Port of San Diego
2012 Maritime Air Emissions Inventory

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GLOSSARY

ARB/CARB: California Air Resources Board

Adjustment factors: Used to adjust emissions or engine load or other situations for non-standard conditions.

Assist tug: Tugboat used to assist a ship to/from the harbor and to/from its berth.

Auxiliary boiler: Boiler used to create steam or hot water for crew use.

Auxiliary engine: Used to drive on-board electrical generators to provide electric power or to operate equipment on board the vessel.

Auxiliary power: Typically electric power generated via the auxiliary engine.

Barge: A flat-bottomed craft built mainly for water transport of heavy goods. Most barges are not self-propelled and need to be moved by tugboats towing or towboats pushing them.

Brake-specific fuel consumption (BSFC): This is the measure of the engines efficiency in terms of the fuel consumption rate (weight of fuel burned per hour) divided by the engine load or output (e.g. kilowatts). For marine engines a different term, standard fuel oil consumption (SFOC), is sometimes used to describe the identical efficiency measure.

CAP: Clean Air Plan

Cargo handling equipment: Equipment used to transfer cargo or containers. Cargo handling equipment is used to move containers from one mode of transportation to another, or from a storage area to a truck chassis, for example. Typical cargo handling equipment at the Port of Oakland include yard trucks, RTG cranes, top and side picks, forklifts, and other general industrial equipment.

CH_4: Methane

CO: Carbon monoxide.

CO_2/CO_2e: Carbon dioxide and carbon dioxide equivalent combining global warming potential of all greenhouse gases.

Cruise mode: The vessel mode while traveling in the open ocean or in an area without speed restrictions.

CST: Cruise ship terminal

Dead weight tonnage (DWT): Dead Weight Tonnage (DWT) is the weight of the ship, all its stores and fuel, pumps and boilers, crew's quarters with crew and the cargo for example. How much water the vessel displaces when loaded.

Deep draft marine vessel: Deep draft vessels are larger vessels typically with draft in excess of 14 feet measured at the highest waterline and the bottom of the vessel. Other works describe this type of vessel as only Ocean-Going Vessels (OGVs), but deep draft may be used in this report to distinguish and avoid confusion between these larger vessels and smaller ocean-going tugs, supply vessels, and fishing vessels that could also be considered "ocean-going vessels".

DPM: Diesel particulate matter.

Emission estimation: Method by which the quantity of a particular pollutant emission is estimated.

Emission factor (EF): The average emission rate of a given pollutant for a given source, relative to a unit of activity. For example, grams per kilowatt of actual power or grams per hour of engine operation.

Emissions inventory: A listing of all the emissions included in the study.

GHG: Greenhouse gases including methane (CH_4), nitrous oxide (N_2O), and carbon dioxide

g/kW-hr: This is the unit for reporting emission or fuel consumption factors, and means the grams per kilowatt-hour of work performed. Work and energy are used synonymously in this context.

HC: Hydrocarbon emissions, see also ROG.

Hotelling: On-board activities while a ship is in port and at its berth or anchored nearby.

Installed power: The engine power available on a vessel. The term most often refers only to the propulsion power available on the vessel, but could incorporate auxiliary engine power as well, depending on how it is reported.

Intermodal site: Location where cargo is transferred from one form of transportation to another; for example, between an ocean-going vessel and a railroad car.

Knot: A nautical unit of speed meaning one nautical mile per hour and is equal to about 1.15 statute miles per hour.

Link: A defined portion of a vessel's, train's, or truck's travel. A series of links defines all of the movements within a defined area or a trip.

Load: The actual power output of the vessel's engines or generator. The load is typically the rated maximum power of the engine multiplied by the load factor if the load has not been measured directly.

Load factor: Average engine load expressed as a fraction or percentage of rated power.

Maximum power: A power rating usually provided by the engine manufacturer that states the maximum continuous power available for an engine.

Medium speed engine: A 4-stroke engine used for auxiliary power and sometimes for propulsion power on OGVs. Medium speed engines typically have rated speeds of greater than 250 revolutions per minute.

Mode: Defines a specific set of activities; for example, a tug's transit mode includes travel time to/from a port berth while escorting a vessel.

NO_x: Nitrogen oxides. Includes all different nitrogen oxide compounds.

Ocean-going vessel (OGV): Vessels equipped for travel across the open ocean. OGVs do not include the shallow draft vessels used for in-harbor work, ocean-going tugs, sightseeing, pilot, crew and supply, or commercial fishing, which are all covered in this report under commercial harbor craft. In this report OGVs are restricted to the deep draft vessels that carry containers, bulk and general cargo, and vehicles or large cruise ships.

Off-Road activity: Activity that occurs off of established roadways. Activity within a marine terminal yard is considered off-road activity.

On-road activity: Activity that occurs on established roadways.

Operation mode: The current modes of operation for a ship such as cruise, reduced speed, near the Port entrance, in-harbor and maneuvering, or at berth.

PM_{10}: Particulate matter emissions less than 10 micrometers in diameter.

$PM_{2.5}$: Particulate matter emissions less than 2.5 micrometers in diameter

Port of Call (POC): A specified port where a ship docks.

Port berth: A location in a port or harbor used specifically for mooring vessels.

Propulsion engine: Shipboard engine used to propel the ship.

Propulsion power demand: Power used to drive the propeller and the ship.

Rated power: A guideline set by the manufacturer as a maximum power that the engine can produce continuously.

ROG: Reactive organic gas; all hydrocarbon compounds that can assist in producing ozone (smog). Includes all hydrocarbon compounds including aldehyde, ketones, and alcohol compounds and subtracts methane, which is not photo-chemically reactive. See HC.

Roll on/roll off vessels (RORO): Ships designed to carry wheeled cargo such as automobiles, trailers, or railway carriages that are driven or are pulled onto the vessels.

RSZ: Reduced speed zone.

RTG Crane: Rubber-tired gantry (RTG) crane is sometimes but rarely called a straddle crane because the crane 'straddles' a row of containers stored in the terminal yard as it drives up and down the row.

SO_2: Sulfur dioxide.

SO_x: Oxides of sulfur. Interchangeable term with sulfur dioxide but includes some other minor forms of sulfur oxides.

Spatial allocation: Areas on a map allocating a specific set of activities.

Spatial scope: A specified area on a map that defines the area covered in study.

Slow speed engine: Typically a 2-stroke engine or an engine that run below 250 revolutions per minute.

Standard fuel oil consumption (SFOC): See brake specific fuel consumption (BSFC).

TEU: Twenty foot equivalent unit; a unit of cargo capacity often used to describe the capacity of container ships and container terminals.

Time in mode: The amount of time a vessel remains in a specified mode, for example the amount of time a ship spends in the reduced speed zone.

Tons: Represents short tons (2,000 lbs) unless otherwise noted.

Towboat: Vessels used to push barges and pontoons. Towboats are characterized by a square bow with steel knees for pushing, a shallow draft, and powerful engines.

Transit mode: Modes when the vessel is moving.

Tugboat: Vessels primarily used to assist other vessels maneuvering in harbors, over the open sea or through rivers and canals by pushing and towing.

Two-stroke engine: Engine designed so that it completes the four processes of internal combustion (intake, compression, power, exhaust) in only two strokes of the piston.

Whistle Buoy: Used to mark a maritime administrative area to allow boats and ships to navigate safely and near where the San Diego Bay Pilots will board and leave a vessel. Located at latitude 32° 37.3'N, and longitude 117° 14.7'W.

Vessel Tracking Service (VTS): The purpose of a Vessel Traffic Service (VTS) is to provide active monitoring and navigational advice for vessels in particularly confined and busy waterways.

Zero-hour: When the engine is new, before the first hour of operation

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EXECUTIVE SUMMARY

Scope of Inventory

The Port of San Diego (Port) has prepared this maritime air emissions inventory for the purpose of identifying and quantifying the air emissions from maritime-related activities during calendar year 2012 (the "2012 inventory"). The Port conducted its first maritime air emissions inventory in 2007 based on activity in the 2006 calendar year (the "2006 inventory"). The 2006 inventory serves as the Port's baseline maritime air emissions inventory to which future inventories will be compared.

This emissions inventory highlights the Port's continued commitment to understanding the sources and magnitude of emissions from its maritime-related operations. The geographic scope of the inventory presented here is relatively the same as the 2006 emissions inventory. The inventory includes Port related maritime operations within a waterside boundary which extends 24 nautical miles from the coastline as well as the landside boundaries of San Diego County as shown in Figure ES-1. The results presented in this inventory are intended to be compared to the 2006 inventory results to evaluate changes over time. Emissions inventories should be used with care and recognize that other information and tools should be used to supplement inventories in order to evaluate and assess air quality and changes in emissions over time.

The inventory provides estimates for emissions of five "criteria" air pollutants, reported as tons per year. The pollutants are:

- Reactive organic gas (ROG)
- Carbon monoxide (CO)
- Nitrogen Oxides (NOx)
- Particulate matter (including diesel) (PM)
- Sulfur Oxides (SOx, primarily sulfur dioxide or SO_2)

Particulate matter emissions estimated in this report are primarily diesel particulate matter (DPM). DPM has been designated a toxic air contaminant by the California Air Resources Board (ARB). A fraction of particulate matter emissions come from boilers and liquefied petroleum gas-powered engines, and thus are not classified as DPM. Total particulate is divided into two size ranges: PM_{10} (particles with aerodynamic diameter 10 microns or less) and $PM_{2.5}$ (particles with aerodynamic diameter 2.5 microns or less).

In addition, three greenhouse gas (GHG) components (carbon dioxide [CO_2], methane [CH_4], and nitrous oxide [N_2O]) were estimated. These components were combined in a CO_2 equivalent (CO_2e) estimate using the relative global warming potential of each component.

Figure ES-1. Spatial scope of the emissions inventory.

Following guidelines established by the ARB and the US Environmental Protection Agency (EPA), emissions were estimated from maritime-related sources which include:

- Ocean-Going Marine Vessels (OGVs)
- Commercial Harbor Craft (Tugs, Ferries, Excursion, Fishing, and Others)
- Cargo Handling and Other Off-Road Equipment (CHE)
- Locomotives
- On-Road Vehicles (Freight/Drayage Trucks, Imported Vehicles, and Cruise Passenger Buses, Shuttles, and Taxis)

The Port's maritime-related operations, focusing primarily on imports/exports of cargo, passenger cruise and excursion services, and commercial fishing, are located along the eastern

shore of San Diego Bay. The three marine terminals from which a majority of the Port's maritime operations occur include the following:

- Broadway Pier and B Street Cruise Ship Terminal (CST)
- Tenth Avenue Marine Terminal (TAMT)
- National City Marine Terminal (NCMT)

Also assessed in this inventory are maritime-related operations which are not based solely on the marine terminals, but whose operations consist of commercial vessel movements in and out of San Diego Bay. These operations are located in the vicinity of the marine terminals between CST and TAMT. Located just south of CST, excursion and charter vessels offer cruises and sight-seeing opportunities and a commercial fishing fleet operates out of San Diego Bay from the Tuna Harbor Marina. Only commercial fishing operations based out of the Port owned and maintained marina was included in this inventory. Military, recreational, and stationary sources of emissions which occur in or around San Diego Bay were not included in this inventory. Consistent with similar port air emissions inventories, the trips for on-road vehicles and locomotives were estimated to include the entire trip length within San Diego County, whether the trips stopped within San Diego County or further.

Regulations and Programs to Reduce Emissions

Since 2006, there have been a number of international, federal, and state regulations aimed at reducing air emissions from goods movement sources. Many of the regulations involve the replacement of older equipment with newer, cleaner technologies. Significant regulations have been approved requiring the use of cleaner marine fuels to decrease the amount of particulate matter and oxides of nitrogen and sulfur emitted from OGVs. During 2007, the Port developed the Clean Air Program to address air emissions associated with maritime activities originating from the Port's three marine terminals. Control measures focused primarily on reducing emissions from OGVs and trucks and include the installation of shore power at CST and TAMT as well as the implementation of a Vessel Speed Reduction Program and the Clean Truck Program. These measures were chosen because they were to be implemented ahead of or beyond regulatory compliance schedules.

Changes in Activity, Operations, and Methodology

Because an air emissions inventory is a modeling exercise used to estimate air emissions, changes to activity levels and/or the methodologies used to assess emissions can alter the results. Between 2006 and 2012, freight and passenger throughput decreased as a result of the economic recession. The effect of reduced OGV calls and passengers had a ripple effect among the other sources leading to a decrease in overall maritime-related activities. In addition, based on the best available information and guidance from ARB and/or the EPA, the methods used to estimate emissions were updated, as applicable, from those used during the 2006 inventory. Since the 2006 inventory was conducted, more refined activity profiles for OGVs have become available and emission factors for OGVs and harbor craft have been updated. As

a result of data which more accurately describes ocean-going vessel activity and updates made to the emission factors, the 2006 ocean-going vessel calls and harbor craft emissions were recalculated to provide a fair comparison with the results from the 2012 inventory.

Summary of Emissions Inventory

Emissions from the Port's maritime activities during 2012 are summarized in Table ES-1. Table ES-2 provides the results from the 2006 inventory which includes the revised calculation of OGV and harbor craft source categories due to the availability of more current data and methods. Table ES-3 provides the percent change between 2012 and 2006.

Overall, emissions demonstrated reductions in 2012 showcasing between 38% and 94% reductions depending upon the pollutant or greenhouse gas. During 2012, NOx accounted for the most emissions per ton of the criteria pollutants followed by CO and ROG. SO_2 experienced the greatest decrease between 2012 and 2006 followed by the fractions of PM and DPM primarily due to regulations mandating low sulfur fuel use.

Table ES-1. 2012 Emissions by source category (tons).

Category	ROG	CO	NO_x	PM_{10}	$PM_{2.5}$	DPM	SO_2	CO_2	CH_4	N_2O	CO_2e
Ocean-going Vessels	20.9	31	368	9.26	8.52	8.28	41.2	22,287	1.9	0.7	22,551
Harbor Craft	40.1	136	362	14.79	14.35	14.79	0.2	23,075	3.2	0.8	23,387
Cargo Handling Equipment	1.1	10	12	0.28	0.25	0.27	0.0	1,674	0.3	0.0	1,680
Rail Locomotives	1.9	6	32	1.14	1.05	1.14	0.0	3,163	0.1	0.1	3,192
On-road Vehicles	3.7	18	62	3.11	2.43	3.09	0.0	14,424	0.2	0.5	14,573
Total	**67.7**	**202**	**836**	**28.59**	**26.60**	**27.57**	**42**	**64,624**	**5.7**	**2.1**	**65,383**

Table ES-2. 2006 Emissions by source category (tons).

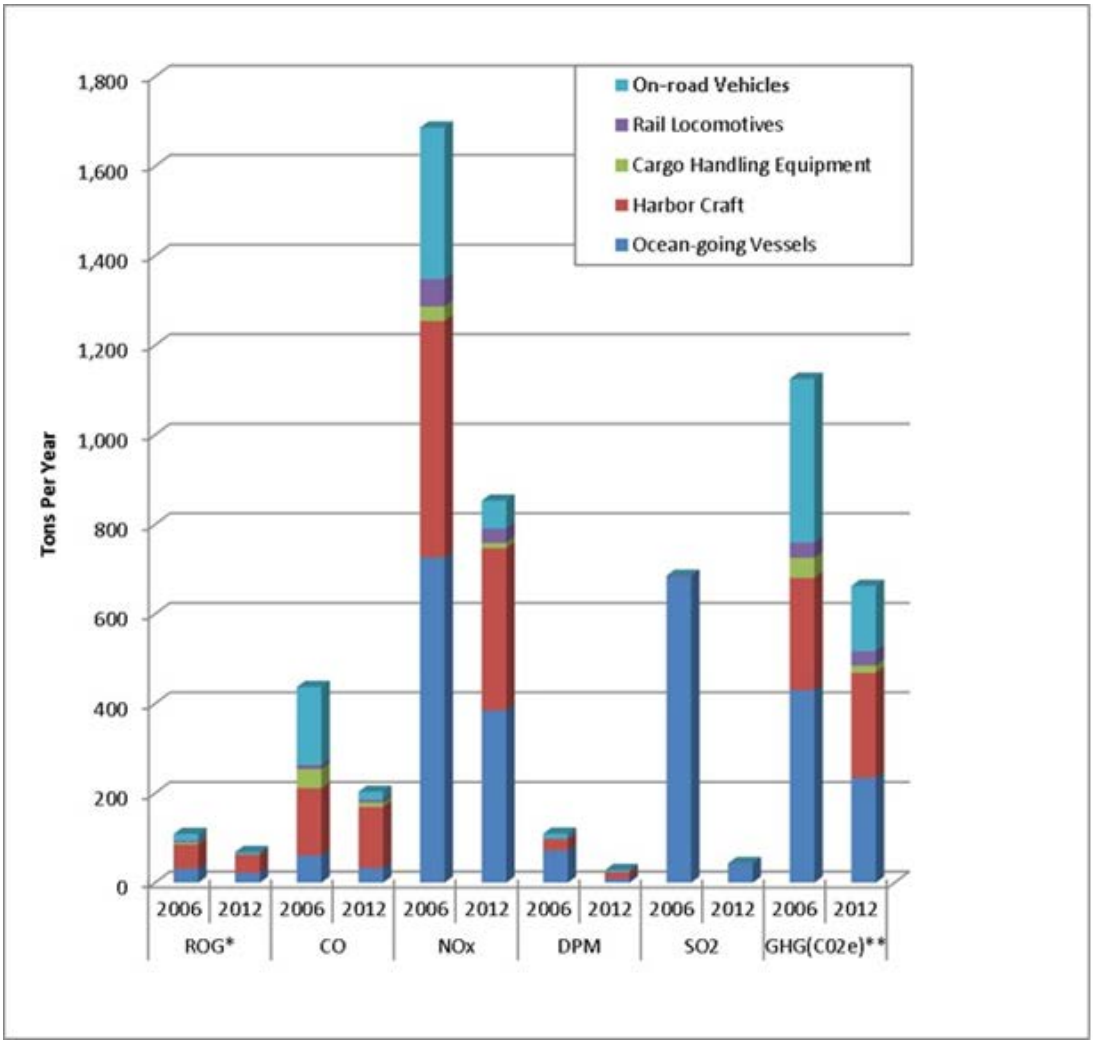
Category	ROG	CO	NO_x	PM_{10}	$PM_{2.5}$	DPM	SO_2	CO_2	CH_4	N_2O	CO_2e
Ocean-going Vessels	31.2	61	726	82.4	75.8	72.2	681.0	42,563	3.2	1.1	42,963
Harbor Craft	54.6	150	528	23.8	23.1	23.8	0.2	24,751	4.9	0.8	25,116
Cargo Handling Equipment	4.0	43	33	1.0	0.9	0.9	0.0	4,412	0.2	0.1	4,452
Rail Locomotives	3.4	9	61	2.1	2.0	2.1	4.1	3,368	0.3	0.1	3,400
On-road Vehicles	15.5	174	338	10.6	9.8	10.5	0.2	36,168	1.2	1.2	36,567
Total	**108.7**	**436**	**1,686**	**119.9**	**111.6**	**109.5**	**686**	**111,262**	**10**	**3**	**112,498**

Table ES-3. Percent change from 2006 to 2012 emissions by source category (tons).

Category	ROG	CO	NO_x	PM_{10}	$PM_{2.5}$	DPM	SO_2	CO_2	CH_4	N_2O	CO_2e
Ocean-going Vessels	-33%	-48%	-49%	-89%	-89%	-89%	-94%	-48%	-40%	-34%	-48%
Harbor Craft	-26%	-9%	-31%	-38%	-38%	-38%	-7%	-7%	-34%	-7%	-7%
Cargo Handling Equipment	-72%	-77%	-64%	-72%	-72%	-70%	-50%	-62%	60%	100%	-62%
Rail Locomotives	-45%	-28%	-48%	-46%	-47%	-46%	-99%	-6%	-73%	-15%	-6%
On-road Vehicles	-76%	-90%	-82%	-71%	-75%	-71%	-30%	-60%	-85%	-61%	-60%
Total	**-38%**	**-54%**	**-50%**	**-76%**	**-76%**	**-75%**	**-94%**	**-42%**	**-42%**	**-38%**	**-42%**

Figure ES-2 portrays a graphical comparison between 2012 and the 2006 emission inventories. The emission reductions shown are due to lower activity and emission reduction programs. The overall CO_2 emissions were reduced in 2012 by 42% primarily due to a 20% reduction in OGV calls, lower berthing times, and reduced freight; a reduction of roughly 50% in the operating time of cargo handling equipment; and a decrease of over 50% drayage truck activity at the marine terminals. Port control measures also contributed to CO_2 reductions through the voluntary Vessel Speed Reduction Program, which began in 2009, and the use of shore power installed at the Cruise Ship Terminal in 2010. Criteria pollutant reductions were mainly attributed regulations which required the use of lower sulfur fuel for OGVs and upgraded engine requirements for trucks, harbor craft, and cargo handling equipment.

Figure ES-2. Emissions comparison for 2006 and 2012 (tons).



*Hydrocarbons (HC) was reported in 2006 whereas Reactive Organic Gas (ROG) was calculated in 2012 which includes all hydrocarbon compounds minus methane.
**For comparative purposes, greenhouse gas emissions, represented as CO2e, was divided by 100.

Figure ES-3 shows the relative contribution of each source category in 2012. Generally, harbor craft produced the greatest emissions followed closely by OGVs. The harbor craft source category experienced less of a reduction of activity compared to the other source categories during 2012. The OGV source category remains the most significant source of SO_2 because, while OGVs have been using low sulfur fuel compared to 2006, other source categories use ultra-low sulfur fuel. However, SO_2 emissions were reduced by 94% for OGV during 2012.

Figure ES-3. Distribution of 2012 emissions by source category.

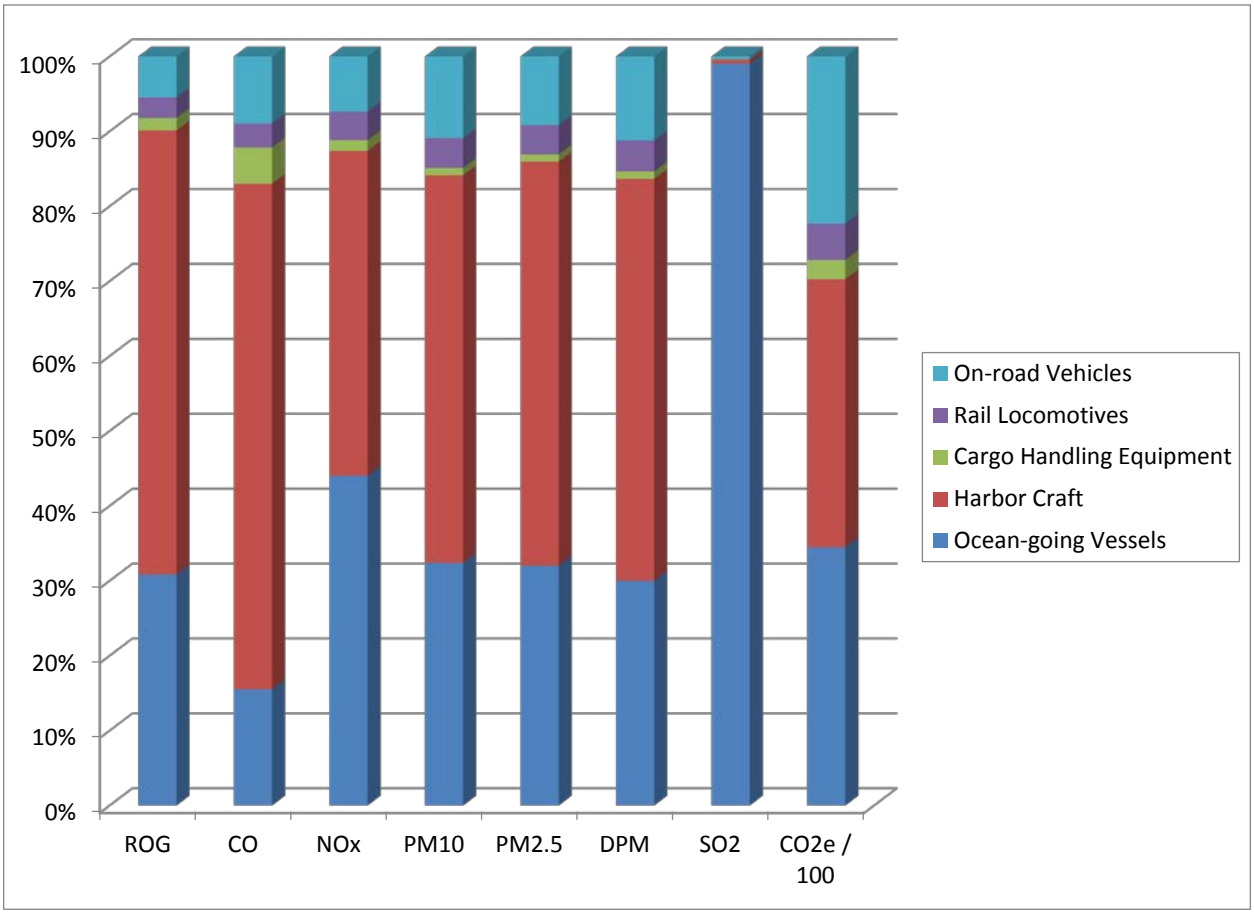


Table ES-4 lists other sources of emissions around San Diego Bay and from within San Diego County as a whole. Although not directly comparable, the table provides an understanding of emissions at different scales throughout the region. As shown in Table ES-4, the Port activity is a relatively small fraction of the San Diego County emissions inventory that includes all emissions sources including stationary, area, and on- and off-road sources. For most pollutants, ROG and the fractions of PM, the Port's contribution to the county-wide emissions total is roughly less than 1%. For NOx and SO_2, the Port contributed approximately 2% and 11%, respectively, on an annual basis. Similar to 2006, SO_2 emissions primarily from OGVs, still represents maritime's largest contribution to the county-wide totals even with the use of lower sulfur fuel by OGVs.

Table ES-4. Emissions in San Diego County (tons per year).

Emissions Inventory	Year	Source	ROG/VOC	NOx	PM_{10}	$PM_{2.5}$	SO_2
Port of San Diego Maritime Emissions	2012	2012 Emissions Maritime Air Emissions Inventory	67.7	836	28.6	26.6	41.7
National Steel and Shipbuilding Co.	2012	ARB Facility Database[a]	105.7	8.7	13.1	9.1	0
San Diego International Airport	2010	Baseline Air Emissions Inventory[b]	154.2	940.1	20.5	18.9	90.4
San Diego County	2012	ARB 2013 Alamanac[c]	45,990	38,690	26,280	7,300	365

a. The ARB Facility Emissions Data was accessed at http://www.arb.ca.gov/ei/disclaim.htm

b. Final Draft San Diego International Airport Air Quality Management Plan Criteria Pollutant and Greenhouse Gases Baseline Emissions Inventory. Results presented in Table 7-2 are a summary of mobile sources including: aircraft, ground support equipment, auxiliary power units, and motor vehicles.

c. The California Almanac of Emissions and Air Quality-2013 Edition. Prepared by the Air Quality Planning and Science Division California ARB.

Discussion of Inventory Results

The 2012 emission estimates decreased compared with those for 2006 due to lower activity, and implementation of international, national, and state regulations as well as Port programs. The following summaries per source category list the significant changes between 2012 and 2006:

Ocean-Going Vessels

- Vessel calls decreased nearly 23% from 530 to 411 (especially cruise and cargo ships) which, in turn, reduced overall OGV transit and berthing emissions proportionally.
- Average berthing time per call for all vessels was lower at about 26 hours compared with 41 hours in 2006 reducing berthing emissions by more than 25%.
- Lower sulfur fuels, used on vessels due to State regulations beginning in 2009 helped to reduce SO_2 emissions by roughly 94% and PM and DPM emissions by 89%.
- Available vessel tracking data in 2012 provided an opportunity to revise the baseline ship transit speeds and routes within the 24 nm water-side boundary. Refinements to the transit

speeds and routes within the study area resulted in significantly lower at sea OGV activity and emission estimates by more than 50% for transiting vessels

- The Port's Vessel Speed Reduction program reduced transit emissions by roughly 10%.
- The Port's Shore Power program reduced cruise ship emissions by approximately 11%.
- ARB ROG emission rates have increased resulting in less of a decrease in ROG emissions.
- A summary of the combined emission effects including the emission changes due to the lower number of calls and berthing time, the Port's emissions control programs such as shore power and VSR, and regulations resulted in a 48% reduction in CO_2e.

Harbor Craft

- ARB emissions factors for new and deteriorated harbor craft engines were updated since 2006. To provide a fair comparison between 2012 and 2006, emissions generated from harbor craft during 2006 were recalculated using the updated emissions factors. Overall, there was a decrease in emissions generated from harbor craft between 2012 and 2006.
- Unlike the other source categories in the 2012 inventory which demonstrated dramatically reduced activity, harbor craft activity represented as fuel use (measured through CO_2 emissions) was relatively similar to the 2006 inventory. As a result, harbor craft emissions reductions were less than those produced by other source categories.
- A slight decrease in horsepower per hour for harbor craft engines contributed to a 7% decrease in GHG emissions.
- New engine upgrades required by ARB regulations and normal turnover (replacements) within the fleet contributed to emissions reductions.
- Harbor craft emissions reductions include a decrease of 26% for ROG, 9% for CO, 31% for NO_x and 38% for PM. CO_2 and SO_2 were down 7% in 2012.

Cargo Handling Equipment

- The number of pieces of equipment and their operating hours were lower due to fewer ship calls and freight moved resulting in a 62% decrease in CO_2 emissions.
- Most equipment has been upgraded due to the ARB regulations mandating the use of lower emitting equipment, particularly lowering DPM emissions by 70%.
- Other emissions reductions include a decrease of 72% for ROG, 77% for CO, and 64% for NOx.

Locomotive

- There were more trains serving the Port for transport of imported vehicles reducing the need for drayage truck movements at NCMT.
- More accurate estimates of rail car weights reduced the estimated gross ton-mile, and therefore the fuel consumption emissions estimates.
- Locomotive emissions were lower due to a 1998 voluntary agreement between ARB and BNSF Railway to use a locomotive fleet that had an average NOx emissions rate equivalent

to or better than the EPA Tier 2 emission standard for years 2010 and later in the South Coast.[1]

- Emissions reductions include 45% for ROG, 46% for DPM, 48% for NOx, 99% for SO_2, and 6% for CO2.

On-road Vehicle

- The number of truck entries at the Port was approximately 53% lower than 2006 resulting in emission reductions, particularly a 60% reduction of CO_2.
- The ARB drayage truck rule and the Port's Clean Truck Program (implemented in 2009) required more use of diesel particulate filters or vehicle upgrades that contributed to reduced PM truck emissions of 71%.
- Further emissions reductions in 2012 included 76% for ROG, 90% for CO, 82% for NO_x, and 30% for SO_2.

The results of the 2012 air emissions inventory will be used to inform other Port-wide programs and goals. In 2013, the Board of Port Commissioners adopted a Climate Action Plan to reduce greenhouse gases from activities which take place within the Port's jurisdiction[2]. The Climate Action Plan contains two goals to reduce greenhouse gas emissions in 2020 and 2035 by 10% and 25%, respectively, of a 2006 baseline. Maritime activity is included in the CAP's Transportation and Land Use category, which has a goal to reduce greenhouse gas emissions by 62,000 metric tons. The greenhouse gas emissions observed in the 2012 inventory accounts for 68% of the Transportation and Land Use category goal. A significant portion of the decrease in emissions observed in 2012 is due to less maritime activity as a result of the economic downturn beginning in 2008. In future inventories, emissions could go up if the number of calls increases faster than implementation of control measures and regulations designed to reduce emissions. Thus, caution must be applied when evaluating the reductions in this report with other Port goals.

Given that state and federal regulations as well as the Port's emission reduction efforts, including the strategies in the Climate Action Plan, have yet to be fully implemented, emissions should continue to decrease in subsequent years. Further initiatives, such as the Sustainable Freight Strategy promoted by ARB[3], are intended to reduce emissions while improving transportation mobility. The 2012 inventory indicates the emissions produced per vessel call are less than what was observed in 2006, which suggests growth in maritime trade can occur more efficiently and with less of an environmental impact. Future efforts by the Port and fleet operations can ensure emissions reductions are maintained or improved while continuing to expand economically.

