PORT OF LOS ANGELES
INVENTORY OF AIR EMISSIONS - 2007

THE PORT OF LOS ANGELES

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Prepared by:
STARCREST CONSULTING GROUP, LLC

ADDENDUM

THE PORT OF LOS ANGELES INVENTORY OF AIR EMISSIONS FOR CALENDAR YEAR 2007

Prepared for:

THE PORT OF LOS ANGELES

Prepared by:

Starcrest Consulting Group, LLC
P.O. Box 434
Poulsbo, WA 98370

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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 2007 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: 2007 Port-wide Published vs. Revised Emissions Comparison, tpy

2007 Published	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC	CO_2	N_2O	CH_4
Ocean-going vessels	416	333	333	6,142	3,718	587	267	361,038	21	5
Harbor craft	53	49	53	1,281	1	348	85	89,130	3	2
Cargo handling equipment	46	43	45	1,662	2	919	81	255,180	5	6
Rail locomotives	60	54	60	1,675	55	268	94	98,059	3	8
Heavy-duty vehicles	370	340	370	7,343	6	2,529	445	611,648	17	26
Total	**944**	**817**	**860**	**18,102**	**3,781**	**4,652**	**973**	**1,415,055**	**48**	**47**
2007 Revised										
Ocean-going vessels	432	346	340	6,127	4,050	591	269	372,705	21	5
Harbor craft	52	48	52	1,263	1	343	84	62,532	3	1
Cargo handling equipment	46	42	44	1,658	2	918	81	189,331	4	5
Rail locomotives	60	54	60	1,675	55	268	94	98,059	3	8
Heavy-duty vehicles	332	305	332	6,580	6	2,274	406	547,664	15	24
Total	**921**	**795**	**828**	**17,303**	**4,113**	**4,394**	**933**	**1,270,291**	**46**	**44**
Difference										
Ocean-going vessels	17	13	7	-15	332	4	1	11,666	1	0
Harbor craft	-1	-1	-1	-19	0	-5	-1	-26,598	0	0
Cargo handling equipment	0	0	0	-4	0	-1	0	-65,849	0	-1
Rail locomotives	0	0	0	0	0	0	0	0	0	0
Heavy-duty vehicles	-38	-35	-38	-763	0	-255	-40	-63,984	-2	-2
Difference	**-22**	**-22**	**-32**	**-800**	**332**	**-258**	**-40**	**-144,764**	**-2**	**-3**
% Difference										
Ocean-going vessels	4%	4%	2%	0%	9%	1%	0%	3%	3%	0%
Harbor craft	-2%	-2%	-2%	-1%	-2%	-2%	-2%	-30%	-9%	-16%
Cargo handling equipment	-1%	-1%	-1%	0%	0%	0%	0%	-26%	-6%	-11%
Rail locomotives	0%	0%	0%	0%	0%	0%	0%	0%	-1%	1%
Heavy-duty vehicles	-10%	-10%	-10%	-10%	-2%	-10%	-9%	-10%	-11%	-9%
% Difference	**-2%**	**-3%**	**-4%**	**-4%**	**9%**	**-6%**	**-4%**	**-10%**	**-3%**	**-7%**

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 – 2007 Inventory

Source Category	Item	Emissions Impact		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 of 2%	Low	Increase	All	Propulsion
OGV	Standardized Fuel Switching Hierarchy	Low	Varies	PM, NO_x, SO_x, N_2O	Prop and Aux
OGV	Changed operator query from Marex to Lloyds for Fuel Switching	Low	Increase	PM, NO_x, SO_x, N_2O	Prop and Aux
OGV	Changed west route, 40 nm, aux eng fuel from 0.5% to IFO 2.7%	Low	Increase	PM, NO_x, SO_x, N_2O	Prop and Aux
OGV	Corrected fuel assignment for 5 cruise ships that were direct drive and G/T	Low	Increase	PM, NO_x, SO_x, N_2O	Propulsion
OGV	Implemented 95% reduction for shore power rather than 100% reduction	Low	Increase	All	Auxiliary
OGV	Corrected low load adjustment factors	Low	Decrease	HC, CH_4	Propulsion
OGV	Corrected miscalculated hoteling times	Low	Increase	All	Aux and Boilers
HC	Removed deterioration rates for GHG	Medium	Decrease	CO_2, N_2O, CH_4	Prop and Aux
CHE	Removed deterioration rates for GHG	Medium	Decrease	CO_2, N_2O, CH_4	Prop and Aux
HDV	Corrected minor calculation errors (SO_2 calc, # truck trips)	Low	Decrease	All	na

2.1 2007 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 2007 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 2007 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 2007 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 2007 criteria pollutant emissions from the new calculation system are close to 0% to 9% higher than those in the published report.

Table 3: 2007 OGV Emission Differences due to Revisions, tpy

2007 OGV	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
2007 Report	416	333	333	6,142	3,718	587	267
2007 Revised	432	346	340	6,127	4,050	591	269
Difference	**17**	**13**	**7**	**-15**	**332**	**4**	**1**
% Difference	**4%**	**4%**	**2%**	**-0.2%**	**9%**	**1%**	**0%**

Table 4 shows that the 2007 greenhouse gas emissions as estimated by the revised calculation system used in preparing those estimates are 0 to 3% higher than the published greenhouse gas emissions.

Table 4: 2007 GHG OGV Emission Differences due to Revisions, metric tons per year

2007 OGV	CO_2 Equivalent	CO_2	N_2O	CH_4
2007 Report	334,121	328,217	19	5
2007 Revised	344,926	338,826	19	5
Difference	**10,805**	**10,609**	**1**	**0**
% Difference	**3%**	**3%**	**3%**	**0%**

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 2007 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 2007 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 2007 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 2007 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 2007 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 2007 EI report, only tankers that were exclusively crude oil tankers were assigned to these tanker subtypes.

Table 5 compares the total revised counts versus the total published 2007 counts of OGV movements. Arrivals and shifts did not change greatly while the number of departures increased by 5%, for a total 2% difference in total movements.

Table 5: Comparison of Total OGV Movements for 2007

	Arrival	Departure	Shift	Total
2007 Report	2,538	2,361	1,100	5,999
2007 Revised	2,527	2,493	1,095	6,115
Difference	**-11**	**132**	**-5**	**116**
% Difference	**-0.4%**	**6%**	**0%**	**2%**

Table 6 (Table 3.5 in the 2007 EI Report) shows the revised 2007 OGV movements table, which takes into account the various vessel activity changes, calendar year definition, and vessel type classification.

Table 6: Revised OGV Movements for 2007

Category	Arrival	Departure	Shift	Total
Auto Carrier	67	69	11	147
Bulk	99	90	105	294
Bulk - Heavy Load	2	2	3	7
Bulk Wood Chips	3	3	1	7
Container1000	237	239	41	517
Container2000	104	104	8	216
Container3000	127	127	22	276
Container4000	537	534	62	1,133
Container5000	328	313	32	673
Container6000	160	160	16	336
Container7000	80	80	11	171
Container8000	4	1	3	8
Cruise	255	256	1	512
General Cargo	105	104	100	309
ITB	65	61	66	192
Reefer	48	46	54	148
RoRo	1	1	0	2
Tanker - Aframax	3	3	2	8
Tanker - Chemical	143	137	254	534
Tanker - Handyboat	104	107	192	403
Tanker - Panamax	55	56	111	222
Total	**2,527**	**2,493**	**1,095**	**6,115**

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 2007 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, to a lower sulfur fuel than the CARB rule required in 2007. 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: Standardized Fuel Switching Hierarchy
Affected Source Category: OGV
Affected Pollutants: PM, NO_x, SO_x, N_2O
Impact on Emissions: Minor

There are multiple sources of information regarding which vessels switched fuels and when. Individual vessels might be known to switch from a vessel boarding or from company statements; the company may have notified the Port of a blanket policy for all their vessels to switch fuels; many operators participated in the Port's fuel switch incentive program; and at various times a state regulation has required the use of different fuels. In comparing the two calculation systems, there were inconsistent determinations of which vessels participated in fuel switching during the inventory year. As a result, the two calculation systems were not producing consistent results. To resolve this, a hierarchy was developed to consistently apply the fuel switching information in the same manner. The hierarchy for fuel switching considers the available information in the following order of precedence:

1. Operator Fuel Switch Policy
2. Port Incentive Fuel Switch Program
3. Vessel Fuel Switch Policy
4. CARB Fuel Switch Regulation
5. Default – IFO 2.7% Sulfur Fuel

During the standardization of both systems to this hierarchy five cruise ships with direct drive or gas turbine propulsion systems were found to be erroneously assigned the wrong fuel for their main engines. Changing the modeled fuel type had a minor effect on the overall vessel emission estimates.

