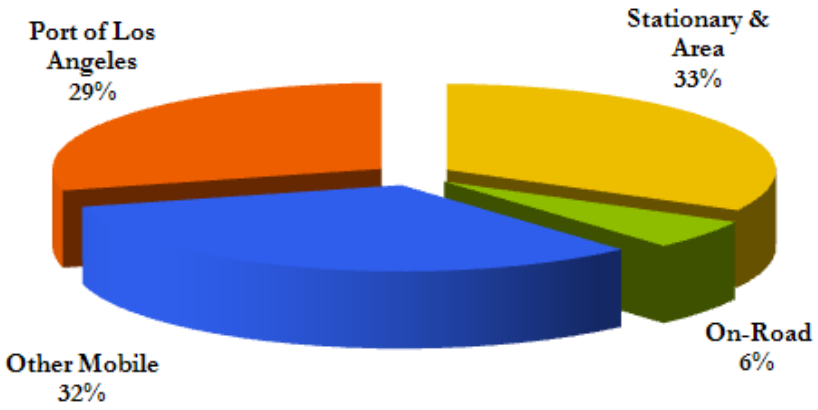

Table ES.10: Port-wide Emissions Comparison, tpy and % Change

EI Year	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
2006	1,236	1,053	1,138	19,585	6,575	4,760	1,006
2005	1,114	949	1,028	17,430	6,022	4,091	888
2006-2005	**11%**	**11%**	**11%**	**12%**	**9%**	**16%**	**13%**

Figure ES.12: Port-wide Emissions Comparison, % Change

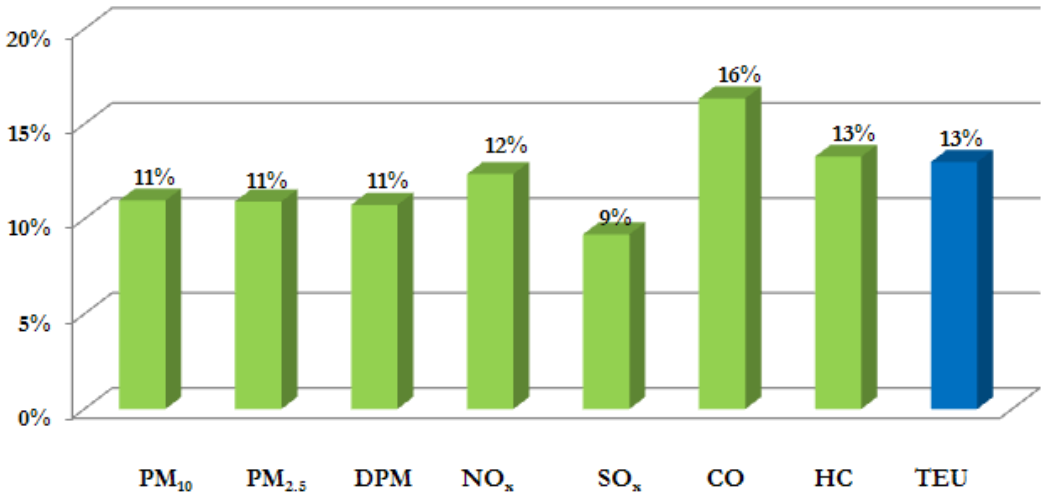

Table ES.11: Port-wide Emissions Efficiency Comparison, tpy and % Change

EI Year	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
2006	1.46	1.24	1.34	23.12	7.76	5.62	1.19
2005	1.49	1.27	1.37	23.29	8.05	5.47	1.19
2006-2005	**-2%**	**-2%**	**-2%**	**-1%**	**-4%**	**3%**	**0%**