[1] Memorandum of Mutual Understandings and Agreements South Coast Locomotive Fleet Average Emissions Program. 1998. Accessed: www.arb.ca.gov/railyard/1998agree/1998agree.htm
[2] Port of San Diego Climate Action Plan. 2013. Accessed: www.portofsandiego.org/environment/3414-port-of-san-diego-adopts-climate-action-plan.html
[3] Sustainable Freight Transport Initiative. 2014. California Air Resources Board. Accessed: http://www.arb.ca.gov/gmp/sfti/sfti.htm

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1.0 INTRODUCTION

1.1 Purpose and Background

The Port of San Diego (Port) has prepared this maritime air emissions inventory for the purpose of identifying and quantifying the air emissions from maritime-related activities during calendar year 2012 (the "2012 inventory"). The Port conducted its first maritime air emissions inventory in 2007 based on activity in the 2006 calendar year (the "2006 inventory," POSD, 2007). The 2006 inventory serves as the Port's baseline air emissions inventory and was a foundation for the development of the Port's Clean Air Program (ENVIRON, 2007) and Climate Action Plan (POSD, 2013). Because maritime emissions vary over time due to changes in cargo type, cargo volume, regulations, and other factors that affect the amount of emissions, the results of the 2012 inventory will be used to compare changes to baseline conditions.

Following guidelines established by the California Air Resources Board (ARB) and the US Environmental Protection Agency (EPA), emissions were estimated from maritime-related sources which include:

- Ocean-Going Marine Vessels (OGVs)
- Commercial Harbor Craft (Tugs, Ferries, Excursion, Fishing, and Others)
- Cargo Handling and Other Off-Road Equipment (CHE)
- Locomotives
- On-Road Vehicles (Freight/Drayage Trucks, Imported Vehicles, and Cruise Passenger Buses, Shuttles, and Taxis)

This emissions inventory highlights the Port's continued commitment to understanding the sources and magnitude of emissions from its maritime-related operations. The geographic scope of the inventory presented here is the essentially same as the 2006 emissions inventory. Emissions inventories should be used with care and recognize that other information and tools should be used to supplement inventories in order to evaluate and assess air quality and changes in emissions over time.

1.2 Important Features of the Port of San Diego Maritime Air Emissions Inventory

1.2.1 Scope

The Port is a special government entity, created in 1962 by an act of the California legislature. The legislature passed the San Diego Unified Port District Act in order to create an entity to manage the San Diego Harbor and to administer approximately 5,500 acres of public lands along San Diego Bay. The Port's jurisdiction includes both submerged lands and tidelands extending upland to the mean high tide mark encompassing portions of the cities of San Diego, National City, Chula Vista, Imperial Beach, and Coronado. The Port is located approximately 10 miles north of the U.S.-Mexico border and 125 miles south of Los Angeles.

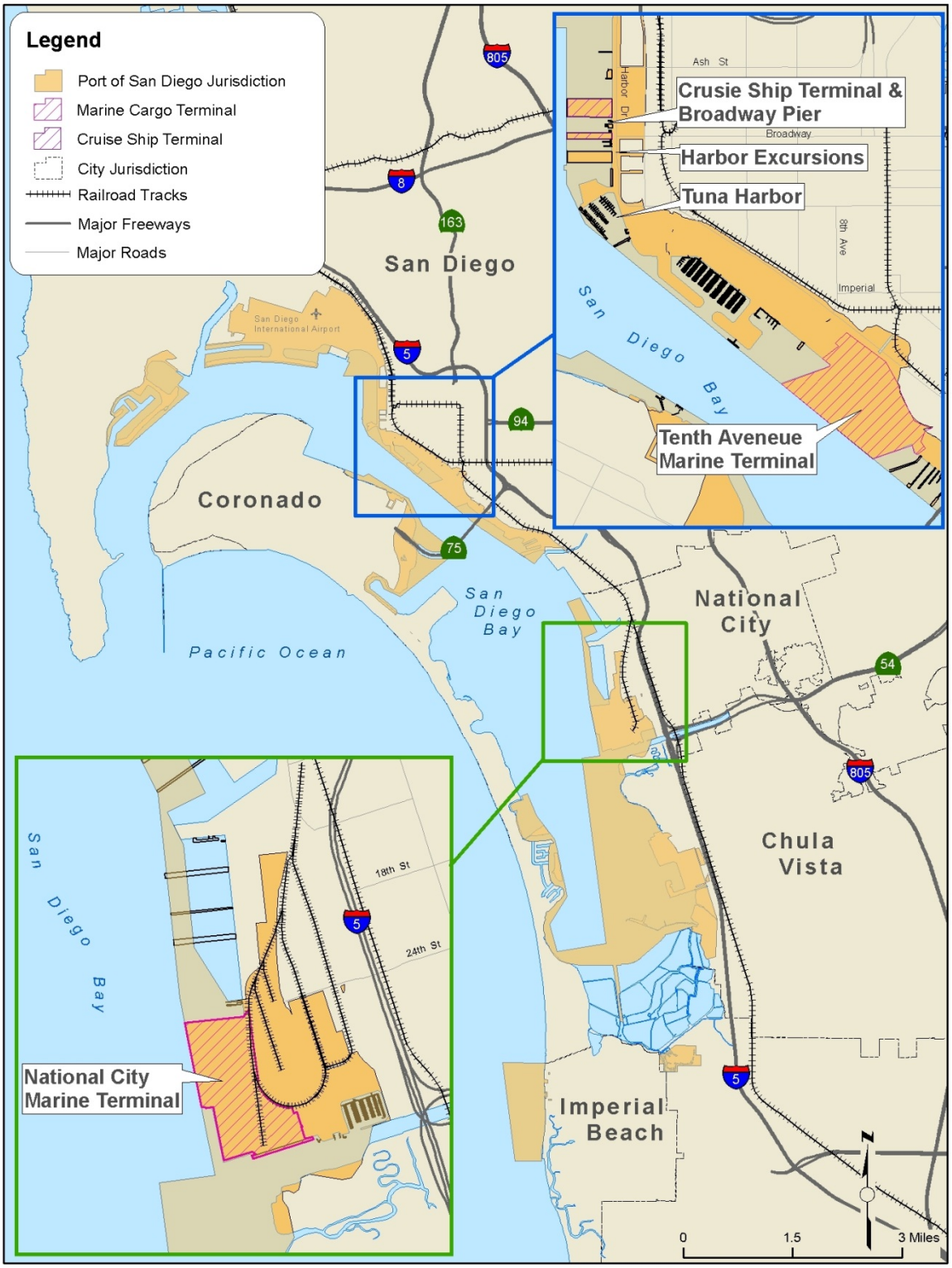
Within the Port's jurisdiction are a number of land uses and operations consisting of commercial facilities including hotels, marinas, restaurants, and retail shops; industrial operations compromising marine vessel, turbine, and raw material manufacturing; and parks and open spaces for active recreation and environmental stewardship. The Port's maritime-related operations, focusing primarily on imports/exports of cargo, passenger cruise and excursion services, and commercial fishing, are located along the eastern shore of San Diego Bay. The three marine terminals from which a majority of the Port's maritime operations occur include the following and are shown in Figure 1-1:

- Broadway Pier and B Street Cruise Ship Terminal (CST)
- Tenth Avenue Marine Terminal (TAMT)
- National City Marine Terminal (NCMT)

Each of the marine terminals service specific water-dependent industries. CST functions exclusively as a passenger cruise terminal where cruise ships arrive from or depart to locations in southern California and Mexico, Central and South America, and the South Pacific. Operations at TAMT consist of containerized and break bulk fruit, dry bulk cargo, and petroleum products. NCMT primarily handles automobiles and lumber. Although the Port administers and owns the three marine terminals, tenants lease specific areas and operations on the terminals to conduct business. Tenants for which emissions were estimated include freight, passenger, and various harbor craft operations. Non-tenant maritime operations associated with the terminals primarily include drayage trucks and other on-road vehicles, some tugs and other assist vessels, and rail locomotive operations.

Also assessed in this inventory are maritime-related operations which are not based solely on the marine terminals, but whose operations consist of vessel movements in and out of San Diego Bay. These operations are located in the vicinity of the marine terminals between the CST and TAMT. Located just south of the CST, excursion and charter vessels offer cruises and sight-seeing opportunities and a commercial fishing fleet operates out of San Diego Bay from the Tuna Harbor Marina. Only commercial fishing operations based out of the Port owned and maintained Tuna Harbor marina were included in this inventory.

Figure 1-1. Port of San Diego maritime facilities



This inventory estimates emissions from maritime operations that occurred during calendar year 2012, using a similar but more specifically defined geographic scope than the 2006 inventory. Figure 1-2 displays the geographic scope of the 2012 inventory. The landside boundaries used to assess on-road vehicle and locomotive sources, which transport cargo to and from the Port, remained similar between the 2012 and 2006 inventories and include the Orange/Riverside County border in the north, the Imperial County border to the east, and the US/Mexico international border to the south. Consistent with similar inventories, the trips for on-road vehicles and locomotives were estimated to include entire trip length within San Diego County, whether the trips stopped within San Diego County or the first stop was outside of the County. The waterside boundary used to assess ocean-going vessels and commercial harbor craft emissions differed slightly between the 2012 and 2006 inventories. The 2006 inventory used a waterside boundary determined by three points 24 nautical miles (nm) from the US/Mexico international border, Point Loma, and the San Diego/Orange County border. The western extent of these points was connected with a straight line in the Pacific Ocean. The 2012 inventory used the waterside regulatory boundary defined by ARB as the National Oceanic and Atmospheric Administration (NOAA) contiguous zone, which extends 24 nm from the California landside baseline. The updated waterside boundary for the 2012 inventory serves as an official boundary consistent with international law. The results were not significantly impacted given the small changes in the waterside boundary.

Figure 1-2. Spatial scope of the emissions inventory.

This inventory focused on maritime operations related to goods and passenger movement and did not include emissions from the following sources:

- Stationary sources
- Recreational vessels
- Military vessels and operations
- Facilities in our around San Diego Bay that are not located within the Port's jurisdiction

1.2.2 Sources

The inventory focused on the largest sources of air emissions from maritime operations, which, except for ship boilers and various gasoline and compressed gas-fueled off-road equipment, are all powered by diesel engines. OGVs consisted of auto carriers, container ships, bulk and general cargo, cruise ships, and other large vessels. The commercial harbor craft included tugs assisting OGVs, tugs towing barges and performing other work, excursion vessels, commercial fishing, and other small commercial boats. Off-road equipment included cargo handling and general purpose equipment at marine terminals. Locomotives, trucks servicing the marine terminals, new imported, vehicles (located at NCMT), and cruise support vehicles were included. The trucks were engaged in transport of maritime cargo containers and imported vehicles. Other vehicles like buses, shuttles and taxis were used to transport cruise ship passengers. The inventory did not address sources, such as gasoline-powered, light-duty vehicles used by employees for commuting to work or for non-freight activity at the Port.

1.2.3 Criteria Air Pollutants

The inventory provided estimates for emissions of five "criteria" air pollutants. Criteria pollutants refer to those air pollutants for which an ambient air quality standard has been set, or which are chemical precursors to pollutants for which an ambient air quality standard has been set. Descriptions regarding the criteria pollutants assessed in the air emissions inventory are included in Table 1-1.

1.2.4 Particulate Matter

The particulate matter estimated in this report is primarily diesel particulate matter (DPM), which is defined as a toxic air contaminant by the ARB. All vessels operate auxiliary boilers for hot water on board and produce particulate emissions but not DPM. In addition, some particulate emissions were from non-diesel gasoline or LPG fueled cargo handling equipment, as noted in Section 4. The particulate emissions were estimated from emission factors where exhaust PM is assumed to be entirely PM_{10} (the fraction of PM less than 10 microns); $PM_{2.5}$ (PM less than 2.5 microns) was calculated as a fraction of PM_{10} which varied by source category. DPM is defined as total PM_{10} from diesel engine exhaust regardless of composition.

Table 1-1. Description of criteria pollutants assessed in the air emissions inventory.

Criteria Pollutant	Description
Reactive Organic Gases (ROG)	Generally colorless hydrocarbon gases that are emitted during combustion or through evaporation. They react with other chemicals in the ambient air to form ozone or particulate matter, both of which can have adverse health effects at higher concentrations. Reactive organic gases include all hydrocarbon species except methane and include aldehydes, ketones, carboxylic acid, and alcohol compounds.
Carbon Monoxide (CO)	Colorless gas that is a product of incomplete combustion. Carbon monoxide has an adverse health effect at higher concentrations.
Nitrogen Oxides (NO_x)	Nitrogen oxides include nitric oxide and nitrogen dioxide. Nitrogen dioxide is a light brown gas formed during combustion from reactions with nitrogen in the fuel or the combustion air. Nitrogen dioxide has adverse health effects at higher concentrations. Both nitrogen dioxide and nitric oxide participate in the formation of ozone and particulate matter in the ambient air.
Particulate Matter (PM)	Solid or liquid particles that form from a variety of chemical reactions during the combustion process. Solid particulate may also be emitted from activities that involve abrasion or friction, such as brake and tire wear. Particulate matter has adverse health effects at higher concentrations. Particulates are divided into those less than 10 microns, PM_{10}, and those less than 2.5 microns, $PM_{2.5}$, aerodynamic diameter. Diesel particulate matter (DPM) is defined as particulates from diesel engine exhaust.
Sulfur Oxides (SO_x)	Sulfur bearing gases, primarily sulfur dioxide or SO_2, that form during combustion of a fuel that contains sulfur. Sulfur dioxide has adverse health effects at higher concentrations and participates in the formation of sulfate particulate matter in the ambient air.

1.2.5 Greenhouse Gases

The greenhouse gas emission inventory includes estimates of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) emissions from each source category. Fuel combustion is the source of CO_2, while CH_4 results from incomplete combustion and N_2O is generated during the high temperature combustion. To account for the greater greenhouse gas potential of CH_4 and N_2O, a combined carbon dioxide equivalent (CO_2e) estimate was prepared by adding 21 times the CH_4 and 310 times N_2O emissions to the CO_2 emissions (IPCC, 1995).

1.3 Regulations and Port's Clean Air Program Affecting Port Source Categories

1.3.1 Overview

The air emissions source categories at the Port are affected by international, federal, state, and Port emission control programs. International and federal regulations address the emission standards for new engines, while state programs address the fuel, retrofits, and fleet composition. Port programs target operations at the berth, on terminals, and in transit. The

summary of the regulations affecting the Port air emission source categories provided here is meant to provide a general understanding and the primary effect of the emission reduction standards and programs since 2006. The details of each regulation or agreement can be found in the referenced documents.

1.3.2 Ocean Going Vessel Regulations

Regulations to reduce emissions from ocean-going vessels fall into two categories: new (or rebuilt) engine performance standards and 2) fuel standards.

Engine Performance Standards

The United States (US) has signed onto the international emission standards for marine engines, called MARPOL Annex VI regulations. The MARPOL (2008a) regulations provide for NOx emission standards for marine engines worldwide and Emission Control Area (ECA) fuel sulfur limits. Emissions standards for marine engines were introduced as a phased, progressive approach consisting of different tiers with increasing levels of emissions reduction. The first set of NO_x emission standards for new marine engines include Tier 1 for 2000 model year OGV. Model year 1990 – 1999 engines must meet Tier 1 standards when rebuilt after 2011 but did not appreciably affect NOx emission rates. Tier 2 NOx emission standards beginning with the 2011 model year provide measureable NOx reductions, and Tier 3 standards beginning in 2016 will provide dramatically lower NOx emissions.

Fuel Standards

The United States and Canada jointly petitioned for and an ECA was declared for US and Canadian waters that will limit marine fuel sulfur content to 0.1% or lower beginning in 2015 out to 200 nm from shore on the entire west coast.

In addition, the state of California (ARB, 2011a) limited marine diesel and auxiliary boiler fuel sulfur content to 0.5% beginning June 28, 2009 and 0.1% by January 1, 2014 within 24 nautical miles from the California coast.

The impact these rules had on the Port's emissions inventory was dramatic in terms of PM and SO_2 emission rates for 2012 because the fuel sulfur was reduced from nominally 27,000 ppm to 3,000 ppm on average. By 2014, the fuel sulfur used in OGVs will be reduced to 0.1% or below generating further reductions in the future. In addition, the Port began to see OGVs in 2012 with Tier 2 engines lowering NOx emission rates, and further reductions are expected in the future as ships are replaced.

1.3.3 Ocean-Going Vessel At Berth Regulation

California approved a regulation that limits the time during which auxiliary diesel engines are operated on frequently calling ocean-going vessel fleets while such ships are docked at-berth in a California port. The 'at berth' regulation is also called the shoreside power rule because the primary technology used to comply with the regulation is for the ship to use shore power

instead of on-board auxiliary diesel engines. The regulation was approved in 2009 and the frist compliance date whereby vessel fleets began utilizing shorepower was January 1, 2014.

The applicable fleets are ships calling a California port including any U.S. or foreign-flagged container vessel, passenger vessel, or refrigerated cargo vessel. The following exceptions are noted in the at-berth regulation:

1. A fleet composed solely of container or refrigerated cargo vessels that visits the same California port fewer than 25 times total in a calendar year; and
2. A fleet composed solely of passenger vessels that visits the same California port fewer than 5 times total in a calendar year.

The requirements of the rule are that in 2014 at least 50 percent of a fleet's visits to the port shall meet the onboard auxiliary diesel engine operational time limit of three hours for most ships, and the fleet's onboard auxiliary-diesel-engine power generation while docked at the berth shall be reduced by at least 50 percent from the fleet's baseline power generation. In 2017, the requirements increase to 70 percent of the fleet's visits, and 80 percent in 2020.

1.3.4 Commercial Harbor Craft

New harbor craft marine diesel engines are regulated by EPA who has set emission standards that meet or exceed the international regulations. EPA has staged the emission standards for commercial marine diesel engines by Tier level. Implementation years for new engines depend upon the power level of the engine, cylinder displacement, and power density in terms of power per displacement. The international standards described for OGV engines were considered 'Tier 1' emission controls, and EPA (2008a) has approved Tier 2, 3, and 4 emission standards that are more stringent than the international standards. Any engines with greater than 30 liters per cylinder must meet the international regulations described for OGV engines.

EPA Tier 2, 3, and 4 emissions standards limit new harbor craft engine NOx and PM emissions. The EPA regulations include some exceptions and special cases, however most vessel engines must comply with the one set of emission limits. The Tier 2 emissions began in 2004 and will be followed by Tier 3 and 4 emissions standards starting in 2013 that will further reduce NOx and PM emissions.

During 2007, the State of California (ARB, 2011b) adopted and then later amended regulatory limits on DPM, NOx, and SOx emissions from diesel propulsion and auxiliary engines on commercial harbor craft such as towboats and tugboats operated within 24 nm of the California coast. This regulation requires that new and in-use diesel-fueled harbor craft comply with the low sulfur fuel use requirement when operating within regulated California waters. It also sets emission standards for new engines equivalent to the federal emission standards, as well as requirements and a schedule for the replacement or otherwise bringing into compliance pre-Tier 1 and Tier 1 engines for in-use fleets (ferries, excursion vessels, tugboats, towboats, push boats and multipurpose harbor craft) to be equivalent or better than the Tier 2 emission standard for new engines. The in-use fleet standards began taking effect in 2009, limiting the

use of 1975 and earlier model year engines and will continue to encourage greater use of Tier 2 or better engines through 2023 when all engines operating more than 300 hours per year will meet Tier 2 or better emissions levels.

The emission standards and the California fleet replacement requirements have led to updates to new engines and retirements of older engines and vessels. The emission rates for PM and NOx from the new engines are considerably lower due to these regulations. With the California fleet upgrade compliance continuing through 2022, the emissions from harbor craft will continue to decline in the future.

1.3.5 Off-Road and Cargo Handling Equipment Regulations

Diesel off-road engines are the primary type used in the Port's cargo handling and other off-road equipment. Emission regulations for new diesel (compression-ignition) engines in off-road equipment have been approved with emission regulations implemented for new engines (EPA, 1998). These regulations supplemented the original (renamed Tier 1) regulations for compression-ignition engines under 50 horsepower (EPA, 1994). The regulations have different implementation years and emission levels depending upon the rated power of the engine with increasingly more stringent NOx and PM emissions standards through 2015 when fully implemented.

In addition, the State of California (ARB, 2012a) has approved regulations mandating retrofit or new engine purchases for cargo handling equipment. The regulations seek to replace or retrofit such that engines meet the Tier 4 off-road engine emission standards.

Yard trucks (also called hostlers) with fleets of four or more must upgrade to low Tier 4 NOx and PM emission levels until fully implemented by 2015. Yard trucks may be upgraded using the highest level 3 verified diesel emission control strategy (VDECS) available, which is usually a diesel particulate filter (DPF), or a new engine model that meets or exceeds the Tier 4 off-road emission standard. Compliance may also be demonstrated using on-road trucks that meet or exceed the Tier 4 off-road emission standard.

For other CHE, the requirement is also to fully meet Tier 4 emission standards by 2013.

The impact of these regulations has been to dramatically lower emissions, especially PM, from off-road equipment used at the Port with further reductions expected in the future.

1.3.6 Locomotive Regulations and Voluntary Commitment

EPA (1997) finalized the first set of locomotive standards that provided three tiers of emission standards, which included provisions for a retrofit of older locomotives to provide greater emission reductions earlier than waiting for fleets to replace older engines. The standards for new locomotives were phased in with three steps to allow retooling of the manufacturing process. The first set of standards, Tier 0, applied to locomotives originally manufactured from 1973 to 2001; this standard includes a retrofit requirement for older engines during remanufacturing. The second standard, Tier 1, applied to model years 2002 to 2004; and a

third standard, Tier 2, applied to model years 2005 and beyond. EPA (2008b) approved additional emission standards for later models of locomotives and instituted emission standards when Tier 0, 1, and 2 engines are rebuilt, and lower new engine NOx and PM emissions levels meeting Tier 3 standards for 2012 and Tier 4 standards for 2015.

The California ARB entered into two agreements with the major railroads, Union Pacific and BNSF railway, to further reduce emissions throughout the state and specifically within the South Coast air basin. The first agreement (ARB, 1998) stipulated that "locomotive fleets operating in the South Coast Nonattainment Area in 2010 and later will emit on average no more than the 5.5 grams per brake horsepower-hour ("g/bhp-hr") Tier 2 (2005 and later) new locomotive oxides of nitrogen ("NOx") emission standard." The agreement to reduce locomotive emissions in the South Coast also provides emission reductions at the Port because trains arrive from and depart to the South Coast. The second agreement (ARB, 2005a) was designed to primarily reduce particulate emissions at rail yards. To that end, the second agreement encouraged idle reduction through installation of idle reductions devices and operational changes with idling time limits for all locomotives operating in California. This agreement also implemented early introduction of low sulfur fuels, maintenance requirements, and additional studies of new technologies and other methods to reduce particulate emissions at rail yards.

The primary effect of the early locomotive emission standards and the agreements has been to reduce NOx emission rates since the 2006 inventory. The later emission standards including ongoing locomotive rebuilds will produce greater particulate emission rate reductions moving into the future.

1.3.7 On-Road Truck Regulations

EPA (2001) approved emission standards for new on-road heavy-duty vehicle emission standards that were phased in starting with the model year 2007 and fully implemented for the 2010 and later model year vehicles. The 2007 emission standard reduced the PM emissions standard by 90% from previous model years. The final 2010 emission standard reduced NOx emissions more than 90% when fully implemented, and applicable to 50% of the fleet starting with the 2007 model year. The primary methods used to achieve these emission levels were the use of DPF for PM control and selective catalytic reduction (SCR) for NOx control. The final 2010 emission standards result in almost a 99% reduction in NOx and PM emissions from uncontrolled levels.

In addition, California ARB (2011c) approved a regulation, commonly referred to as the Drayage Truck Rule, to upgrade drayage truck fleets. Starting in 2012, trucks with engine model year 1996 or newer were required to install the best available DPF. As of January 1, 2014, all engines were required to be 2007 or newer to operate at ports and railyards. All drayage trucks will need to use engines meeting the 2010 emission standards by 2023.

The drayage truck compliance with the ARB rulemaking mandating fleet turnover and PM filter installation was nearly complete in 2012, substantially reducing particulate matter emissions rates since the 2006 inventory. The additional mandate for 2010 engines will reduce NOx emission rates from these vehicles through 2023.

1.3.8 Port's Clean Air Program

During 2007, the Port developed the Clean Air Program to address air emissions associated with maritime activities originating from the Port's three marine terminals (ENVIRON, 2007). The Clean Air Program was voluntarily developed by the Port beyond regulatory requirements during 2007, however it was designed to build upon existing or proposed goods movement regulations by ARB and the EPA. Utilizing the results of the 2006 maritime air emissions inventory, the Clean Air Program identified and prioritized maritime-related emissions sources as well as measures to control them. The primary control measures presented in the Clean Air Program are aimed at addressing emissions from OGVs and trucks. The control measures implemented through the Clean Air Program are discussed below.

1.3.8.1 Shore Power

The installation of shore power was selected as a control measure in the Clean Air Program to reduce air emissions from OGVs at berth. As the primary source of air emissions from maritime sources in 2006, OGVs accounted for roughly 60% of NOx emissions and 83% of DPM emissions Port-wide. While at berth, OGV auxiliary engines produced an estimated 25% of NOx emissions and 36% of DPM Port emissions in 2006. Shore power was determined to be an effective control measure allowing vessels to shut down their auxiliary engines and draw cleaner electrical power from a shore-side source, thereby drastically reducing their emissions at berth. Concurrent to the Clean Air Program, ARB approved the At-Berth Regulation in 2007 requiring vessel operators to reduce emissions while at berth through the use of shore power or an alternative control device beginning January 1, 2014. As a result, the Port has invested in shore power at CST and TAMT. Utilizing a grant of $2.4 million from the Carl Moyer Program, the Port finalized installation of shore power at CST in 2010—roughly three years ahead of ARB's regulatory schedule. Installation at TAMT was completed in February 2014.

1.3.8.2 Vessel Speed Reduction

The 2006 inventory indicated that the most significant source of emissions was from OGVs in transit to and from the Port. Transiting accounted for roughly 29% of NOx emissions and 40% of DPM emissions. The primary reason for higher emissions during transiting is because the vessels are under propulsion of the main engine. As a result, the Clean Air Program identified an operational control measure to reduce vessel speeds, which lessens fuel consumption resulting in reduced emission rates. The vessel speed reduction (VSR) program is a voluntary program where cruise ships reduce speeds to 15 knots or less and other OGVs reduce speeds to 12 knots or less within 20 nm of Point Loma. The program was implemented by the Port in 2009 and is monitored quarterly for assessment. Since its inception, 59% of inbound and outbound trips to the Port have been compliant with the VSR speed limit, which has reduced

emissions compared to business as usual operations. ARB has been evaluating a regulation requiring vessel speed reduction; however, a formal regulation has not been approved.

1.3.8.3 Engine Replacements and the Clean Truck Program

The 2006 inventory indicated that, next to OGVs, trucks were the second highest generating source of air emissions from the Port. Trucks accounted for nearly 18% of NOx emissions and 8% of DPM emissions. Truck activity encompassed trips to and from the marine terminals as well as activity on the terminal, including idling time. Most of these emissions occurred off of Port tidelands in transit from County boundaries. During 2007, ARB approved the Drayage Truck Regulation which requires that all drayage truck operators who conduct business at ports equip trucks with engines or filters that meet or exceed specific emissions standards. Consequently, the Clean Air Program identified engine replacements and retrofits as a control measure to help drayage truck operators, who regularly visit the Port, replace older truck engines with newer, less pollutant-generating models to comply with the state regulation.

The Port approved $1.1M to be used as a match to grants administered by the San Diego Air Pollution Control District to fund these retrofits and replacements. To date, 36 trucks have been replaced using the Port's matching funds. In addition, during 2010, the Port adopted the Clean Truck Program which bans trucks which do not meet the requirements of the Drayage Truck Regulation from entering the Port's marine terminals. The program is beyond compliance with ARB's program, which only requires ports to report non-compliant trucks. As a result of the program, 100% of trucks which visit the Port are in compliance with ARB emissions standards leading to reduced emissions. ARB also implemented regulations that limit idling time. Operationally, truck drivers limit their idling time when on the terminals. This best practice is supported by the ARB regulation.

1.4 Changes to Emissions Calculations

Because an air emissions inventory is a modeling exercise used to estimate air emissions, changes to the methodologies used to assess emissions may alter the results. Based on the best available information and guidance from ARB and/or the EPA, the methods used to estimate emissions were updated, as applicable, from those used during the 2006 inventory. Most notably, ARB updated auxiliary boiler loads and emission factors for OGVs since 2006. In addition, emissions factors developed for ARB's Commercial Harbor Craft Emission Inventory Database and the Crew and Supply Vessel Emission Inventory Database were also updated. Furthermore, since the 2006 inventory was conducted, more refined activity profiles for OGVs has become available. The data for 2012 showed that most large OGVs transited at slower speeds and used shorter routes within the study area than was assumed during 2006. As a result of data which more accurately describes ocean-going vessel activity and updates made to the estimation of emissions from OGVs and harbor craft, the 2006 OGV calls and harbor craft emissions were recalculated to provide a better comparison with the results from the 2012 inventory. The 2006 results presented in this inventory and used to compare to the results from 2012 reflect these revisions.

1.5 Considerations and Limitations When Interpreting Results from Emissions Inventories

Emissions inventories may be used for many purposes: to analyze air quality, to develop pollutant control strategies or plans, and to track and communicate progress toward air quality goals. When GHG emissions are included, emissions inventories can also be used to support climate action planning. Emissions inventories are essential tools, but they have some inherent limitations that are often overlooked and can lead to misconceptions about their use and results. The term "inventory" is something of a misnomer because it implies greater precision in "counting" emissions than is really the case. An emissions inventory is better understood as an estimate of the quantity of pollutants that a group of sources produce in a given area over a prescribed period of time. Activity information (e.g., vessel calls, truck trips, etc.), average engine specifications, and known emissions qualities of fuels are combined into a modeled estimate. The methods of making estimates are usually very technical in nature, a characteristic that makes the limitations of emissions inventories less transparent.

The accuracy of emissions estimates varies due to a number of factors. Even a well-conducted, detailed and carefully constructed inventory does not have access to direct emissions measurements from the specific, individual sources being studied. As a result, it is necessary to rely on surrogate information to characterize sources, describe source activities, and specify pollutant emission rates. ARB models, guidance, and estimates were used, and in all cases where there was any uncertainty in local activity estimate, the ARB estimates were used.

In addition, emission inventories are highly dependent on the level of activity in the year that the inventory efforts are conducted, so caution must be used when evaluating trends between emission inventories. For example, increase in the activity level can mask reductions due to lower emitting equipment if the activity level increases at a faster rate than the amount of the emission reduction per equipment. Conversely, reductions seen between two emission inventory efforts might appear to indicate significant emission reductions, yet this reduction may be mostly attributable to lower levels of activity (e.g., reduction in cruise ship related calls in 2012 as compared to 2006). Thus, understanding changes in activity levels for activities covered by an emission inventory is critical to interpreting the results between two inventory efforts.

Lastly, as described in Section 1.4, emissions estimation methodologies are continuously changing and evolving over time as better and more accurate information becomes available. As methodologies change, the results of calculating emissions will likely change as well. New methodologies need to be described and taken into consideration when evaluating trends over time.

As a result of the above considerations, limitations exist and should be noted when comparing emissions inventories conducted even a few years apart. Details on important considerations for this emissions inventory and interpreting its results as compared to the 2006 emissions inventory are presented in Section 7 of this report.

1.6 Report Organization

This emissions inventory report is organized into a glossary, an Executive Summary, and eight sections, including reference appendices.

- A glossary defines the technical terms used in the report.
- The Executive Summary briefly describes the methodologies used to estimate air emissions for all Port activities, and includes a summary of the results (Tables ES-1 and ES-2).
- Section 1 contains this introduction to the report.
- Section 2 describes deep-draft ocean-going marine vessels.
- Section 3 describes harbor craft.
- Section 4 describes cargo handling and other off-road equipment.
- Section 5 describes the on-road drayage truck, passenger transport, and new vehicle activity.
- Section 6 describes locomotive activity and emissions.
- Section 7 contains the summary and results of the report and a comparison with the 2006 maritime emission inventory.
- Section 8 provides the references used in developing the emissions inventory.