Issue: Western Route and CARB Aux Engine Rule
Affected Source Category: OGV
Affected Pollutants: PM, NO_x, SO_x, N_2O
Impact on Emissions: Minor

Three of the four shipping lanes into and out of San Pedro Bay are within 24 nm of the coastline for their entire extent while within the geographical boundaries of the Port's emissions inventory. Therefore, the CARB Auxiliary Engine Rule applied to the entire lengths of these routes within the inventory boundary. The calculations that produced the published 2007 emission estimates erroneously assigned the CARB Rule to the whole of the western route as well, although the area of the rule's applicability did not cover the whole of the 20-40 nm segment of the western route since its direction is westward, away from the coastline. The outer part of the western route should have been modeled with the vessels' auxiliary engines burning the default 2.7% IFO fuel instead of the CARB compliant fuel. The western route is not a major shipping route, as are the northern and southern routes, so the effect of the discrepancy was not significant to the overall emission estimates.

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

The low load adjustment factor for the pollutant hydrocarbons (HC) was incorrectly calculated due to a typographical error. This had a minor impact on overall vessel emission estimates.

Issue: Shore power control effectiveness
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 2007 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 2007.

2.2 2007 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 2007 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 2007 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: 2007 Harbor Craft Emissions Differences

2007 Harbor Craft	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC	CO_2	N_2O	CH_4
2007 Report	53	49	53	1,281	1	348	85	89,130	3	2
2007 Revised	52	48	52	1,263	1	343	84	62,532	3	1
Difference	**-1**	**-1**	**-1**	**-19**	**0.0**	**-5**	**-1**	**-26,598**	**-0.3**	**-0.3**
% Difference	**-2%**	**-2%**	**-2%**	**-1%**	**-2%**	**-2%**	**-2%**	**-30%**	**-9%**	**-16%**

Table 8 shows the effect on the cargo handling equipment emission estimates.

Table 8: 2007 Cargo Handling Equipment Emissions Differences

2007 CHE	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC	CO_2	N_2O	CH_4
2007 Report	46	43	45	1,662	2	919	81	255,180	5	6
2007 Revised	46	42	44	1,658	2	918	81	189,331	4	5
Difference	**-0.3**	**-0.3**	**-0.3**	**-4**	**0**	**-1**	**0**	**-65,849**	**-0.3**	**-1**
% Difference	**-1%**	**-1%**	**-1%**	**-0.2%**	**0%**	**-0.1%**	**0%**	**-26%**	**-6%**	**-11%**

2.3 2007 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.

The net result of these changes was an overestimate of all emissions except for SO_x, for which the issues cancelled, resulting in virtually no net change in emissions. Tables 9 and 10 show the differences in emission estimates between the 2007 report and the revised calculations.

Table 9: 2007 HDV Emissions Differences

2007 HDV	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
2007 Report	370	340	370	7,343	5.9	2,529	445
2007 Revised	332	305	332	6,580	5.8	2,274	406
Difference	**-38**	**-35**	**-38**	**-763**	**-0.1**	**-255**	**-40**
% Difference	**-10%**	**-10%**	**-10%**	**-10%**	**-2%**	**-10%**	**-9%**

Table 10: 2007 HDV GHG Emissions Differences

2007 HDV	CO_2 Equivalent	CO_2	N_2O	CH_4
2007 Report	561,303	556,044	15	24
2007 Revised	502,588	497,881	14	22
Difference	**-58,715**	**-58,163**	**-1**	**-2**
% Difference	**-10%**	**-10%**	**-9%**	**-9%**

SECTION 3 REPORT TABLES AND FIGURES AFFECTED

The following is a list of published report table numbers that are affected due to the changes listed in the addendum. In this Addendum, all of the GHG tables are provided in metric tons per year instead of short tons per year which were the units used for some of the GHG tables in the published report. Additionally, since the published 2005 and 2006 EI report values have changed with an addendum to that report, all the comparison tables in Chapter 9 had to be revised.

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Figure 9.1: TEUs and Vessel Call Comparison, %
Figure 9.2: Port-wide Emissions Comparison, 2007-2006, % Change

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

EI Year	All Calls	Containership Calls	TEUs	Average TEUs/Call
2007	2,527	1,577	8,355,038	5,298
2006	2,701	1,632	8,469,853	5,190
2005	2,500	1,477	7,484,625	5,067
2007-2006	**-6%**	**-3%**	**-1%**	**2%**
2007-2005	**1%**	**7%**	**12%**	**5%**

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

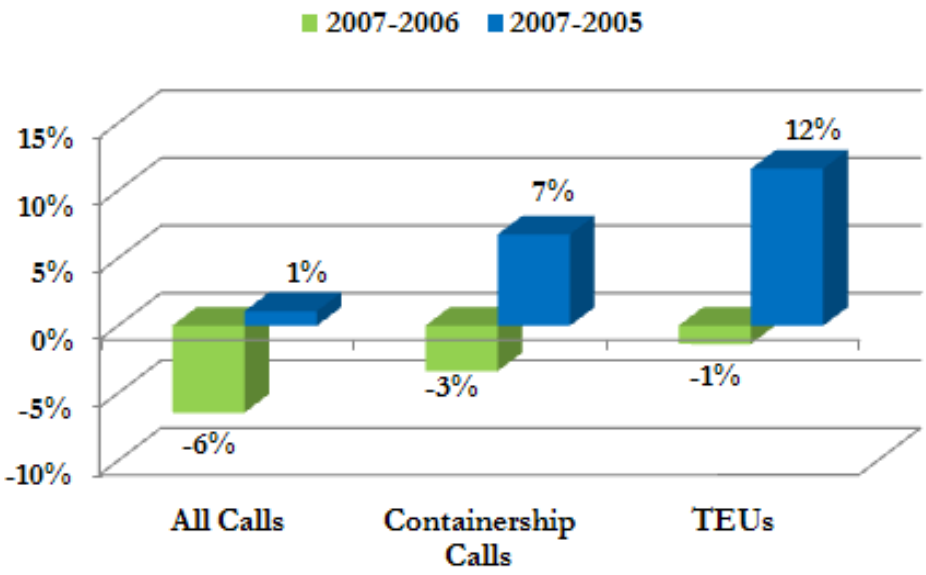

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Table ES.8: 2007 Port-related Emissions by Category, tpy

Category	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
Ocean-going vessels	432	346	340	6,127	4,050	591	269
Harbor craft	52	48	52	1,263	1	343	84
Cargo handling equipment	46	42	44	1,658	2	918	81
Rail locomotives	60	54	60	1,675	55	268	94
Heavy-duty vehicles	332	305	332	6,580	6	2,274	406
Total	**921**	**795**	**828**	**17,303**	**4,113**	**4,394**	**933**

Table ES.9: 2007 Port-related GHG Emissions by Category, metric tons per year

Category	CO_2 Equivalent	CO_2	N_2O	CH_4
Ocean-going vessels	344,926	338,826	19	5
Harbor craft	57,667	56,848	3	1
Cargo handling equipment	173,447	172,121	4	5
Rail locomotives	90,033	89,145	2	7
Heavy-duty vehicles	502,588	497,881	14	22
Total	**1,168,661**	**1,154,821**	**42**	**40**