Figure ES.14: Port-wide Emissions Efficiency Comparison, 2006-2005, % Change

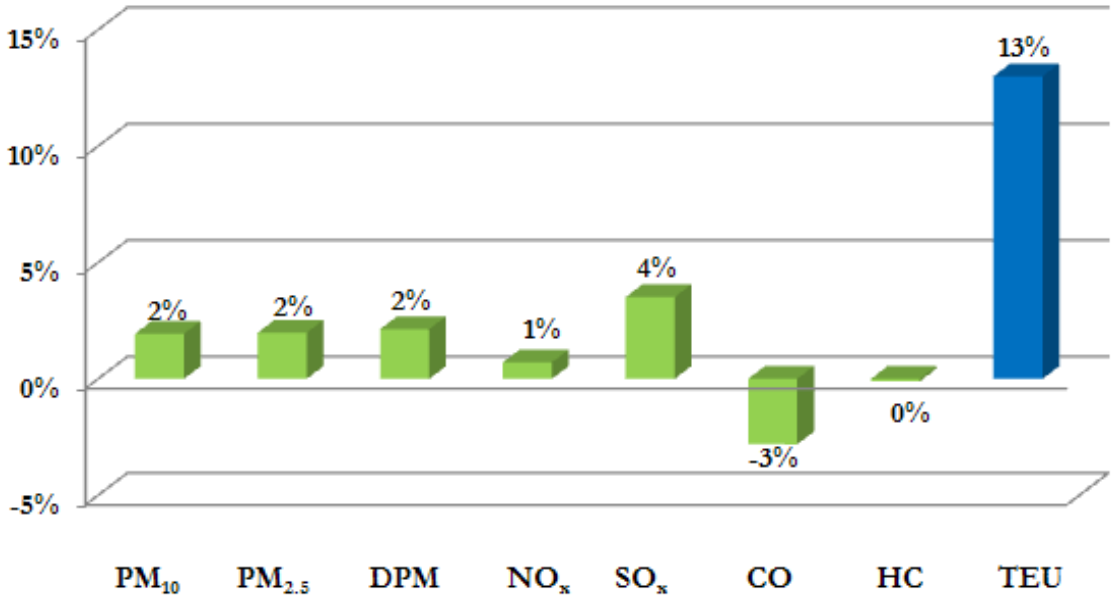

Table 3.5: OGV Movements for 2006

Category	Arrivals	Departures	Shifts	Total
Auto Carrier	71	71	9	151
Bulk	177	168	168	513
Bulk - Heavy Load	5	3	8	16
Bulk - Self Discharging	1	1	0	2
Bulk Wood Chips	2	1	3	6
Container1000	218	216	49	483
Container2000	149	149	20	318
Container3000	201	200	30	431
Container4000	515	511	83	1,109
Container5000	289	282	23	594
Container6000	181	181	19	381
Container7000	78	79	3	160
Container8000	1	2	2	5
Cruise	261	261	0	522
General Cargo	126	116	142	384
ITB	53	47	53	153
MISC	1	1	0	2
Reefer	33	34	47	114
RoRo	2	1	1	4
Tanker - Aframax	4	5	11	20
Tanker - Chemical	172	162	251	585
Tanker - Handyboat	96	101	153	350
Tanker - Panamax	65	64	94	223
Total	**2,701**	**2,656**	**1,169**	**6,526**

Table 3.19: 2006 Ocean-Going Vessel Emissions by Vessel Type, tpy

2006 OGV	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
Auto Carrier	7	6	7	72	60	6	3
Bulk	29	23	27	276	258	23	9
Bulk - Heavy Load	1	1	1	7	6	1	0
Bulk - Self Discharging	0	0	0	1	1	0	0
Bulk Wood Chips	0	0	0	3	3	0	0
Container - 1000	28	22	21	245	299	21	9
Container - 2000	24	19	19	233	225	21	9
Container - 3000	41	33	37	431	347	37	17
Container - 4000	133	107	123	1,368	1,065	131	65
Container - 5000	92	74	83	967	753	97	47
Container - 6000	77	62	72	840	586	80	38
Container - 7000	27	22	25	341	205	34	16
Container - 8000	1	1	1	7	8	1	0
Cruise	105	84	102	969	936	76	30
General Cargo	21	17	19	206	174	17	7
Ocean Tug	1	1	1	26	1	2	1
Miscellaneous	0	0	0	2	3	0	0
Reefer	8	6	7	71	75	6	2
RoRo	0	0	0	5	3	0	0
Tanker - Aframax	2	2	2	18	30	2	1
Tanker - Chemical	51	41	30	345	672	29	12
Tanker - Handyboat	26	20	13	167	375	14	6
Tanker - Panamax	24	19	13	159	317	14	6
Total	**700**	**560**	**603**	**6,760**	**6,401**	**612**	**279**

Table 3.20: 2006 Ocean-Going Vessel GHG Emissions by Vessel Type, metric tons

2006 OGV	CO_2 Equivalent	CO_2	N_2O	CH_4
Auto Carrier	3,201	3,146	0	0
Bulk	13,603	13,381	1	0
Bulk - Heavy Load	327	322	0	0
Bulk - Self Discharging	42	41	0	0
Bulk Wood Chips	159	156	0	0
Container - 1000	17,090	16,761	1	0
Container - 2000	13,500	13,252	1	0
Container - 3000	20,002	19,648	1	0
Container - 4000	62,541	61,483	3	1
Container - 5000	48,737	47,926	3	1
Container - 6000	39,688	39,045	2	1
Container - 7000	17,432	17,164	1	0
Container - 8000	395	389	0	0
Cruise	49,326	48,557	2	1
General Cargo	9,180	9,030	0	0
Ocean Tug	1,376	1,358	0	0
Miscellaneous	142	139	0	0
Reefer	3,975	3,904	0	0
RoRo	235	231	0	0
Tanker - Aframax	1,609	1,575	0	0
Tanker - Chemical	36,128	35,357	2	0
Tanker - Handyboat	20,293	19,843	1	0
Tanker - Panamax	17,056	16,688	1	0
Total	**376,035**	**369,398**	**21**	**5**

Table 3.21: 2006 Ocean-Going Vessel Emissions by Engine Type, tpy

2006 OGV	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
Auxiliary Engine	308	246	308	3,237	2,356	264	96
Auxiliary Boiler	93	74	0	243	1,908	23	12
Main Engine	299	240	295	3,281	2,138	325	172
Total	**700**	**560**	**603**	**6,760**	**6,401**	**612**	**279**

Table 3.22: 2006 Ocean-Going Vessel GHG Emissions by Engine Type, metric tons

2006 OGV	CO_2 Equivalent	CO_2	N_2O	CH_4
Auxiliary Engine	150,561	148,482	7	2
Auxiliary Boiler	104,357	101,751	8	0
Main Engine	121,117	119,165	6	3
Total	**376,035**	**369,398**	**21**	**5**

Table 3.23: 2006 Ocean-Going Vessel Emissions by Mode, tpy

Mode	Engine Type	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
Transit	Aux	36	29	36	361	285	29	11
Transit	Auxiliary Boiler	0	0	0	0	0	0	0
Transit	Main	279	223	275	3,101	2,079	292	140
Total Transit		**315**	**252**	**311**	**3,462**	**2,364**	**321**	**151**
Maneuvering	Aux	25	20	25	263	190	21	8
Maneuvering	Auxiliary Boiler	2	2	0	6	47	1	0
Maneuvering	Main	20	16	20	180	59	33	32
Total Maneuvering		**48**	**38**	**45**	**448**	**296**	**55**	**40**
Hotelling - Berth	Aux	226	181	226	2,420	1,710	198	72
Hotelling - Berth	Auxiliary Boiler	85	68	0	222	1,747	21	11
Hotelling - Berth	Main	0	0	0	0	0	0	0
Total Hotelling - Berth		**311**	**249**	**226**	**2,643**	**3,457**	**219**	**83**
Hotelling - Anchorage	Aux	21	17	21	193	170	15	6
Hotelling - Anchorage	Auxiliary Boiler	6	4	0	14	114	1	1
Hotelling - Anchorage	Main	0	0	0	0	0	0	0
Total Hotelling - Anchorage		**26**	**21**	**21**	**207**	**283**	**17**	**6**
Total		**700**	**560**	**603**	**6,760**	**6,401**	**612**	**279**