2.0 OCEAN-GOING VESSELS

2.1 Introduction

Ocean going vessels (OGVs) were defined for this inventory as deep draft vessels that cross open oceans. The vessels calling at the Port in 2012 were auto carriers, cruise, container ships, and general and bulk cargo vessels. The most recent ARB (2011d) emission estimation methodology was used to calculate OGV emissions. This methodology relied on combining vessel call data with vessel movement and characteristics information to determine time in mode and load factors (defined as the fraction of available power at which an engine operates), along with propulsion and auxiliary engine characteristics (type of engine, model year, and rated power) to determine emission rates for each vessel call to the Port. The operating modes used in this analysis were defined as follows:

- Transiting in the outer unrestricted speed zone;
- Transiting in the vessel speed reduction zone;
- Movements near the Whistle Buoy where the harbor pilots board;
- Movement and maneuvering in harbor; and
- Vessels at berth.

The methods used to calculate OGV emissions were not significantly different than the approach used for the 2006 Inventory (POSD, 2007), however more refined input data was available for this study that better represented the vessel activity near the Port. Rather than estimating an average speed by mode, Automatic Information System (AIS) data was used to estimate the distribution of vessel movement time in one knot speed bins for each of several operating modes from samples of historic movements within the study area. Shore power and voluntary VSR program data collected by the Port was also used to adjust engine activity estimates and vessel speeds. Vessel call data was collected from the Port, which provided date and time stamps for vessels at berth.

2.2 Emission Calculation Method

The emissions were estimated from a combination of the engine power and load demanded. The types of propulsion engines for OGVs found at the Port were 2-stroke slow speed or 4-stroke medium speed diesel engines or gas turbines. The basic engine emission calculation used the engine load multiplied by the emission factor as shown in the following equation:

$$\text{Emissions (per hour)} = \text{Engine Power} \times \text{Load Factor} \times \text{Emission Factor} \qquad (2\text{-}1)$$

The propulsion engine load was estimated as a function of the vessel speed as shown in the equations below, therefore it was important to accurately characterize vessel speeds in the emission inventory development. The maximum speed represents the vessel speed at full engine load, however vessels rarely transit at these speeds. Each vessel has a design speed used as the typical transiting speed for a vessel that ARB (2011d) estimates main engine loads

of 82.5%. The design speed was considered to be the highest speed that an individual vessel will ever transit.

$$\text{Load Factor} = (\text{Vessel Speed} / \text{Maximum Speed})^3 \quad (2\text{-}2)$$

The propulsion engine emission factors were adjusted as a function of load factor as shown in the equation below if it falls into an inefficient mode during low load activity. The adjustment factors are shown in Table 2-1. Most cruise ships are designed such that banks of diesel engines or gas turbines generate electric power used for propulsion and do not result in low engine load conditions and therefore emission factors for ships of this design were not adjusted for low load.

$$\text{Emission Factor}_{\text{Low-load}} = \text{Emission Factor} \times \text{Low Load Adjustment Factor} \quad (2\text{-}3)$$

Table 2-1. Propulsion engine low load emission adjustment factors. (ARB, 2006).

Load	ROG	CO	NO_x	PM	CO_2	SO_2
0.02	31.62	10.00	4.63	7.29	1	1
0.03	17.21	6.67	2.92	4.33	1	1
0.04	11.18	5.00	2.21	3.09	1	1
0.05	8.00	4.00	1.83	2.44	1	1
0.06	6.09	3.33	1.60	2.04	1	1
0.07	4.83	2.86	1.45	1.79	1	1
0.08	3.95	2.50	1.35	1.61	1	1
0.09	3.31	2.22	1.27	1.48	1	1
0.10	2.83	2.00	1.22	1.38	1	1
0.11	2.45	1.82	1.17	1.30	1	1
0.12	2.15	1.67	1.14	1.24	1	1
0.13	1.91	1.54	1.11	1.19	1	1
0.14	1.71	1.43	1.08	1.15	1	1
0.15	1.54	1.33	1.06	1.11	1	1
0.16	1.40	1.25	1.05	1.08	1	1
0.17	1.28	1.18	1.03	1.06	1	1
0.18	1.17	1.11	1.02	1.04	1	1
0.19	1.08	1.05	1.01	1.02	1	1
0.20	1	1	1	1	1	1

For auxiliary engines, the ARB (2011d) load and emission factor estimates shown in Table 2-2 were used to estimate the auxiliary engine load in use.

Table 2-2. Ocean-Going Vessels – Auxiliary engine load factors assumptions. (ARB, 2011d).

Ship-Type	Transit	Maneuvering	Hotel
Auto Carriers	15%	45%	26%
Cruise	See description below	See description below	16%
Container Ship	13%	50%	18%
Bulk Carrier	17%	45%	10%
General Cargo	17%	45%	22%

One exception to the approach described for propulsion and auxiliary engine emissions were cruise ships with diesel-electric or gas turbine-electric drives that meet combined propulsion and auxiliary load demands with a set of engines or turbines and engines. For these electric ships designs, the auxiliary load has a base power demand of 16% and propulsion demand increases the total set of engines' load factor to 80% at design speeds (ARB, 2011d). Of the 87 cruise ship calls in 2012, 72 were from cruise ships equipped with electric designs.

For boilers, emissions were calculated by multiplying the estimated fuel use and an emission factor. In-use boiler power estimates were assumed to depend upon the vessel type based on ARB (2011d). Vehicle carriers have an auxiliary boiler load of 371 kW; container ships, 506 kW; cruise ships 1000 kW; general cargo, 106 kW; and bulk cargo, 109 kW for transit and hotelling modes near port.

Emissions (per hour) = Boiler Load x Emission Factor (2-4)

2.3 Vessel and Engine Characteristics

For the vessel and engine characteristics, IHS Fairplay data was used and supplemented with the characteristics used in the 2006 inventory for vessels still calling the Port in 2012. Table 2-3 shows an example of the critical vessel characteristics extracted from the IHS Fairplay database.[4] Appendix A provides the characteristics for all vessels calling in 2012. The primary vessel characteristics shown in Table 2-3 define the main engine by type and power, the vessel design speed and type, and auxiliary engine generator capacity. The auxiliary generator capacity was determined as the sum of all generators listed.

Table 2-3. Sample vessel characteristics from the Fairplay database.

IMO	Vessel Name	Engine Stroke	Design Speed (knots)	Keel Laid	Engine Power (KW)	Vessel Type	Auxiliary Generators
8513467	Dole California	2	20	1985	15,189	Container	2 x 1,360kW, 3 x 1,200kW, 1 x 900kW
8900323	Dole Honduras	2	20	1990	15,190	Container	2 x 1,360kW, 3 x 1,200kW, 1 x 900kW
8513479	Dole Ecuador	2	20	1985	15,189	Container	2 x 1,360kW, 3 x 1,200kW, 1 x 900kW

The critical data are the engine descriptions which include 2 and 4-stroke diesel engines and gas turbines and model year. Ship diesel engines must meet NOx emission standards defined by Tier level under international regulation (MARPOL, 2008b). For diesel engines, the model year determines whether the engine is precontrolled, meets lower Tier 1NO_x emission standards for vessels constructed (defined as when the keel is laid) after 2000, or more stringent Tier 2 NOx

[4] http://www.ihs.com/products/maritime-information/index.aspx

emission standards for engines on vessels constructed in 2011 or later. A Tier III standard will be in effect for ships built in 2016 and later.

The vessel types calling in 2012 included passenger cruise, vehicle carriers, roll on/roll off (RoRo), bulk, container, and general cargo vessels. Table 2-4 provides a summary of the vessel calls in 2012, and individual vessel calls are provided in Appendix B. In addition, there were 54 ocean-going tug and barge calls that are included in the inventory under the Harbor Craft category presented in Section 3. Primarily, auto carriers called to NCMT, and cruise and training ships to CST. The rest of the calls, including general and bulk cargo, RoRo, and container ships called to TAMT.

Table 2-4. Summary of ship calls in 2012.

Vessel Type	Calls	Terminal
Auto Carrier	228	NCMT
Bulk Cargo	12	TAMT
Cruise Ship	86	CST
Container	53	TAMT
General Cargo	29	TAMT
RoRo	2	TAMT
Training	1	CST
Total	411	

2.4 Mode and Activity Estimates

The basic vessel activity included number of calls, time at berth, and the last and next port of call. There was not precise data on the route or speed of the vessel during the transit mode. Because the time and engine load is required to estimate the emissions during transiting, the time by speed bin for inbound and outbound vessels was estimated for each of several modes while operating in the geographic scope of the emission inventory.

The study area was defined in the 2006 Inventory as 24 nm from shore, consistent with the proposed ARB statewide low sulfur fuel requirement at that time. ARB provided the description of the San Diego County waterside boundary, which is shown in Figure 2-1 along with the vessel speed reduction area defined as 20 nm from Point Loma. The State of California defined more precisely the 24 nm boundary as identical to the NOAA contiguous zone[5] for the purpose of enforcing the final fuel rule. The revised waterside scope represents the official State boundary. The definition of the water boundary shown in Figure 2-1 was more precisely defined than that used for the 2006 Inventory (POSD, 2007).

[5] http://www.csc.noaa.gov/mbwg/_pdf/products/US.Contiguous.Zone.pdf

Figure 2-1. Map of waterside of study area.

PortVision AIS data of individual ships transiting during 2009 (prior to the introduction of the voluntary VSR program representing business-as-usual operations) was analyzed to determine a distribution of time in speed bin and other important aspects of vessel movements within the study area. The time by speed bin was determined for each subset of the study area labeled in Figure 2-2 and described here: 1) maneuvering near dock and in-harbor, 2) between the harbor and where the pilot boarded or disembarked in the vicinity of the San Diego Bay Approach Lighted Whistle Buoy 1 (32° 37.3'N, 117° 14.7'W);[6] 3) in the VSR zone; and 4) outside of the VSR region labeled Outer. The VSR and Outer zones were split into North and South to show how the routes vary by direction from the last port or to the next port. A fifth mode of activity occurs when the vessel is at berth.

[6] http://www.portofsandiego.org/maritime/check-port-and-harbor-conditions/421-bay-pilots.html

Figure 2-2. Example of ship transits through the study area.

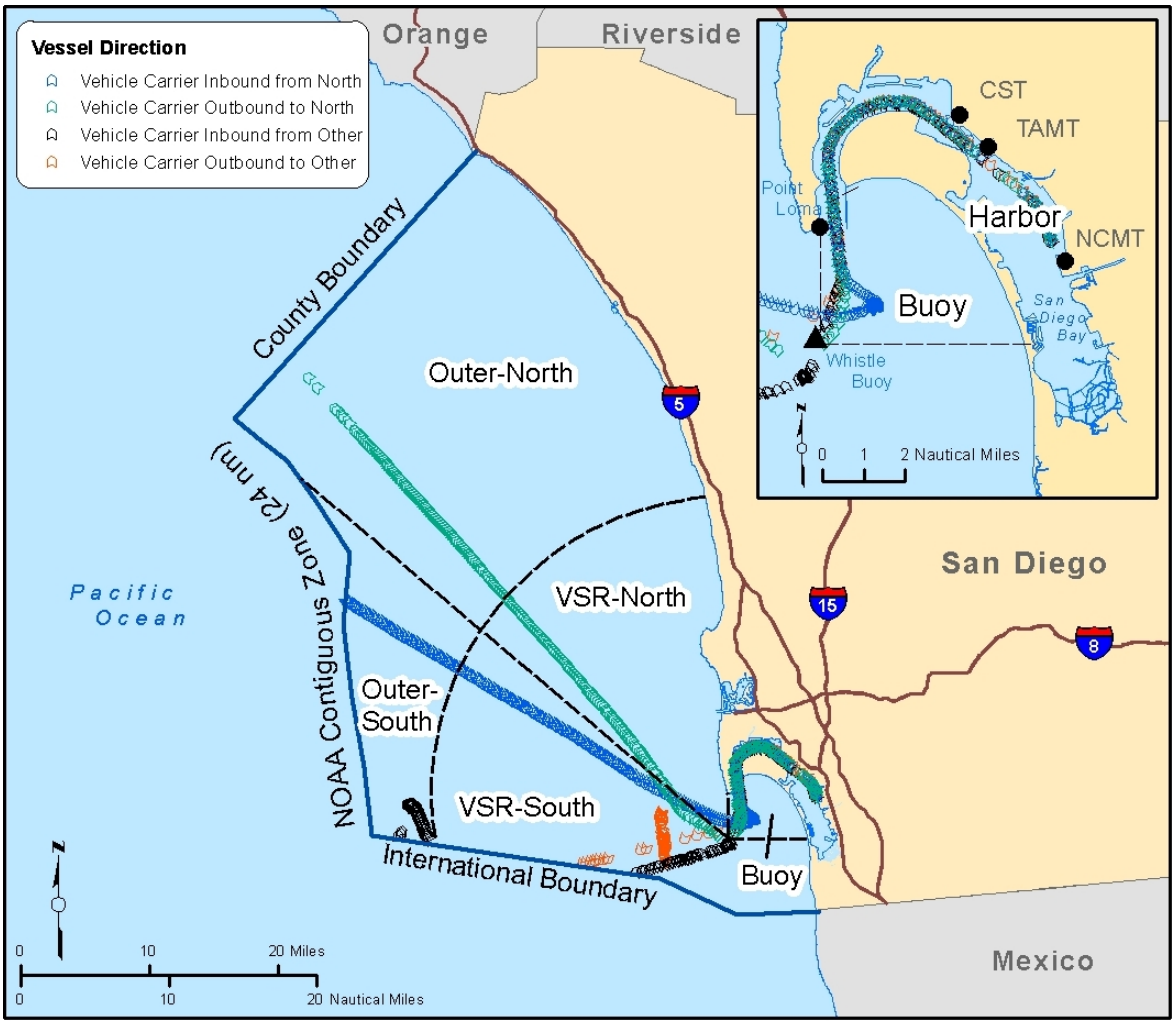


Figure 2-2 portrays four example ship transits to and from the Port for ships coming from or heading to the north to the Ports of Los Angeles or Long Beach, and to and from other ports. The trips to or from the north were significantly longer than other movements. The time in mode for transit movements for Los Angeles and Long Beach were separated from all other ports' vessel transits because the distances traveled within the inventory scope were longer. Vessels transiting to other ports spent less time within the study area, and some vessels exited the study boundary at the international boundary before reaching the 24 nm waterside boundary.

Figure 2-2 also shows vessels making indirect transit movements either upon entrance and exit from the Port. The inbound vehicle carrier from the north shown in Figure 2-2 waited about 17 hours within the Buoy zone at zero speed. Likewise, the inbound (marked with black triangles) and outbound (marked by red triangles) vehicle carriers from other ports exhibited slow speed or indirect transiting to or from the Port shown by the points drifting off the direct line from sea

to buoy. This time spent drifting is conducted at very low speeds within the waterside boundary of the study.

Table 2-5 shows the number of transit moves (a move is inbound or outbound from a Port call) used to estimate average time in mode for the Port. Most of the vessels calling to the Port in 2012 were vehicle carriers. Cargo vessel activity was used for both general cargo and bulk carrier vessel calls. The final summary vessel activity profiles are found in Appendix C.

Table 2-5. Transit moves used to estimate average activity.

Vessel Type	Inbound Other	Outbound Other	Inbound North	Outbound North
Cargo	4	4	6	7
Cruise Ship	21	21	3	2
Vehicle Carrier	18	17	15	15
Container Ship	7	6	0	0

Figures 2-3 through 2-6 show the speed distributions for a number of vessel types by direction within the VSR zone. The data analyzed was from 2009 prior to the start of the voluntary VSR program and represents a baseline condition. As described later, an adjustment of the time in mode was made in the emissions calculations to incorporate the vessels that voluntarily complied with the VSR speed limits within the VSR, Buoy, and Harbor zones. In all of these figures, the inbound transit occurred at slower speeds than the outbound movements. Vehicle carriers spent more time at higher speeds in the VSR zone when arriving from or departing to the Ports of Los Angeles and Long Beach. Cargo vessels transited at slower speeds than other vessel types. Container ships transited shorter periods because the exclusive route for container ships was to and from the south, whereby ships entered and exited at the international boundary through the VSR zone and did not pass through the outer zone.

Figure 2-3. Activity distributions of vehicle carriers to or from other ports in the VSR zone in 2009.

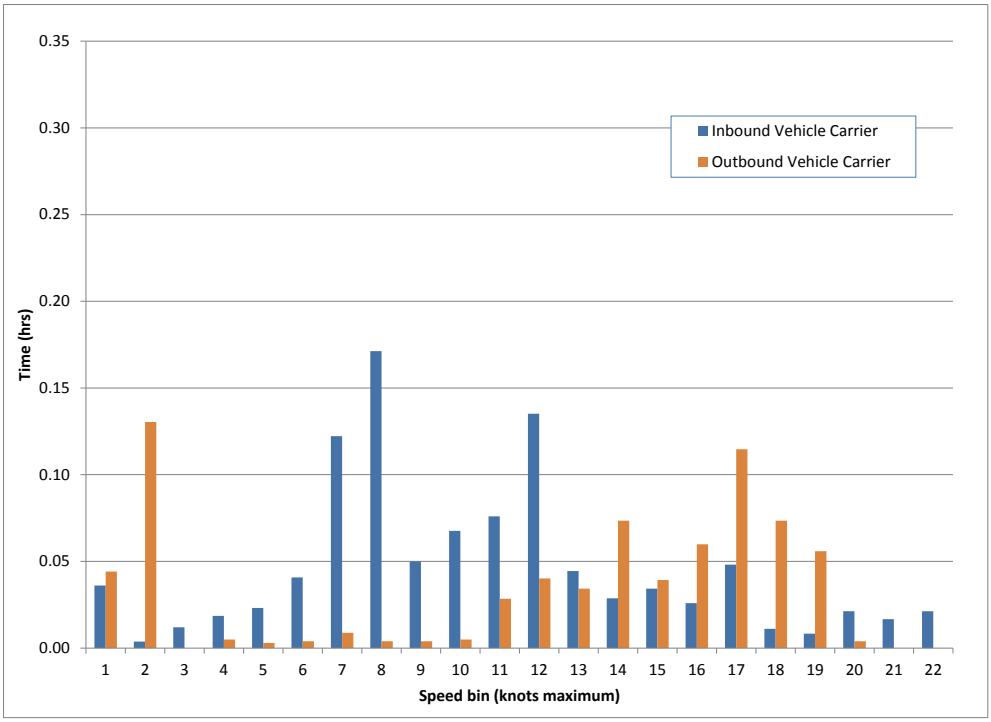


Figure 2-4. Activity distributions of vehicle carriers to or from the Ports of Los Angeles or Long Beach in the VSR zone in 2009.

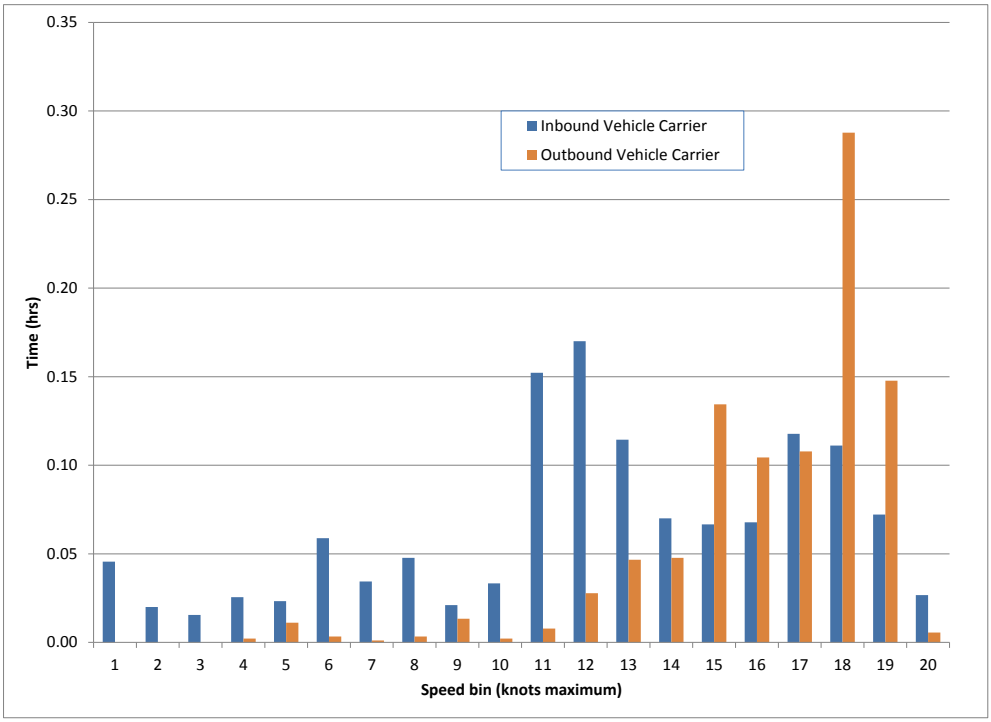


Figure 2-5. Activity distributions of cargo vessels to or from other ports in the VSR zone in 2009.

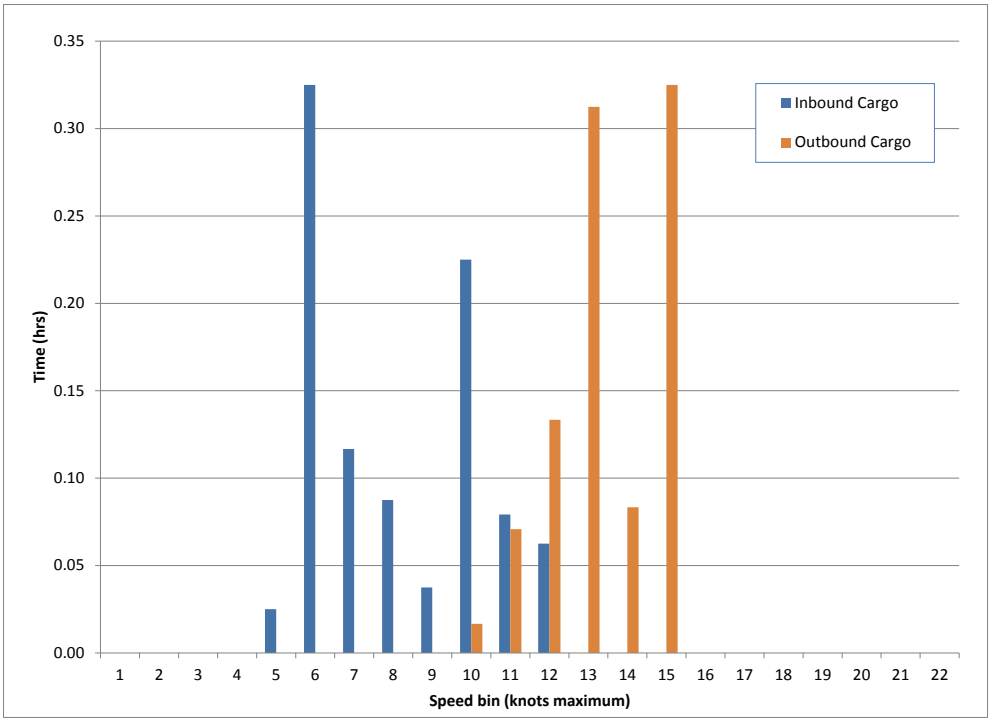
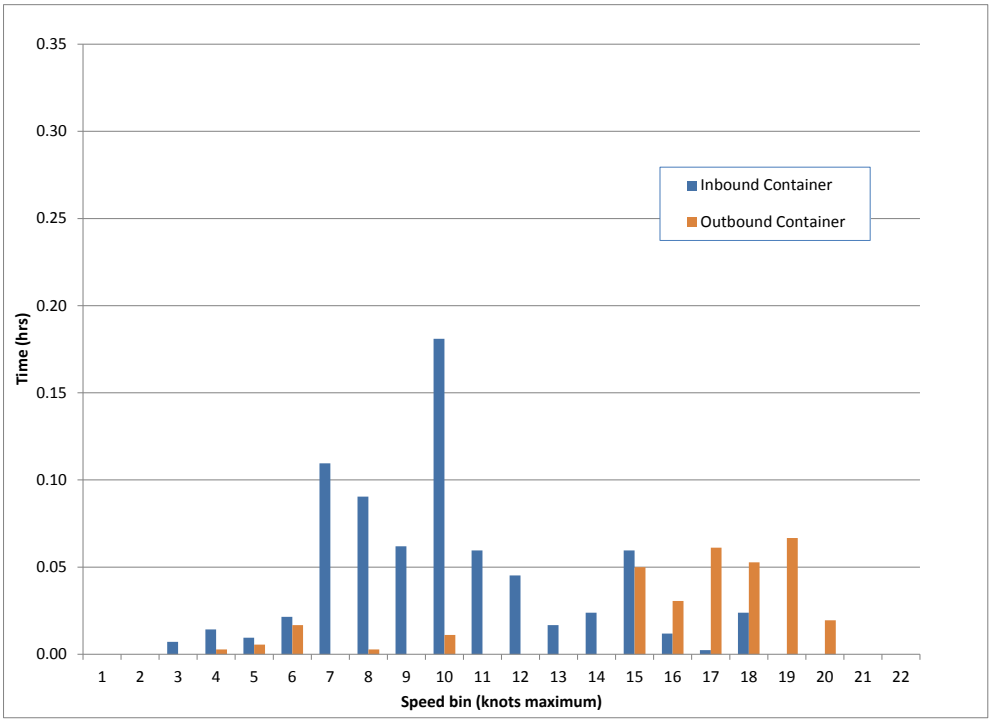


Figure 2-6. Activity distributions of container ships to or from other ports in the VSR zone in 2009.



Figures 2-7 and 2-8 describe the activity within the Buoy and Harbor zones. Comparing Figure 2-2 and Figure 2-7, some vessels wait for significant time before entering the harbor, either in what was defined as the Buoy zone near where the pilots assume control or further from shore in other zones. After the pilot takes control of the vessel near the boundary of the Buoy zone, the vessel speeds had a more narrow speed distribution both inbound and outbound. The last transit mode included in the analysis was in the harbor including maneuvering near the dock where the vessel berthed. Vessel activity in the Outer zone varied more than the Buoy or Harbor zones because vessels had a variety of design speeds and entered or exited the study area at different points. Some vessels never passed through the Outer zone at all.

Figure 2-7. Activity distributions of vehicle carriers to or from other ports in the Buoy zone.

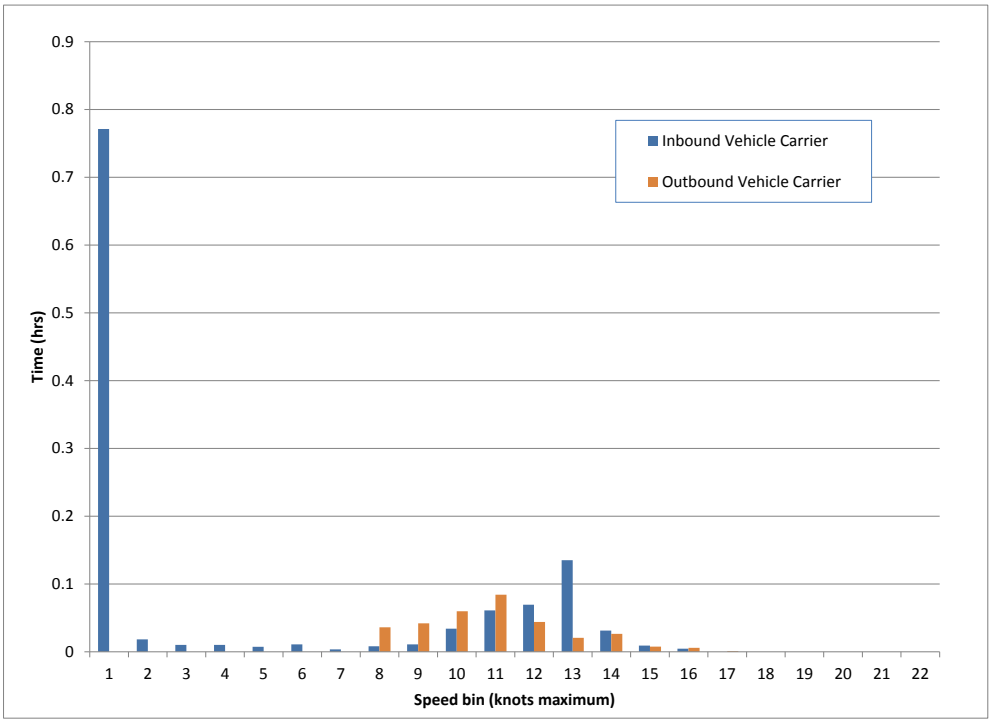
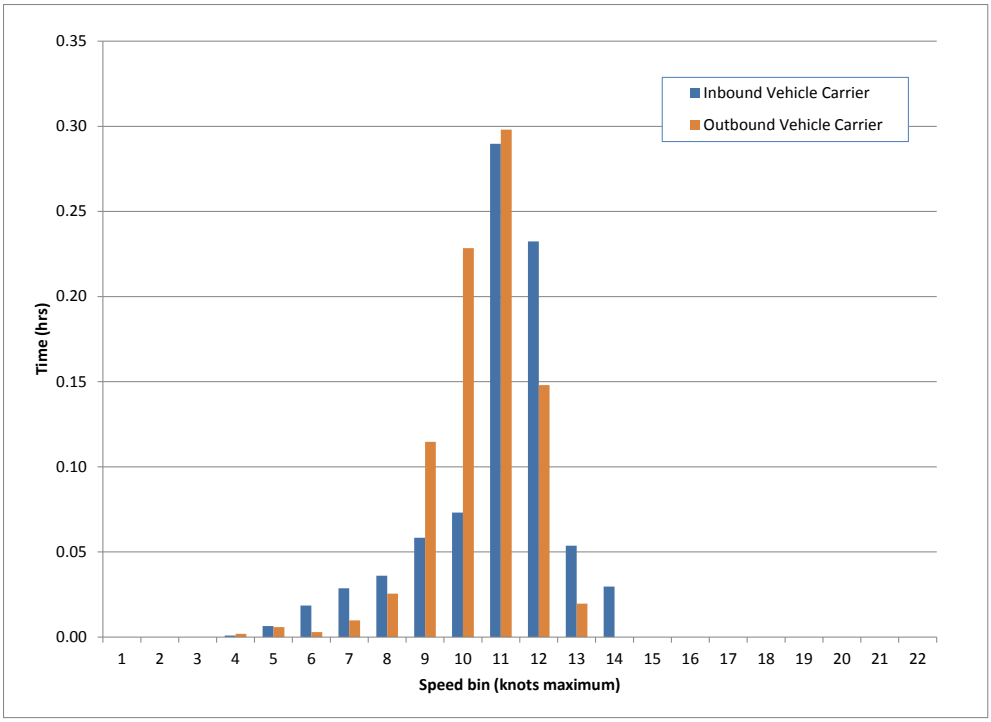


Figure 2-8. Activity distributions of vehicle carriers to or from other ports in the Harbor zone.



To estimate vessel emissions, an OGV emission estimation tool was developed and customized to account for time distribution by speed bin for each vessel type. Using historic vessel movement time by speed average distributions within the study area as the basis, the tool adjusts for in-use vessel maximum speed.

Two types of adjustments to the baseline speed profiles were developed and used in the emission calculation program. The first adjustment was to ensure that the individual vessel does not exceed its designed cruise speed when using the baseline time in speed bin distributions. The second adjustment was to correct individual vessels within the VSR designated area (includes the VSR, Buoy, or Harbor zones) where the top speed was recorded for each vessel move in 2012. The top speed was recorded to determine whether that vessel complied with the voluntary VSR guidelines or not. The program was designed to use the top speeds to adjust the time in speed bin distribution. The 2012 VSR tracking top speed are provided in Appendix D.

The emission calculation program developed for this study redistributes the time in speed bins exceeding the designed cruise or actual top speed of an individual vessel or call such that distance traveled is the same as shown in the equations:

Design speed x time at design speed = Baseline speed x time at baseline speed (2-5)

Top speed x time at top speed = Baseline speed x time at baseline speed (within VSR) (2-6)

With the adjusted speed distributions, the engine load was estimated from the cube of the ratio of the actual speed and maximum speed of each vessel as shown in equation 2-2. The engine load was set to no lower than 2% for the lower speed bin activity when the calculated load from equation 2-2 would have been lower.