Figure ES.8: 2007 Port-related Emissions by Category, %

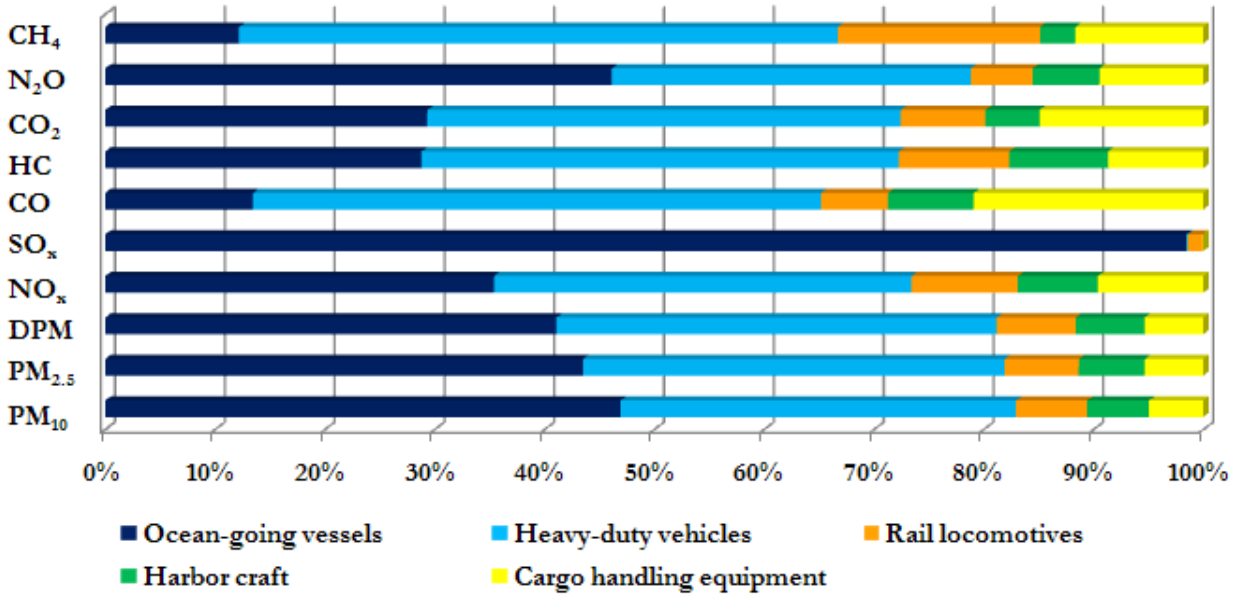

Figure ES.11: 2007 SO_x Emissions in the South Coast Air Basin, %

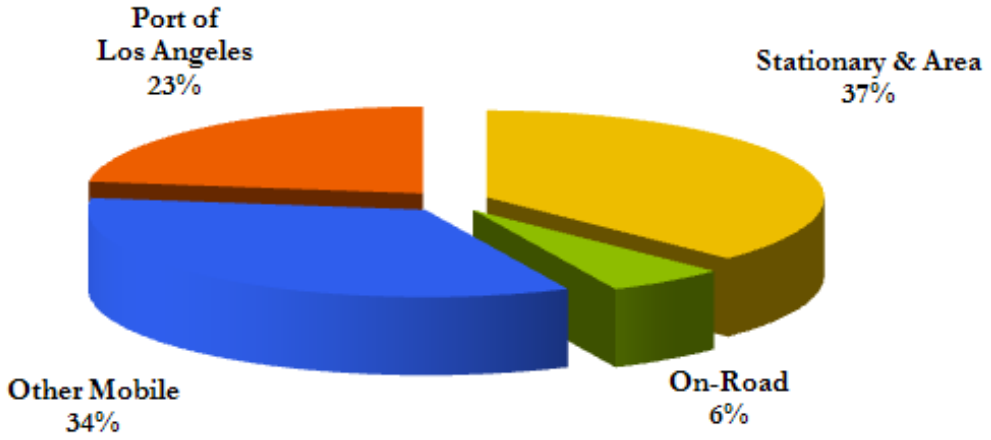

Figure ES.12: Emission Efficiency Comparison, 2007-2006, % Change

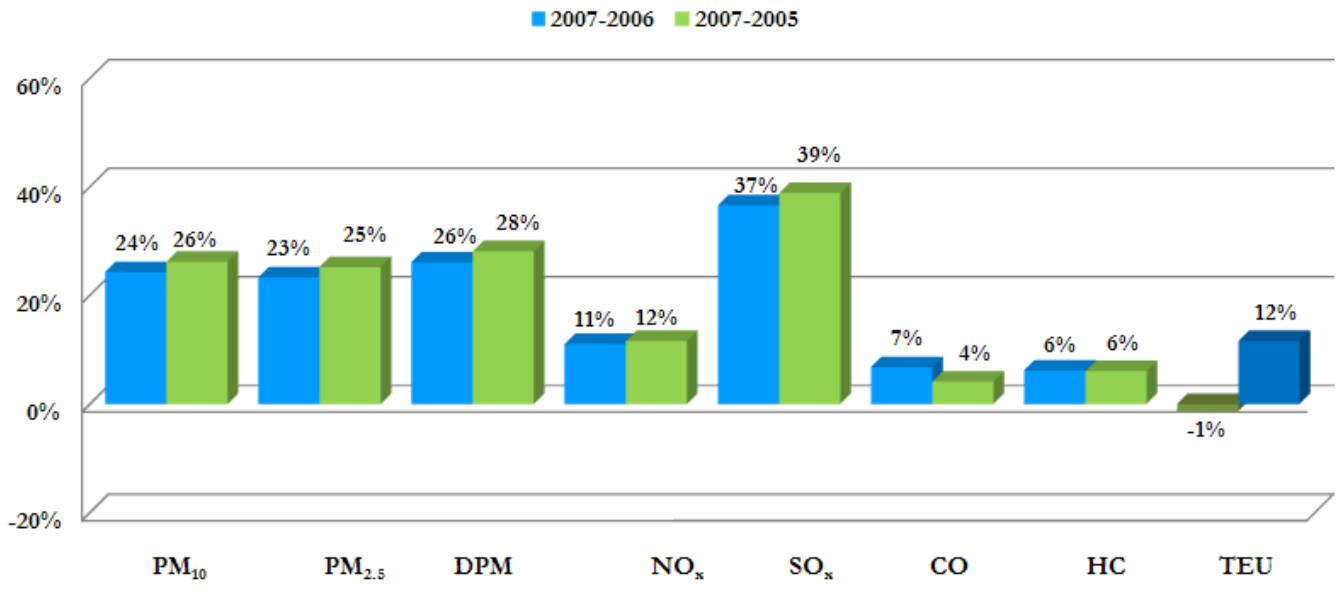

Table ES.10: Port-wide Emissions Comparison, tpy and % Change

EI Year	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
2007	921	795	828	17,303	4,113	4,394	933
2006	1,234	1,051	1,136	19,714	6,578	4,778	1,008
2005	1,118	952	1,032	17,529	6,024	4,106	890
2007-2006	**-25%**	**-24%**	**-27%**	**-12%**	**-37%**	**-8%**	**-7%**
2007-2005	**-18%**	**-17%**	**-20%**	**-1%**	**-32%**	**7%**	**5%**

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

EI Year	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
2007	1.1	1.0	1.0	20.7	4.9	5.3	1.1
2006	1.5	1.2	1.3	23.3	7.8	5.6	1.2
2005	1.5	1.3	1.4	23.4	8.0	5.5	1.2
2007-200	**24%**	**23%**	**26%**	**11%**	**37%**	**7%**	**6%**
2007-200	**26%**	**25%**	**28%**	**12%**	**39%**	**4%**	**6%**

Table 3.5: OGV Movements for 2007

Category	Arrival	Departure	Shift	Total
Auto Carrier	67	69	11	147
Bulk	99	90	103	292
Bulk - Heavy Load	2	2	3	7
Bulk Wood Chips	3	3	1	7
Container1000	237	239	41	517
Container2000	104	104	8	216
Container3000	127	127	22	276
Container4000	537	534	62	1,133
Container5000	328	313	32	673
Container6000	160	160	16	336
Container7000	80	80	11	171
Container8000	4	1	3	8
Cruise	255	256	1	512
General Cargo	105	104	100	309
ITB	65	61	70	196
Reefer	48	46	54	148
RoRo	1	1	0	2
Tanker - Aframax	3	3	2	8
Tanker - Chemical	143	137	257	537
Tanker - Handyboat	104	107	200	411
Tanker - Panamax	55	56	113	224
Total	**2,527**	**2,493**	**1,110**	**6,130**

Table 3.19: 2007 Ocean-Going Vessel Emissions by Vessel Type, tpy

2007 OGV	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
Auto Carrier	5	4	5	76	41	7	3
Bulk	8	7	7	115	79	10	4
Bulk - Heavy Load	0	0	0	3	3	0	0
Bulk Wood Chips	0	0	0	3	2	0	0
Container - 1000	17	14	15	237	157	22	9
Container - 2000	10	8	6	123	116	12	5
Container - 3000	21	17	18	303	171	27	12
Container - 4000	106	85	96	1,479	777	148	71
Container - 5000	75	60	64	975	632	107	51
Container - 6000	43	35	37	669	331	68	32
Container - 7000	18	14	16	338	138	35	16
Container - 8000	1	1	1	9	8	1	1
Cruise	38	30	34	890	333	74	29
General Cargo	12	9	10	170	109	14	6
Ocean Tugboat	1	1	1	34	1	3	1
Reefer	5	4	4	84	52	7	3
RoRo	0	0	0	1	1	0	0
Tanker - Aframax	1	1	0	6	8	0	0
Tanker - Chemical	30	24	12	269	451	24	10
Tanker - Handyboat	24	19	8	197	400	18	8
Tanker - Panamax	16	13	6	145	242	13	6
Total	**432**	**346**	**340**	**6,127**	**4,050**	**591**	**269**