Table 3.24: 2006 Ocean-Going Vessel GHG Emissions by Mode, metric tons

Mode	Engine Type	CO_2 Equivalent	CO_2	N_2O	CH_4
Transit	Aux	16,533	16,303	1	0
Transit	Auxiliary Boiler	0	0	0	0
Transit	Main	117,547	115,703	6	3
Total Transit		**134,080**	**132,006**	**7**	**3**
Maneuvering	Aux	12,233	12,064	1	0
Maneuvering	Auxiliary Boiler	2,589	2,525	0	0
Maneuvering	Main	3,570	3,462	0	1
Total Maneuvering		**18,392**	**18,050**	**1**	**1**
Hotelling - Berth	Aux	112,956	111,401	5	1
Hotelling - Berth	Auxiliary Boiler	95,555	93,169	8	0
Hotelling - Berth	Main	0	0	0	0
Total Hotelling - Berth		**208,511**	**204,570**	**13**	**1**
Hotelling - Anchorage	Aux	8,839	8,714	0	0
Hotelling - Anchorage	Auxiliary Boiler	6,212	6,057	0	0
Hotelling - Anchorage	Main	0	0	0	0
Total Hotelling - Anchorage		**15,051**	**14,772**	**1**	**0**
Total		**376,035**	**369,398**	**21**	**5**

Table 4.10: 2006 Commercial Harbor Craft Emissions by Engine Type, tpy

Vessel Type	Engine Type	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
Assist Tug	Auxiliary	1	1	1	26	0	13	3
Assist Tug	Propulsion	18	17	18	459	0	116	27
Commercial Fishing	Auxiliary	1	1	1	11	0	7	1
Commercial Fishing	Propulsion	5	5	5	135	0	32	8
CrewBoat	Auxiliary	0	0	0	8	0	3	1
CrewBoat	Propulsion	3	2	3	70	0	19	4
Excursion	Auxiliary	1	1	1	9	0	6	2
Excursion	Propulsion	6	6	6	150	0	40	10
Ferry	Auxiliary	0	0	0	2	0	1	0
Ferry	Propulsion	7	6	7	151	0	42	11
Government	Auxiliary	0	0	0	1	0	0	0
Government	Propulsion	2	2	2	40	0	10	3
Ocean Tug	Auxiliary	0	0	0	2	0	1	0
Ocean Tug	Propulsion	2	2	2	53	0	14	3
Tugboat	Auxiliary	0	0	0	4	0	3	1
Tugboat	Propulsion	4	4	4	102	0	26	7
WorkBoat	Auxiliary	0	0	0	1	0	1	0
WorkBoat	Propulsion	1	1	1	21	0	6	1
Total		**51**	**47**	**51**	**1,245**	**1**	**339**	**82**

Table 4.11: 2006 Commercial Harbor Craft GHG Emissions by Engine Type, metric tons

Vessel Type	Engine Type	CO_2	CO_2 Equivalent	N_2O	CH_4
Assist Tug	Auxiliary	1,600	1,577	0	0
Assist Tug	Propulsion	17,838	17,584	1	0
Commercial Fishing	Auxiliary	823	811	0	0
Commercial Fishing	Propulsion	6,554	6,461	0	0
CrewBoat	Auxiliary	368	363	0	0
CrewBoat	Propulsion	2,794	2,754	0	0
Excursion	Auxiliary	564	555	0	0
Excursion	Propulsion	7,643	7,535	0	0
Ferry	Auxiliary	108	107	0	0
Ferry	Propulsion	8,592	8,470	0	0
Government	Auxiliary	53	52	0	0
Government	Propulsion	1,934	1,907	0	0
Ocean Tug	Auxiliary	84	83	0	0
Ocean Tug	Propulsion	1,838	1,812	0	0
Tugboat	Auxiliary	281	277	0	0
Tugboat	Propulsion	4,551	4,486	0	0
WorkBoat	Auxiliary	94	93	0	0
WorkBoat	Propulsion	1,159	1,143	0	0
Total		**56,878**	**56,070**	**3**	**1**

Table 5.14: 2006 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	1	0
Break-Bulk	10	9	10	241	0	108	17
Container	35	32	34	1,332	2	512	44
Cruise	0	0	0	10	0	16	2
Dry Bulk	1	0	1	10	0	4	1
Liquid	0	0	0	2	0	3	0
Other	6	5	5	231	0	326	29
Total	**51**	**47**	**50**	**1,826**	**2**	**970**	**94**

Table 5.15: 2006 CHE GHG Emissions by Terminal Type, metric tons

Terminal Type	CO_2 Equivalent	CO_2	N_2O	CH_4
Auto	17	17	0	0
Break-Bulk	13,977	13,857	0	1
Container	151,172	150,043	3	4
Cruise	517	514	0	0
Dry Bulk	569	564	0	0
Liquid	108	108	0	0
Other	18,741	18,604	0	1
Total	**185,102**	**183,708**	**4**	**5**

Table 5.16: 2006 CHE Emissions by Equipment Type, tpy

Port Equipment	Engine Type	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
Bulldozer	Diesel	0	0	0	2	0	0	0
Crane	Diesel	1	1	1	19	0	8	1
Dump Truck	Diesel	4	3	4	63	0	25	5
Electric Pallet Jack	Electric	0	0	0	0	0	0	0
Excavator	Diesel	2	2	2	56	0	12	3
Forklift	Gasoline	0	0	0	7	0	19	2
Forklift	Propane	1	1	0	105	0	307	26
Forklift	Diesel	3	3	3	50	0	20	4
Fuel Truck	Gasoline	0	0	0	1	0	2	0
Fuel Truck	Diesel	0	0	0	4	0	1	0
Loader	Diesel	1	1	1	43	0	9	2
Man Lift	Diesel	0	0	0	2	0	1	0
Rail Pusher	Diesel	0	0	0	0	0	0	0
RMG cranes	Electric	0	0	0	0	0	0	0
Roller	Diesel	0	0	0	0	0	0	0
RTG Aux Eng	Diesel	0	0	0	3	0	2	0
Rub-trd Gantry Crane	Diesel	5	5	5	210	0	52	7
Side pick	Diesel	1	1	1	44	0	10	2
Skid Steer Loader	Diesel	0	0	0	1	0	1	0
Sweeper	Gasoline	0	0	0	1	0	4	0
Sweeper	Diesel	0	0	0	2	0	1	0
Top handler	Diesel	8	7	8	284	0	55	10
Vacuum Truck	Diesel	0	0	0	0	0	0	0
Water Truck	Diesel	1	1	1	12	0	4	1
Yard tractor	LNG	0	0	0	1	0	0	0
Yard tractor	Propane	1	1	0	49	0	262	8
Yard tractor	Diesel	24	22	24	866	1	174	21
Total		**51**	**47**	**50**	**1,826**	**2**	**970**	**94**