2.5 At Berth Activity and Shore power Adjustment

At berth (also called hotelling) emissions were calculated using vessel time at berth combined with engine and boiler loads. Vessel call data provided the date and time stamps to calculate the time at berth. For vessels using shore power, the time while under shore power was used to adjust the time when the diesel generator engines were running prior to estimating emissions. Appendix B provides the time when shore power was used for each call. There were sixteen shore power calls for cruise ships. The cruise ship shore power time amounted to about 11% of the at-berth time of all cruise ship calls during 2012.

2.6 Emission Factors

Emission factors depend on the type of engine and fuel used in the vessel for propulsion or auxiliary engines. Three types of engines were used for propulsion power on ships: slow speed engines (2-stroke and typically lower than 250 rpm), medium speed engines (4-stroke), and gas turbines. Emission factors for these engines are shown in Table 2-6 (ARB, 2011d). In the ARB reference,[7] it was noted that 0.3% (3,000 ppm) sulfur fuel represents an average in-use fuel sulfur level complying with the 0.5% maximum sulfur level requirement in 2012, and the PM and SO_2 emission factors were estimated as the average of the 0.5% and 0.1% sulfur emission factor for this inventory. In 2006, prior to the introduction of the ARB OGV low sulfur fuel rule, most ships were using heavy or residual fuel oil in their engines.

Table 2-6. Ocean-Going Vessels – Emission factors (g/kW-hr) for Precontrol, Tier 1, and Tier 2engines as noted. (Source: ARB, 2011d)

Engine Type	Fuel Type	ROG	CO	NO_x	PM_{10}	$PM_{2.5}$
Slow Speed	Marine Distillate (0.1% S)	0.78	1.10	17.0	0.25	0.23
Slow Speed	Marine Distillate (0.5% S) (Tier II: 2011 – 2015)	0.78	1.10	17.0 (14.4)	0.375	0.345
Slow Speed	Heavy Fuel Oil	0.69	1.38	18.1	1.50	1.46
Medium Speed	Marine Distillate (0.1% S)	0.65	1.10	13.2	0.25	0.23
Medium Speed	Marine Distillate (0.5% S) (Tier II: 2011 – 2015)	0.65	1.10	13.2 (10.9)	0.375	0.345
Medium Speed	Heavy Fuel Oil	0.57	1.10	14.0	1.50	1.46
Gas Turbine	Gas Oil	0.80	0.20	2	0.13	0.12
Auxiliary	Marine Distillate (0.1% S)	0.52	1.10	13.9	0.25	0.23
Auxiliary	Marine Distillate (0.5% S) (Tier I: 2000 – 2010) ((Tier II: 2011 – 2015))	0.52	1.10	13.9 (11.54) ((9.2))	0.375	0.345
Auxiliary	Residual Oil	0.46	1.10	14.7	1.5	1.46

[7] http://www.arb.ca.gov/regact/2011/ogv11/ogv11isor.pdf

NO_x emissions from marine engines are regulated by model year, beginning with Tier 1 for the 2000 model year and Tier 2for model year 2011. There will be Tier III standards for model years 2016 and later for vessels operating in the North American Emission Control Area. These marine engine emission standards for domestic and foreign flagged vessels are specified in MARPOL (2008b) Annex 13 which defines the model year as the year when ships are constructed and, "Ships constructed means ships the keels of which are laid or which are at a similar stage of construction." Though not all of the ships have 'keel laid' as an entry in the Fairplay database, all ships have a date of delivery listed. This date was used together with the average time of 300 days from the keel laid to delivery date for ships calling the Port (where both dates were provided) to estimate the model year of the vessel.

Greenhouse gas emission rates are provided in Table 2-7. (ARB, 2011d)

Table 2-7. Greenhouse gas emission factors (g/kW-hr).

Source	Fuel	CH_4	N_2O	CO_2
Main 2-Stroke	MGO	0.078	0.018	588
Main 2-Stroke	Residual	0.078	0.018	620
Main 4-Stroke	MGO	0.08	0.018	645
Main 4-Stroke	Residual	0.09	0.018	677
Gas Turbine	MGO	0	0.018	970
Auxiliary Engine	MGO	0.08	0.018	690
Auxiliary Engine	Residual	0.09	0.018	722

Boiler emission factors are shown in Table 2-8, (ARB,2011d) and $PM_{2.5}$ was assumed to be 92% of PM_{10} emissions similar to diesel engine emissions rates. Boiler PM_{10} emissions are by definition not DPM.

Table 2-8. Auxiliary boiler emission rates (g/kW-hr). (ARB, 2011d)

Fuel Type	ROG	CO	NO_x	PM_{10}	SO_2	CO_2	CH_4	N_2O
Residual	0.11	0.20	2.1	0.80	16.50	970	0.032	0.013
0.5% Sulfur	0.11	0.20	1.995	0.20	2.99	921.5	0.032	0.013
0.1% Sulfur	0.11	0.20	1.995	0.133	0.58	921.5	0.032	0.013

2.7 Emission Results

Vessel call and characteristic data were combined into a single database program that uses the ARB methodology to estimate activity and emissions. The vessel speeds by mode, berthing time, and engine loads were used to estimate emissions for each vessel call. Auto carriers called exclusively to NCMT, cruise ships to CST, and all other OGV to TAMT. The two RoRo vessel calls to TAMT did not contribute significantly to emissions and were combined with Auto Carriers in the summary tables.

Estimated total emissions from the Port OGVs are presented in Table 2-9 and relative emissions in Figure 2-9 by ship type. Table 2-10 presents the emissions by operating mode (transit in different zones and berthing) and relative emissions by mode in Figure 2-10. Auto carriers were the most numerous types of vessels, but cruise and container ships had higher emissions per call owing to higher auxiliary loads, especially at berth. The emissions from ships were found to be primarily during the at berth mode where ships spent the longest time while in the study area. About 11% of total cruise ships' time at berth was spent using the Port's Shore Power System. In addition, transit emissions were reduced by almost 10% due to the Port's VSR Program.

Table 2-9. Emissions by ship type (tons).

Vessel Type	Terminal	ROG	CO	NO_x	PM_{10}	$PM_{2.5}$	DPM	SO_2	CO_2	CH_4	N_2O	CO_2e
Auto Carrier	NCMT	8	9	108	2.70	2.49	2.36	12	6,204	0.8	0.2	6,270
Bulk	TAMT	1	1	7	0.18	0.16	0.16	1	411	0.1	0.0	415
Container	TAMT	5	7	86	2.18	2.01	1.85	10	5,619	0.4	0.1	5,674
Cruise	CST	7	12	145	3.67	3.37	3.41	16	8,862	0.5	0.4	8,989
General Cargo	TAMT	1	2	22	0.53	0.49	0.50	2	1,191	0.1	0.0	1,204
Total		**21**	**31**	**368**	**9.26**	**8.52**	**8.28**	**41**	**22,287**	**1.9**	**0.7**	**22,551**

Table 2-10. Emissions by mode (tons).

Mode	ROG	CO	NO_x	PM_{10}	$PM_{2.5}$	DPM	SO_2	CO_2	CH_4	N_2O	CO_2e
Berthing	9	18	213	5.66	5.21	4.86	28	15,159	0.7	0.4	15,292
Harbor	5	5	54	1.28	1.17	1.20	5	2,440	0.5	0.1	2,482
Buoy	3	3	30	0.73	0.67	0.69	3	1,394	0.3	0.0	1,422
VSR	4	5	59	1.32	1.22	1.26	5	2,766	0.4	0.1	2,817
Outer	1	1	12	0.27	0.25	0.26	1	528	0.1	0.0	538
Total	**21**	**31**	**368**	**9.26**	**8.52**	**8.28**	**41**	**22,287**	**1.9**	**0.7**	**22,551**

Figure 2-9. Relative emissions by ship type.

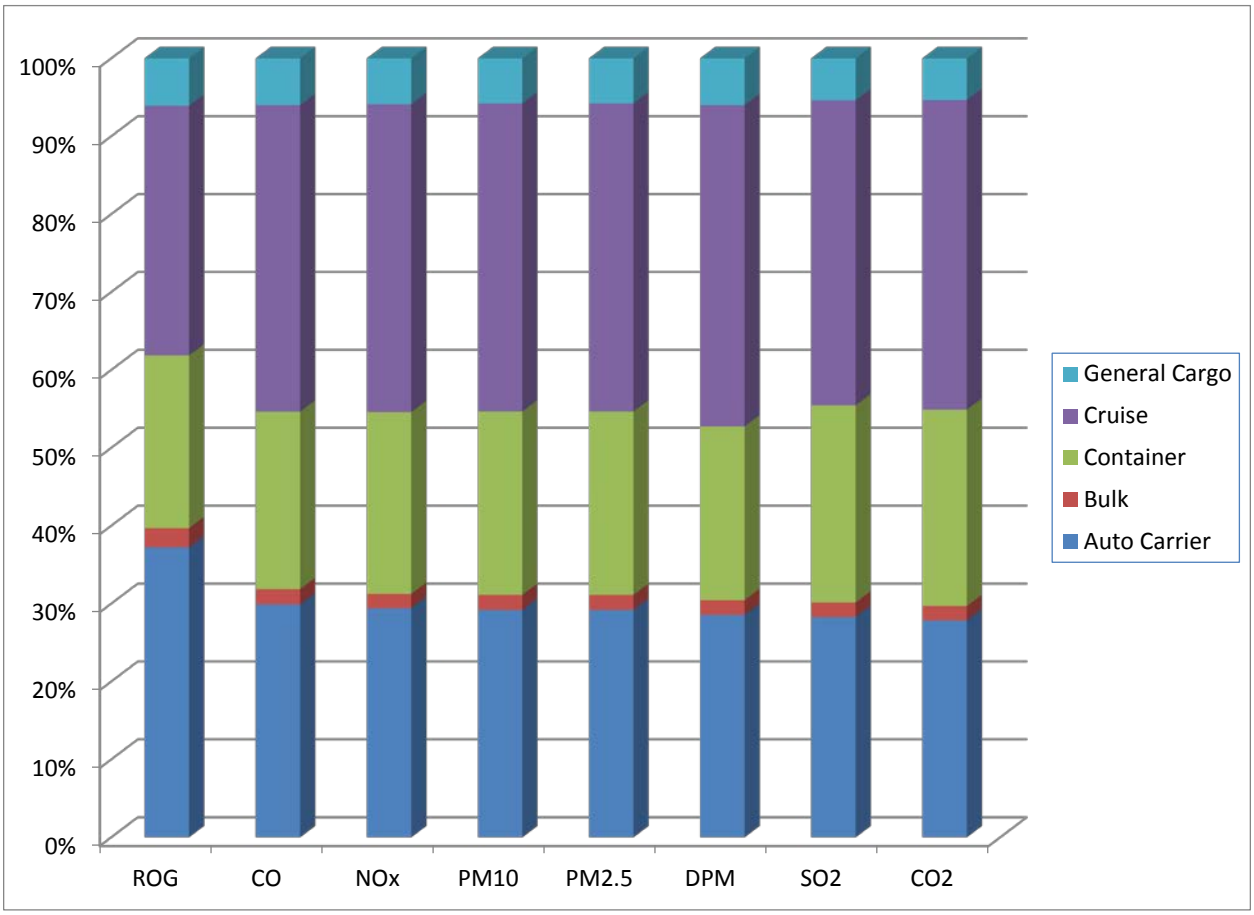
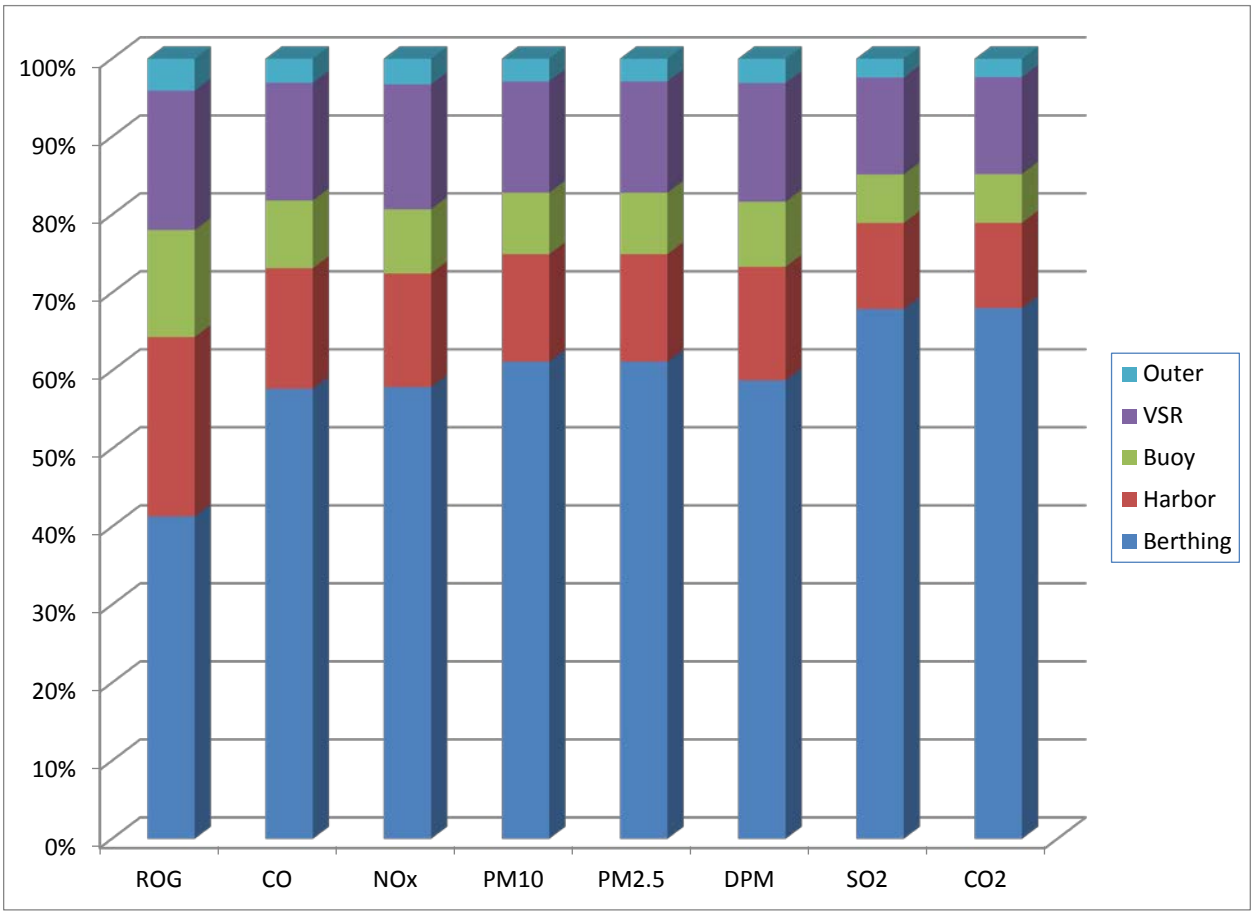


Figure 2-10. Emission by mode.



The per call average emissions by ship type are shown in Table 2-11 that highlights the relative impact of each vessel call. The relative average emissions of each vessel are due to the ship type and cargo, size of vessel, time in the Port, and other unique characteristics. While auto carriers are the most frequent callers, container and cruise ships contribute more emissions per call.

Table 2-11. Emissions per call by ship type (pounds).

Calls	Vessel Type	ROG	CO	NOx	PM_{10}	$PM_{2.5}$	DPM	SO_2	CO_2	CH_4	N_2O	CO_2e
230	Auto Carrier	68	81	942	23.51	21.63	20.55	101	53,951	7	1	54,521
12	Bulk	86	102	1,118	29.87	27.48	26.26	128	68,486	8	2	69,191
53	Container	175	269	3,241	82.24	75.66	69.64	394	212,029	16	6	214,103
87	Cruise	154	283	3,343	84.26	77.52	78.46	371	203,713	12	9	206,637
29	General Cargo	88	130	1,499	36.85	33.90	34.30	153	82,159	8	2	83,017

3.0 COMMERCIAL HARBOR CRAFT

Commercial harbor craft (CHC) activities that regularly occurred at the Port in 2012 consisted of several categories: vessel assist, tow, and ocean-going tugs, commercial fishing boats, passenger ferries/excursion boats, work boats, crew and supply, and other vessels. This section describes the emissions estimation methodologies and results for these CHCs that serve the Port.

3.1 Background

3.1.1 Assist Tugs, Tow (Push) Boats, and Ocean-Going Tugs

There were three types of activity that tugs serving the Port provided including vessel assist, push barges and general work functions within harbor, and ocean-going tow boats. Assist tugs ensure safe navigation for large cargo vessel movements upon arrival to and departure from the Port. Cargo vessels vary greatly in size and maneuverability, and the tugs that assist them have unique power levels, rudders and other equipment. Tugs performed a variety of services around and at the Port, including vessel escort, berthing and departure assists, and towing or pushing a wide variety of barges and other equipment within the harbor. Ocean-going tugs tow lumber and fuel barges between San Diego and other ports. The ocean-going tugs comprised relatively little of the harbor craft activity near the Port, but they had a disproportional amount of emissions due to their larger size and greater horsepower to cruise long distance in open water. Assist tugs, work tugs, and ocean-going tugs function similarly, but assist tugs are generally smaller and operate under a lower load than ocean-going tugs, and work tugs operate at higher loads according to ARB (2011e). Both assist tugs and ocean-going tugs may operate outside the Port area, but the emission estimates of this study considered only activities occurring within 24 nm of the Port.

3.1.2 Commercial Fishing Boats

Fishing boats that harbored at the Port included those used for commercial fishing, which search and collect fish or other seafood to sell at market. Commercial fishing vessels do not operate from the three marine terminals. Only commercial fishing boats which operate out of the Port-administered marina located at Tuna Harbor were included in this inventory. Fishing boats at Tuna Harbor varied in size and level of activities due to seasonal availability of specific types of fish or seafood. Because fishing boats may call to different ports depending on the availability of fish, the emission estimates of this study considered only the activity that occurred during the months these fishing boats were based at the Port in 2012.

3.1.3 Passenger Ferries and Excursion

Ferries or excursion boats were generally used as a mode of public transportation for passenger travel or for sightseeing, whale watching, dinner cruising, and other special events. Ferry and excursion services operate from the Embarcadero area along the eastern shore of San Diego Bay within the vicinity of the Broadway and B Street Cruise Ship Terminal. Two companies primarily provide ferry and excursion services: San Diego Harbor Excursion and Hornblower

Cruises and Events. Because passenger ferries and excursion boats rarely traveled beyond 24 nm from the Port, all of their activities were included in the emission estimates of this study.

3.1.4 Other Harbor Craft

The harbor craft fleets serving the Port also included several work boats comprised of general purpose vessels that ARB describes as including fire rescue, law enforcement, hydrographic surveys, spill/response research, training, construction, and other operations; crew and supply vessels, which carry personnel and supplies to and from offshore and in-harbor locations, including vessels at anchor, construction sites, and off-shore platforms; pilot boats, which carry pilots to and from ships to provide pilot service into and out of a port or harbor; and others. The harbor craft working or based at the Port were surveyed and could have included any of the types defined by ARB, but were limited to the types described in this section and in Appendix E. The activities of these other categories of vessels varied significantly depending on their functions; they were tracked closely and only the activities occurring within 24 nm of the Port were included in the emission estimates of this study.

Table 3-1 summarizes the count of each type of harbor craft vessel that called to the Port in 2012.

Table 3-1. Count of harbor crafts by type.

Type of Vessel	Count	% Total
Crew and Supply	1	1%
Commercial Fishing	73	64%
Excursion and Ferries	16	14%
Other	1	1%
Pilot Vessel	1	1%
Tow Boats	6	5%
Tug Boats (Assist & Ocean-Going)	12	11%
Work Boats	4	4%
Total	114	100%

3.2 Methodology

The updated emissions estimation methodology that was developed for ARB's Commercial Harbor Craft Emission Inventory Database and the Crew and Supply Vessel Emission Inventory Database was closely followed. (ARB, 2011e) The ARB methodology provides emission factors that are specific to main propulsion and auxiliary engine model year, and applies both an engine emissions deterioration rate and a fuel correction factor.

The basic equation used to calculate emissions from each type of vessel is the following:

$$Emissions = \frac{EF_{zh} \times FC \times \left(1 + DE \times \frac{A}{UL}\right) \times HP \times LF_{wt} \times Hrs}{(453.6 \times 2000)} \quad (3\text{-}1)$$

Where:

Emissions – Emissions in tons
EF_{zh} – Horsepower and model year specific zero-hour emission factor [g/hp-hr]
FC – Fuel correction factors for using low sulfur content diesel fuels
DE – Deterioration rate of the engine
A – Age of the engine as provided by the operators
UL – Useful life of the engine
HP – Weighted average main propulsion and/or auxiliary engine brake horsepower rating of the engines in each tug group
LF_{wt} – Time weighted load factor for the maneuvering phase for the main engine and/or auxiliary engine, taken from the literature or the ARB methodology, stated as a fraction of full load
Hrs – Annual operating hours within 24nm of the Port; provided by the operators

The Crew and Supply Vessel Emission Inventory Database input data were used to estimate emissions from crew and supply vessels; input data estimates for all other types of crafts were found in the Commercial Harbor Craft Emission Inventory Database.

3.3 Input Data and Emissions

A survey was conducted to collect the following vessel engine characteristics (type of vessel, model year, retrofit records, and horsepower) and activity level (hours of operation, number of calls) from CHC operating at the Port in 2012. This information was used as input for the emissions calculations. Detailed vessel characteristics and activity estimates are provided in Appendix E.

1. Vessel Name
2. Vessel Type
3. Number of Propulsion (Main) Engines
4. Propulsion (Main) Engine Make and Model
5. Propulsion (Main) Engine Model Year
6. Propulsion (Main) Engine Rated Horsepower
7. Propulsion (Main) Engine Retrofit Type / Repower
8. Propulsion (Main) Engine Annual Usage
9. Number of Auxiliary Engines
10. Auxiliary Engine Rated Horsepower
11. Auxiliary Engine Annual Usage
12. Percentage of time spent outside of 24nm of Port

While the survey covered most vessels operating at the Port in 2012, information for commercial fishing boats and ocean-going tugs were collected separately.

For the commercial fishing fleet, the default parameter values from ARB's Commercial Harbor Craft Emission Estimation Methodology (ARB, 2011e) were used, including the number of

engines and engine model year, horsepower, and operation hours for annual activity and within 24 nm of shore. The number of months in 2012 these boats called to the Port was used to determine the fraction of time these boats operate within the study area with the remainder of the year assumed to occur elsewhere.

For ocean-going tugs, the Port supplied data on the lumber and fuel barge port calls by month in 2012 and hours spent at Port for each call. For those vessels where the Port could not provide data, engine characteristics were obtained from company personnel or websites. The lumber barges were towed from Longview, WA and the fuel barges from San Pedro Bay, and both return to Long Beach or to the San Pedro vicinity. To estimate the tug transit time, the route to and from the north was assumed with a one-way distance of 50 nautical miles at 8.2 knots along with an in-harbor distance of 5 nautical miles at 6 knots to TAMT for fuel barges and 10 nautical miles to NCMT for lumber barges. The per-call transit time and the number of calls (12 lumber and 42 fuel barge calls) were used to estimate the total tug transit hours. In addition, the time at berth for these barges was used to add auxiliary power activity hours to the transit time for the auxiliary engine activity for these tugs.

The zero-hour emission factors, engine deterioration factors and fuel correction factors for main propulsion and auxiliary engines, as well as useful life and load factors came from ARB's Commercial Harbor Craft Emission Inventory (EI) Database and the Crew and Supply Vessel EI Database (ARB, 2011e) and are provided in Appendix F. Appendix F compares the POSD (2007) reported emission factors and an example comparison that shows that the revised ARB (2011e) emission factors are considerably higher than the emission factors used in the 2006 inventory. The main engine and auxiliary engine load factors were estimated to be 0.31 and 0.43, respectively, for assist tugs only. These load factors corresponded to values used in both the Port of Oakland 2012 Seaport Air Emissions Inventory (ENVIRON, 2013) and the Port of Los Angeles Inventory of Air Emissions (POLA, 2012). For other categories of vessels the respective load factors from ARB's database were used.

Table 3-2. 2012 Annual activities within 24 nm of San Diego County coast and load factors by vessel type.

	All Vessels Annual Hours		Load Factors (ARB)	
Type of Vessel	Main Engine	Aux. Engine	Main Engine	Aux. Engine
Crew and Supply	1,590	533	0.38	0.32
Commercial Fishing	40,072	52,350	0.27	0.43
Excursion and Ferries	19,086	18,300	0.42	0.43
Others	467	483	0.52	0.43
Pilot Vessels	1,300	-	0.51	0.43
Tow Boats	11,099	1,580	0.68	0.43
Tug Boats (Assist)	13,885	18,381	0.31[1]	0.43[a]
Tug Boats (Ocean-Going)			0.50	0.31
Work Boats	3,835	1,260	0.45	0.43
Total	91,334	92,887	***N/A***	***N/A***

[a] POLA (2012)

The vessel characteristic activity data was input into a spreadsheet model that uses the ARB methodology and emission factors to estimate emissions. The emission calculation combined the vessels annual hours of operation with ARB default engine load factor estimates and emission factor to estimate emissions for each vessel.

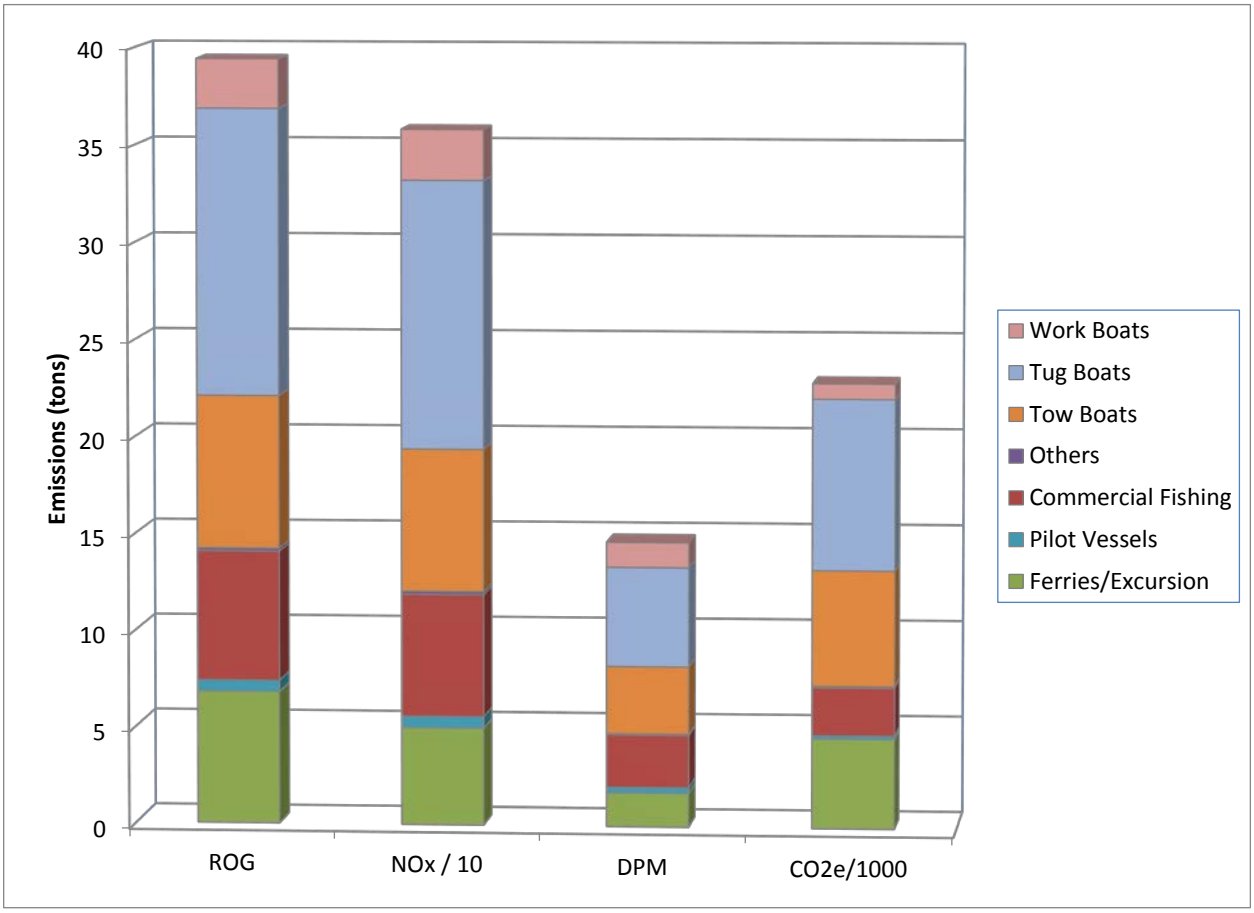
Table 3-3 summarizes the emissions for harbor crafts calling to the Port in 2012. PM_{10} and DPM are the same for harbor craft because diesel engines are the only emission source. Figure 3-1 shows the relative contribution of each vessel type to emissions. Although tow boats and tug boats accounted for 5% and 11%, respectively, of the total harbor craft inventory, emissions generated by these vessels accounted for at least 50% of the total emissions per criteria pollutant and greenhouse gas.

Table 3-3. Total harbor crafts 2012 emissions (tons).

Type of Vessel	ROG	CO	NO_x	SO_2	PM_{10} [a]	$PM_{2.5}$	CO_2	CH_4	N_2O	CO_2e
Crew and Supply	0.7	3.1	3.989	0.004	0.105	0.102	470	0.063	0.016	476
Commercial Fishing	6.7	18.4	63.018	0.023	2.700	2.619	2,441	0.274	0.083	2,473
Excursion and Ferries	6.8	28.5	50.013	0.043	1.730	1.678	4,563	0.613	0.155	4,624
Others	0.2	0.4	1.548	0.001	0.065	0.063	66	0.008	0.002	67
Pilot Vessels	0.6	1.4	6.070	0.002	0.302	0.293	176	0.053	0.006	179
Tow Boats	7.9	22.4	73.478	0.055	3.472	3.368	5,887	0.709	0.201	5,964
Tug Boats	14.8	56.1	138.156	0.082	5.123	4.970	8,696	1.292	0.296	8,814
Work Boats	2.5	6.0	26.074	0.007	1.293	1.254	777	0.222	0.027	790
Total	**40.1**	**136.3**	**362.35**	**0.22**	**14.79**	**14.35**	**23,075**	**3.23**	**0.79**	**23,387**

[a] PM_{10} is identical to DPM.

Figure 3-1. Relative emission contribution by vessel type.



4.0 CARGO HANDLING EQUIPMENT

4.1 Background

Cargo handling equipment (CHE) is primarily used to transfer freight between modes of transportation, such as between marine vessels and trucks or between trains and trucks. CHE are used in many types of operations including moving containers, bulk materials, general cargo, and lumber. As such, the types of CHE at the Port consisted of forklifts, stackers, and yard trucks (hostlers). Other types of equipment used as CHE for transfer of bulk materials were found at the Port, including general purpose aerial lifts, sweepers, and rubber tired loaders. Therefore the activity and emissions reported in this section include both CHE and an "off-road equipment" category. The emission estimation methods and results for cargo handling and other off-road equipment operated at Port terminals are presented here.

4.2 Emission Calculation Methodology

The approach used to estimate CHE emissions was to determine annual 2012 emissions for each piece of equipment by terminal according to engine characteristics (model year, rated power, and equipment type) and equipment operation (hours of operation and load factor). The equipment population and operation estimates were derived from terminal surveys conducted by ENVIRON and the Chambers Group. Where there were missing data regarding the equipment characteristics or operation estimates, either an averaged value of similar equipment in the fleet or default input estimates obtained from the inventory guidance documentation published by ARB (2011f) were used.

Per ARB (2011f) guidance, the following types of equipment were used to categorize CHE:

- Forklifts
- Container Handling Equipment
- Yard Trucks

Other off-road equipment may have been listed in the CHE survey and included general industrial and construction equipment that are most often used to transfer liquid and solid bulk cargo. At the Port, there was equipment listed as industrial or construction equipment but may have been used either for sporadic maintenance and construction activity or cargo handling but is not be strictly considered CHE. The equipment activity and emissions for these equipment types are included in this section but under the category for "off-road equipment."