Table 3.20: 2007 Ocean-Going Vessel GHG Emissions by Vessel Type, metric tons

2007 OGV	CO_2 Equivalent	CO_2	N_2O	CH_4
Auto Carrier	3,236	3,183	0	0
Bulk	6,331	6,224	0	0
Bulk - Heavy Load	217	213	0	0
Bulk Wood Chips	172	169	0	0
Container - 1000	13,044	12,834	1	0
Container - 2000	8,789	8,624	1	0
Container - 3000	14,062	13,811	1	0
Container - 4000	64,307	63,200	3	1
Container - 5000	50,670	49,798	3	1
Container - 6000	32,591	32,035	2	1
Container - 7000	16,376	16,120	1	0
Container - 8000	612	602	0	0
Cruise	47,099	46,402	2	1
General Cargo	8,973	8,819	0	0
Ocean Tugboat	1,720	1,697	0	0
Reefer	4,815	4,731	0	0
RoRo	67	66	0	0
Tanker - Aframax	487	476	0	0
Tanker - Chemical	29,700	29,069	2	0
Tanker - Handyboat	25,605	25,042	2	0
Tanker - Panamax	16,054	15,712	1	0
Total	**344,926**	**338,826**	**19**	**5**

Table 3.21: 2007 Ocean-Going Vessel Emissions by Engine Type, tpy

2007 OGV	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
Auxiliary Engine	75	60	75	2,761	423	234	85
Auxiliary Boiler	89	71	0	232	1,827	22	11
Main Engine	269	215	265	3,133	1,800	335	173
Total	**432**	**346**	**340**	**6,127**	**4,050**	**591**	**269**

Table 3.22: 2007 Ocean-Going Vessel GHG Emissions by Engine Type, metric tons

2007 OGV	CO_2 Equivalent	CO_2	N_2O	CH_4
Auxiliary Engine	133,445	131,671	6	2
Auxiliary Boiler	99,905	97,410	8	0
Main Engine	111,575	109,744	6	3
Total	**344,926**	**338,826**	**19**	**5**

Table 3.23: 2007 Ocean-Going Vessel Emissions by Mode, tpy

Mode	Engine Type	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
Transit	Aux	10	8	10	341	60	29	10
Transit	Auxiliary Boiler	0	0	0	0	0	0	0
Transit	Main	243	194	239	2,896	1,750	292	137
Total Transit		**253**	**202**	**249**	**3,237**	**1,810**	**321**	**147**
Maneuvering	Aux	6	5	6	237	36	20	7
Maneuvering	Auxiliary Boiler	2	2	0	6	45	1	0
Maneuvering	Main	26	21	26	237	50	43	36
Total Maneuvering		**35**	**28**	**32**	**480**	**131**	**64**	**44**
Hotelling - Berth	Aux	54	43	54	2,010	297	170	62
Hotelling - Berth	Auxiliary Boiler	80	64	0	210	1,648	20	10
Hotelling - Berth	Main	0	0	0	0	0	0	0
Total Hotelling - Berth		**134**	**107**	**54**	**2,219**	**1,946**	**190**	**72**
Hotelling - Anchorage	Aux	5	4	5	173	30	15	5
Hotelling - Anchorage	Auxiliary Boiler	6	5	0	17	133	2	1
Hotelling - Anchorage	Main	0	0	0	0	0	0	0
Total Hotelling - Anchorage		**11**	**9**	**5**	**190**	**163**	**17**	**6**
Total		**432**	**346**	**340**	**6,127**	**4,050**	**591**	**269**

Table 3.24: 2007 Ocean-Going Vessel GHG Emissions by Mode, metric tons

Mode	Engine Type	CO_2 Equivalent	CO_2	N_2O	CH_4
Transit	Aux	16,485	16,255	1	0
Transit	Auxiliary Boiler	0	0	0	0
Transit	Main	117,267	115,428	6	3
Total Transit		**133,752**	**131,683**	**6**	**3**
Maneuvering	Aux	11,452	11,300	0	0
Maneuvering	Auxiliary Boiler	2,453	2,391	0	0
Maneuvering	Main	3,472	3,335	0	1
Total Maneuvering		**17,377**	**17,026**	**1**	**1**
Hotelling - Berth	Aux	97,079	95,788	4	1
Hotelling - Berth	Auxiliary Boiler	90,160	87,909	7	0
Hotelling - Berth	Main	0	0	0	0
Total Hotelling - Berth		**187,239**	**183,696**	**11**	**1**
Hotelling - Anchorage	Aux	8,545	8,431	0	0
Hotelling - Anchorage	Auxiliary Boiler	7,294	7,111	1	0
Hotelling - Anchorage	Main	0	0	0	0
Total Hotelling - Anchorage		**15,839**	**15,542**	**1**	**0**
Total		**344,926**	**338,826**	**19**	**5**

Table 4.10: 2007 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	25	0	12	3
Assist Tug	Propulsion	17	16	17	432	0	109	25
Commercial Fishing	Auxiliary	1	1	1	11	0	7	1
Commercial Fishing	Propulsion	6	5	6	154	0	36	9
CrewBoat	Auxiliary	0	0	0	7	0	3	1
CrewBoat	Propulsion	4	3	4	91	0	22	6
Excursion	Auxiliary	1	1	1	9	0	6	2
Excursion	Propulsion	6	6	6	149	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	38	0	10	3
Ocean Tug	Auxiliary	0	0	0	2	0	1	0
Ocean Tug	Propulsion	2	2	2	52	0	13	3
Tugboat	Auxiliary	0	0	0	5	0	3	1
Tugboat	Propulsion	4	4	4	110	0	29	7
WorkBoat	Auxiliary	0	0	0	1	0	1	0
WorkBoat	Propulsion	1	1	1	22	0	6	2
Total		**52**	**48**	**52**	**1,263**	**1**	**343**	**84**

Table 4.11: 2007 Commercial Harbor Craft GHG Emissions by Engine Type, metric tons

Vessel Type	Engine Type	CO_2 Equivalent	CO_2	N_2O	CH_4
Assist Tug	Auxiliary	1,594	1,571	0	0
Assist Tug	Propulsion	17,098	16,854	1	0
Commercial Fishing	Auxiliary	803	791	0	0
Commercial Fishing	Propulsion	7,523	7,416	0	0
CrewBoat	Auxiliary	308	304	0	0
CrewBoat	Propulsion	3,275	3,228	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	55	54	0	0
Government	Propulsion	1,887	1,861	0	0
Ocean Tug	Auxiliary	84	83	0	0
Ocean Tug	Propulsion	1,838	1,812	0	0
Tugboat	Auxiliary	334	329	0	0
Tugboat	Propulsion	4,709	4,642	0	0
WorkBoat	Auxiliary	94	93	0	0
WorkBoat	Propulsion	1,159	1,143	0	0
Total		**57,667**	**56,848**	**3**	**1**

Table 5.14: 2007 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	7	6	7	179	0	85	12
Container	32	30	32	1,220	2	480	36
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	5	5	5	238	0	328	29
Total	**46**	**42**	**44**	**1,658**	**2**	**918**	**81**

Table 5.15: 2007 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	11,568	11,467	0	1
Container	140,917	139,847	3	3
Cruise	517	514	0	0
Dry Bulk	569	564	0	0
Liquid	108	108	0	0
Other	19,751	19,603	0	1
Total	**173,447**	**172,121**	**4**	**5**

Table 5.16: 2007 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	1	0	1	0
Crane	Diesel	1	1	1	22	0	9	2
Dump Truck	Diesel	2	2	2	34	0	14	3
Electric Pallet Jack	Electric	0	0	0	0	0	0	0
Electric Wharf Crane	Electric	0	0	0	0	0	0	0
Excavator	Diesel	1	1	1	39	0	8	2
Forklift	Electric	0	0	0	0	0	0	0
Forklift	Gasoline	0	0	0	7	0	19	2
Forklift	Propane	1	0	0	100	0	297	25
Forklift	Diesel	2	2	2	38	0	16	3
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	41	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
Rub-trd Gantry Crane	Diesel	5	5	5	205	0	48	6
Side pick	Diesel	1	1	1	40	0	8	1
Skid Steer Loader	Diesel	0	0	0	1	0	1	0
Sweeper	Gasoline	0	0	0	1	0	6	0
Sweeper	Diesel	0	0	0	1	0	1	0
Top handler	Diesel	7	7	7	273	0	48	8
Water Truck	Diesel	0	0	0	2	0	0	0
Yard tractor	LNG	0	0	0	1	0	0	0
Yard tractor	Propane	1	1	0	47	0	255	8
Yard tractor	Diesel	22	21	22	796	1	175	18
Total		**46**	**42**	**44**	**1,658**	**2**	**918**	**81**