Table 5.17: 2006 CHE GHG Emissions by Equipment Type, metric tons

Port Equipment	Engine Type	CO_2 Equivalent	CO_2	N_2O	CH_4
Bulldozer	Diesel	123	122	0	0
Crane	Diesel	831	823	0	0
Dump Truck	Diesel	2,109	2,091	0	0
Electric Pallet Jack	Electric	0	0	0	0
Excavator	Diesel	4,280	4,243	0	0
Forklift	Gasoline	312	310	0	0
Forklift	Propane	5,945	5,945	0	0
Forklift	Diesel	3,340	3,307	0	0
Fuel Truck	Gasoline	57	56	0	0
Fuel Truck	Diesel	444	441	0	0
Loader	Diesel	3,183	3,155	0	0
Man Lift	Diesel	159	157	0	0
Rail Pusher	Diesel	34	34	0	0
RMG cranes	Electric	0	0	0	0
Roller	Diesel	0	0	0	0
RTG Aux Eng	Diesel	298	295	0	0
Rub-trd Gantry Crane	Diesel	24,235	24,028	1	1
Side pick	Diesel	4,194	4,155	0	0
Skid Steer Loader	Diesel	85	84	0	0
Sweeper	Gasoline	103	102	0	0
Sweeper	Diesel	222	220	0	0
Top handler	Diesel	29,380	29,150	1	1
Vacuum Truck	Diesel	6	6	0	0
Water Truck	Diesel	456	452	0	0
Yard tractor	LNG	0	0	0	0
Yard tractor	Propane	6,785	6,785	0	0
Yard tractor	Diesel	98,520	97,746	2	2
Total		**185,102**	**183,708**	**4**	**5**

Table 6.17: GHG Port-Related Locomotive Operations Estimated Emissions, metric tons

	CO_2 Equivalent	CO_2	N_2O	CH_4
Swithching	8,469	8,385	0	1
Line Haul	98,234	97,261	3	8
Total	**106,703**	**105,646**	**3**	**9**

Table 7.11: Summary of HDV Emissions, tpy

Activity Location	VMT	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
On-Terminal	7,131,837	31	28	31	528	1	236	91
On-Road	307,914,072	332	305	332	7,144	39	2,282	345
Total	**315,045,909**	**362**	**333**	**362**	**7,672**	**40**	**2,518**	**437**

Table 7:12: Summary of HDV GHG Emissions, metric tons

Activity Location	VMT	CO_2 Equivalent	CO_2	N_2O	CH_4
On-Terminal	7,131,837	36,041	34,856	4	4
On-Road	307,914,072	555,716	533,229	71	18
Total	**315,045,909**	**591,757**	**568,085**	**75**	**23**

Table 7.13: 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	5,775,450	26	23	26	421	1	192	75
On-Road	277,422,931	299	275	299	6,437	35	2,057	311
Total	**283,198,381**	**324**	**298**	**324**	**6,858**	**36**	**2,248**	**386**

Table 7.14: Summary of HDV GHG Emissions Associated with Container Terminals, metric tons

Activity Location	VMT	CO_2	CO_2 Equivalent	N_2O	CH_4
On-Terminal	5,775,450	28,923	27,974	3	4
On-Road	277,422,931	500,713	480,452	64	17
Total	**283,198,381**	**529,636**	**508,426**	**67**	**20**

Table 7.15: 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	1,356,387	5	5	5	107	0	44	16
On-Road	30,491,141	33	30	33	707	4	226	34
Total	**31,847,528**	**38**	**35**	**38**	**814**	**4**	**270**	**50**

Table 7.16: Summary of HDV GHG Emissions Associated with Other Port Terminals, metric tons

Activity Location	VMT	CO_2	CO_2 Equivalent	N_2O	CH_4
On-Terminal	1,356,387	7,118	6,882	1	1
On-Road	30,491,141	55,004	52,777	7	2
Total	**31,847,528**	**62,121**	**59,659**	**8**	**3**

Table 8.1: 2006 Port-related Emissions by Category, tpy

Category	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
Ocean-going vessels	700	560	603	6,760	6,401	612	279
Harbor craft	51	47	51	1,245	1	339	82
Cargo handling equipment	51	47	50	1,826	2	970	94
Rail locomotives	72	65	72	2,081	131	320	115
Heavy-duty vehicles	362	333	362	7,672	40	2,518	437
Total	**1,236**	**1,053**	**1,138**	**19,585**	**6,575**	**4,760**	**1,006**

Table 8.2: 2006 Port-related GHG Emissions by Category, tpy

Category	CO_2	N_2O	CH_4
Ocean-going vessels	406,334	23	6
Harbor craft	61,676	3	1
Cargo handling equipment	202,076	5	6
Rail locomotives	116,210	3	10
Heavy-duty vehicles	624,888	82	25
Total	**1,411,184**	**116**	**47**

Table 8.3: 2006 Port-related GHG Emissions by Category, metric tons per year

Category	CO_2 Equivalent	CO_2	N_2O	CH_4
Ocean-going vessels	376,035	369,398	21	5
Harbor craft	56,878	56,070	3	1
Cargo handling equipment	185,102	183,708	4	5
Rail locomotives	106,703	105,647	3	9
Heavy-duty vehicles	591,757	568,085	75	23
Total	**1,316,474**	**1,282,908**	**105**	**43**