CHE emissions were calculated using the following equation:

$$Equip_{emiss} = \frac{(EF_{zh} + dr \times CHrs) \times HP \times FCF \times LF_{wt} \times CF \times Hrs \times Pop}{(453.6 \times 2000)} \quad (4\text{-}1)$$

Where:

Equip $_{emiss}$ is the annual emissions in tons,
EF $_{zh}$ is the zero-hour emission factor in grams per brake horsepower-hour,
dr is the deterioration rate or the increase in zero-hour emissions as the equipment is used (grams/bhp-hr^2),
CHrs is the cumulative hours or total number of hours accumulated on the equipment
HP is the engine rated brake horsepower
FCF is the fuel control factor (% reduction) used to correct for emission reductions due to California diesel fuel,
LF $_{wt}$ is the weighted load factor (average load expressed as a % of rated power),
CF is the control factor (% reduction) associated with use of emission control technologies where applicable,
Hrs is the annual operating hours of the equipment,
Pop is the population number of the equipment, and
(453.6 x 2000) is a conversion from grams to tons.

4.3 Input Data and Use

Surveys were sent out to the Port terminals requesting the following detailed information for each piece of CHE. This information was used as input for the emissions calculations.

1. Equipment Type
2. Number of equipment
3. Engine Model
4. Engine Model Year
5. Engine Retrofit Type / Repower
6. Chassis Make / Model
7. Chassis Model Year
8. Fuel Type
9. Annual hours of operation
10. Cumulative hours on the engine
11. Engine Rated horsepower
12. Fuel consumption per piece of equipment

Surveys were returned for eleven companies, and others indicated that they did not use off-road equipment. For diesel-powered equipment, the zero-hour emission factors, deterioration rates, fuel correction factors, and emission control factors for HC, CO, NO_x, and PM were obtained from ARB's Cargo Handling Equipment Inventory (CHEI) model (ARB, 2012b). Because

the current version of the CHEI model does not support emission estimates for other pollutants or other fuel types, emission factors for gasoline- and propane-powered equipment, and for SO_2 and greenhouse gases (CO_2, CH_4 and N_2O) were obtained from ARB's OFFROAD2007 model. Note that the OFFROAD2007 model reports N_2O emissions as zero for all of the equipment included in this inventory.

CHE were grouped into equipment type categories as defined by ARB (2011f). The resulting populations by equipment type for the Port are summarized in Table 4-1. Out of 118 total pieces of equipment, the majority were cargo handling equipment (113). The remaining 5 were designated in the other off-road equipment category. Seventy three of CHE were diesel powered, 16 forklifts were LPG (liquid petroleum gas) powered, and 24 forklifts were electric and assumed to produce no emissions. The majority of CHE is operated at TAMT. All of the off-road category equipment were diesel-powered.

Table 4-1. Cargo handling equipment - population by type.

Equipment Type	Equip Population	% Total
CHE		
Container Handling Equipment	7	6%
Forklift	91	77%
Yard Tractor	15	13%
OFFROAD		
Aerial Lifts	1	1%
Rubber Tired Loaders	3	3%
Sweepers/Scrubbers	1	1%
Total	**118**	**100%**

Table 4-2 summarizes the average horsepower and annual use by equipment type and power range. Actual annual hours of operation for each piece of equipment were used to estimate emissions.

Table 4-2. Cargo handling equipment - Average horsepower and actual hours of operation by equipment type and horsepower range.

Equipment Type	HP Bin	Equipment Population	Average HP	Average Annual Operation (Hours)
CHE				
Container Handling Equipment	100	1	99	245
	300	2	253	190
	600	4	353	485
Forklift	75	11	69	429
	100	7	85	868
	175	73	133	301
Yard Tractor	300	15	200	959
OFFROAD				
Aerial Lifts	75	1	70	240
Rubber Tired Loaders	300	3	238	431
Sweepers/Scrubbers	50	1	34	240

4.4 Cargo Handling Equipment Emission Results

The surveyed equipment characteristic and activity were combined with the ARB (2011f) load and emission factors in a spreadsheet model program to estimate emissions. Table 4-3 and Table 4-4 present emission results for the CHE by equipment type and by fuel type, respectively, based on the survey data. All PM_{10} from diesel engines listed in Table 4-4 is DPM. $PM_{2.5}$ emissions were calculated as a fraction of PM_{10} based on fuel type using factors provided by ARB.[8] The per terminal CHE emissions appear in Table 4-5. Because a majority of the CHE are operated at TAMT the emissions from CHE are greatest at TAMT.

Table 4-3. 2012 Port of San Diego CHE emissions by equipment type (tons).

Equipment Type	ROG	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O[a]	CO_2e
CHE										
Container Handling Equipment	0.11	0.66	1.72	0.00	0.01	0.01	294	0.02	0.00	294
Forklift	0.70	7.61	6.33	0.01	0.10	0.09	609	0.25	0.00	614
Yard Tractor	0.25	1.28	3.05	0.01	0.14	0.12	703	0.04	0.00	704
OFFROAD										
Aerial Lifts	0.01	0.02	0.05	0.00	0.00	0.00	3	0.00	0.00	3
Rubber Tired Loaders	0.05	0.13	0.75	0.00	0.02	0.02	63	0.01	0.00	63
Sweepers/Scrubbers	0.01	0.04	0.03	0.00	0.00	0.00	2	0.00	0.00	2
Total	**1.12**	**9.75**	**11.92**	**0.02**	**0.28**	**0.25**	**1,674**	**0.32**	**0.00**	**1,680**

[a] The OFFROAD 2007 model reports N_2O emissions as zero.

Table 4-4. 2012 Port of San Diego CHE emissions by fuel type (tons).

Equipment Type	ROG	CO	NO_x	SO_2	PM_{10}[a]	$PM_{2.5}$	CO_2	CH_4	N_2O[b]	CO_2e
CHE										
Diesel	0.83	4.90	9.93	0.02	0.24	0.22	1,465	0.12	0.00	1,468
Propane	0.23	4.66	1.17	0.00	0.01	0.01	140	0.19	0.00	145
Electric	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0
OFFROAD										
Diesel	0.06	0.19	0.82	0.00	0.03	0.02	68	0.01	0.00	68
Total	**1.12**	**9.75**	**11.92**	**0.02**	**0.28**	**0.25**	**1,674**	**0.32**	**0.00**	**1,680**

[a] All diesel PM_{10} emissions are DPM.
[b] Assumes GHG emissions from gasoline powered equipment are negligible.

Table 4-5. 2012 Port of San Diego CHE emissions by terminal (tons).

Terminal	ROG	CO	NO_x	SO_2	PM_{10}[a]	$PM_{2.5}$	CO_2	CH_4	N_2O[b]	CO_2e
CST	0.02	0.26	0.39	0.00	0.01	0.00	49	0.00	0.00	49
TAMT	0.68	4.00	7.59	0.01	0.19	0.17	1,172	0.21	0.00	1,176
NCMT	0.42	5.49	3.94	0.00	0.08	0.08	453	0.11	0.00	455
Total	**1.12**	**9.75**	**11.92**	**0.02**	**0.28**	**0.25**	**1,674**	**0.32**	**0.00**	**1,680**

[a.] All diesel PM_{10} emissions are DPM.
[b.] Assumes GHG emissions from gasoline powered equipment are negligible.

[8] http://www.arb.ca.gov/planning/tsaq/eval/pmtables.pdf

5.0 RAIL LOCOMOTIVES

5.1 Background

Locomotive activity at the port was exclusively derived from activity at the NCMT and operated by BNSF railway. BNSF primarily operated auto trains that carry imported vehicles, but some lumber cars were moved from the port via rail as well. The on-terminal tracks, defined here as 'near port,' are shown in Figure 5-1. The tracks used for auto train cars are on the terminal grounds, while the tracks which serve lumber yards are located off of the terminal next to the lumber yards Dixieline and Weyerhaeuser located east of the terminal along Tidelands avenue in National City. Trains arrived at the yard and were broken into sections for vehicle loading and reassembled upon departure.

5.2 Activity

BNSF provided an estimate of the number of cars moved in 2012, and this estimate was used to calculate the number of trains and locomotives. The number of locomotive was used to estimate the number of near-port locomotive hours. The weight of the rail cars and locomotives was used to determine gross train tonnage and, combined with the rail distance in the study area, the gross ton-miles (GTM).

BNSF uses two main types of auto-rack rail cars called tri-level and bi-level. Tri-level rail cars have three levels and are limited to moving low height passenger cars, and bi-level rail cars are used to transport taller SUVs and trucks. The rail car specifications were provided by BNSF (2013). The tri-level rail car's light (empty) weight is 105,800 in pounds and can fit up to 15 passenger cars (e.g. Hyundai Sonata's weighing about 3,300 pounds apiece), so the loaded weight is about 155,000 pounds. The bi-level rail car's light weight is 100,000 pounds and can hold about 10 trucks or SUVs (e.g. Honda Pilots at 4,500 pounds apiece) or a loaded weight of 145,000 pounds. About half of each rail car type were assumed to be used resulting in an average car light weight of 51.5 tons and loaded weight of 75 tons.

Flexibeam cars are appropriate rail cars used for cut lumber transport with a light weight of 70,500 pounds and a maximum loaded weight of 286,000 pounds.

Using the car and locomotive tonnage, the total tonnage one-way (either inbound or outbound) was estimated as shown in Table 5-1 from the BNSF estimate of the number of rail cars moved in 2012. For 2012, the 2006 Port inventory's assumption that each train consisted of 50 cars and three locomotives per train was used to estimate the number of trains and locomotives. The total freight annual tonnage inbound and outbound together was about 2 million tons.

Figure 5-1. Rail lines near port at NCMT. (Port of San Diego)

Table 5-1. Rail car activity at NCMT.

Type	Inbound	Outbound	Weight Each (tons)	Annual Tonnage
Loaded Auto Cars	1,000	13,000	75.0	1,050,000
Unloaded Auto Cars	12,000	0	51.5	618,000
Loaded Lumber Box Cars	275	0	143	39,325
Unloaded Lumber Box Cars	0	275	35.25	9,694
Locomotives[a]	798	798	208	331,968
Total				**2,048,987**

a. 3 Locomotives per 50 cars

The on port locomotive hours of use activity was taken from the 2006 emission inventory estimate that 468 trains demanded 3,510 locomotive hours. For 2012, the estimated number of locomotive hours increased to 3,990 hours based on the ratio of the 532 trains (inbound plus outbound) estimated for 2012 to the 468 trains in 2006. The locomotives hours were distributed across the modes presented in Table 5-2 for idle and notches 1 through 8 representing the EPA switch engine duty cycle for breaking and assembling trains characteristic of near port activity.

Table 5-2. Near terminal locomotive mode fraction.

Mode	Time Fraction
Idle	59.8%
1	12.4%
2	12.3%
3	5.8%
4	3.6%
5	3.6%
6	1.5%
7	0.2%
8	0.8%

For regional activity, all inbound and outbound trains were expected to operate along the main line within San Diego County, which was determined to be a one-way distance of 65.7 miles (from NCMT, National City, to the San Diego/Orange County Line), derived from the mile posts provided in the BNSF system map. The route is relatively level crossing no mountain ranges. All inbound trains were assumed to originate and all outbound trains were assumed to terminate outside the county. Multiplying the total gross tonnage from Table 5-1 by 65.7 miles (track mile 273.1 at National City minus 207.4 at the County Line) leads to an estimate of 134,618,429 gross ton-miles (GTM).

From Gould and Niemeier (2011), an intermodal train fuel consumption figure of 700.8 GTM/gallon (without adjustments for grade) was used to estimate the train activity within the county. Combined with the gross tonnage and system mileage, the fuel consumption estimate

provides the expected fuel consumption in the county under line-haul conditions. This leads to an estimate of 187,124 gallons consumed by inbound and outbound trains from the Port.

5.3 Emissions Methodology

The emission estimates were addressed for near port and region wide using two different methods. The near port activity used per mode emission rates with the estimated fleet composition. Equation 5-1 shows the basic calculation method for near port activity. The regional emission used a method combining estimated main line fuel consumption (from train gross tonnage and miles traveled) and emission factors as a function of fuel consumption. Equation 5-2 shows the calculation method for regional emissions.

Emissions (near port) = Number of Locomotives x Time in Mode (hrs.) x EF (g/hr) (5-1)

Emissions (regional) = Gross Tonnage x Mileage x Fuel Consumption (gal./GTM) x EF (g/gal.) (5-2)

BNSF indicated that the locomotive fleet serving the Port needed to satisfy the South Coast Tier 2 averaging agreement (ARB, 1998). For 2012 the BNSF fleet consisted of 90% Tier 2 and 10% Tier 1+, where the '+' indicated a rebuilt engine. BNSF primarily runs General Electric (GE) ES44 Tier 2 locomotives and Tier 1 Dash 9 line-haul locomotives. No switching engines were used at the Port, and the line-haul locomotives were used instead of switching engines to break and assemble trains.

Emission factors and fuel consumption by notch used in this study are the same as those used in the Port of Oakland 2005 Seaport Air Emissions Inventory (ENVIRON, 2008), with adjustments for updated fuel sulfur values and new emission standards applied as described here.

The PM emissions were corrected to 15 ppm fuel sulfur using the methodology described by ARB (2005b) to adjust PM emission rates from an average fuel sulfur level of 0.3% used during emissions testing. Low sulfur fuel was mandated nationwide starting in 2012 and in California before 2012. Emission reductions in terms of percent reduction by notch calculated for GE engines shown in Table 5-3 were applied to the base emission rates to calculate the emission rates at the in-use fuel sulfur levels for each locomotive model.

Table 5-3. Locomotive - Fuel sulfur PM emission reductions by notch and engine type. (ARB, 2005b).

Notch	Coefficient B[a]	Coefficient A[a]	Fuel Sulfur 0.3% PM (g/hp-hr)	Fuel Sulfur 15 ppm PM (g/hp-hr)	Reduction
GE 4-stroke Engine					
8	0.00001308	0.0967	0.13594	0.0968962	28.72%
7	0.00001102	0.0845	0.11756	0.0846653	27.98%
6	0.00000654	0.1037	0.12332	0.1037981	15.83%
5	0.00000548	0.132	0.14844	0.1320822	11.02%
4	0.00000663	0.1513	0.17119	0.1513995	11.56%
3	0.00000979	0.1565	0.18587	0.1566469	15.72%

a. Coefficients are used in the ARB fuel sulfur adjustment equation: PM emissions = B x (fuel sulfur) + A

No emissions data were available for Tier 0, 1, and 2 rebuilt engines, so the emission factor ratio adjustment shown in Table 5-4 was applied to the pre-rebuild engine emission rates using the EPA (2009) estimated emission factors. No change in CO or fuel consumption was expected due to the rebuild.

Table 5-4. Emission ratio due to rebuild. (EPA, 2009).

Tier	HC	NO_x	PM
0+ / 0	0.625	0.837	0.625
1+ / 1	0.617	1.000	0.625
2+ / 2	0.500	0.900	0.444

The final by-mode emission rates (in units of grams per hour) that include the adjustments described in Tables 5-3 and 5-4 are provided below in Table 5-5 which ARB reviewed in detail, approved, and used to evaluate air quality in West Oakland[9].

Table 5-5. Emission factors (gram/hour) by mode. (ENVIRON, 2008).

Locomotive Class and Emission	Tier	Idle	Dynamic Brake	Notch							
				1	2	3	4	5	6	7	8
Dash 9 HC	1+	34	191	130	184	374	440	487	574	604	675
Dash 9 CO	1+	49	461	244	368	896	1,505	1,788	2,014	2,714	3,356
Dash 9 NO_x	1+	376	2,036	1,538	4,672	14,369	16,071	13,855	18,020	20,886	23,913
Dash 9 PM	1+	10.6	55.3	38.8	87.6	160.1	212.0	235.7	273.7	245.1	346.6
Dash 9 Fuel (lb/hr)	1+	19.7	54.3	85.9	183.9	371.2	509.5	719.9	938.1	1161.4	1461.0
ES44 HC	2	24	65	62	120	220	224	311	408	488	619
ES44 CO	2	30	120	142	239	607	806	479	537	790	1,034
ES44 NO_x	2	329	657	1,135	2,730	5,310	7,246	9,612	13,455	16,005	18,566
ES44 PM	2	7.7	42.0	69.3	145.8	256.5	322.8	360.5	352.2	369.8	433.0
ES44 Fuel (lb/hour)	2	19.9	43.9	101.7	209.3	447.3	612.3	824.7	1060.0	1310.0	1598.1

To estimate CO_2, N_2O, and CH_4 emissions for locomotives, a ratio was applied to fuel consumption for CO_2 and N_2O and THC emissions for methane. The CH_4/THC ratio was determined using the ARB SPECIATE TOG profile number 818 for diesel engines, which provides the weight fraction of methane and other chemical species in the exhaust emissions. The fraction of TOG that is THC was determined by subtracting the weight fraction of the oxygenated species (alcohol, aldehydes, and ketones) that do not respond to the flame ionization detection method that is used to measure THC. The N_2O emission factor estimate was assumed to be the same as other diesel engines at 0.018 g/kW-hr that is available in the ARB emission inventory tool for diesel engines on Ocean-Going Vessels[10] and dividing by an assumed average fuel consumption of 210 g/kW-hr to derive an emission factor in terms of fuel consumption. This leads to an N_2O emission factor of 0.039 g/lb-fuel. Finally, CO_2 was estimated using the fuel consumption and converting to CO_2 by multiplying by the molecular

[9] http://www.arb.ca.gov/ch/communities/ra/westoakland/westoakland.htm
[10] http://www.arb.ca.gov/msei/categories.htm#ogv_category

weight of CO_2 of 44 divided by the per carbon molecular weight of diesel fuel of 13.8 (approximately 1.8 hydrogen atoms for each carbon atom).

For regional emissions estimates, it is easier to use emission factors in units of grams per gallon because gallons of fuel consumption could be estimated rather than a distribution of time in mode. The EPA (2009) emission rates in units of grams per gallon are shown in Table 5-6 for the national average fleet, individual Tier 1+ and Tier 2 engines, and the BNSF 2012 averaged South Coast specific fleet.

Table 5-6. Emission factors (g/gallon) for large line-haul locomotives (EPA, 2009).

Calendar Year	HC[a]	CO	NO_x	PM
2006 EPA National	9.5	26.6	180	6.4
2012 EPA National	7.1	26.6	144	4.1
Tier 1+	6.0	26.6	139	4.2
Tier 2	5.4	26.6	103	3.7
2012 Average South Coast	**5.5**	**26.6**	**107**	**3.8**

[a] ROG to HC ratio for diesel engines is 1.21 from Wong, ARB (2007)

In addition, the SO_2 and CO_2 emission rates were calculated from the fuel consumption. Locomotive fuel sulfur levels were mandated by EPA to be 15 ppm starting June 2012 nationwide, but locomotives refueling in California were mandated to use 15 ppm before 2012. EPA (2009) provided the estimated SO_2 (at 15 ppm) and CO_2 emission rates to be 0.093 and 10,217 (g/gallon) respectively. Methane and nitrous oxide were estimated using the same approach for the near port emission estimates described above.

5.4 Results

By combining the regional gallons consumed in the county and near port locomotive hours by mode with the emissions rates described in this chapter, the locomotive emissions were estimated for calendar year 2012 and shown in Table 5-7.

Table 5-7. Emission (tons) locomotives in 2012.

Estimate	ROG	CO	NO_x	PM_{10}	$PM_{2.5}$	DPM	SO_2	CO_2	CH_4	N_2O	CO_2e
Regional	1.40	5.64	22.57	0.80	0.74	0.80	0.02	2,163	0.06	0.06	2,183
Near Port	0.46	0.80	9.30	0.34	0.31	0.34	0.01	1,000	0.02	0.03	1,009
Total	**1.86**	**6.44**	**31.87**	**1.14**	**1.05**	**1.14**	**0.03**	**3,163**	**0.08**	**0.08**	**3,192**

6.0 ON-ROAD VEHICLES

On-road vehicles comprise a variety of vehicles types, including: drayage trucking; smaller service vehicles, such as those used for transporting local perishable products for shipping or supplies for cruise ships; and light-duty automobiles and trucks from car import/ export or to carry passengers to and from the cruise terminal. This section describes the emissions estimation methodologies and results for the on-road vehicles that serve the Port.

6.1 Background

The on-road vehicle activity evaluated in this inventory includes the main freight and passenger traffic for the following terminals owned and overseen by the Port:

- Cruise Ship Terminal (CST)
- 10th Avenue (TAMT)
- National City (NCMT)

Vehicles that served CST in 2012 consisted of taxis, shuttle and charter vehicles, buses, and personal vehicles. The bus and for-hire vehicles were assumed to make round trips to and from the airport, while personal vehicles were assumed to make trips from the population centroid of San Diego County.

Both TAMT and NCMT are cargo terminals, where drayage trucks, reefers, and other heavy-duty freight vehicles delivered to or picked up from and transported goods to local stores or to other distribution centers in California, Nevada, and Arizona.

New imported cars arriving at the Port were off-loaded at the NCMT and driven a short distance and stored temporarily at a parking area on or near the terminal prior for loading onto trucks or rail. Emissions from imported vehicle off-loading are included in this inventory.

The vehicle activities not included in this inventory are employee-owned, small delivery (e.g. FedEx), and other miscellaneous and unscheduled vehicle traffic that could not be well defined. The G St. Tuna Harbor marina did not create significant freight traffic to warrant evaluation for this inventory.

6.2 Emission Calculation Methodology

It was important to account for all vehicle traffic to and from terminals in terms of vehicle type and number of trips, and descriptions of those trips in terms of the speed and distance. Using the number of visits by vehicle type and model year, and an estimate of the average trip mileage and speed, on-road vehicle exhaust and evaporative emissions were estimated as follows:

$$Emissions = \frac{EF \times Miles \times Trips}{(453.6 \times 2000)} \quad (6\text{-}1)$$

Where:

Emissions is the annual emissions in tons,
EF is the vehicle type-, regional-, model year-, and speed-specific emission factor in grams per miles traveled; generated using ARB's EMFAC 2011 model
Miles is the miles traveled in one trip,
Trips is the number of trips
(453.7 x 2000) is a conversion from grams to tons.

For idling activities, the "miles traveled" were substituted for "idling hours." Starting emissions for new car off-load were also estimated using a similar method, except that emissions were based on the number of trips instead of miles. For the purpose of this study, one cold-start trip was assigned to each new car off-loaded at the auto terminal.

6.3 Input Data

6.3.1 CST

The vehicles serving passengers at the CST were assumed to be similar to the estimates in the 2006 emission inventory. However, the miles per trip assumptions have been revised for 2012. All buses and for-hire vehicles were assumed to travel between the airport and the CST, a round trip of 5.2 miles. Personal vehicles were assumed to make trips from the population centroid of San Diego County, a round trip of 27.5 miles. Table 6-1 below summarizes the activities for the CST.

Table 6-1. Activities by vehicle type at CST.

Type of Transportation	Vehicle Type Model As	Passengers / Vehicle	Vehicles	Total Passengers	Miles / R-Trip	% of Trips
Taxis	LDA	3	240	720	5.2	24%
Shuttles	MDV	7	45	315	5.2	10%
Charter	LDT1	4	75	300	5.2	10%
Buses	Motor Coach	40	8	320	5.2	11%
POVs	LDA	4	338	1,352	27.5	45%
Total			**706**	**3,007**	**11,209**	**100%**

Each type of vehicle calling to the CST was modeled by the appropriate vehicle class according to the ARB's EMFAC2011 model. Emission factors generated using EMFAC for these vehicles assumed a regional-average model year and speed.

6.3.2 TAMT and NCMT

The main gates located at TAMT and NCMT are monitored and record the truck counts. The number of trips (one trip inbound and outbound for each gate count) by vehicle type were combined with the estimated mileage for trip origination and destination all supplied by the Port to estimate the regional mileage of those vehicle trips.

The activity for all the truck trips was split into three groups: driving and idling on the terminal, driving between the terminal and nearest freeway entrance defined as “near Port”, and driving region wide. Figure 6-1 shows the truck route for trips to the TAMT, and Figure 6-2 outlines the primary route to and from I-5 using Bay Marina to the NCMT. The number of visits (gate counts) to the terminal, the time idling, and distance traveled by speed bin per vehicle were used to determine the on terminal and near Port activities. The remainder of each truck trip was addressed as regional travel, where a general estimate was based on the best available data of origin and destination of vehicle trips. The off-port trips were estimated using Port estimates of major customers and delivery depots for port freight. Tables 6-2 and 6-3 below summarize the activities at TAMT and NCMT, respectively and the estimated truck trip distances by origin and destination.

The Port last collected the age distribution of the truck fleet serving the TAMT and NCMT in 2010. The fleet age distributions are provided in Appendix G for the previous 2006 emission inventory, the 2010 survey, and projected 2012 fleet. In accordance with the Port’s Clean Truck Program, after December 31, 2011, all drayage trucks with 2004 model year or older engines and had a gross vehicle weight rating greater than 33,000 pounds were required to be equipped with a level 3 verified diesel emission control strategy (most probably diesel particulate filters) for PM emissions or be replaced with a new truck. The truck fleet identified by age from the 2010 survey was modified to comply with the ARB drayage truck rule by replacing vehicles with 2004 model year and earlier with trucks of newer model years and distributed equally over 2010, 2011, and 2012.

Figure 6-1. Port of San Diego TAMT truck route.

Figure 6-2. Port of San Diego NCMT truck route.

Table 6-2. Activities by vehicle type at the TAMT.

Mode/Direction	Round Trip Distance (miles)	Idling (hours)	Average Speed (mph)	Round Trips
In terminal				
Driving	0.5	---	12	42,370
Idling	---	0.25	0	42,370
To and from I-5				
Cesar Chavez Pkwy./Crosby Dr.	0.6	---	25	18,243
E. Harbor Dr.	2.2	---	40	18,243
S. 28th St.	0.6	---	25	18,243
Regional				
Reefer - North (I-5)	118	---	Aggregate	18,243
Reefer - NE (I-15)	113	---	Aggregate	2,684
Reefer - East (I-8)	150	---	Aggregate	2,904
Bulk – (SE I-5/905 Otay Mesa)	17	---	Aggregate	350
Bulk – NE (I-15 Victorville, CA)	113	---	Aggregate	18,189

Table 6-3. Activities by vehicle type at the NCMT.

Mode	Round Trip Distance (miles)	Idling (hours)	Average Speed (mph)	Round Trips
In terminal				
Driving	---		12	19,868
Idling	---	1.5	---	19,868
To and from I-5				
Bay Marina Dr.	1.2	---	35	19,868
Regional				
Outside San Diego County – (NE I-15 Mira Loma, CA)	114	---	Aggregate	16,748
From Lumber Yards				
Within San Diego County	34	---	Aggregate	2,974
Outside San Diego County	114	---	Aggregate	146

6.3.3 Imported Cars Off-Load

Imported cars off-loaded at the NCMT were driven a short distance of 1.5 miles at 10 miles per hour to a parking area, as assumed in the 2006 inventory. In 2012, there were a total of 306,620 new cars off-loaded at the Port (see Table 6-4). They were modeled as model year 2012 light duty vehicles using EMFAC2011.

Table 6-4. Imported car arrivals by month at Port in 2012.

Month	# Cars	Miles / Trip
Jan	23,146	1.5
Feb	23,622	1.5
Mar	23,842	1.5
Apr	25,942	1.5
May	25,403	1.5
Jun	28,917	1.5
Jul	28,750	1.5
Aug	23,435	1.5
Sep	20,127	1.5
Oct	26,493	1.5
Nov	29,591	1.5
Dec	27,352	1.5
Total	**306,620**	**459,930**

6.4 Emissions Summary

Emissions from on-road vehicles serving the Port in 2012 are summarized in Table 6-5 below.

Table 6-5. Summary of on-road source emissions. (tons)

Terminal	Sources	ROG	TOG	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O	CO_2e
CST	Taxis	0.0002	0.0002	0.0025	0.0003	0.0000	0.0001	0.0000	0.5	0.0000	0.0000	0.5
	Shuttles	0.0000	0.0000	0.0001	0.0002	0.0000	0.0000	0.0000	0.1	0.0000	0.0000	0.1
	Charter	0.0001	0.0002	0.0015	0.0002	0.0000	0.0000	0.0000	0.2	0.0000	0.0000	0.2
	Buses	0.0000	0.0000	0.0001	0.0005	0.0000	0.0000	0.0000	0.1	0.0000	0.0000	0.1
	POVs	0.0016	0.0018	0.0189	0.0019	0.0000	0.0005	0.0002	3.4	0.0002	0.0001	3.5
	Subtotal	***0.0019***	***0.0022***	***0.0231***	***0.0030***	***0.0000***	***0.0006***	***0.0003***	**4.2**	**0.0002**	**0.0001**	**4.3**
TAMT	On-Terminal	0.14	0.16	0.60	1.26	0.00	0.01	0.01	153.4	0.0065	0.0021	154.1
	Near Port	0.03	0.03	0.12	0.54	0.00	0.02	0.02	123	0.0013	0.0041	124.3
	Regional	2.22	2.52	10.12	40.43	0.09	2.15	1.68	9,489.40	0.1029	0.3249	9,592.30
	Subtotal	***2.38***	***2.71***	***10.84***	***42.23***	***0.09***	***2.19***	***1.71***	**9,765.80**	**0.1107**	**0.3311**	**9,870.70**
NCMT New Vehicles	New Cars	0.11	0.13	1.64	0.10	0.00	0.03	0.01	427.7	0.0086	0.0013	428.3
NCMT	On-Terminal	0.29	0.33	1.48	2.81	0.00	0.02	0.02	297.1	0.0136	0.0033	298.4
	Near Port	0.01	0.01	0.04	0.20	0.00	0.01	0.01	46.6	0.0005	0.0016	47.1
	Regional	0.90	1.02	4.09	16.26	0.04	0.87	0.68	3,882.50	0.0416	0.133	3,924.60
	Subtotal	***1.20***	***1.36***	***5.61***	***19.28***	***0.04***	***0.90***	***0.71***	**4,226.20**	**0.0557**	**0.1378**	**4,270.10**
	Total	**3.70**	**4.21**	**18.11**	**61.60**	**0.14**	**3.11**	**2.43**	**14,423.90**	**0.1753**	**0.4704**	**14,573.40**

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7.0 SUMMARY OF RESULTS

7.1 Introduction

This section summarizes the Port's Maritime Air Emissions Inventory for 2012 and describes the source categories that contribute most to the overall results. The 2012 inventory was prepared using updated activity estimates that reflects the best understanding of 2012 maritime-related activities at the Port.

Furthermore, the 2012 inventory is compared with the 2006. The comparison discusses the differences, by source category, between the two inventories in terms of Port operations, methods used to estimate the activity, regulations that have affected sources, and changes that ARB has made to the emission inventory methods or emission factors. This discussion provides context for the changes in results seen between the 2012 and 2006 inventories.