Table 5.17: 2007 CHE GHG Emissions by Equipment Type, metric tons

Port Equipment	Engine Type	CO_2	CO_2 Equivalent	N_2O	CH_4
Bulldozer	Diesel	299	296	0	0
Crane	Diesel	981	972	0	0
Dump Truck	Diesel	1,135	1,125	0	0
Electric Pallet Jack	Electric	0	0	0	0
Electric Wharf Crane	Electric	0	0	0	0
Excavator	Diesel	3,063	3,037	0	0
Forklift	Electric	0	0	0	0
Forklift	Gasoline	312	310	0	0
Forklift	Propane	5,741	5,741	0	0
Forklift	Diesel	2,686	2,659	0	0
Fuel Truck	Gasoline	57	56	0	0
Fuel Truck	Diesel	297	295	0	0
Loader	Diesel	3,008	2,982	0	0
Man Lift	Diesel	154	152	0	0
Rail Pusher	Diesel	20	19	0	0
RMG cranes	Electric	0	0	0	0
Rub-trd Gantry Crane	Diesel	24,597	24,381	1	1
Side pick	Diesel	3,833	3,795	0	0
Skid Steer Loader	Diesel	85	84	0	0
Sweeper	Gasoline	178	176	0	0
Sweeper	Diesel	137	136	0	0
Top handler	Diesel	27,627	27,398	1	1
Water Truck	Diesel	205	203	0	0
Yard tractor	LNG	0	0	0	0
Yard tractor	Propane	6,696	6,696	0	0
Yard tractor	Diesel	92,337	91,607	2	2
Total		**173,447**	**172,121**	**4**	**5**

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	7,235,800	31	28	31	480	0	233	90
On-Road	269,904,539	301	277	301	6,100	6	2,041	316
Total	**277,140,339**	**332**	**305**	**332**	**6,580**	**6**	**2,274**	**406**

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

Activity Location	VMT	CO_2 Equivalent	CO_2	N_2O	CH_4
On-Terminal	7,235,800	32,932	32,640	1	5
On-Road	269,904,539	469,657	465,241	13	17
Total	**277,140,339**	**502,588**	**497,881**	**14**	**22**

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	5,586,774	24	22	24	364	0	179	68
On-Road	243,266,375	272	250	272	5,499	5	1,840	285
Total	**248,853,149**	**295**	**272**	**295**	**5,862**	**5**	**2,019**	**353**

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

Activity Location	VMT	CO_2 Equivalent	CO_2	N_2O	CH_4
On-Terminal	5,586,774	25,211	24,989	0	4
On-Road	243,266,375	423,319	419,339	12	15
Total	**248,853,149**	**448,530**	**444,328**	**12**	**19**

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	1,649,026	7	6	7	116	0	54	21
On-Road	26,638,165	30	27	30	602	1	201	31
Total	**28,287,190**	**37**	**34**	**37**	**718**	**1**	**255**	**52**

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

Activity Location	VMT	CO_2 Equivalent	CO_2	N_2O	CH_4
On-Terminal	1,649,026	7,721	7,651	0	1
On-Road	26,638,165	46,338	45,902	1	2
Total	**28,287,190**	**54,058**	**53,553**	**1**	**3**

Table 8.1: 2007 Port-related Emissions by Category, tpy

Category	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
Ocean-going vessels	432	346	340	6,127	4,050	591	269
Harbor craft	52	48	52	1,263	1	343	84
Cargo handling equipment	46	42	44	1,658	2	918	81
Rail locomotives	60	54	60	1,675	55	268	94
Heavy-duty vehicles	332	305	332	6,580	6	2,274	406
Total	**921**	**795**	**828**	**17,303**	**4,113**	**4,394**	**933**

Table 8.2: 2007 Port-related GHG Emissions by Category, tpy

Category	CO_2	N_2O	CH_4
Ocean-going vessels	372,705	21	5
Harbor craft	62,532	3	1
Cargo handling equipment	189,331	4	5
Rail locomotives	98,059	3	8
Heavy-duty vehicles	547,664	15	24
Total	**1,270,291**	**46**	**44**

Table 8.3: 2007 Port-related GHG Emissions by Category, metric tons per year

Category	CO_2 Equivalent	CO_2	N_2O	CH_4
Ocean-going vessels	344,926	338,826	19	5
Harbor craft	57,667	56,848	3	1
Cargo handling equipment	173,447	172,121	4	5
Rail locomotives	90,033	89,145	2	7
Heavy-duty vehicles	502,588	497,881	14	22
Total	**1,168,661**	**1,154,821**	**42**	**40**

Table 8.4: 2007 DPM Emissions Percentage Comparison, tpy and %

Category	Subcategory	DPM Emissions	Percent DPM Emissions of Total Category	Port	SoCAB AQMP
CHE	RTG crane, crane	6	13%	1%	0%
CHE	Forklift	2	5%	0%	0%
CHE	Top handler, side pick	8	19%	1%	0%
CHE	Other	6	14%	1%	0%
CHE	Yard tractor	22	50%	3%	0%
CHE	**Subtotal**	**44**	**100%**	**5%**	**0%**
OGV	Auto carrier	5	1%	1%	0%
OGV	Bulk vessel	7	2%	1%	0%
OGV	Containership	252	74%	30%	3%
OGV	Cruise	34	10%	4%	0%
OGV	General cargo	10	3%	1%	0%
OGV	Ocean tugboat	1	0%	0%	0%
OGV	Miscellaneous	0	0%	0%	0%
OGV	Reefer	4	1%	0%	0%
OGV	RoRo	0	0%	0%	0%
OGV	Tanker	27	8%	3%	0%
OGV	**Subtotal**	**340**	**100%**	**41%**	**4%**
Harbor Craft	Assist tug	18	35%	2%	0%
Harbor Craft	Harbor tug	6	11%	1%	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	4	8%	1%	0%
Harbor Craft	Work boat	1	2%	0%	0%
Harbor Craft	**Subtotal**	**52**	**100%**	**6%**	**1%**
HDV	On-Terminal	31	9%	4%	0%
HDV	On-Road	301	91%	36%	3%
HDV	**Subtotal**	**332**	**100%**	**40%**	**4%**
Rail	Switching	7	11%	1%	0%
Rail	Line haul	53	89%	6%	1%
Rail	**Subtotal**	**60**	**100%**	**7%**	**1%**
Port	**Total**	**828**		**100%**	**9%**
SoCAB AQM	**Total**	**9,190**			

Table 8.5: 2007 NO_x Emissions Percentage Comparison, tpy and %

Category	Subcategory	NO_x Emissions	Percent NO_x Emissions of Total		
			Category	Port	SoCAB AQMP
CHE	RTG crane	205	12%	1%	0%
CHE	Forklift	146	9%	1%	0%
CHE	Top handler, side pick	313	19%	2%	0%
CHE	Other	198	12%	1%	0%
CHE	Yard tractor	796	48%	5%	0%
CHE	**Subtotal**	**1,658**	**100%**	**10%**	**1%**
OGV	Auto carrier	76	1%	0%	0%
OGV	Bulk vessel	121	2%	1%	0%
OGV	Containership	4,133	67%	24%	1%
OGV	Cruise	890	15%	5%	0%
OGV	General cargo	170	3%	1%	0%
OGV	Ocean tugboat	34	1%	0%	0%
OGV	Miscellaneous	0	0%	0%	0%
OGV	Reefer	84	1%	0%	0%
OGV	RoRo	1	0%	0%	0%
OGV	Tanker	617	10%	4%	0%
OGV	**Subtotal**	**6,127**	**100%**	**35%**	**2%**
Harbor Craft	Assist tug	457	36%	3%	0%
Harbor Craft	Harbor tug	130	10%	1%	0%
Harbor Craft	Commercial fishing	165	13%	1%	0%
Harbor Craft	Ferry	152	12%	1%	0%
Harbor Craft	Line haul tug	54	4%	0%	0%
Harbor Craft	Government	39	3%	0%	0%
Harbor Craft	Excursion	158	12%	1%	0%
Harbor Craft	Crewboat	102	8%	1%	0%
Harbor Craft	Work boat	24	2%	0%	0%
Harbor Craft	**Subtotal**	**1,263**	**100%**	**7%**	**0%**
HDV	On-Terminal	480	7%	3%	0%
HDV	On-Road	6,100	93%	35%	2%
HDV	**Subtotal**	**6,580**	**100%**	**38%**	**2%**
Rail	Switching	283	17%	2%	0%
Rail	Line haul	1,392	83%	8%	0%
Rail	**Subtotal**	**1,675**	**100%**	**10%**	**1%**
Port	**Total**	**17,303**		**100%**	**5%**
SoCAB AQMP	**Total**	**326,906**			