Figure 8.1: 2006 Port-related Emissions by Category, %

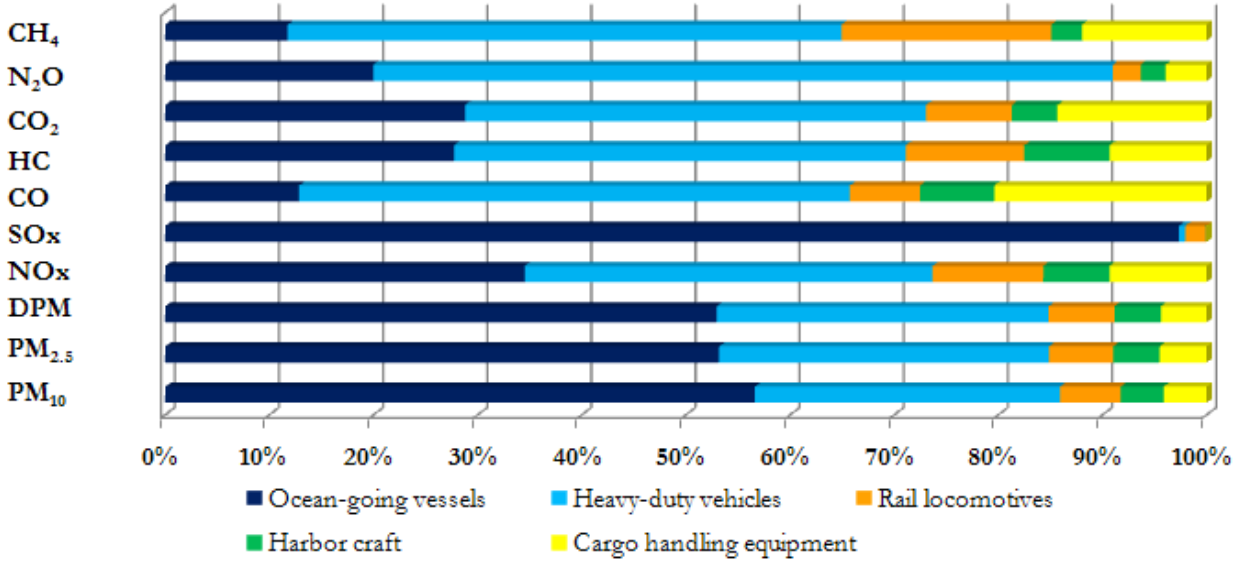

Figure 8.4: 2006 SO_x Emissions in the South Coast Air Basin, %

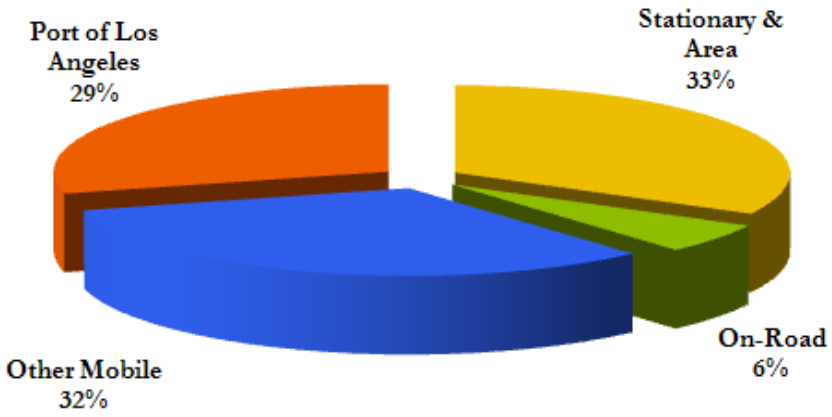

Table 8.4: 2006 DPM Emissions Percentage Comparison, tpy and %

Category	Subcategory	DPM Emissions	Percent DPM Emissions of Total		
			Category	Port	SoCAB AQMP
CHE	RTG crane, crane	5	11%	0%	0%
CHE	Forklift	3	5%	0%	0%
CHE	Top handler, side pi	9	18%	1%	0%
CHE	Other	9	18%	1%	0%
CHE	Yard tractor	24	47%	2%	0%
CHE	**Subtotal**	**50**	**100%**	**4%**	**0%**
OGV	Auto carrier	7	1%	1%	0%
OGV	Bulk vessel	28	5%	2%	0%
OGV	Containership	381	63%	33%	4%
OGV	Cruise	102	17%	9%	1%
OGV	General cargo	19	3%	2%	0%
OGV	Ocean tugboat	1	0%	0%	0%
OGV	Miscellaneous	0	0%	0%	0%
OGV	Reefer	7	1%	1%	0%
OGV	RoRo	0	0%	0%	0%
OGV	Tanker	58	10%	5%	1%
OGV	**Subtotal**	**603**	**100%**	**53%**	**6%**
Harbor Craft	Assist tug	19	38%	2%	0%
Harbor Craft	Harbor tug	5	10%	0%	0%
Harbor Craft	Commercial fishing	6	12%	1%	0%
Harbor Craft	Ferry	7	13%	1%	0%
Harbor Craft	Line haul tug	2	4%	0%	0%
Harbor Craft	Government	2	3%	0%	0%
Harbor Craft	Excursion	7	13%	1%	0%
Harbor Craft	Crewboat	3	6%	0%	0%
Harbor Craft	Work boat	1	2%	0%	0%
Harbor Craft	**Subtotal**	**51**	**100%**	**4%**	**0%**
HDV	On-Terminal	31	9%	3%	0%
HDV	On-Road	332	91%	29%	3%
HDV	**Subtotal**	**362**	**100%**	**32%**	**4%**
Rail	Switching	6	9%	1%	0%
Rail	Line haul	66	91%	6%	1%
Rail	**Subtotal**	**72**	**100%**	**6%**	**1%**
Port	**Total**	**1,138**		**100%**	**11%**
SoCAB AQM	**Total**	**10,271**			