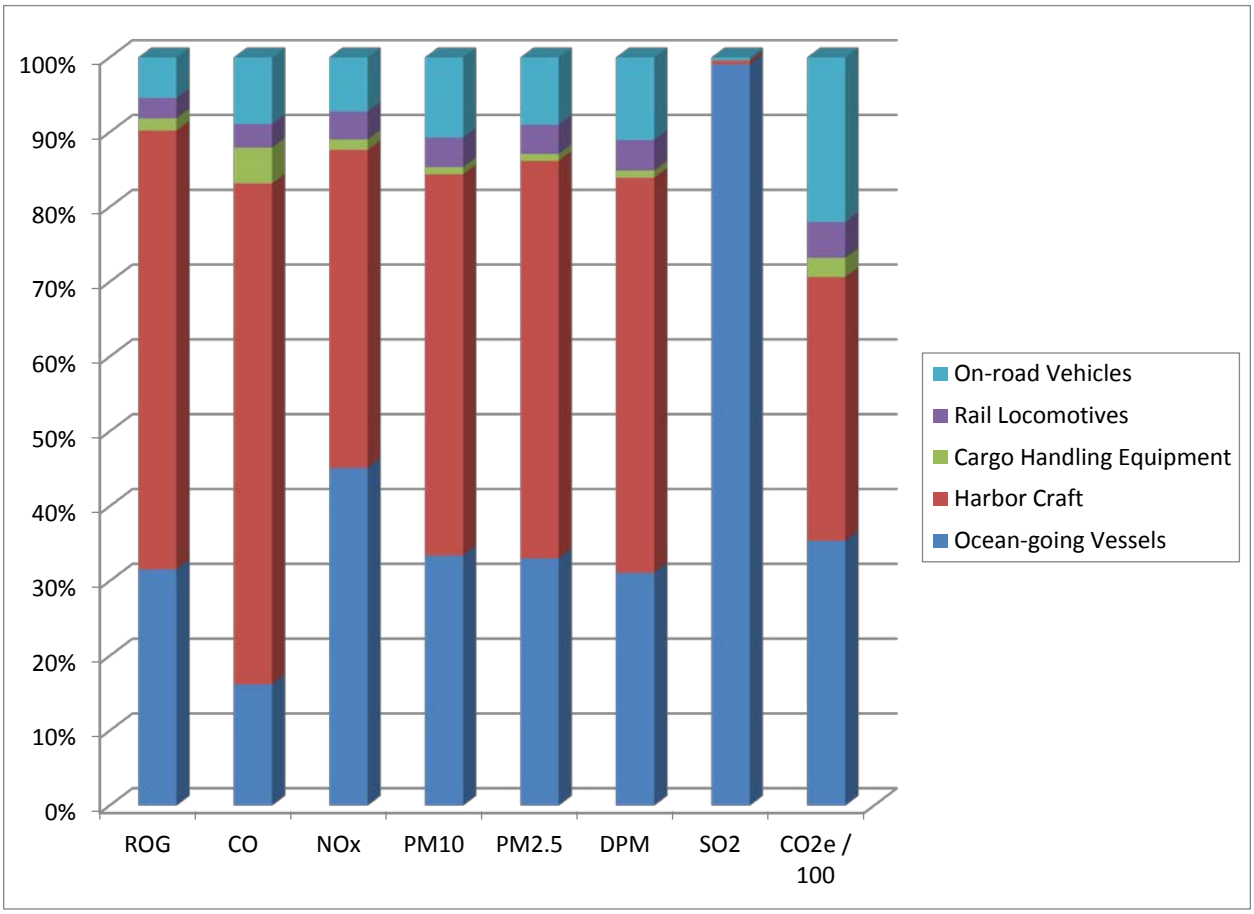
7.2 Air Emissions Inventory for 2012

The 2012 air emissions inventory by source category is summarized in Table 7-1 and portrayed in Figure 7-1. Commercial harbor craft and OGV activity represent the two largest criteria pollutant and GHG emission source categories followed by on-road vehicles. NOx accounted for the most emissions per ton of the criteria pollutants followed by CO and ROG. As presented in Figure 7-1, harbor craft and OGVs were the primary sources of these emissions. Together, OGVs and harbor craft accounted for roughly 70% of the GHG emissions. Further details regarding each source category will be discussed in Sections 7-4 through 7-8.

Table 7-1. 2012 Emissions by source category (tons).

Category	ROG	CO	NO_x	PM_{10}	$PM_{2.5}$	DPM	SO_2	CO_2	CH_4	N_2O	CO_2e
Ocean-going Vessels	20.9	31	368	9.26	8.52	8.28	41.25	22,287	1.9	0.7	22,551
Harbor Craft	40.1	136	362	14.79	14.35	14.79	0.22	23,075	3.2	0.8	23,387
Cargo Handling Equipment	1.1	10	12	0.28	0.25	0.27	00.02	1,674	0.3	0.0	1,680
Rail Locomotives	1.9	6	32	1.14	1.05	1.14	00.03	3,163	0.1	0.1	3,192
On-road Vehicles	3.7	18	62	3.11	2.43	3.09	0.14	14,424	0.2	0.5	14,573
Total (tons)	67.7	202	836	28.59	26.60	27.57	41.65	64,624	5.7	2.1	65,383

Figure 7-1. Distribution of 2012 emissions by category.



To provide perspective on the emissions from maritime-related activities generated at the Port, Table 7-2 presents additional sources of emissions between 2010 and 2012 from facilities and/or operations around San Diego Bay and within San Diego County. The table adds context to the understanding of emissions within localized areas as well as regionally. It should be noted that the emissions presented in the table are not directly comparable due to differences in the types and quantities of sources related to each facility or operation. The emissions presented for San Diego County comprise all sources, including both stationary and mobile sources. The Port's maritime contribution to the county-wide emissions during 2012 for ROG and the fractions of PM are less than 1%. For NOx and SO_2, the Port's contribution to county-wide emissions accounts for 2% and 11%, respectively. OGVs represent the most significant source of SO_2 from maritime operations because, while OGVs have been using low 3,000 ppm sulfur fuel compared with 27,000 ppm in 2006, other maritime source categories use ultra-low 15 ppm sulfur fuel. The County emissions of NOx and PM are largely due to on-road vehicles.

Table 7-2. Emissions in San Diego County (tons per year).

Emissions Inventory	Year	Source	ROG/VOC	NOx	PM_{10}	$PM_{2.5}$	SO_2
Port of San Diego Maritime Emissions	2012	2012 Emissions Maritime Air Emissions Inventory	67.7	836	28.6	26.6	41.7
National Steel and Shipbuilding Co.	2012	ARB Facility Database[a]	105.7	8.7	13.1	9.1	0
San Diego International Airport	2010	Baseline Air Emissions Inventory[b]	154.2	940.1	20.5	18.9	90.4
San Diego County	2012	ARB 2013 Alamanac[c]	45,990	38,690	26,280	7,300	365

a. The ARB Facility Emissions Data was accessed at http://www.arb.ca.gov/ei/disclaim.htm

b. Final Draft San Diego International Airport Air Quality Management Plan Criteria Pollutant and Greenhouse Gases Baseline Emissions Inventory. Results presented in Table 7-2 are a summary of mobile sources including: aircraft, ground support equipment, auxiliary power units, and motor vehicles.

c. The California Almanac of Emissions and Air Quality-2013 Edition. Prepared by the Air Quality Planning and Science Division California ARB.

7.3 2012 Emissions Inventory and Comparison with 2006 Emissions Inventory

In 2012, the Port maritime activity was similar in type to that in 2006 with lower freight and passenger throughput (i.e. level of activity). While refrigerated container activity held constant, refrigerated and other bulk cargo throughput was reduced at TAMT. In addition, cruise ship calls were down to almost half the level of 2006. Auto carrier traffic increased modestly and lumber barges continued to make regular calls at NCMT. The effect of reduced vessel calls and passengers at CST and TAMT was a decrease in vehicle traffic and shore-based off-road equipment activity. The decrease in activity as well as regulations led to reductions in emissions measured in 2012 as compared to 2006.

The results of the 2012 emissions inventory are summarized in Table 7-3. As indicated in Section 1.4, more refined data regarding vessel movements available during the preparation of the 2012 inventory showed that most OGVs transited at slower speeds and used shorter routes within the study area than was assumed in the original 2006 emission inventory. In addition, ARB provided harbor craft emission factors that were significantly higher than those used in the original 2006 inventory. To provide a fair comparison with the 2012 emissions inventory, the 2006 OGV and harbor craft emissions were recalculated. Table 7-4 and Table 7-5 provide the results from the revised 2006 inventory and the percent change between 2012 and 2006, respectively. Figure 7-2 portrays a graphical comparison between the 2012 and the 2006 emission inventories.

Table 7-3. 2012 Emissions by source category (tons).

Category	ROG	CO	NO_x	PM_{10}	$PM_{2.5}$	DPM	SO_2	CO_2	CH_4	N_2O	CO_2e
Ocean-going Vessels	20.9	31	385	9.29	8.52	8.28	41.2	22,287	1.9	0.7	22,551
Harbor Craft	40.1	136	362	14.79	14.35	14.79	0.2	23,075	3.2	0.8	23,387
Cargo Handling Equipment	1.1	10	12	0.28	0.25	0.27	0.0	1,674	0.3	0.0	1,680
Rail Locomotives	1.9	6	32	1.14	1.05	1.14	0.0	3,163	0.1	0.1	3,192
On-road Vehicles	3.7	18	62	3.11	2.43	3.09	0.1	14,424	0.2	0.5	14,573
Total	67.7	202	836	28.59	26.60	27.57	42	64,624	5.7	2.1	65,383

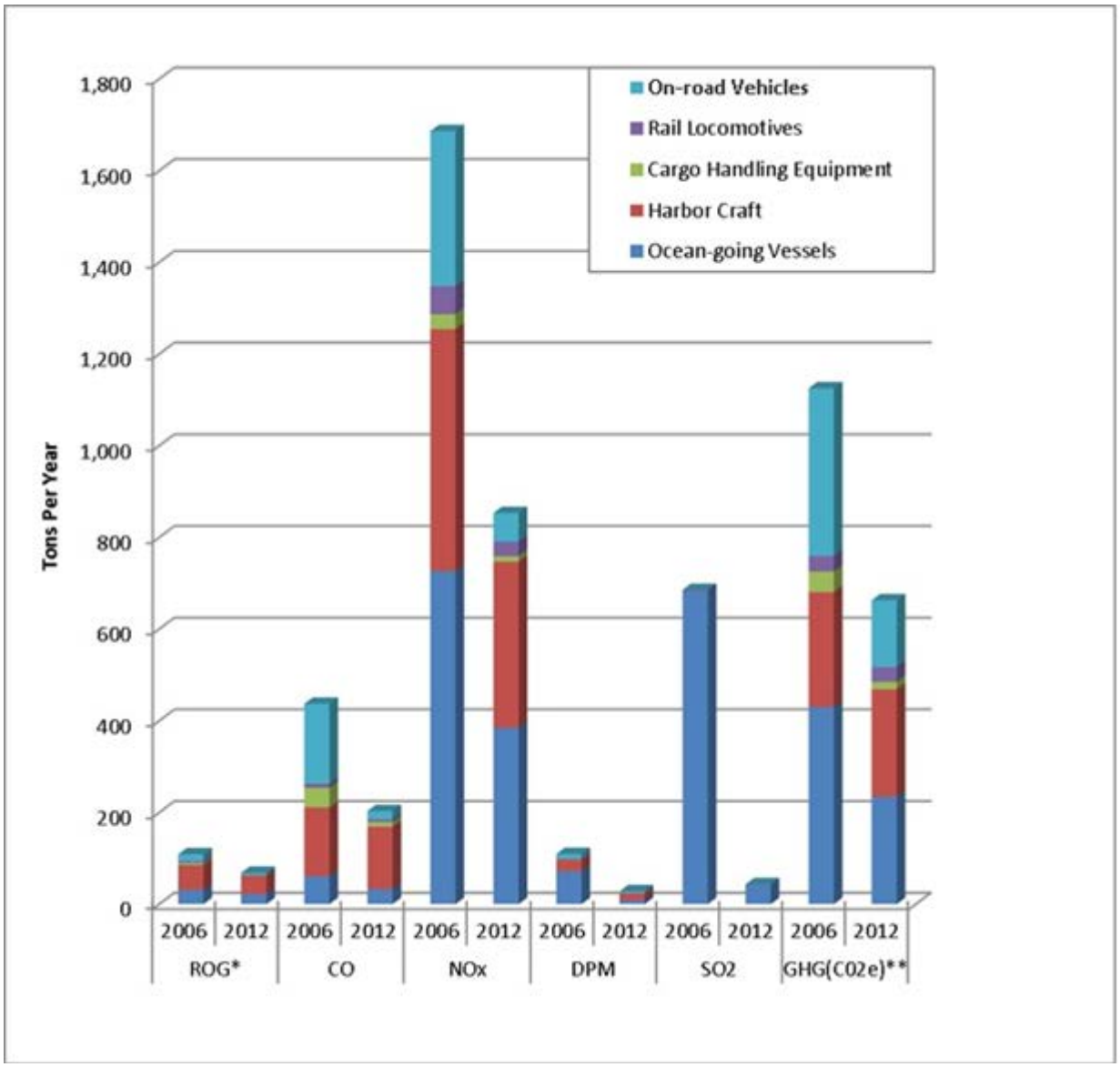
Table 7-4. Revised 2006 emissions by source category (tons).

Category	ROG	CO	NO_x	PM_{10}	$PM_{2.5}$	DPM	SO_2	CO_2	CH_4	N_2O	CO_2e
Ocean-going Vessels	31.2	61	726	82.4	75.8	72.2	681.0	42,563	3.2	1.1	42,963
Harbor Craft	54.6	150	528	23.8	23.1	23.8	0.2	24,751	4.9	0.8	25,116
Cargo Handling Equipment	4.0	43	33	1.0	0.9	0.9	0.0	4,412	0.2	0.1	4,452
Rail Locomotives	3.4	9	61	2.1	2.0	2.1	4.1	3,368	0.3	0.1	3,400
On-road Vehicles	15.5	174	338	10.6	9.8	10.5	0.2	36,168	1.2	1.2	36,567
Total	**108.7**	**436**	**1,686**	**119.9**	**111.6**	**109.5**	**686**	**111,262**	**10**	**3**	**112,498**

Table 7-5. Change from revised 2006 to 2012 emissions by source category (tons).

Category	ROG	CO	NO_x	PM_{10}	$PM_{2.5}$	DPM	SO_2	CO_2	CH_4	N_2O	CO_2e
Ocean-going Vessels	-33%	-48%	-49%	-89%	-89%	-89%	-94%	-48%	-40%	-34%	-48%
Harbor Craft	-26%	-9%	-31%	-38%	-38%	-38%	-7%	-7%	-34%	-7%	-7%
Cargo Handling Equipment	-72%	-77%	-64%	-72%	-72%	-70%	-50%	-62%	60%	-100%	-62%
Rail Locomotives	-45%	-28%	-48%	-46%	-47%	-46%	-99%	-6%	-73%	-15%	-6%
On-road Vehicles	-76%	-90%	-82%	-71%	-75%	-71%	-30%	-60%	-85%	-61%	-60%
Total	-38%	-54%	-50%	-76%	-76%	-75%	-94%	-42%	-42%	-38%	-42%

Figure 7-2. Emission comparison for 2006 and 2012.



*Hydrocarbons (HC) was reported in 2006 whereas Reactive Organic Gas (ROG) was calculated in 2012 which includes all hydrocarbon compounds minus methane.
**For comparative purposes, greenhouse gas emissions, represented as CO2e, was divided by 100.

Overall, all source categories demonstrated emissions reductions of the criteria pollutants and greenhouse gases during 2012 as compared to 2006. OGVs, cargo handling equipment, and on-road vehicles exhibited the greatest reductions of emissions. Together, these three source categories reduced GHG emissions by approximately 54% of their 2006 baseline. Primarily, the reductions of GHGs are due to decreased activity including fewer OGV calls, lower berthing time, and reduced freight; a reduction of roughly 50% in the operating time of cargo handling equipment; and a decrease of approximately 53% drayage truck activity at the marine terminals. A smaller portion of the decrease in GHGs can be attributed to emission control

programs including the Port's shore power and VSR programs. Criteria pollutants for these source categories were drastically reduced—often by greater than 50%. In particular, SO_2, PM and DPM, and NOx showcased significant reductions. These decreases are the result of regulations which targeted specific sources and pollutants such as the Drayage Truck Rule and the requirement for OGVs to use low sulfur fuel in California waters. Overall, ship calls during 2012 produced fewer emissions than during 2006.

Comparatively, harbor craft and locomotives experienced less of a reduction of criteria pollutants and greenhouse gases during 2012. This is partially due to the fact that harbor craft activity is not entirely dependent upon OGV activity. CO_2 for harbor craft decreased by 7% during 2012 indicating that the overall activity of this source category was relatively similar to the 2006 inventory. The regulatory schedules targeting engine replacements or upgrades for harbor craft began in 2009 for engines older than model year 1975 and are due to replace engines through 2022 whereby all engines will meet model year 2007 standards. As such, the turnover of the harbor craft fleet has only just begun. As vessel engines are replaced with cleaner engines, more reductions of criteria pollutants are expected to occur. Furthermore, locomotive activity actually increased during 2012 as more trains transported imported vehicles arriving at NCMT. The lower emissions produced by locomotives between the two inventories is largely a product of a voluntary agreement between BNSF and ARB to lower emissions of NOx within the South Coast Air Basin. Further use of rail is expected in the future, which will decrease the need for on-road vehicle or truck activity thereby further reducing emissions.

To further understand the changes between 2012 and 2006 at a more detailed level, the remainder of this section outlines operational, activity, and methodological changes that occurred in the preparation of the 2012 emission inventory compared to the 2006 emission inventory for each source category.

7.4 Ocean Going Vessels

7.4.1 Operational Changes

OGV calls to the Port were approximately 22% fewer in calendar year 2012 at 411 compared with 530 calls in calendar year 2006 contributing to a reduction in ship transit and at berth emissions. Berthing time per ship call decreased from 41 hours in 2006 to 25.5 hours on average reducing at berth ship emissions. Table 7-6 details the ship calls and berthing time by ship type. There were fewer bulk carrier, cruise and refrigerated cargo ship calls but more auto carrier calls in 2012. Refrigerated cargo calls dropped to zero in 2012 as operations shifted at TAMT. Many ship types, particularly bulk carriers, spent less average time in port in 2012 than in 2006.

Table 7-6. Calls and berthing time by ship type.

Ship	2012 Calls	2012 Per Call Average Berthing Time (hrs)	2006 Calls	2006 Per Call Average Berthing Time (hrs)
Bulk	12	82.0	25	342.1
Cruise Ship	87	12.5	167	13.2
Container	53	62.0	51	62.0
Auto Carrier/RoRo	230	15.5	210	18.3
General Cargo	29	54.3	35	51.0
Refrigerated Cargo	0	--	40	53.6
Tanker	0	--	2	13.8
Total/Average	**411**	**25.5**	**530**	**41.0**

7.4.2 Regulations and Port Programs

As presented in Section 1.3, since 2006 there have been a number of regulations aimed at reducing emissions from OGVs. The most significant has been the ARB (2011a) Ocean-Going Fuel rule to use 0.5% or lower sulfur fuel for main and auxiliary engines and boilers within 24 nm of the California coast. The regulation targeted emissions of sulfur and PM. The result has been a 94% reduction in SO_2 and an 89% reduction in PM emissions.

Although ARB's (2007) regulation requiring reduced emissions for OGVs at berth through the use of shore power, or an alternative technology, became enforceable in 2014, the Port finalized shore power at CST in 2010. It is estimated that the use of shore power decreased at-berth emissions of GHGs by roughly 11% from cruise ships during 2012.—particularly NOx and DPM. The Port's voluntary VSR program also is responsible for reducing emissions by 10%. Both of these emissions control programs instituted by the Port have co-benefits of reducing NOx and DPM as well.

7.4.3 Activity Estimate Changes

Since 2006, data regarding vessel activity has become available to more precisely determine transit speeds of OGVs. As described in Section 2.4, for the 2012 inventory, revised baseline transit speed distributions were created which proved to be lower than those assumed for the 2006 inventory. The revised transit speeds distributions represent a change to the understanding of ship activity near the Port. The revised baseline speed distributions were also determined using a more precise definition of the waterside boundary for the 2012 emission inventory.

7.4.4 Methods Changes

Changes to the methods used to estimate emissions primarily affected the calculation of ROG emissions. An increase in the estimated ROG emission factors for OGVs resulted in an increase in the estimated ROG emissions rates relative to other pollutant emissions. The revised ROG emission factors that ARB is currently using in their statewide inventory and that was used in this inventory is a 30% increase over the emission factors used in the 2006 emissions inventory.

The increase ROG emission factors, combined with a revised methane CH_4 fraction of ROG, resulted in increased CH_4 emissions estimates.

The ARB updated auxiliary boiler load factor for container ships used in the 2012 inventory are marginally higher than those used in the 2006 inventory. This resulted in marginally higher non-DPM emissions for this source category.

7.4.5 OGV Comparison between 2012 and 2006

As demonstrated in Table 7-6 above, there were fewer ship calls during 2012 than during 2006. To compare emissions between the two inventories, Tables 7-7 and 7-8 present the summary of emissions per call for all modes (transiting and berthing) compared by OGV type. As indicated in the tables, 2012 emissions were generally lower per call for most of the criteria pollutants than the 2006 inventory. PM and SO_2 emissions were dramatically lower for all vessel types because of the use of low sulfur fuel. A data analysis regarding the reduction of emissions due to the use of low sulfur fuel between 2012 and 2006 can be found in Appendix I. Small NO_x reductions were realized from new ships built after 2011, which met international regulations for Tier 2 engine standards.

Overall, greenhouse gas emissions were lower per ship call for OGVs. However, greenhouse gas emissions fluctuated per ship type between 2012 and 2006. The differences between 2012 and 2006 can be attributed to a variety of factors. In 2006, bulk refrigerated cargo vessels, or reefers, and container ships that carried refrigerated cargo were combined, and most comparable to the container ship category in the 2012 emission inventory. During 2012 there were no reefers included in the inventory of calls. Reefers have a lower power for both propulsion and auxiliary engines. When coupled with container ships, the lower emissions produced by reefers drove down the average greenhouse gas emissions during 2006. Likewise, auto carriers and RoRo were combined to compare with the 2012 auto carrier category. There were slightly more auto carrier calls during 2012 which explains the slight increase in greenhouse gas emissions during 2012. Most importantly, bulk carriers and tankers were combined into one bulk category in 2012. Bulk ships during 2006 accounted for an average berthing time of 342 hours compared with only 82 hours during 2012. As a result, bulk ship emissions of greenhouse gases were reduced by 75% in 2012.

Additional changes to the activity levels of OGVs between the two inventories is due to the distance travelled and length of time ships spend within the study area as they arrive and depart from the Port. During 2012, there were fewer ships travelling south to the Port or north from the Port. Vessels travelling to or from the north spend more time within the study area producing more emissions than those ships travelling to or from the south. Furthermore, the Port's emission reduction programs also contributed to a decrease in greenhouse gas emissions. During 2012, 268 inbound and 200 outbound ships met the VSR requirements as ship speeds were voluntarily reduced within 20 nm of Point Loma. As a result, the VSR program reduced transiting emissions by roughly 10%. Further reductions in greenhouse gas emissions

were realized as cruise ships plugged into shore power. Overall, 17 cruise ships connected to shore power during 2012 reducing at berth emission by approximately 11%.

Table 7-7. Transiting and berthing emissions per call by ship type (pounds) in 2012.

Vessel Type	ROG	CO	NOx	PM_{10}	$PM_{2.5}$	DPM	SO_2	CO_2	CH_4	N_2O	CO_2e
Auto Carrier	68	81	942	24	22	21	101	53,951	7	1	54,521
Bulk	86	102	1,118	30	27	26	128	68,486	8	2	69,191
Container	175	269	3,241	82	76	70	394	212,029	16	6	214,103
Cruise	154	283	3,343	84	78	78	371	203,713	12	9	206,637
General Cargo	88	130	1,499	37	34	34	153	82,159	8	2	83,017

Table 7-8. Transiting and berthing emissions per call by ship type (pounds) in 2006.

Vessel Type	ROG	CO	NOx	PM_{10}	$PM_{2.5}$	DPM	SO_2	CO_2	CH_4	N_2O	CO_2e
Auto Carrier[a]	60	96	1,086	115	106	108	857	52,819	7	1	53,381
Bulk[b]	207	378	4,333	511	467	444	4,378	273,037	22	7	275,630
Container[c]	107	189	2,289	276	253	220	2,680	165,867	13	4	167,422
Cruise	193	414	5,092	578	532	509	4,665	293,641	19	7	296,299
General Cargo	67	122	1,417	156	139	144	1,211	74,889	6	0	75,667

a. Auto Carrier ships includes both Auto Carrier and RoRo calls.
b. Bulk Carriers and Tankers
c. Container ships include Reefers.

7.4.6 OGV Summary

The following changes have occurred since 2006 affecting the 2012 OGV emissions estimates:

- Available data allowed for a more thorough understanding of ship transit speeds and routes within the 24 nm water-side boundary. As such, the 2006 baseline OGV emissions were recalculated to provide a better comparison to the OGV activity during 2012.
- Vessel calls decreased from 530 to 411 (particularly for cruise and cargo ships) with generally lower berthing times reducing overall OGV activity and GHG emissions.
- Lower sulfur fuels used on vessels due to State regulations beginning in 2009 helped to reduce SO_2 emissions by roughly 94% and PM and DPM emissions by 89%.
- Less ships traveled to or from the Port from the north resulting in less operating hours spent within the study area resulting in a reduction in emissions.
- The Port's VSR program reduced transit emissions by up to 10%. .
- The Port's Shore Power program reduced at berth emissions for cruise ships by about 11%.
- ARB ROG emission rates increased resulting in less of a decrease for ROG emission.s.
- Per call, emissions were reduced during 2012.

Given current regulations and Port programs discussed in Section 1, it is anticipated, on a per call basis, the following future emission reductions will likely occur:

- Fuel sulfur will reduce to 1,000 ppm from 3,000 ppm in 2014 further reducing SO_2 and PM emissions.
- NOx emissions are expected to decrease due to cleaner international emissions standards for marine diesel engines. Tier 1 standards started in 2000, Tier 2standards started with 2011 ships and Tier III will begin with 2016 and later ships and have begun to significantly reduce NOx emissions as fleets turn over.
- Reductions from the Port's VSR and Shore Power programs will also continue to occur in future. The Shore Power program assists in compliance with the ARB's Auxiliary Diesel Engines Operated On Ocean-Going Vessels At-Berth regulation which requires the use of shore power or an equivalent technology to reduce emissions while at berth beginning in 2014.

7.5 Harbor Craft

7.5.1 Operational Changes

Unlike the other source categories included in this inventory, the harbor craft source category increased operating hours between 2012 and 2006. The increase in operating hours for harbor craft is reflective of the fact that harbor craft activity is not as dependent on OGV activity as the other source categories. Excursion vessels used for sightseeing tours and commercial fishing vessels are included in this inventory and do not correlate directly to OGV calls. Table 7-15 identifies the average hours of operation for propulsion engines for harbor craft between 2012 and 2006. Although there was an increase in operating hours during 2012, fuel consumption for the harbor craft activity was relatively constant from 2006 to 2012.

7.5.2 Regulations and Port Programs

Many vessels have replaced engines or entire vessels to meet the ARB regulations (ARB, 2011b) to reduce emissions by requiring owners to update engines in commercial harbor craft. The implementation of the rule began in 2009 and will phase in through 2022 when all vessels need to be a 2008 model year or newer.

7.5.3 Activity Estimate Changes

There were a number of revisions to the harbor craft activity including a change in the description of those vessels and the scope of the survey. For 2012, commercial fishing boats have been defined as those vessels operating out of the Port administered marina based at Tuna Harbor. Since 2006, the definition of vessel categories has been more refined. Table 7-9 identifies the harbor craft propulsion engines' population and activity surveyed in 2012 and 2006. There are some notable differences in the numbers of vessels and engines as well as average hours of use and power. The surveys for 2012 show that the overall activity (combining engine population, average hours and engine power) was higher for assist and ocean-going tugs, tow, and other work boats and lower for commercial fishing and excursions and ferries.

Table 7-9. Propulsion engine activity comparison.

2012				2006			
Vessel Type	Engines	Average Hours	Average Power (hp)	Vessel Type	Engines	Average Hours	Average Power (hp)
Crew and Supply	3	1,590	400	N/A			
Commercial Fishing	82	549	239	Commercial Fishing	44	1,968	350
Excursion and Ferry	29	1,193	423	Excursion	61	1,431	413
Other Service	2	467	200	N/A			
Pilot Vessel	1	1,300	410	Government	4	900	500
Tow Boat	10	1,850	520	Tugboat	29	507	391
Assist and Ocean Tug	21	1,157	1,078	Assist Tug	10	670	1,375
Work Boat	6	959	312	N/A			

7.5.4 Methods Changes

Harbor craft emissions have changed from 2006 primarily due to the use of revised marine engine criteria pollutant emission factors developed by ARB initially in 2008 for the Harbor Craft regulations. The emission factors used for the 2006 emission inventory were generally lower than the ARB zero-hour (when the engine was new) emission factors and were more significantly lower once the ARB deterioration factors were included. As a result of the updated emission factors, the 2006 baseline emissions for harbor craft were recalculated using the more current methods. Table 7-10 shows emissions for the 2006 inventory. Comparatively, Table 7-11 shows the emissions for 2012 and the percent chage between 2012 and 2006. Emission rates in 2012 were reduced for all criteria pollutants and GHGs with a greater than 30% emission reduction for NOx and PM in 2012 due to fleet turnover.

Table 7-10. Harbor Craft emissions by vessel type for 2006.

Vessel Type	ROG	CO	NOx	SO_2	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O	CO_2e
Commercial Fishing	17.4	47.2	160.7	0.07	7.39	7.17	7,347	1.6	0.3	7,458
Excursion & Ferries	23.0	66.1	216.5	0.11	9.69	9.40	11,842	2.1	0.4	12,010
Pilot Vessels	1.9	4.5	19.7	0.01	0.94	0.91	606	0.2	0.0	616
Tow Boats[a]	7.6	18.5	76.3	0.03	3.5	3.41	2,766	0.7	0.1	2,809
Tug Boats[b]	4.6	13.9	54.5	0.02	2.25	2.18	2,191	0.4	0.1	2,223
Total	**54.6**	**150.1**	**527.6**	**0.23**	**23.77**	**23.06**	**24,751**	**4.9**	**0.8**	**25,116**

[a] Called 'tugboat' in 2006 emission inventory report
[b] Called 'assist tug' in 2006 emission inventory report

Table 7-11. Harbor Craft emissions by vessel type for 2012.

Vessel Type	ROG	CO	NOx	SO_2	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O	CO_2e
Crew and Supply	0.7	3.1	3.99	0.00	0.11	0.10	470	0.06	0.02	476
Commercial Fishing	6.7	18.4	63.02	0.02	2.70	2.62	2,441	0.27	0.08	2,473
Excursion & Ferries	6.8	28.5	50.01	0.04	1.73	1.68	4,563	0.61	0.16	4,624
Others	0.2	0.4	1.55	0.00	0.07	0.06	66	0.01	0.00	67
Pilot Vessels	0.7	1.4	6.07	0.00	0.30	0.29	176	0.05	0.01	179
Tow Boats	7.9	22.4	73.48	0.06	3.47	3.37	5,887	0.71	0.20	5,964
Tug Boats	14.8	56.1	138.16	0.08	5.12	4.97	8,696	1.29	0.30	8,814
Work Boats	2.5	6.0	26.07	0.01	1.29	1.25	777	0.22	0.03	790
Total	**40.1**	**136.3**	**362.35**	**0.22**	**14.79**	**14.35**	**23,075**	**3.23**	**0.79**	**23,387**
% Change from Adjusted values in Table 7-10	-26%	-9%	-31%	-7%	-38%	-38%	-7%	-34%	-7%	-7%

7.5.5 Harbor Craft Summary

The primary changes to the harbor craft emission estimates are listed here:

- ARB emissions factors for new and deteriorated harbor craft engines were updated since 2006. To provide a fair comparison between 2012 and 2006, emissions generated from harbor craft during 2006 were recalculated using the updated emissions factors. Overall, there was a decrease in emissions generated from harbor craft between 2012 and 2006.
- Unlike the other source categories in the 2012 inventory which demonstrated dramatically reduced activity, harbor craft activity represented as fuel use (measured through CO_2 emissions) was relatively similar to the 2006 inventory. As a result, harbor craft emissions reductions were less than those produced by other source categories.
- The 2012 inventory showcases a reduction in both criteria pollutant emissions ranging between 9% and 38% depending on the pollutant and a reduction of 7% for GHG emissions.
- Engine upgrades required by ARB regulations and normal turnover within the harbor craft fleet contributed to reduced emissions during 2012.

7.6 Cargo Handling and Other Off-Road Equipment

7.6.1 Operational Changes

The number of equipment used for cargo handling was lower during 2012 than in 2006. In 2006, there were 126 pieces of equipment operated, while 118 operated in 2012. There was also roughly a 50% decrease in operating hours for cargo handling equipment between 2006 and 2012. Nearly all of the cargo handling equipment is used at TAMT.

7.6.2 Regulation and Port Programs

Emission retrofits or fleet replacements and use of ultralow sulfur diesel fuel complying with the California regulations (ARB, 2012a) resulted in reduced emission rates for CHE.

7.6.3 Activity Estimate Changes

In 2006, imported vehicles shipped through NCMT were included in the CHE emissions, while for this 2012 inventory they were included with other on-road vehicles. Imported vehicles were new; therefore, their emission rates were low and had little effect on the CHE emissions inventory for 2006 and little effect on the on-road vehicle emissions inventory for 2012.

7.6.4 Methods Changes

No significant change in the emission inventory method occurred for the 2012 inventory.