Table 8.6: 2007 SO_x Emissions Percentage Comparison, tpy and %

Category	Subcategory	SO_x Emissions	Percent SO_x Emissions of Total		
			Category	Port	SoCAB AQMP
CHE	RTG crane	0	14%	0%	0%
CHE	Forklift	0	2%	0%	0%
CHE	Top handler, side pick	0	17%	0%	0%
CHE	Other	0	5%	0%	0%
CHE	Yard tractor	1	62%	0%	0%
CHE	**Subtotal**	**2**	**100%**	**0%**	**0%**
OGV	Auto carrier	41	1%	1%	0%
OGV	Bulk vessel	84	2%	2%	0%
OGV	Containership	2,329	57%	57%	13%
OGV	Cruise	333	8%	8%	2%
OGV	General cargo	109	3%	3%	1%
OGV	Ocean tugboat	1	0%	0%	0%
OGV	Miscellaneous	0	0%	0%	0%
OGV	Reefer	52	1%	1%	0%
OGV	RoRo	1	0%	0%	0%
OGV	Tanker	1,101	27%	27%	6%
OGV	**Subtotal**	**4,050**	**100%**	**98%**	**22%**
Harbor Craft	Assist tug	0.2	32%	0%	0%
Harbor Craft	Harbor tug	0.1	10%	0%	0%
Harbor Craft	Commercial fishing	0.1	14%	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	0	3%	0%	0%
HDV	On-Road	6	97%	0%	0%
HDV	**Subtotal**	**6**	**100%**	**0%**	**0%**
Rail	Switching	0	0%	0%	0%
Rail	Line haul	9	17%	0%	0%
Rail	**Subtotal**	**55**	**100%**	**1%**	**0%**
Port	**Total**	**4,113**		**100%**	**23%**
SoCAB AQMP	**Total**	**18,037**			

Table 91: TEUs and Vessel Call Comparison, %

EI Year	All Calls	Containership Calls	TEUs	Average TEUs/Call
2007	2,527	1,577	8,355,038	5,298
2006	2,701	1,632	8,469,853	5,190
2005	2,500	1,477	7,484,625	5,067
2007-2006	**-6%**	**-3%**	**-1%**	**2%**
2007-2005	**1%**	**7%**	**12%**	**5%**

Figure 9.1: TEUs and Vessel Call Comparison, %

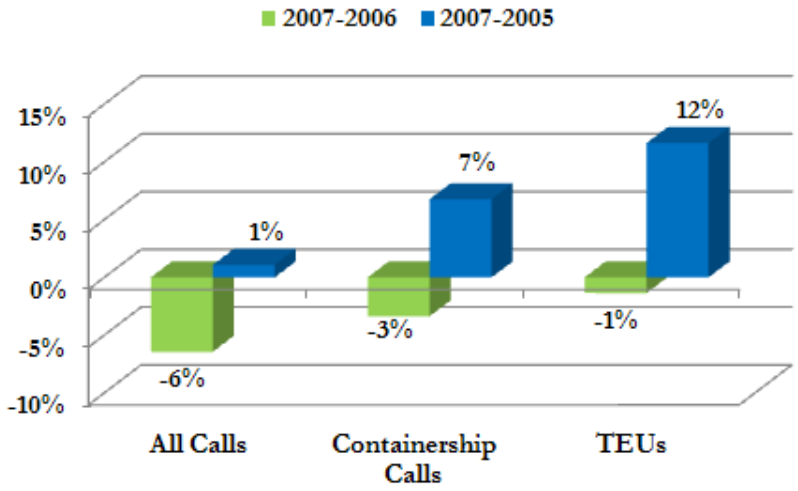

Table 9.2: Port-wide Emissions Comparison, tpy and % Change

EI Year	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
2007	921	795	828	17,303	4,113	4,394	933
2006	1,234	1,051	1,136	19,714	6,578	4,778	1,008
2005	1,118	952	1,032	17,529	6,024	4,106	890
2007-2006	**-25%**	**-24%**	**-27%**	**-12%**	**-37%**	**-8%**	**-7%**
2007-2005	**-18%**	**-17%**	**-20%**	**-1%**	**-32%**	**7%**	**5%**

Table 9.3: Port-wide GHG Emissions Comparison, MT/yr

Year	CO_2 Equivalent	CO_2	N_2O	CH_4
2007	1,168,661	1,154,821	42	40
2006	1,316,543	1,282,908	106	43
Change (%)	**-11%**	**-10%**	**-60%**	**-7%**

Figure 9.2: Port-wide Emissions Comparison, 2007-2006, % Change

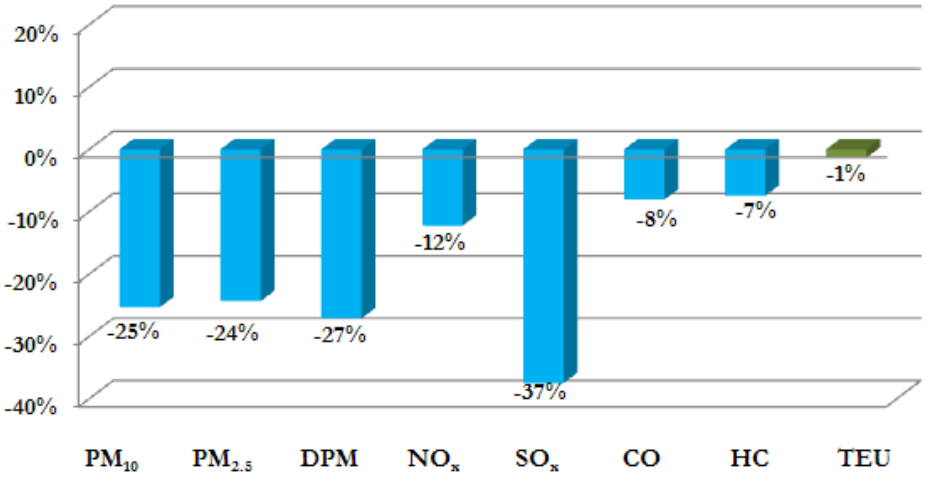

Figure 9.3: Port-wide Emissions Comparison, 2007-2005, % Change

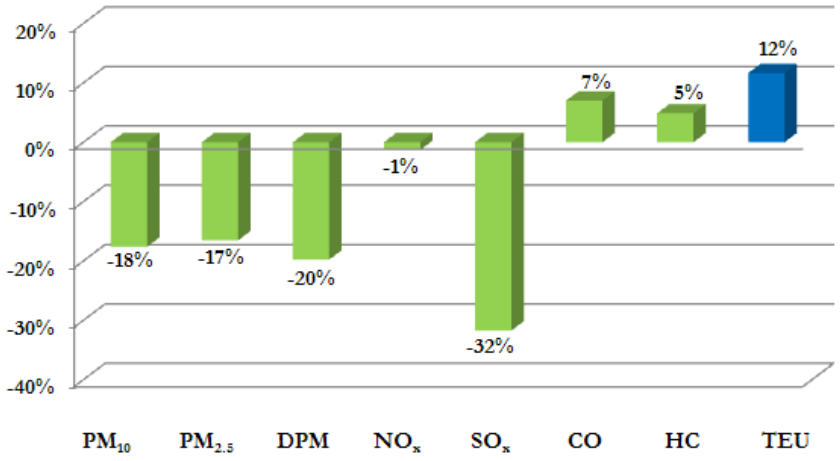

Table 9.4: Port-wide Emissions Efficiency Comparison, tons/10,000 TEU and %

EI Year	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
2007	1.1	1.0	1.0	20.7	4.9	5.3	1.1
2006	1.5	1.2	1.3	23.3	7.8	5.6	1.2
2005	1.5	1.3	1.4	23.4	8.0	5.5	1.2
2007-200	**24%**	**23%**	**26%**	**11%**	**37%**	**7%**	**6%**
2007-200	**26%**	**25%**	**28%**	**12%**	**39%**	**4%**	**6%**