Table 8.5: 2006 NO_x Emissions Percentage Comparison, tpy and %

Category	Subcategory	NOx Emissions	Percent NOx Emissions of Total		
			Category	Port	SoCAB AQMP
CHE	RTG crane	213	12%	1%	0%
CHE	Forklift	162	9%	1%	0%
CHE	Top handler, side pi	328	18%	2%	0%
CHE	Other	212	12%	1%	0%
CHE	Yard tractor	914	50%	5%	0%
CHE	**Subtotal**	**1,826**	**100%**	**9%**	**1%**
OGV	Auto carrier	72	1%	0%	0%
OGV	Bulk vessel	287	4%	1%	0%
OGV	Containership	4,432	66%	23%	1%
OGV	Cruise	969	14%	5%	0%
OGV	General cargo	206	3%	1%	0%
OGV	Ocean tugboat	26	0%	0%	0%
OGV	Miscellaneous	2	0%	0%	0%
OGV	Reefer	71	1%	0%	0%
OGV	RoRo	5	0%	0%	0%
OGV	Tanker	689	10%	4%	0%
OGV	**Subtotal**	**6,760**	**100%**	**35%**	**2%**
Harbor Craft	Assist tug	485	39%	2%	0%
Harbor Craft	Harbor tug	122	10%	1%	0%
Harbor Craft	Commercial fishing	146	12%	1%	0%
Harbor Craft	Ferry	152	12%	1%	0%
Harbor Craft	Line haul tug	55	4%	0%	0%
Harbor Craft	Government	41	3%	0%	0%
Harbor Craft	Excursion	159	13%	1%	0%
Harbor Craft	Crewboat	82	7%	0%	0%
Harbor Craft	Work boat	23	2%	0%	0%
Harbor Craft	**Subtotal**	**1,245**	**100%**	**6%**	**0%**
HDV	On-Terminal	528	7%	3%	0%
HDV	On-Road	7,144	93%	36%	2%
HDV	**Subtotal**	**7,672**	**100%**	**39%**	**2%**
Rail	Switching	302	14%	2%	0%
Rail	Line haul	1,779	86%	9%	1%
Rail	**Subtotal**	**2,081**	**100%**	**11%**	**1%**
Port	**Total**	**19,585**		**100%**	**6%**
SoCAB AQMP	**Total**	**354,298**			

Table 8.6: 2006 SO_x Emissions Percentage Comparison, tpy and %

Category	Subcategory	SOx Emissions	Percent SOx Emissions of Total		
			Category	Port	SoCAB AQMP
CHE	RTG crane	0	13%	0%	0%
CHE	Forklift	0	2%	0%	0%
CHE	Top handler, side pi	0	17%	0%	0%
CHE	Other	0	5%	0%	0%
CHE	Yard tractor	1	63%	0%	0%
CHE	**Subtotal**	**2**	**100%**	**0%**	**0%**
OGV	Auto carrier	60	1%	1%	0%
OGV	Bulk vessel	268	4%	4%	1%
OGV	Containership	3,487	54%	53%	15%
OGV	Cruise	936	15%	14%	4%
OGV	General cargo	174	3%	3%	1%
OGV	Ocean tugboat	1	0%	0%	0%
OGV	Miscellaneous	3	0%	0%	0%
OGV	Reefer	75	1%	1%	0%
OGV	RoRo	3	0%	0%	0%
OGV	Tanker	1,394	22%	21%	6%
OGV	**Subtotal**	**6,401**	**100%**	**97%**	**28%**
Harbor Craft	Assist tug	0.2	34%	0%	0%
Harbor Craft	Harbor tug	0.1	10%	0%	0%
Harbor Craft	Commercial fishing	0.1	13%	0%	0%
Harbor Craft	Ferry	0.1	15%	0%	0%
Harbor Craft	Line haul tug	0.0	3%	0%	0%
Harbor Craft	Government	0.0	3%	0%	0%
Harbor Craft	Excursion	0.1	14%	0%	0%
Harbor Craft	Crewboat	0.0	6%	0%	0%
Harbor Craft	Work boat	0.0	2%	0%	0%
Harbor Craft	**Subtotal**	**1**	**100%**	**0%**	**0%**
HDV	On-Terminal	1	2%	0%	0%
HDV	On-Road	39	98%	1%	0%
HDV	**Subtotal**	**40**	**100%**	**1%**	**0%**
Rail	Switching	2	1%	0%	0%
Rail	Line haul	130	99%	2%	1%
Rail	**Subtotal**	**131**	**100%**	**2%**	**1%**
Port	**Total**	**6,575**		**100%**	**29%**
SoCAB AQMP	**Total**	**22,626**			

Table 9.2: Port-wide Emissions Comparison, tpy and % Change

EI Year	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
2006	1,236	1,053	1,138	19,585	6,575	4,760	1,006
2005	1,114	949	1,028	17,430	6,022	4,091	888
2006-2005	**11%**	**11%**	**11%**	**12%**	**9%**	**16%**	**13%**

Table 9.3: Port-wide Emissions Efficiency Comparison, tons/10,000 TEU and %

EI Year	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
2006	1.46	1.24	1.34	23.12	7.76	5.62	1.19
2005	1.49	1.27	1.37	23.29	8.05	5.47	1.19
2006-2005	**2%**	**2%**	**2%**	**1%**	**4%**	**-3%**	**0%**