7.6.5 CHE Summary

The 2012 CHE emissions are lower because of lower activity and ARB's regulations (ARB, 2012a) for cargo handling equipment that mandate new engines or retrofit of existing engines.

- The number of pieces of equipment and their operating hours were lower contributing to a reduction of over 60% of GHG emissions.
- Most equipment has been upgraded due to the ARB regulations mandating the use of lower emitting equipment, particularly lowering DPM emissions by 70%.
- Other emissions reductions include a decrease of 72% for ROG, 77% for CO, and 64% for NO_x.

7.7 Rail Locomotives

7.7.1 Operational Changes

Rail activity was marginally higher in 2012 compared with 2006 based on the number of trains and rail cars moved.

7.7.2 Regulations and Port Programs

The line-haul locomotive fleet serving the Port has been upgraded with new engines meeting EPA regulations through normal attrition and for complying with the South Coast Tier 2 NOx averaging agreement (ARB 1998), resulting in reduced fleet average emission rates. Also, locomotives now use ultralow sulfur diesel fuel as a result of federal and State regulations.

7.7.3 Activity Estimate Changes

The rail car weight was revised with more precise estimates, resulting in a small reduction in gross tonnage compared to 2006 despite a greater number of trains. The lower estimated train tonnage resulted in marginally lower estimates of regional fuel consumption and emissions.

7.7.4 Methods Changes

The methods used were similar to those used in the 2006 emissions inventory, but updated emission factor references from national and statewide program evaluations were available for this work. The revised emission factors by themselves did not significantly change the

emissions estimates as the emission reductions were due primarily to the operational change using an updated, cleaner locomotive fleet due to the requirements discussed in Section 7.7.2.

7.7.5 Locomotive Summary

A summary of the major differences observed between the 2012 and 2006 inventories for the locomotive source category is as follows:

- There were slightly more trains serving the Port reducing the need for drayage truck movements to transport imported vehicles from NCMT.
- More accurate estimates of car weights reduced the estimated gross ton-mile, and therefore reducing the fuel consumption emissions estimates.
- The primary reason for reduced locomotive emissions was due to BNSF Railway's compliance with a voluntary agreement to use a locomotive fleet that had an average NOx emissions rate equivalent to or better than the EPA Tier 2 emission standard for years 2010 and later in the South Coast and therefore the Port.

7.8 Drayage Truck and Other On-road Vehicles

7.8.1 Operational Changes

Drayage truck activity in 2012 was lower than that estimated for 2006. The decrease in truck activity is a result of a decrease in vessel calls to the marine terminals. In addition, the use of rail increased at NCMT thereby reducing the need for trucks. In 2006, TAMT was estimated to have about 97,000 truck entries compared with 42,370 in 2012, and NCMT was estimated to have about 36,000 truck entries in 2006 compared with less than 20,000 trucks in 2012.

7.8.2 Regulations and Port Programs

Lower NO_x and PM emissions in 2012 are a result of vehicle replacements encouraged through implementation of the ARB Drayage Truck regulations (ARB, 2011c) that require diesel particulate filters for nearly all drayage trucks. The filters reduce DPM by approximately 85%. In addition, the Port's Clean Truck Program banned drayage trucks from entering the marine terminals that do not meet ARBs engine standards. As part of the Clean Truck Program, thePort was active, beginning in 2008, to promote early DPM filter retrofits to assist truck owners in complying with the ARB regulation. Furthermore, the use of ultralow sulfur diesel fuel is now widespread reducing SO_2 emissions from trucks.

7.8.3 Activity Estimate Changes

Revised origin and destination routes for cruise ship passenger vehicle trips were significantly lower than those assumed for the 2006 emissions inventory. However emissions from these vehicles were a small fraction of those from all on-road vehicles.

The 2012 inventory combined the cruise terminal passenger service vehicles and the imported car on-terminal driving with the drayage truck activity to create an on-road vehicle source category, while the 2006 emission inventory included those sources with OGV and CHE

categories, respectively. Drayage trucks were the overwhelming source of on-road vehicle emissions in 2012 and 2006.

7.8.4 Methods Changes

No significant change in the emission inventory method occurred for the 2012 inventory.

7.8.5 On-road Vehicle Summary

The important changes to the On-road Vehicle emission inventory affected drayage trucks and included the following two significant factors:

- The number of truck entries at the Port was substantially lower leading to a decrease in emissions during 2012 including a reduction of 60% for GHG emissions
- The ARB drayage truck rule and the Port's Clean Truck Program encouraged more use of diesel particulate filters or vehicle upgrades that helped to reduce DPM truck emissions by roughly71% and NO_x emissions by 82% .
- Trucks that do not meet the requirements of the ARB drayage truck regulation are banned from entering the Port's marine terminals

7.9 Conclusion

Since 2006, a number of factors occurred which led to changes in maritime-related emissions at the Port during calendar year 2012. Many regulations were approved by international, federal, state, and local agencies to curb emissions from maritime activities. Subsequently, economic activity decreased as the result of a major, world-wide recession. The decrease in economic activity had a ripple effect where fewer ship calls carrying less freight resulted in less need for cargo handling equipment and trucks to move goods and services from maritime facilities. In addition, new methods and more precise measurements of activity were available for estimating emissions from maritime sources. Where methods or activity measurements were radically different from the 2006 inventory, emissions were recalculated for the 2006 baseline inventory to provide a fair comparison of changes between 2012 and 2006. As such, the baseline emissions for OGVs and harbor craft were updated using more recent methods and activity measurements due to more recent state-wide guidance and better technologies used to assess vessel speeds.

Overall, all source categories demonstrated emissions reductions of the criteria pollutants and GHGs during 2012 as compared to 2006. Reductions of the criteria pollutants ranged from 38% for ROG to over 90% for SO_2. GHG emissions were reduced 42% from the 2006 baseline. OGVs, cargo handling equipment, and on-road vehicles exhibited the greatest reductions of emissions. Fewer vessel calls and less berthing time reduced activity for these source categories. Port control measures also contributed to GHG reductions for OGVs through the VSR program, which began in 2009, and the use of shore power installed at CST in 2010. As a result, GHG emissions for these three source categories were reduced approximately 54% of their combined 2006 baseline. Harbor craft and locomotives demonstrated less emissions

reductions. This is due, in part, to less of a reduction in activity since 2006 and fewer engine replacements for harbor craft given the regulatory schedule will turn over all pre-2007 model year engines by 2023. GHGs for these two source categories were reduced only 7% of their combined 2006 baseline. Criteria pollutants for all source categories were dramatically reduced—primarily as a result of specific regulations which targeted individual source categories and pollutants. Ultimately, ship calls during 2012 produced less emissions than during 2006.

The results of the 2012 air emissions inventory will be used to inform other Port-wide programs and goals. In 2013, the Board of Port Commissioners adopted a Climate Action Plan to reduce greenhouse gases from activities which take place within the Port's jurisdiction[11]. The Climate Action Plan contains two goals to reduce greenhouse gas emissions in 2020 and 2035 by 10% and 25%, respectively, of a 2006 baseline. Maritime activity is included in the CAP's Transportation and Land Use category, which has a goal to reduce greenhouse gas emissions by 62,000 metric tons. The greenhouse gas emissions observed in the 2012 inventory accounts for 68% of the Transportation and Land Use category goal. A significant portion of the decrease in emissions observed in 2012 is due to less maritime activity as a result of the economic downturn. In future inventories, emissions could go up if the number of calls increases faster than implementation of control measures and regulations designed to reduce emissions. Thus, caution must be applied when evaluating the reductions in this report with other Port goals.

Given that state and federal regulations as well as the Port's emission reduction efforts, including the strategies in the Climate Action Plan, have yet to be fully implemented, emissions should continue to decrease in subsequent years. For example, shorepower was recently installed at TAMT in 2014 and is expected to reduce emissions from container ships which visit the terminal. The Port's Climate Action Plan includes a number of strategies to further reduce GHGs and criteria pollutants such as increasing the use of alternate powered vehicles and vessels and reducing idling while on the marine terminals. Further initiatives, such as the Sustainable Freight Strategy promoted by ARB[12], are intended to reduce emissions while improving transportation mobility. The 2012 inventory indicates the emissions produced per vessel call are less than what was observed in 2006, which suggests growth in maritime trade can occur more efficiently and with less of an environmental impact. Future efforts by the Port and fleet operations can ensure emissions reductions are maintained or improved while continuing to expand economically.

[11] Port of San Diego Climate Action Plan. 2013. Port of San Diego. Accessed: www.portofsandiego.org/environment/3414-port-of-san-diego-adopts-climate-action-plan.html

[12] Sustainable Freight Transport Initiative. 2014. California Air Resources Board. Accessed: http://www.arb.ca.gov/gmp/sfti/sfti.htm

8.0 REFERENCES

ARB, 1998. "Memorandum of Mutual Understandings and Agreements, South Coast Locomotive Fleet Average Emissions Program," July 2, 1998, http://www.arb.ca.gov/railyard/1998agree/1998agree.htm. Accessed 2013.

ARB, 2005a. "ARB/Railroad Statewide Agreement, Particulate Emission Reduction Program at California Rail Yards.

ARB, 2005b. "Staff Report: Initial Statement of Reasons for Proposed Rulemaking for the Regulation for Mobile Cargo Handling Equipment at Ports and Intermodal Rail Yards," Appendix B: Emission Inventory Methodology. California Air Resources Board, October, 2005. http://www.arb.ca.gov/regact/cargo2005/appb.pdf

ARB, 2006. Email from Dan Donohue of ARB to Chris Lindhjem of ENVIRON, May 9, 2006.

ARB, 2007. "Airborne Toxic Control Measure for Auxiliary Diesel Engines Operated on Ocean-Going Vessels At- Berth in a California Port," Section 93118.3, Title 17, Chapter 1, Subchapter 7.5, California Code of Regulations.

ARB, 2011a. "Fuel Sulfur and Other Operational Requirements for Ocean-Going Vessels within California Waters and 24 Nautical Miles of the California Baseline," Final Regulation Order: Amend section 2299.2, Title 13, California Code of Regulations," October 27, 2011.

ARB, 2011b. "Amendments to the Regulations to Reduce Emissions from Diesel Engines on Commercial Harbor Craft Operated within California Waters and 24 Nautical Miles of the California Baseline," Final Regulation Order, Available online (accessed January 2014) at http://www.arb.ca.gov/regact/2010/chc10/chc10.htm, July 20, 2011.

ARB, 2011c. "Regulation to Reduce Emissions of Diesel Particulate Matter, Oxides of Nitrogen and Other Criteria Pollutants from In-Use On-Road Diesel-Fueled Vehicles, the Heavy-Duty Vehicle Greenhouse Gas Emission Reduction Measure, and the Regulation to Control Emissions from In-Use On-Road Diesel-Fueled Heavy-Duty Drayage Trucks at Ports and Intermodal Rail Yard Facilities," Final Regulation Order, December 14, 2011.

ARB, 2011d. Initial Statement of Reasons for Proposed Rulemaking, Proposed Amendments to the Regulations "Fuel Sulfur and Other Operational Requirements for Ocean-Going Vessels within California Waters and 24 Nautical Miles of the California Baseline" Appendix D, May 2011. And Mobile Source Emission Inventory -- Current Methods and Data. http://www.arb.ca.gov/msei/categories.htm#ogv_category

ARB, 2011e. "California Air Resources Board Harbor Craft Emissions Inventory Database Instructions," October 2011. Available online at: http://www.arb.ca.gov/msei/categories.htm#chc_category

ARB, 2011f. "Staff Report: Initial Statement of Reasons for Proposed Rulemaking for the Amendment to the Regulation for Mobile Cargo Handling Equipment at Ports and Intermodal Rail Yards," Appendix B: Emission Inventory Methodology. California Air

Resources Board, August, 2011. http://www.arb.ca.gov/regact/2011/cargo11/cargoappb.pdf

ARB, 2012a. "Amendments to the Regulation for Mobile Cargo Handling Equipment at Ports and Intermodal Rail Yards," http://www.arb.ca.gov/regact/2011/cargo11/cargo11.htm October 14, 2012.

ARB, 2012b. Cargo Handling Emissions Inventory (CHEI) Model. California Air Resources Board, March, 2012. http://www.arb.ca.gov/ports/cargo/cheamd2011.htm

ARB, 2013. "The California Almanac of Emissions and Air Quality - 2013 Edition," Available Online at: http://www.arb.ca.gov/aqd/almanac/almanac13/almanac13.htm.

BNSF, 2013. Car Specifications and System Maps. http://www.bnsf.com/customers/how-can-i-ship/individual-railcar/, http://www.bnsf.com/customers/pdf/maps/div_ca.pdf, accessed 2013. (http://www.bnsf.com/customers/pdf/Tri-Level-Specs.pdf, http://www.bnsf.com/customers/pdf/Bi-Level-Specs.pdf, (http://www.bnsf.com/customers/pdf/Flexibeam.pdf)

ENVIRON, 2007, "2007 Clean Air Program Draft Report," prepared for: San Diego Unified Port District, December 2007.

ENVIRON, 2008. "Port of Oakland 2005 Seaport Air Emissions Inventory," prepared for Port of Oakland, March 14, 2008. (http://www.portofoakland.com/environment/seaport.aspx).

ENVIRON, 2013. "Port of Oakland 2012 Seaport Air Emissions Inventory," prepared for Port of Oakland, November 5, 2013. (http://www.portofoakland.com/pdf/environment/maqip_emissions_inventory.pdf)

EPA, 1994. "Determination of Significance for Nonroad Sources and Emission Standards for New Nonroad Compression-Ignition Engines at or above 37 Kilowatts; Final Rule," Federal Register, v. 59, n. 116, June 17, 1994.

EPA, 1997. "Locomotive Emissions Final Rulemaking," Available Online: http://www.epa.gov/otaq/locomotv.htm#regs, signed December 17, 1997.

EPA, 1998. "Control of Emissions of Air Pollution From Nonroad Diesel Engines; Final Rule," Federal Register v.63 n. 205, October 23, 1998.

EPA, 2001. "Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements."

EPA, 2008a. "Part 1042-Control of Emissions from New and In-use Marine Compression-Ignition Engines and Vessels," Code of Federal Regulations 2008, U.S. EPA; Office of Transportation and Air Quality; Assessment and Standards Division, February 27, 2008.

EPA, 2008b. "Part 1033C-Control of Emission from Locomotives, "Code of Federal Regulations, 2008, U.S. EPA; Office of Transportation and Air Quality; Assessment and Standards Division, March 14, 2008.

EPA, 2009. "Emission Factors for Locomotives," Office of Transportation and Air Quality EPA-420-F-09-025, April 2009.

Gould, Gregory M. and Deb A. Niemeier, 2011. "Spatial Assignment of Emissions Using a New Locomotive Emissions Model," *Environ. Sci. Technol*. 2011, 45, 5846–5852.

IPCC, 1995. Second Assessment Report: Climate Change 1995 (SAR), Working Group I: The Science of Climate Change. Intergovernmental Panel on Climate Change, 1995. Available online at http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml#.UwfsaMaYbcs

MARPOL, 2008a. "Revised Annex VI adopted October 2008: MEPC 176(58) Amendments to the Annex of the Protocol of 1997 to amend the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (Revised MARPOL Annex VI)" Available online at http://www.imo.org/OurWork/Environment/PollutionPrevention/AirPollution/Pages/Air-Pollution.aspx ,accessed January 2014.

MARPOL, 2008b. "Nitrogen Oxides (NOx) – Regulation 13," NOx Technical Code 2008 (resolution MEPC.177(58)). International Convention for the Prevention of Pollution from Ships (MARPOL), Available online (accessed January 2014) at: http://www.imo.org/OurWork/Environment/PollutionPrevention/AirPollution/Pages/Nitrogen-oxides-(NOx)-–-Regulation-13.aspx

POLA, 2012. "Port of Los Angeles Inventory of Air Emissions – 2011," prepared for The Port of Los Angeles, Prepared by: Starcrest Consulting Group, LLC, July 2012.

POSD, 2007. "The Port of San Diego 2006 Emissions Inventory," prepared for The Port of San Diego, Prepared by Starcrest Consulting Group, LLC., September 2007.

POSD, 2008. "San Diego Unified Port District Maritime Business Plan Update," Submitted by: TEC Inc., December 2008.

POSD 2013, "Climate Action Plan," San Diego Unified Port District http://www.portofsandiego.org/environment/3414-port-of-san-diego-adopts-climate-action-plan.html

Wong, Walter, 2007. Air Resources Board, memorandum, May 29, 2007.

APPENDIX A

OGV Vessel Characteristics

Appendix A. Vessel Characteristics

IMO	Flag	LOA	Engine Stroke	Engine Speed	Design Speed	Engine Type	Engine Builder	Keel Laid	Engine Make	Engine Model	Number of Engines	Propulsion Engine Power	Vessel Type	DWT	Operator	Auxiliary Engine Power
7104714	Honduras	141.05	2	Slow	14	Motor Diesel	Cegielski	8/5/1970	Sulzer	5RD68	1	4046	Dry Cargo	15320	East West Marine	654
7119678	United States of America	71.81	4	High	13	Motor Diesel	Caterpillar	9/4/1970	Caterpillar	3512B	1	2115	Dry Cargo	1383	Coastal Transportation	300
7917551	Singapore	198.13	2	Slow	19.5	Motor Diesel	Gotaverken	12/5/1980	B&W	7L80GFCA	1	13496	Roro	28223	Wallenius Wilhelmsen Log.	4800
7927415	Panama	174.8	4	Medium	17.8	Motor Diesel	IHI	2/28/1979	Semt-Pielstick	16PC2-5V-400	1	10003	Roro	12917	Mitsui OSK Lines Ltd	2850
8011330	Norwegian	179.61	2	Slow	15	Motor Diesel	Mitsui	9/16/1981	B&W	6L67GFCA	1	9635	Dry Cargo	39718	Grieg Star Shipping AS	2400
8013613	Norwegian	190	2	Slow	19.3	Motor Diesel	Hitachi	9/26/1980	B&W	9L67GFCA	1	12357	Roro	17650	Hoegh Autoliners AS	2040
8014227	Malta	165	4	Medium	18	Motor Diesel	Kawasaki	8/21/1979	MAN	12V52/55A	1	8826	Roro	10677	Abou Merhi Lines SAL	2040
8016548	Singapore	198	2	Slow	18.3	Motor Diesel	Gotaverken	9/28/1981	B&W	7L80GFCA	1	13500	Roro	28100	Wallenius Wilhelmsen Log.	4800
8018168	Norwegian	194.49	2	Slow	19.5	Motor Diesel	Mitsui	6/2/1982	B&W	6L80GFCA	1	13542	Roro	17863	Wallenius Wilhelmsen Log.	2670
8102115	Korea (North)	144.02	2	Slow	15	Motor Diesel	Clark Hawthorn	7/28/1981	Sulzer	4RND68M	1	5600	Dry Cargo	15175	Sinhung Trading Corp	1050
8211514	Panama	176	2	Slow	18.3	Motor Diesel	Mitsui	7/15/1982	B&W	8L55GFCA	1	8827	Roro	12507	Kawasaki Kisen Kaisha Ltd	1350
8313324	Singapore	198.8	2	Slow	17.5	Motor Diesel	Ube Industries	5/20/1983	Mitsubishi	6UEC60HA	1	7326	Roro	18293	Mitsui OSK Lines Ltd	1680
8319689	Panama	175.16	2	Slow	18	Motor Diesel	Mitsui	3/15/1984	B&W	6L60MC	1	8459	Roro	13208	Cido Car Carrier Service Co	1440
8420787	Norwegian	197.8	2	Slow	15	Motor Diesel	Mitsui	8/1/1985	B&W	6L60MCE	1	7443	Dry Cargo	43712	Grieg Star Shipping AS	2400
8506749	Norwegian	190.05	2	Slow	18	Motor Diesel	Sumitomo	2/4/1986	Sulzer	7RTA58	1	7848	Roro	15546	Wallenius Wilhelmsen Log.	2340
8506751	Panama	190	2	Slow	19	Motor Diesel	Sumitomo	3/13/1986	Sulzer	8RTA58	1	11298	Roro	15199	Mitsui OSK Lines Ltd	1710
8511263	Panama	162.34	2	Slow	18	Motor Diesel	Mitsui	11/8/1984	B&W	6L60MCE	1	8886	Roro	11241	Kawasaki Kisen Kaisha Ltd	2100
8513467	Bahamas	179	2	Slow	20	Motor Diesel	Fincantieri	10/10/1985	Sulzer	7RTA68	1	15189	Container	11800	Dole Ocean Cargo Express	7220
8513479	Bahamas	179	2	Slow	20	Motor Diesel	Fincantieri	10/10/1985	Sulzer	7RTA68	1	15189	Container	11613	Dole Ocean Cargo Express	7220
8513560	Norwegian	190.05	2	Slow	18	Motor Diesel	Sumitomo	6/19/1986	Sulzer	7RTA58	1	8715	Roro	15577	Wallenius Wilhelmsen Log.	2340
8517944	Panama	184.03	2	Slow	18.3	Motor Diesel	Hyundai Eng & Mchy	4/28/1986	B&W	8L60MCE	1	8789	Roro	12893	EUKOR Car Carriers Inc	2550
8605167	Norwegian	190.05	2	Slow	18	Motor Diesel	Sumitomo	6/25/1986	Sulzer	7RTA58	1	8716	Roro	15577	Wallenius Wilhelmsen Log.	1560
8608080	Bahamas	199.53	2	Slow	18	Motor Diesel	Korea HI	9/23/1987	B&W	6S60MC	1	9445	Roro	23052	Hoegh Autoliners AS	2347
8608133	Liberia	174	2	Slow	18	Motor Diesel	Hyundai Eng & Mchy	12/26/1986	B&W	6L60MC	1	8870	Roro	9783	EUKOR Car Carriers Inc	1740
8608145	Liberia	174	2	Slow	18.5	Motor Diesel	Hyundai Eng & Mchy	1/23/1987	B&W	6L60MC	1	8870	Roro	9675	EUKOR Car Carriers Inc	1740
8610124	Panama	180	2	Slow	17.8	Motor Diesel	Mitsubishi	4/15/1986	Mitsubishi	7UEC60LA	1	8269	Roro	14189	Mitsui OSK Lines Ltd	2250
8611946	Italy	101.19	4	Medium	12.5	Motor Diesel	MWM	6/23/1986	MWM	TBD510-6	1	1659	Dry Cargo	4741	Cafiservice SpA	588
8612251	Liberia	179.99	2	Slow	20.9	Motor Diesel	Kawasaki	11/7/1986	B&W	8S60MCE	1	8753	Roro	14487	Kawasaki Kisen Kaisha Ltd	2850
8708244	Liberia	187.03	2	Slow	19	Motor Diesel	Sumitomo	4/5/1987	Sulzer	8RTA58	1	9128	Roro	13224	Mitsui OSK Lines Ltd	2040
8708907	Panama	180	2	Slow	19	Motor Diesel	Mitsubishi	1/3/1987	Mitsubishi	8UEC60LA	1	10665	Roro	13162	Excel Marine Co Ltd	2140
8709119	Panama	174	2	Slow	18	Motor Diesel	Hyundai Eng & Mchy	3/25/1987	B&W	6L60MCE	1	8871	Roro	9694	EUKOR Car Carriers Inc	576
8709145	Singapore	183.9	2	Slow	19.8	Motor Diesel	Hyundai Eng & Mchy	5/22/1987	B&W	8L60MC	1	10592	Roro	12730	EUKOR Car Carriers Inc	1950
8709157	Singapore	183.9	2	Slow	19.7	Motor Diesel	Hyundai Eng & Mchy	12/19/1986	B&W	8L60MCE	1	10592	Roro	12706	EUKOR Car Carriers Inc	1947
8712324	Panama	199.5	2	Slow	19.5	Motor Diesel	Kobe	3/20/1987	Mitsubishi	7UEC60LS	1	11694	Roro	18777	Mitsui OSK Lines Ltd	2508
8819926	Danish	164.33	2	Slow	20.5	Motor Diesel	Korea HI	8/7/1989	B&W	6L60MC	1	11245	Container	16950	NYKCool AB	6200

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8900323	Bahamas	179	2	Slow	20	Motor Diesel	Fincantieri	2/12/1990	Sulzer	7RTA68	1	15190	Container	16337	Dole Ocean Cargo Express	7220
8912663	Norwegian	183.93	2	Slow	18.6	Motor Diesel	Hyundai Eng & Mchy	6/15/1987	B&W	8L60MCE	1	10592	Roro	12763	OSM Maritime AS	1950
8913514	Japan	198.6	2	Slow	19.2	Motor Diesel	Mitsubishi	3/16/1989	Mitsubishi	7UEC60LS	1	11122	Roro	17435	Nippon Yusen Kaisha	3190
8919245	Netherlands	219.21	4	Medium	20	Diesel-Electric	Fincantieri	7/30/1991	Sulzer	12ZAV40S	2	34448	Pass./Ferry	7637	Holland America Line Inc	44042
9053505	Panama	195.54	2	Slow	18.8	Motor Diesel	Kobe	12/2/1992	Mitsubishi	7UEC60LA	1	9731	Roro	17183	Nippon Yusen Kaisha	2400
9056296	United States of America	180	2	Slow	19	Motor Diesel	Mitsubishi	9/9/1993	Mitsubishi	7UEC60LS	1	11916	Roro	14930	Sulphur Carriers Inc	3090
9064126	Bahamas	170.69	4	Medium	17.5	Motor Diesel	Wartsila NSD	4/12/1988	Wartsila	8L38	4	15536	Pass./Ferry	2581	Regent Seven Seas Cruises Inc	6600
9066667	Bahamas	238.01	4	Medium	21	Diesel-Electric	Wartsila	1/10/1994	Sulzer	9ZAL40S	6	36330	Pass./Ferry	4500	Crystal Cruises	44042
9071557	Norwegian	198	2	Slow	16.3	Motor Diesel	Mitsui	1/20/1994	B&W	6S60MC	1	9047	Dry Cargo	45000	Grieg Star Shipping AS	3320
9071569	Norwegian	198	2	Slow	16.3	Motor Diesel	Mitsui	4/25/1994	B&W	6S60MC	1	9047	Dry Cargo	46547	Grieg Star Shipping AS	3320
9072446	Malta	246.5	4	Medium	21.5	Motor Diesel	MAN B&W	1/30/1994	MAN	9L48/60	2	29250	Pass./Ferry	7260	Celebrity Cruises Inc	26800
9078220	Panama	179.99	2	Slow	18.5	Motor Diesel	Mitsubishi	2/10/1994	Sulzer	6RTA62	1	10224	Roro	12229	Kawasaki Kisen Kaisha Ltd	3548
9088249	Singapore	179.47	2	Slow	19.9	Motor Diesel	Mitsui	1/3/1996	B&W	7S60MC	1	13900	Roro	12490	Hoegh Autoliners AS	3510
9103128	Norwegian	198	2	Slow	16	Motor Diesel	Mitsui	11/17/1994	B&W	6S60MC	1	9467	Dry Cargo	46580	Grieg Star Shipping AS	3320
9103130	Norwegian	198	2	Slow	16	Motor Diesel	Mitsui	6/12/1997	B&W	6S60MC	1	9467	Dry Cargo	46604	Grieg Star Shipping AS	3320
9110107	Philippines	188	2	Slow	18.5	Motor Diesel	Mitsui	12/10/1993	B&W	6L60MC	1	11475	Roro	15181	Mitsui OSK Lines Ltd	2560
9112557	Panama	128	2	Slow	14.7	Motor Diesel	Akasaka	5/4/1994	Mitsubishi	6UEC45LA	1	5296	Roro	11464	Eastern Car Liner	729
9116876	Bahamas	279	4	Medium	22.3	Diesel-Electric	Wartsila NSD	10/28/1996	Wartsila	12V46C	4	50400	Pass./Ferry	5000	Royal Caribbean Cruises Ltd	44042
9126819	Bahamas	294	4	Medium	21.5	Diesel-Electric	Fincantieri	5/15/1997	Sulzer	16ZAV40S	5	57670	Pass./Ferry	8604	Disney Cruise Line	44042
9141211	Panama	128	2	Slow	14.7	Motor Diesel	Akasaka	11/12/1995	Mitsubishi	6UEC45LA	1	5296	Roro	11285	Far-East Transport Co Ltd	2184
9150339	Panama	175	2	Slow	15	Motor Diesel	Kobe	8/22/1997	Mitsubishi	8UEC52LS	1	9003	Roro	14353	Mitsui OSK Lines Ltd	2646
9153549	Panama	188	2	Slow	18.5	Motor Diesel	Mitsui	9/10/1996	B&W	8S50MC	1	9701	Roro	15522	Mitsui OSK Lines Ltd	2460
9156527	Netherlands	237	4	Medium	22	Diesel-Electric	Fincantieri	6/26/1998	Sulzer	12ZAV40S	5	43200	Pass./Ferry	6150	Holland America Line Inc	44042
9174490	Panama	199.9	2	Slow	19.3	Motor Diesel	Kobe	11/20/1997	Mitsubishi	8UEC60LS	1	12709	Roro	22734	Hachiuma Steamship Co Ltd	3600
9177026	Norwegian	176.7	2	Slow	19.5	Motor Diesel	Uljanik	5/10/1998	B&W	7S50MC-C	1	11060	Roro	12780	Kawasaki Kisen Kaisha Ltd	2736
9177040	Panama	176.7	2	Slow	19.5	Motor Diesel	MAN B&W	4/4/1999	B&W	7S50MC-C	1	11060	Roro	12743	Nippon Yusen Kaisha	2736
9177052	Panama	176.7	2	Slow	19.5	Motor Diesel	Uljanik	12/24/1999	B&W	7S50MC-C	1	11060	Roro	12743	Mitsui OSK Lines Ltd	2850
9182954	Norwegian	198	2	Slow	16.2	Motor Diesel	Mitsui	12/9/1998	B&W	6S60MC	1	9467	Dry Cargo	46428	Grieg Star Shipping AS	3320
9182978	Norwegian	198	2	Slow	16.4	Motor Diesel	Mitsui	9/22/1999	B&W	6S60MC	1	9466	Dry Cargo	46428	Grieg Star Shipping AS	3588
9183518	Bahamas	180.45	4	Medium	27	Motor Diesel	Wartsila NSD	7/10/1999	Wartsila	9L46C	4	37800	Pass./Ferry	2500	Semester at Sea	2850
9184940	Panama	179.16	2	Slow	19.2	Motor Diesel	Kobe	12/11/1998	Mitsubishi	7UEC60LS	1	10503	Roro	16689	EUKOR Car Carriers Inc	3060
9185047	Liberia	174.98	2	Slow	18.9	Motor Diesel	Kobe	10/4/1999	Mitsubishi	8UEC52LS	1	9002	Roro	14067	Mitsui OSK Lines Ltd	2280
9187887	Bermuda	181	4	Medium	18	Diesel-Electric	Wartsila NSD	5/16/1998	Wartsila	12V32	4	19440	Pass./Ferry	2700	Princess Cruise Lines Ltd	44042
9188037	Netherlands	237.83	4	Medium	21	Diesel-Electric	Fincantieri	3/10/1999	Sulzer	16ZAV40S	2	55216	Pass./Ferry	7327	Holland America Line Inc	1200
9188647	Panama	292.5	4	Medium	22	Diesel-Electric	Wartsila NSD	8/31/1999	Wartsila	9R46	6	62370	Pass./Ferry	7200	Carnival Cruise Lines	44042
9189419	Malta	294	0		24	Gas Turbine	General Electric	1/11/1999	General Electric	LM2500+	2	50000	Pass./Ferry	11928	Celebrity Cruises Inc	12450
9189421	Malta	294	0	High	24	Gas Turbine	General Electric	11/15/1999	General Electric	LM2500+	2	70742	Pass./Ferry	11778	Celebrity Cruises Inc	12450
9192363	Bermuda	289.51	4	Medium	22	Diesel-Electric	Fincantieri	6/10/1999	Sulzer	16ZAV40S	4	63360	Pass./Ferry	6750	Princess Cruise Lines Ltd	44042
9213818	Panama	180	2	Slow	19.3	Motor Diesel	Diesel United	12/22/1999	Sulzer	7RTA62	1	12190	Roro	16396	Nippon Yusen Kaisha	3600
9219331	Bahamas	196.35	4	Medium	19	Motor Diesel	Wartsila	5/4/2000	Wartsila	12V32	2	11880	Pass./Ferry	4558	Wilhelmsen Ship Mgmt Ltd-USA	9050
9221279	Netherlands	285.42	0	High	22	Combined	GEC	2/17/2001	General Electric	LM2500	1	75140	Pass./Ferry	10965	Holland America Line Inc	44042