Figure 9.5: Port-wide Changes in Emissions Efficiency, % Change

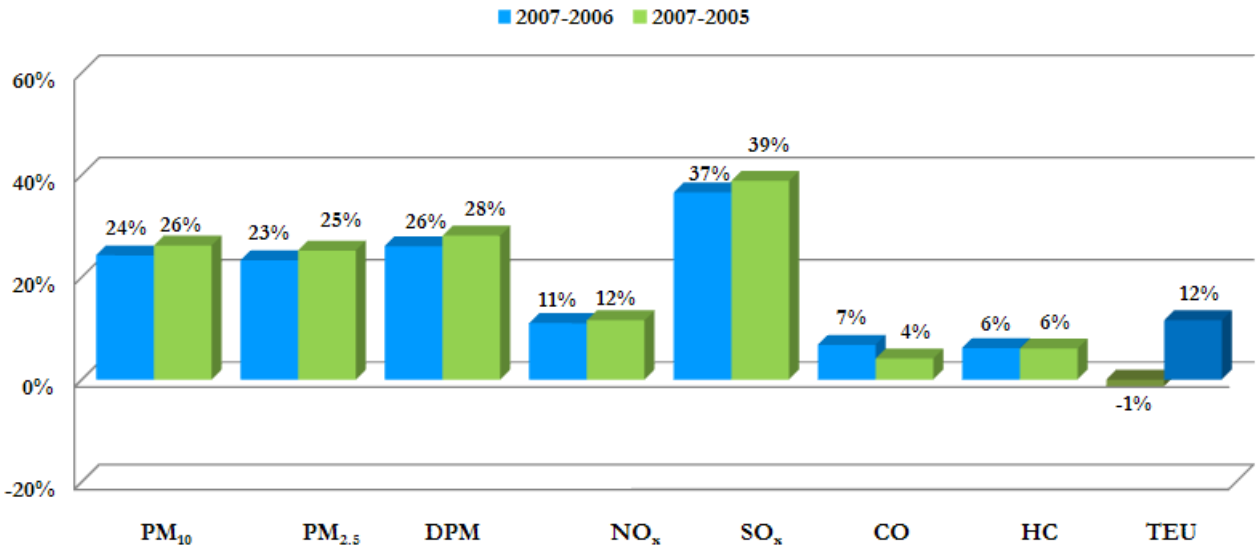

Table 9.7: OGV Emissions Comparison, tpy and % Change

EI Year	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC	TEU
2007	432	346	340	6,127	4,050	591	269	8,355,038
2006	697	558	600	6,890	6,404	630	280	8,469,853
2005	648	519	563	6,251	5,863	556	246	7,484,625
2007-2006	**-38%**	**-38%**	**-43%**	**-11%**	**-37%**	**-6%**	**-4%**	**-1%**
2007-2005	**-33%**	**-33%**	**-40%**	**-2%**	**-31%**	**6%**	**9%**	**12%**

Figure 9.6: OGV Emissions Comparison, %

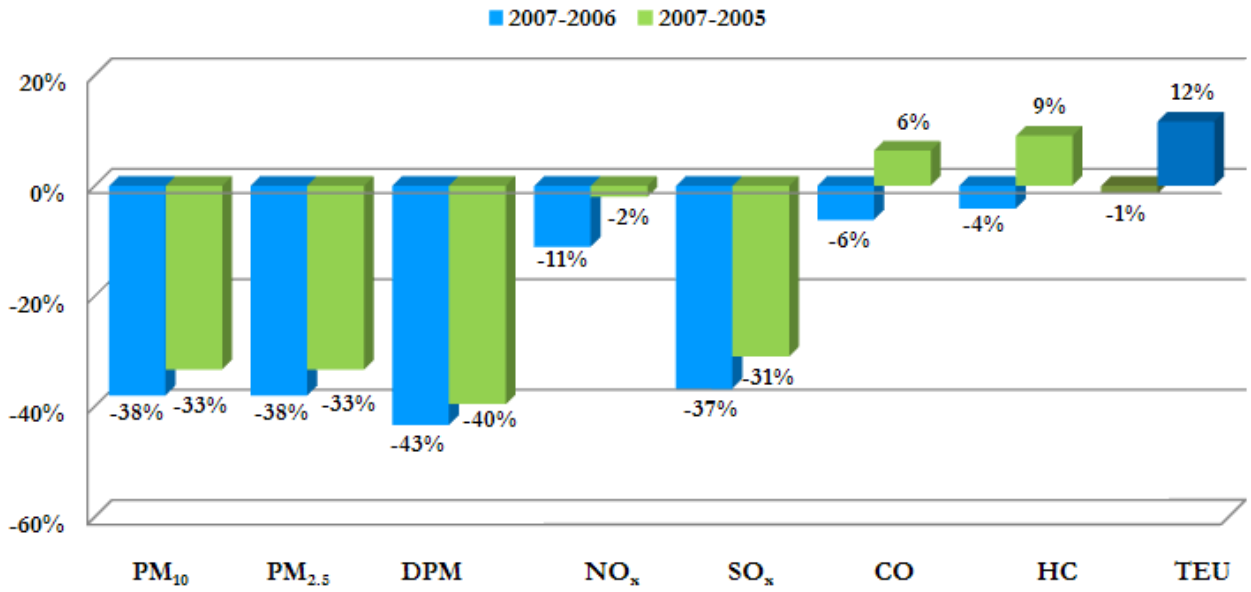

Table 9.8: OGV Emissions Efficiency Comparison, tons/10,000 TEU and %

EI Year	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
2007	0.5	0.4	0.4	7.3	4.8	0.7	0.3
2006	0.8	0.7	0.7	8.1	7.6	0.7	0.3
2005	0.9	0.7	0.8	8.4	7.8	0.7	0.3
2007-2006	**37%**	**37%**	**43%**	**10%**	**36%**	**5%**	**3%**
2007-2005	**40%**	**40%**	**46%**	**12%**	**38%**	**5%**	**2%**

Figure 9.7: OGV Emissions Efficiency Comparison, %

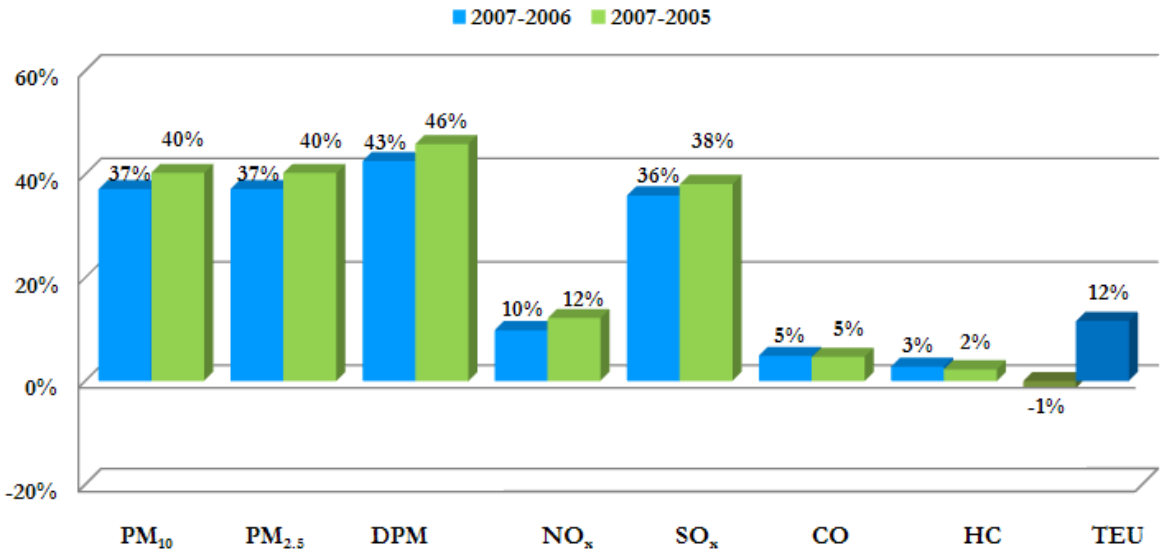

Table 9.13: Harbor Craft Emissions Comparison, tpy and % Change

EI Year	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
2007	52	48	52	1,263	1	343	84
2006	51	47	51	1,245	1	339	82
2005	56	52	56	1,336	6	369	89
2007-2006	**2%**	**2%**	**2%**	**1%**	**1%**	**1%**	**2%**
2007-2005	**-8%**	**-8%**	**-8%**	**-5%**	**-90%**	**-7%**	**-6%**

Table 9.14: Harbor Craft Emissions Efficiency Comparison, tons/10,000 TEU and %

EI Year	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
2007	0.06	0.06	0.06	1.51	0.00	0.41	0.10
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
2007-2006	**-3%**	**-3%**	**-3%**	**-3%**	**-3%**	**-2%**	**-3%**
2007-2005	**17%**	**17%**	**17%**	**15%**	**91%**	**17%**	**15%**