Figure 9.4: Port-wide Emissions Efficiency Comparison, %

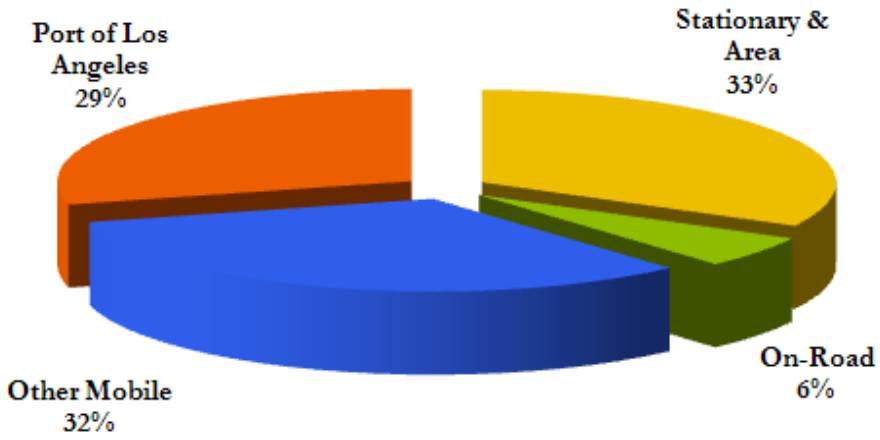

Table 9.6: OGV Emissions Comparison, tpy and % Change

EI Year	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
2006	700	560	603	6,760	6,401	612	279
2005	644	515	559	6,151	5,861	541	245
2006-2005	**9%**	**9%**	**8%**	**10%**	**9%**	**13%**	**14%**

Table 9.7: OGV Emissions Efficiency Comparison, tons/10,000 TEU and %

EI Year	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
2006	0.83	0.66	0.71	7.98	7.56	0.72	0.33
2005	0.86	0.69	0.75	8.22	7.83	0.72	0.33
2006-2005	**4%**	**4%**	**5%**	**3%**	**3%**	**0%**	**-1%**

Figure 9.6: OGV Emissions Efficiency Comparison, %

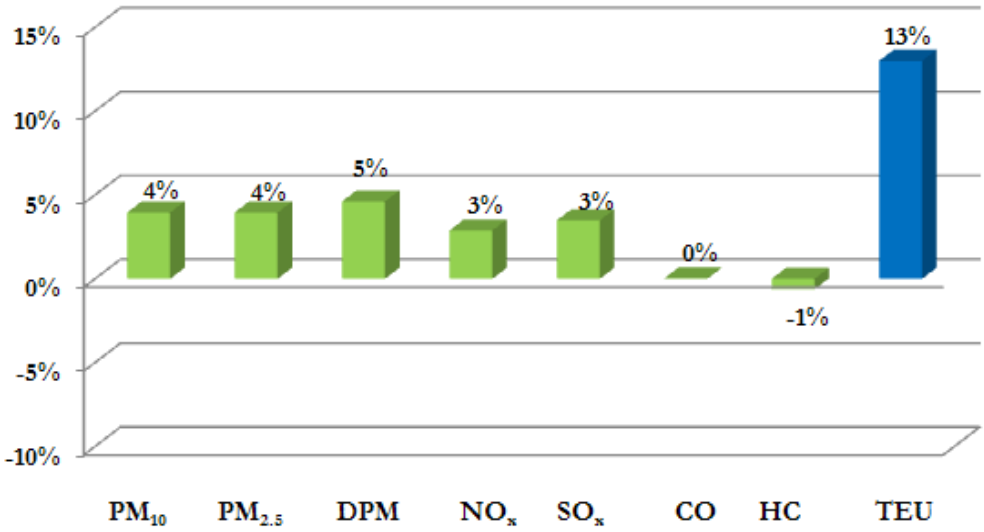

Table 9.12: Harbor Craft Emissions Comparison, tpy and % Change

EI Year	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
2006	51	47	51	1,245	1	339	82
2005	56	52	56	1,336	6	369	89
2006-2005	**-9%**	**-9%**	**-9%**	**-7%**	**-90%**	**-8%**	**-7%**

Table 9.13: Harbor Craft Emissions Efficiency Comparison, tons/10,000 TEU and %

EI Year	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
2006	0.06	0.06	0.06	1.47	0.00	0.40	0.10
2005	0.07	0.07	0.07	1.78	0.01	0.49	0.12
2006-2005	**20%**	**20%**	**20%**	**18%**	**91%**	**19%**	**18%**

Figure 9.7: Harbor Craft Emissions Efficiency Comparison, %

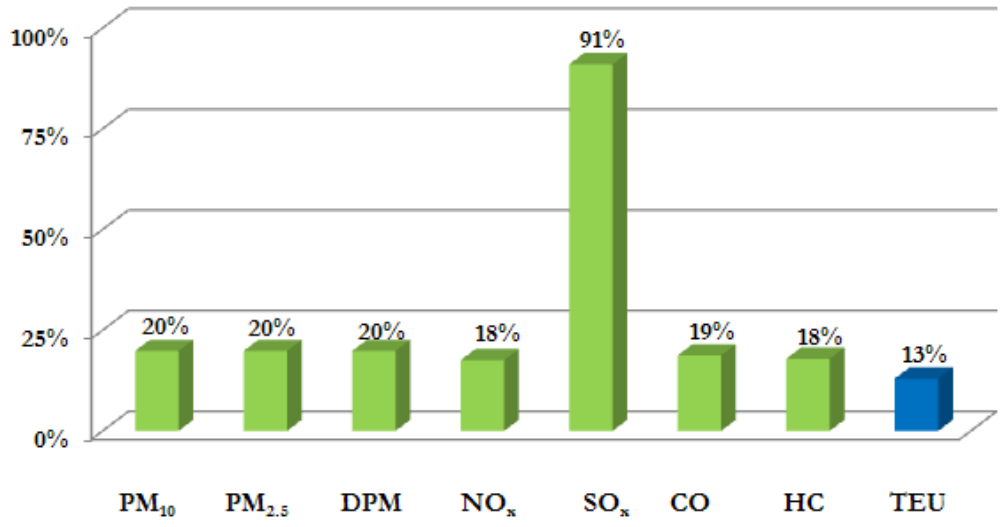

Table 9.17: CHE Emissions Comparison, tpy and % Change

EI Year	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
2006	51	47	50	1,826	2	970	94
2005	46	43	46	1,516	9	759	80
2006-2005	**10%**	**10%**	**9%**	**20%**	**-78%**	**28%**	**18%**