Figure 9.8: Harbor Craft Emissions Efficiency Comparison, %

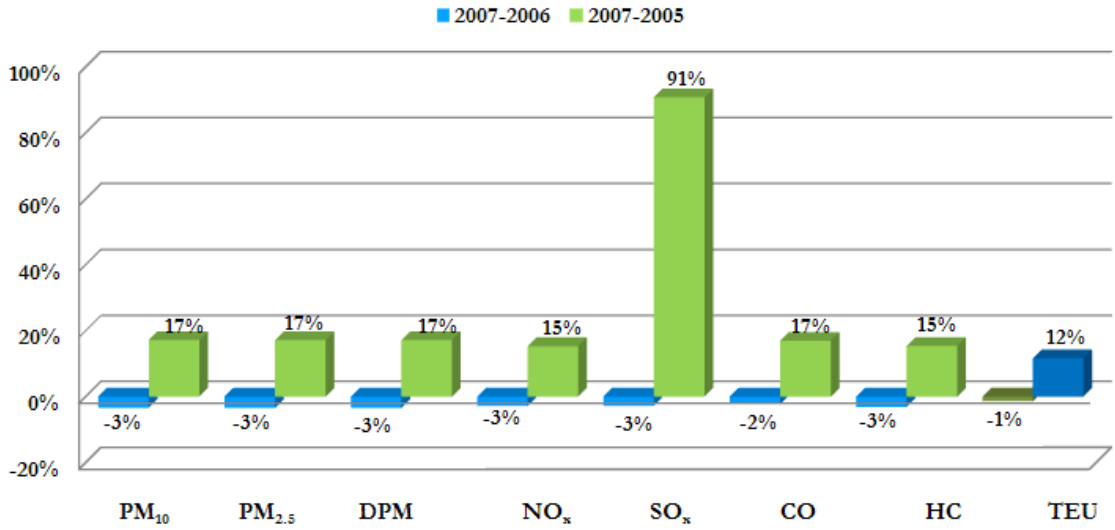

Table 9.18: CHE Emissions Comparison, tpy and % Change

EI Year	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
2007	46	42	44	1,658	2	918	81
2006	51	47	50	1,826	2	970	94
2005	46	43	46	1,516	9	759	80
2007-2006	**-11%**	**-11%**	**-11%**	**-9%**	**-6%**	**-5%**	**-14%**
2007-2005	**-2%**	**-2%**	**-3%**	**9%**	**-80%**	**21%**	**2%**

Table 9.19: CHE Emissions Efficiency Comparison, tons/10,000 TEU and %

EI Year	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
2007	0.05	0.05	0.05	1.98	0.00	1.10	0.10
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
2007-2006	**10%**	**10%**	**10%**	**8%**	**5%**	**4%**	**12%**
2007-2005	**12%**	**12%**	**13%**	**2%**	**82%**	**-8%**	**9%**

Figure 9.9: CHE Emissions Efficiency Comparison, %

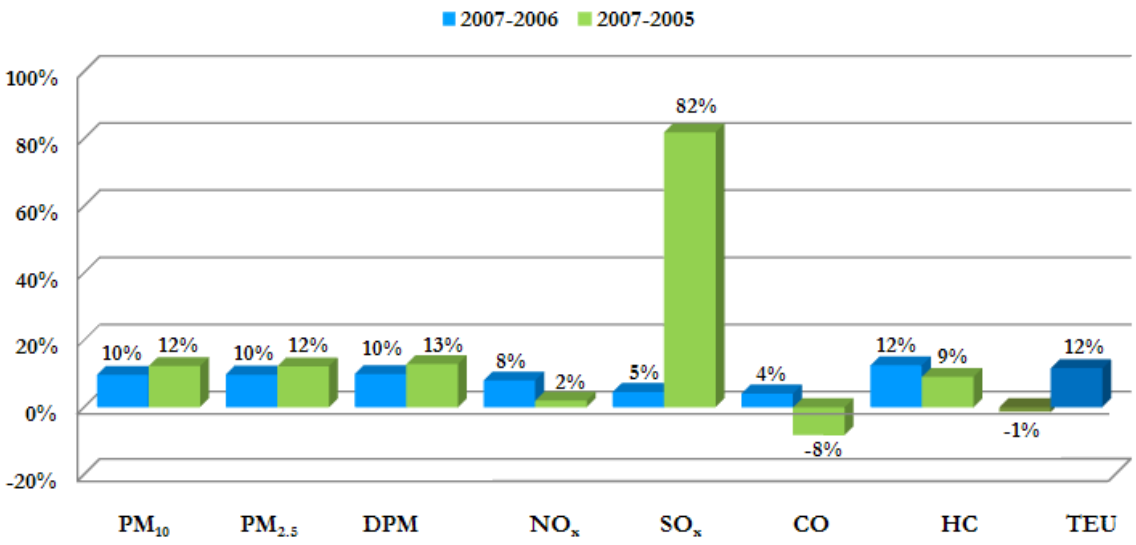

Table 9.21: Rail Emissions Comparison, tpy and % Change

EI Year	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
2007	60	54	60	1,675	55	268	94
2006	72	65	72	2,081	131	320	115
2005	57	53	57	1,712	97	237	89
2007-2006	**-17%**	**-17%**	**-17%**	**-20%**	**-58%**	**-16%**	**-18%**
2007-2005	**5%**	**1%**	**5%**	**-2%**	**-43%**	**13%**	**5%**

Table 9.22: Rail Emissions Efficiency Comparison, tons/10,000 TEU and %

EI Year	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
2007	0.1	0.1	0.1	2.0	0.1	0.3	0.1
2006	0.1	0.1	0.1	2.5	0.2	0.4	0.1
2005	0.1	0.1	0.1	2.3	0.1	0.3	0.1
2007-2006	**16%**	**16%**	**16%**	**18%**	**58%**	**15%**	**17%**
2007-2005	**6%**	**9%**	**6%**	**12%**	**49%**	**-1%**	**6%**

Figure 9.10: Rail Emissions Efficiency Comparison, %

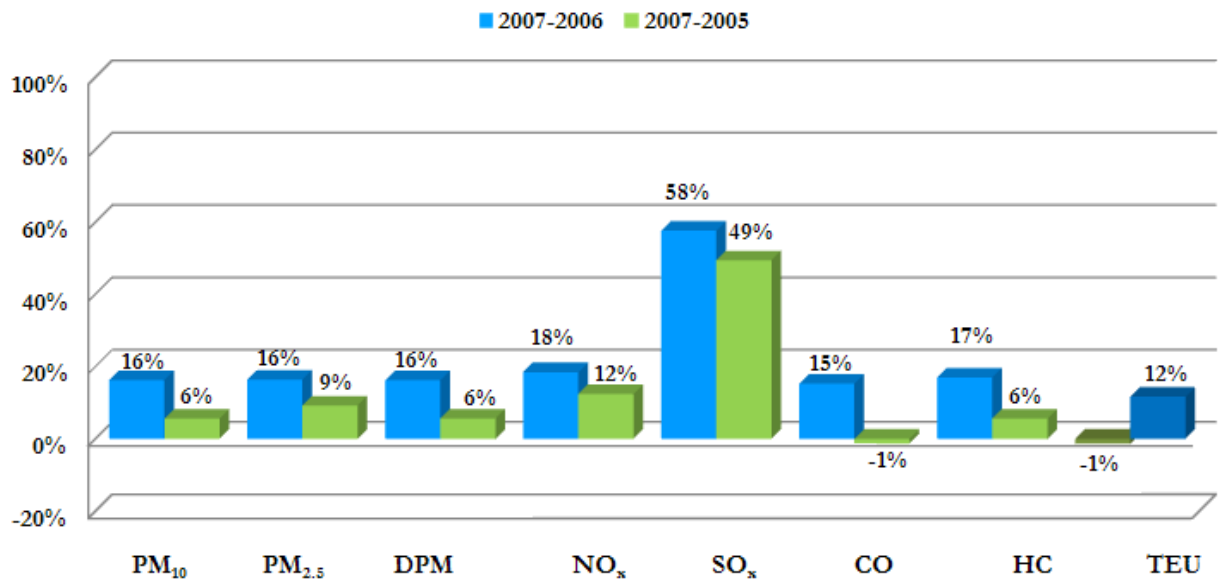

Table 9.24: HDV Emissions Comparison, tpy and % Change

EI Year	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
2007	332	305	332	6,580	6	2,274	406
2006	362	333	362	7,672	40	2,518	437
2005	311	286	311	6,715	48	2,185	386
2007-2006	**-8%**	**-8%**	**-8%**	**-14%**	**-86%**	**-10%**	**-7%**
2007-2005	**7%**	**7%**	**7%**	**-2%**	**-88%**	**4%**	**5%**

Table 9.25: HDV Emissions Efficiency Comparison, tons/10,000 TEU and %

EI Year	PM_{10}	$PM_{2.5}$	DPM	NO_x	SO_x	CO	HC
2007	0.40	0.37	0.40	7.88	0.01	2.72	0.49
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
2007-2006	**7%**	**7%**	**7%**	**13%**	**85%**	**8%**	**6%**
2007-2005	**4%**	**4%**	**4%**	**12%**	**89%**	**7%**	**6%**

Figure 9.11: HDV Emissions Efficiency Comparison, %