Table 9.18: CHE Emissions Efficiency Comparison, tons/10,000 TEU and %

EI Year	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
2006	0.06	0.06	0.06	2.16	0.00	1.15	0.11
2005	0.06	0.06	0.06	2.03	0.01	1.01	0.11
2006-2005	**3%**	**3%**	**3%**	**-6%**	**81%**	**-13%**	**-4%**

Figure 9.8: CHE Emissions Efficiency Comparison, %

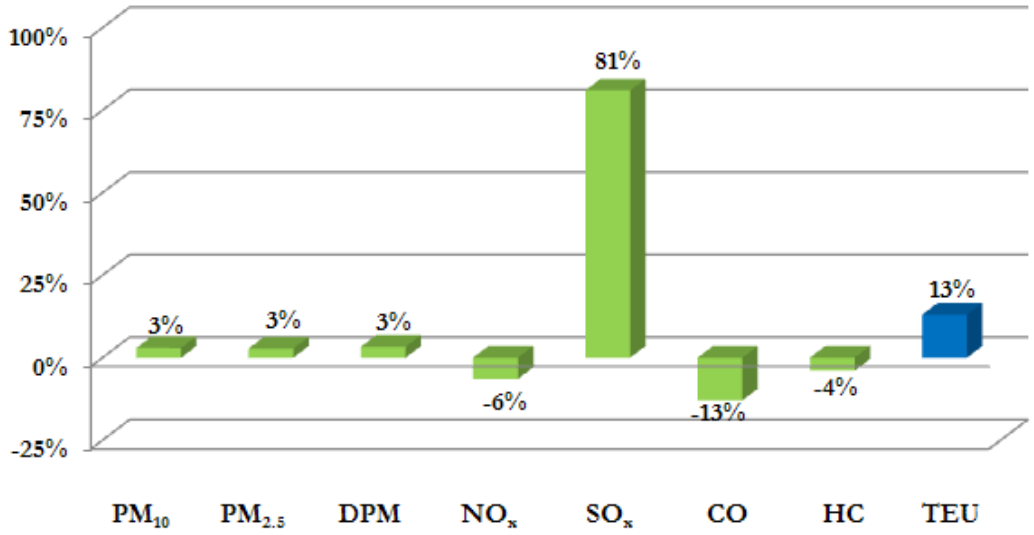

Table 9.20: Rail Emissions Comparison, tpy and % Change

EI Year	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
2006	72	65	72	2,081	131	320	115
2005	57	53	57	1,712	97	237	89
2006-2005	**27%**	**23%**	**27%**	**22%**	**35%**	**35%**	**29%**

Table 9.21: Rail Emissions Efficiency Comparison, tons/10,000 TEU and %

EI Year	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
2006	0.09	0.08	0.09	2.46	0.16	0.38	0.14
2005	0.08	0.07	0.08	2.29	0.13	0.32	0.12
2006-2005	**-13%**	**-9%**	**-13%**	**-7%**	**-19%**	**-19%**	**-14%**

Figure 9.9: Rail Emissions Efficiency Comparison, %

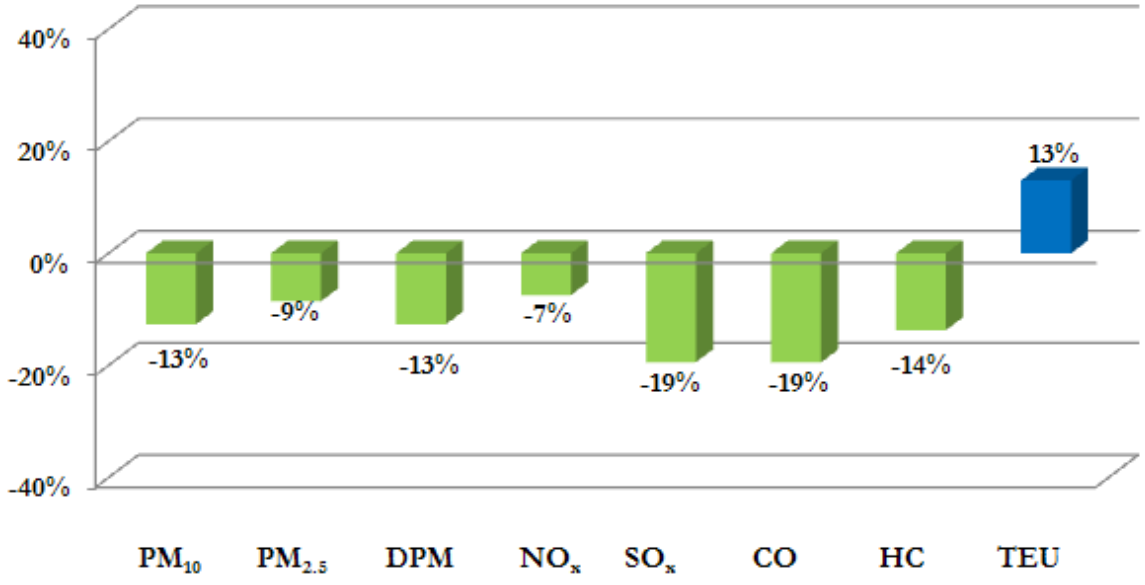

Table 9.23: HDV Emissions Comparison, tpy and % Change

EI Year	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
2006	362	333	362	7,672	40	2,518	437
2005	311	286	311	6,715	48	2,185	386
2006-2005	**17%**	**17%**	**17%**	**14%**	**-17%**	**15%**	**13%**

Table 9.24: HDV Emissions Efficiency Comparison, tons/10,000 TEU and %

EI Year	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
2006	0.43	0.39	0.43	9.06	0.05	2.97	0.52
2005	0.42	0.38	0.42	8.97	0.06	2.92	0.52
2006-2005	**-3%**	**-3%**	**-3%**	**-1%**	**26%**	**-2%**	**0%**

Figure 9.10: HDV Emissions Efficiency Comparison, %