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9221281	Netherlands	285.24	0	High	22	Combined	GEC	1/22/2002	General Electric	LM2500	1	75140	Pass./Ferry	10965	Holland America Line Inc	44042
9226891	Netherlands	285.24	0	High	22	Combined	GEC	9/19/2002	General Electric	LM2500	1	75140	Pass./Ferry	10965	Holland America Line Inc	44042
9228186	Bermuda	290	0	High	23	Combined	GEC	7/29/2001	General Electric	LM2500+	1	60700	Pass./Ferry	7921	Princess Cruise Lines Ltd	44042
9233167	United States of America	176.47	2	Slow	20	Motor Diesel		9/21/2000	B&W	7S50MC-C	1	11060	Roro	12561	Pasha Group	2850
9247572	Panama	199.54	2	Slow	20	Motor Diesel	Kobe	6/30/2001	Mitsubishi	8UEC60LS	1	14162	Roro	19120	Mitsui OSK Lines Ltd	2850
9250220	Panama	199.94	2	Slow	20	Motor Diesel	Kobe	6/1/2001	Mitsubishi	8UEC60LSII	1	13940	Roro	17228	Kawasaki Kisen Kaisha Ltd	2850
9262560	Malta	188.35	2	Slow	15	Motor Diesel	Yichang Marine	6/5/2002	Sulzer	6RTA48T	1	8730	Dry Cargo	35079	Bertling FH	1800
9265926	Singapore	178	2	Slow	15.3	Motor Diesel	Kobe	5/15/2003	Mitsubishi	6UEC50LSII	1	8250	Dry Cargo	27516	PACCship UK Ltd	1776
9267297	United Kingdom	145.63	4	Medium	14.8	Motor Diesel	Caterpillar	12/22/2001	MaK	9M32	1	4320	Dry Cargo	10649	Carisbrooke Shipping Ltd	1217
9267675	Panama	199.54	2	Slow	20	Motor Diesel	Kobe	9/5/2002	Mitsubishi	8UEC60LS	1	14160	Roro	19531	Mitsui OSK Lines Ltd	2850
9267699	Panama	199.54	2	Slow	20	Motor Diesel	Kobe	12/26/2002	Mitsubishi	8UEC60LS	1	14161	Roro	19550	Mitsui OSK Lines Ltd	2850
9268083	Liberia	171.6	2	Slow	14.7	Motor Diesel	Akasaka	11/2/2002	Mitsubishi	6UEC52LA	1	7061	Bulker	31646	Oldendorff Carriers GmbH & Co	1440
9272773	Liberia	171.6	2	Slow	14.7	Motor Diesel	Akasaka	3/23/2004	Mitsubishi	6UEC52LA	1	7061	Dry Cargo	31647	Oldendorff Carriers GmbH & Co	960
9277486	Panama	177.13	2	Slow	14.3	Motor Diesel	Kobe	10/9/2003	Mitsubishi	6UEC52LA	1	6620	Bulker	32354	d'Amico Dry Ltd	2850
9283875	Panama	199.94	2	Slow	20	Motor Diesel	Kobe	10/25/2003	Mitsubishi	8UEC60LSII	1	13210	Roro	20146	Nippon Yusen Kaisha	4280
9283887	Panama	199.94	2	Slow	20	Motor Diesel	Kobe	3/3/2004	Mitsubishi	8UEC60LSII	1	13210	Roro	20098	Nippon Yusen Kaisha	4280
9289908	United Kingdom	182.8	2	Slow	20	Motor Diesel		12/9/2004	MAN B&W	9S50MC-C	1	12087	Roro	12600	EUKOR Car Carriers Inc	2520
9289910	United Kingdom	182.8	2	Slow	20	Motor Diesel	Alpha	5/4/2005	MAN B&W	9S50MC-C	1	12087	Roro	12672	Zim Integrated Shipping Serv	2520
9290050	Marshall Islands	145.63	4	Medium	14.8	Motor Diesel	Caterpillar	6/1/2002	MaK	9M32C	1	4320	Dry Cargo	10385	Scanscot Shipping Services	1490
9293595	Panama	199.95	2	Slow	20.7	Motor Diesel	Kobe	11/4/2004	Mitsubishi	8UEC60LSII	1	15130	Roro	18944	Mitsui OSK Lines Ltd	3900
9303209	Panama	199.9	2	Slow	19.8	Motor Diesel	Mitsui	4/5/2005	MAN B&W	7S60MC	1	12139	Roro	17550	Nippon Yusen Kaisha	2850
9303211	Panama	199.99	2	Slow	20.6	Motor Diesel	Mitsui	11/9/2004	MAN B&W	7S60MC	1	12139	Roro	18318	Nippon Yusen Kaisha	3840
9308883	Panama	199.94	2	Slow	20	Motor Diesel	Kobe	9/14/2005	Mitsubishi	8UEC60LSII	1	13210	Roro	21402	Nippon Yusen Kaisha	2850
9308895	Panama	199.94	2	Slow	20	Motor Diesel	Kobe	11/25/2004	Mitsubishi	8UEC60LSII	1	13210	Roro	21420	Nippon Yusen Kaisha	2850
9310513	Norwegian	198	2	Slow	16	Motor Diesel	Mitsui	10/7/2005	MAN B&W	6S60MC	1	10520	Dry Cargo	44692	Grieg Star Shipping AS	3300
9317705	Liberia	177.8	2	Slow	14.5	Motor Diesel	Akasaka	12/10/2004	Mitsubishi	6UEC52LA	1	6355	Bulker	37534	Oldendorff Carriers GmbH & Co	800
9318515	Bahamas	176	2	Slow	20.8	Motor Diesel	Uljanik	5/12/2007	MAN B&W	8S50MC-C	1	12640	Roro	12300	EUKOR Car Carriers Inc	2850
9324667	Liberia	189.99	2	Slow	14.3	Motor Diesel	Mitsui	8/7/2005	MAN B&W	6S50MC	1	7796	Bulker	52385	Orion Bulkers GmbH & Co KG	2850
9325439	Panama	183	2	Slow	20	Motor Diesel	Kawasaki	7/7/2006	MAN B&W	6S60MC-C	1	11620	Roro	12851	Mitsubishi Logistics Corp	2850
9325764	Panama	188.03	2	Slow	20	Motor Diesel	Kobe	11/9/2005	Mitsubishi	8UEC50LSII	1	11000	Roro	12991	Kawasaki Kisen Kaisha Ltd	2850
9325776	Panama	188.03	2	Slow	20	Motor Diesel	Kobe	2/10/2006	Mitsubishi	8UEC50LSII	1	11000	Roro	12980	Kawasaki Kisen Kaisha Ltd	2850
9330616	Singapore	179.9	2	Slow	20	Motor Diesel	MAN B&W	4/24/2006	MAN B&W	6S60ME-C	1	11526	Roro	21500	Hoegh Autoliners AS	2850
9330678	Liberia	190	2	Slow	14.5	Motor Diesel		2/1/2007	MAN B&W	6S50MC-C	1	7260	Bulker	53000	Bolten A	2040
9335953	PANAMA	199.94	2	Slow	19	Motor Diesel		11/18/2006				15540	Roro	18772		2850
9338632	Panama	188.03	2	Slow	20	Motor Diesel	Kobe	5/16/2007	Mitsubishi	8UEC50LSII	1	10999	Roro	12892	Kawasaki Kisen Kaisha Ltd	2850
9338826	Bahamas	199.95	2	Slow	20	Motor Diesel		6/27/2007	Mitsubishi	8UEC60LSII	1	15540	Roro	18867	Mitsui OSK Lines Ltd	2850
9338840	Bahamas	199.95	2	Slow	20	Motor Diesel	Mitsui	11/20/2007	MAN B&W	7S60MC-C	1	15130	Roro	18864	Mitsui OSK Lines Ltd	2850
9338864	Bahamas	199.95	2	Slow	20	Motor Diesel	Mitsui	9/4/2008	MAN B&W	7S60MC-C	1	13447	Roro	19000	Mitsui OSK Lines Ltd	2850

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9339818	United States of America	199.9	2	Slow	19.8	Motor Diesel	Mitsui	12/15/2004	MAN B&W	7S60MC	1	12139	Roro	18090	LMS Shipmanagement Inc	3090
9355185	Cayman Islands	199.99	2	Slow	20.7	Motor Diesel	Kobe	10/30/2006	Mitsubishi	8UEC60LSII	1	12827	Roro	17339	New Asian Shipping Co Ltd	2850
9355214	Japan	199.94	2	Slow	20	Motor Diesel	Kobe	1/10/2008	Mitsubishi	8UEC60LSII	1	13210	Roro	21428	Nippon Yusen Kaisha	2850
9357327	Bahamas	199.91	2	Slow	21	Motor Diesel	Cegielski	8/23/2007	MAN B&W	7S60ME-C	1	13447	Roro	21020	Nippon Yusen Kaisha	2850
9358010	Antigua	138.04	4	Medium	15	Motor Diesel	Caterpillar	12/29/2004	MaK	6M43	1	5400	Dry Cargo	12705	Beluga Shipping GmbH	1935
9361809	Bahamas	176	2	Slow	20.8	Motor Diesel	Uljanik	11/5/2005	MAN B&W	8S50MC-C	1	12640	Roro	12105	Stamco Ship Management Co Ltd	2850
9361823	Bahamas	176	2	Slow	20.8	Motor Diesel	Uljanik	9/15/2007	MAN B&W	8S50MC-C	1	12640	Roro	12300	China Shipping Car Carrier Inc	2850
9367607	Singapore	179.9	2	Slow	19.3	Motor Diesel	Mitsui	1/19/2008	MAN B&W	7S60MC-C	1	14120	Roro	17382	Nippon Yusen Kaisha	2850
9371579	Netherlands	145.04	4	Medium	16.5	Motor Diesel	Caterpillar	6/28/2006	MaK	9M32C	2	7650	Dry Cargo	13278	Kahn Scheepvaart BV	9650
9372327	Panama	180	2	Slow	19.9	Motor Diesel	Mitsubishi	9/6/2006	Mitsubishi	8UEC50LSII	1	11560	Roro	15261	Nissan Motor Car Carrier	3500
9380817	Panama	177.8	2	Slow	14.5	Motor Diesel	Akasaka	6/7/2006	Mitsubishi	6UEC52LA	1	6355	Bulker	37296	d'Amico Dry Ltd	1320
9380829	Panama	177.8	2	Slow	14.5	Motor Diesel	Akasaka	6/7/2006	Mitsubishi	6UEC52LA	1	6372	Bulker	37277	d'Amico Dry Ltd	1350
9381249	Panama	199.94	2	Slow	19.3	Motor Diesel	Kobe	5/25/2006	Mitsubishi	8UEC60LSII	1	15540	Roro	20180	Nippon Yusen Kaisha	2850
9381665	Panama	199.94	2	Slow	20	Motor Diesel	Kawasaki	11/23/2006	MAN B&W	8S50MC-C	1	12640	Roro	17699	Kawasaki Kisen Kaisha Ltd	2850
9382102	Liberia	176	2	Slow	19.7	Motor Diesel	Treci Maj	8/14/2008	Wartsila	7RT-flex50	1	9639	Roro	12300	STX Pan Ocean Co Ltd	3840
9392339	Panama	177	2	Slow	18.5	Motor Diesel	Kobe	11/7/2008	Mitsubishi	8UEC50LSII	1	9826	Roro	12856	Kawasaki Kisen Kaisha Ltd	2850
9395630	Bahamas	185.6	2	Slow	18.2475	Motor Diesel	HSD	3/2/2009	MAN B&W	6S60MC-C	1	11526	Roro	10300	Stamco Ship Management Co Ltd	2850
9397705	China	190	2	Slow	14.7	Motor Diesel	Hudong	7/5/2009	MAN B&W	6S50MC-C	1	8058	Bulker	53300	Shanghai Time Shipping Co Ltd	2040
9397987	Cayman Islands	199.99	2	Slow	20.7	Motor Diesel	Mitsubishi	8/8/2007	Mitsubishi	7UEC60LSII	1	12170	Roro	18772	Mitsui OSK Lines Ltd	2850
9398917	Italy		4	Medium	23.6	Diesel-Electric	Caterpillar	12/20/2007	MaK	12M43C	4	54400	Pass./Ferry	8000	Costa Crociere SpA	44042
9402718	Singapore	199.99	2	Slow	20.7	Motor Diesel	Mitsubishi	10/24/2007	Mitsubishi	7UEC60LSII	1	12167	Roro	18686	Nippon Yusen Kaisha	2850
9403217	Singapore	179.9	2	Slow	19.3	Motor Diesel	Mitsui	9/5/2007	MAN B&W	7S60MC-C	1	15820	Roro	17212	United Ocean Ship Management	2850
9407598	Antigua	139	4	Medium	16.5	Motor Diesel	Caterpillar	11/21/2008	MaK	6M43C	1	5100	Dry Cargo	10000	Intermarine LLC	1900
9412567	Panama	180	2	Slow	19.9	Motor Diesel	Mitsubishi	4/27/2007	Mitsubishi	8UEC52LSE	1	11560	Roro	15154	Toyofuji Shipping Co Ltd	2850
9416434	Bahamas	180	2	Slow	14	Motor Diesel		5/3/2007	MAN B&W	6S46MC-C	1	6100	Bulker	34000	Graig Shipmanagement GmbH	1800
9426350	Japan	199.94	2	Slow	20	Motor Diesel	Kobe	11/11/2008	Mitsubishi	8UEC60LSII	1	13209	Roro	20800	Nippon Yusen Kaisha	2850
9426362	Japan	199.94	2	Slow	20	Motor Diesel	Kobe	11/11/2008	Mitsubishi	8UEC60LSII	1	13209	Roro	20800	Nippon Yusen Kaisha	2850
9427940	Liberia	182.2	2	Slow	20	Motor Diesel	Hyundai	8/5/2008	MAN B&W	9S50MC-C	1	12087	Roro	11760	TB Marine-Hamburg GmbH	2850
9431434	Gibraltar	138.54	4	Medium	15	Motor Diesel	Caterpillar	7/6/2008	MaK	6M43	1	4590	Dry Cargo	12840	SE Shipping Lines Pte Ltd	1776
9431836	Singapore	183	2	Slow	20	Motor Diesel	Hyundai	6/5/2009	MAN B&W	9S50MC-C	1	12087	Roro	12280	Hoegh Autoliners AS	2850
9432880	United Kingdom	182.8	2	Slow	20	Motor Diesel	Hyundai	7/4/2007	MAN B&W	9S50MC-C	1	12087	Roro	12315	Zodiac Maritime Agencies Ltd	2520
9432892	United Kingdom	182.8	2	Slow	20	Motor Diesel	Hyundai	10/24/2007	MAN B&W	9S50MC-C	1	12087	Roro	12300	Zodiac Maritime Agencies Ltd	2520
9432907	United Kingdom	182.8	2	Slow	20	Motor Diesel	Hyundai	5/20/2008	MAN B&W	9S50MC-C	1	12087	Roro	12300	Zodiac Maritime Agencies Ltd	2520
9434319	Philippines	180	2	Slow	19.9	Motor Diesel	Mitsubishi	10/18/2008	Mitsubishi	8UEC50LSII	1	10115	Roro	14850	Vroon BV	2850
9441520	Bahamas	199.94	2	Slow	20.5	Motor Diesel	Hyundai	9/4/2009				14280	Roro	21450	Stamco Ship Management Co Ltd	2850
9441568	Bahamas	199.94	2	Slow	20.5	Motor Diesel	Hyundai	3/7/2010				14280	Roro	21450	Stamco Ship Management Co Ltd	2850
9442873	Panama	199.97	2	Slow	20	Motor Diesel	Kobe	10/4/2007	Mitsubishi	8UEC60LSII	1	13260	Roro	18930	Shoei Kisen Kaisha Ltd	2850
9446881	Bahamas	176	2	Slow	21.5	Motor Diesel	Uljanik	2/20/2008	MAN B&W	8S50MC-C	1	12640	Roro	12300	Mitsui OSK Lines Ltd	2850
9448140	Liberia	182.8	2	Slow	20	Motor Diesel		2/4/2009	MAN B&W	9S50MC-C	1	12087	Roro	11650	Rickmers Reederei GmbH & Cie	2850
9454759	Panama	165	2	Slow	19.7	Motor Diesel		11/5/2009	MAN B&W	6S60MC-C	1	13560	Container	15600	Seatrade Groningen BV	2083.843137

IMO	Flag	LOA	Engine Stroke	Engine Speed	Design Speed	Engine Type	Engine Builder	Keel Laid	Engine Make	Engine Model	Number of Engines	Propulsion Engine Power	Vessel Type	DWT	Operator	Auxiliary Engine Power
9464455	Panama	199.94	2	Slow	19.3	Motor Diesel	Kobe	4/17/2008	Mitsubishi	8UEC60LSII	1	15540	Roro	20096	Nippon Yusen Kaisha	2850
9473468	Panama	140	2	Slow	16.9	Motor Diesel		5/5/2010	MAN B&W	1 x 7L42MC 176 rpm		6965	Roro	6500	Nissan Motor Car Carrier	44042
9476733	Japan	199.9	2	Slow	18.2475	Motor Diesel		11/1/2008				0	Roro	14000	Confirmation Of Info Awaited	2850
9477921	Panama	199.94	2	Slow	20	Motor Diesel	Mitsubishi	3/21/2008	Mitsubishi	8UEC60LSII	1	16360	Roro	20019	Nippon Yusen Kaisha	2850
9487031	China	178	2	Slow	18.2475	Motor Diesel		3/7/2009				0	Dry Cargo	32000	SINOTRANS	1776
9494905	Liberia	199.95	2	Slow	20.5	Motor Diesel	Mitsui	4/16/2009	MAN B&W	7S60MC-C	1	15090	Roro	17100	Zodiac Maritime Agencies Ltd	2850
9497335	Antigua	229	2	Slow	14	Motor Diesel	Sulzer	6/5/2010	Wartsila	7RT-flex50	1	11620	Bulker	82500	DT-Bereederungs GmbH & Co KG	1776
9498597	Panama	199.99	2	Slow	18.2475	Motor Diesel	Kobe	11/28/2008	MAN B&W	7S60MC	1	12138	Roro	17100	Cido Shipping HK Co Ltd	2850
9498602	Panama	199.99	2	Slow	19.8	Motor Diesel	Kobe	11/28/2008	MAN B&W	7S60MC	1	12138	Roro	17550	Cido Shipping HK Co Ltd	2850
9500091	Italy	197	2	Slow	14	Motor Diesel		7/6/2011	MAN B&W	6S50MC-C	1	8058	Bulker	59000	Gestioni Armatoriali SpA	2850
9506746	Antigua	153.8	2	Slow	14	Motor Diesel		2/4/2010	Wartsila	6RT-flex50	1	8466	Dry Cargo	12000	Jungerhans Maritime Servs GmbH	2850
9509619	Cyprus		2	Slow	14	Motor Diesel		2/4/2010	MAN B&W	6S50MC-C	1	8058	Dry Cargo	30500	Medstar Shipmanagement Ltd	1776
9519092	Panama	199.94	2	Slow	18.2475	Motor Diesel	Kobe	5/4/2008	Mitsubishi	8UEC60LSII	1	15100	Roro	19265	Mitsui OSK Lines Ltd	2850
9519092	Panama	199.94	2	Slow	18.2475	Motor Diesel	Kobe	5/4/2008	Mitsubishi	8UEC60LSII	1	16360	Roro	13200	Mitsui OSK Lines Ltd	2850
9519121	Panama	199.94	2	Slow	18.2475	Motor Diesel	Kobe	11/5/2008	Mitsubishi	8UEC60LSII	1	15540	Roro	22723	Triton Navigation BV	2850
9530319	Italy	179.5	2	Slow	14	Motor Diesel	Wartsila SACM	6/1/2008	Wartsila	6RTA48T	1	8726	Dry Cargo	33200	Ilva Servizi Marittimi SpA	1776
9531741	Singapore	199.9	2	Slow	20.6	Motor Diesel	Kobe	12/16/2008	Mitsubishi	8UEC60LSII	1	13906	Roro	20700	Owner Unknown	2850
9534444	Netherlands	114	4	Medium	14	Motor Diesel		12/15/2008	MaK			4000	Dry Cargo	8000	CFL Shipmanagement BV	1776
9536959	Panama	199.9	2	Slow	20.5	Motor Diesel	Kawasaki	3/7/2010	MAN B&W	7S60MC-C	1	14280	Roro	18100	Owner Unknown	2850
9536961	Panama	199.9	2	Slow	20.5	Motor Diesel	Kawasaki	5/5/2010	MAN B&W	7S60MC	1	12138	Roro	21300	Owner Unknown	2850
9539169	Japan	199.99	2	Slow	20.7	Motor Diesel	Mitsubishi	6/5/2010	Mitsubishi	7UEC60LSII	1	12167	Roro	18600	Nippon Yusen Kaisha	2850
9539171	Japan	199.99	2	Slow	20.7	Motor Diesel	Mitsubishi	9/4/2010	Mitsubishi	7UEC60LSII	1	12167	Roro	18600	Nippon Yusen Kaisha	2850
9539183	Cayman Islands	199.99	2	Slow	20.7	Motor Diesel	Mitsubishi	12/5/2010	Mitsubishi	7UEC60LSII	1	12167	Roro	18600	Mitsui OSK Lines Ltd	2850
9539212	Cayman Islands	199.99	2	Slow	20.7	Motor Diesel	Mitsubishi	11/1/2010	Mitsubishi	7UEC60LSII	1	12167	Roro	18600	Mitsui OSK Lines Ltd	2850
9542283	Panama	180	2	Slow	20	Motor Diesel	Mitsubishi	8/5/2010	Mitsubishi	8UEC50LSII	1	9826	Roro	14850	Eastern Car Liner	2850
9544918	Panama	199.99	2	Slow	20.7	Motor Diesel		12/9/2010		8S60MC-C		13411	Roro	17300	Owner Unknown	2850
9544920	Panama	199.99	2	Slow	20.7	Motor Diesel		12/9/2010		8S60MC-C		13411	Roro	17300	Owner Unknown	2850
9553103	Panama	199.94	2	Slow	19.5	Motor Diesel	Mitsubishi	6/7/2008	Mitsubishi	8UEC60LSII	1	13906	Roro	22657	Owner Unknown	2850
9553115	Panama	199.94	2	Slow	19.5	Motor Diesel	Mitsubishi	5/27/2008	Mitsubishi	8UEC60LSII	1	13906	Roro	20037	Owner Unknown	2850
9561253	Cayman Islands	199.95	2	Slow	20.7	Motor Diesel	Mitsui	12/22/2008	MAN B&W	7S60MC-C	1	13447	Roro	18840	Owner Unknown	2850
9561289	Panama	199.95	2	Slow	20.7	Motor Diesel	Mitsui	12/22/2008	MAN B&W	7S60MC-C	1	13447	Roro	18828	Owner Unknown	2850
9583055	Antigua & Barbuda		4	Medium	12	Motor Diesel		3/7/2011	MAK	8 M 32		3000	Dry Cargo			776
9585651	Liberia	182.83	2		14.46	Motor Diesel		5/5/2010				7860	Dry Cargo	37064		2850
9604940	Panama	199	2	Slow	19.5	Motor Diesel		2/5/2012				13906	Roro	20037		2850
9610391	Panama	199.95	2	Slow	20.6	Motor Diesel		11/4/2010	MAN B&W	1 x 7S60MC-C		15130	Roro	18900		2850

APPENDIX B

OGV Vessel Calls

Appendix B. Calls

Trip Ref.	Last Port of Call	Next Port of Call	Arrived	Sailed	Hrs.	Berth	Vessel Type	Commodity	IMO#	Shore Pwr Time (hrs)
12-0480	Puerto Quetzal, Guatemala	Guayaquil, Equador	1/1/2012 15:22	1/3/2012 18:30	51.13	Berth 10-02	Container	Bananas	8900323	0
12-0483	New Minister,B.C.	Yokohama,Japan	1/2/2012 19:43	1/4/2012 14:58	43.25	Berth 24-05	Auto Carrier	Vehicles	9610391	0
12-0484	Los Angeles, CA	Yokohama,Japan	1/3/2012 0:33	1/3/2012 16:00	15.45	Berth 24-04	Auto Carrier	Vehicles	9153549	0
12-0485	Manzanillo, Panama	Long Beach, CA	1/3/2012 6:13	1/3/2012 15:55	9.70	Berth 24-10	Auto Carrier	Vehicles	9553103	0
12-0402	Cabo San Lucas, Mx	Kona, Hawaii	1/4/2012 5:59	1/4/2012 17:10	11.18	B - Berth 01	Cruise Ship	Passengers	9473468	0
12-0489	Los Angeles, CA	Portland	1/5/2012 0:46	1/5/2012 12:59	12.22	Berth 24-10	Auto Carrier	Vehicles	9446881	0
12-0490	Korea	Port Hueneme, CA	1/6/2012 5:58	1/6/2012 16:05	10.12	Berth 24-10	Auto Carrier	Vehicles	9432907	0
12-0406	Cabo San Lucas, Mx	Puerto Vallarta, Mx	1/7/2012 5:30	1/7/2012 16:57	11.45	B - Berth 01	Cruise Ship	Passengers	9221281	7.50
12-0492	TBN	TBN	1/8/2012 8:40	1/11/2012 3:08	66.47	Berth 10-02	Container	Bananas	8819926	0
12-0496	New Minister,B.C.	Japan	1/9/2012 22:36	1/10/2012 16:06	17.50	Berth 24-05	Auto Carrier	Vehicles	9476733	0
12-0497	Hilo, Hawaii	Hawaii	1/10/2012 7:13	1/11/2012 0:08	16.92	Berth 24-02	Auto Carrier	Vehicles	9233167	0
12-0498	Los Angeles, CA	Japan	1/11/2012 3:00	1/11/2012 12:03	9.05	Berth 24-05	Auto Carrier	Vehicles	9432880	0
12-0499	Korea	Portland, Oregon	1/11/2012 6:20	1/15/2012 14:06	103.77	Berth 10-07	General Cargo	Project Cargo	9103130	0
12-0505	Vlissingen, Netherlands	Los Angeles, CA	1/13/2012 11:45	1/16/2012 7:00	67.25	Berth 10-04	General Cargo	Fertilizer	9103128	0
12-0407	Cabo San Lucas, Mx	Hawaii	1/14/2012 6:27	1/14/2012 16:50	10.38	B - Berth 01	Cruise Ship	Passengers	9221281	8.01
12-0507	Puerto Quetzal, Guatemala	Paita, Peru	1/14/2012 22:23	1/17/2012 17:05	66.70	Berth 10-02	Container	Bananas	8513479	0
12-0509	Japan	Long Beach, CA	1/15/2012 15:30	1/16/2012 13:05	21.58	Berth 10-07	RoRo	Military	9141211	0
12-0510	Brunswick, Georgia	Japan	1/16/2012 6:46	1/16/2012 16:07	9.35	Berth 24-10	Auto Carrier	Vehicles	9330616	0
12-0511	Benecia, CA	Japan	1/17/2012 0:45	1/17/2012 15:05	14.33	Berth 24-05	Auto Carrier	Vehicles	9361809	0
12-0513	Portland, Oregon	Lazaro Cardenas, Mexico	1/18/2012 19:36	1/19/2012 14:05	18.48	Berth 24-10	Auto Carrier	Vehicles	9338632	0
12-0515	Los Angeles, CA	Japan	1/20/2012 1:46	1/20/2012 12:03	10.28	Berth 24-10	Auto Carrier	Vehicles	9448140	0
12-0405	Ensenada, Mexico	Hawaii	1/20/2012 3:23	1/20/2012 22:58	19.58	B- Berth 04	Cruise Ship	Passengers	9188647	0
12-0409	Cabo San Lucas, Mx	Puerto Vallarta, Mx	1/20/2012 6:44	1/20/2012 16:45	10.02	B - Berth 02	Cruise Ship	Passengers	8919245	0
12-0516	Port Hueneme, CA	Japan	1/20/2012 8:04	1/20/2012 18:20	10.27	Berth 24-05	Auto Carrier	Vehicles	9355214	0
12-0526	Korea	Unknown	1/21/2012 21:40	1/22/2012 16:13	18.55	Berth 24-10	Auto Carrier	Vehicles	8016548	0
12-0528	Puerto Quetzal, Guatemala	Paita, Peru	1/22/2012 12:15	1/24/2012 17:55	53.67	Berth 10-02	Container	Bananas	8900323	0
12-0529	Port Hueneme, CA	Lazaro Cardenas, Mexico	1/23/2012 5:40	1/23/2012 15:00	9.33	Berth 24-05	Auto Carrier	Vehicles	9177040	0
12-0403	Cabo San Lucas, Mx	Los Angeles, CA	1/23/2012 5:45	1/23/2012 18:52	13.12	B - Berth 01	Cruise Ship	Passengers	9398917	0
12-0530	Ulsan, Korea	Port Hueneme, CA	1/23/2012 7:11	1/23/2012 17:14	10.05	Berth 24-10	Auto Carrier	Vehicles	9382102	0
12-0531	Hilo, Hawaii	Hawaii	1/24/2012 7:14	1/25/2012 16:10	32.93	Berth 24-02	Auto Carrier	Vehicles	9233167	0
12-0532	Ulsan, Korea	Balboa, Panama	1/26/2012 22:20	1/27/2012 17:05	18.75	Berth 10-07	General Cargo	Yachts	9371579	0
12-0533	Richmond, Ca	Japan	1/27/2012 14:01	1/27/2012 23:47	9.77	Berth 24-10	Auto Carrier	Vehicles	8506751	0
12-0408	Ensenada, Mexico	Puerto Cabello, Venezuela	1/28/2012 5:55	1/28/2012 16:58	11.05	B - Berth 01	Cruise Ship	Passengers	9221281	8.14
12-0404	Nicaragua	Honolulu, HI	1/28/2012 6:36	1/28/2012 17:34	10.97	B- Berth 04	Cruise Ship	Passengers	9187887	0
12-0535	Puerto Quetzal, Guatemala	Paita, Peru	1/29/2012 1:45	2/3/2012 11:48	130.05	Berth 10-02	Container	Bananas	8819926	0

Trip Ref.	Last Port of Call	Next Port of Call	Arrived	Sailed	Hrs.	Berth	Vessel Type	Commodity	IMO#	Shore Pwr Time (hrs)
12-0536	Korea	Unknown	1/30/2012 4:45	2/1/2012 16:12	59.45	Berth 10-07	General Cargo	Project Cargo	9290050	0
12-0537	Port Hueneme, CA	Japan	1/30/2012 13:16	1/30/2012 18:00	4.73	Berth 24-05	Auto Carrier	Vehicles	8511263	0
12-0539	Korea	Port Hueneme, CA	1/31/2012 7:32	1/31/2012 17:00	9.47	Berth 24-05	Auto Carrier	Vehicles	9361823	0
12-0549	Los Angeles, CA	Japan	2/1/2012 1:56	2/1/2012 15:30	13.57	Berth 24-10	Auto Carrier	Vehicles	9519121	0
12-0524	Nuku Hiva	Cabo San Lucas, Mx	2/3/2012 6:02	2/3/2012 16:59	10.95	B - Berth 01	Cruise Ship	Passengers	9473468	0
12-0550	Long Beach, CA	Japan	2/3/2012 7:25	2/3/2012 16:00	8.58	Berth 24-10	Auto Carrier	Vehicles	9426362	0
12-0521	Cabo San Lucas, Mx	Puerto Vallarta, Mx	2/4/2012 5:58	2/4/2012 16:56	10.97	B - Berth 01	Cruise Ship	Passengers	9221281	8.13
12-0517	Ensenada, Mexico	Cabo San Lucas, Mx	2/4/2012 6:32	2/4/2012 17:42	11.17	B- Berth 04	Cruise Ship	Passengers	9188647	0
12-0552	New Minister,B.C.	Japan	2/4/2012 23:29	2/5/2012 15:32	16.05	Berth 24-05	Auto Carrier	Vehicles	9539183	0
12-0611	Puerto Quetzal, Guatemala	Paita, Peru	2/5/2012 14:10	2/7/2012 19:47	53.62	Berth 10-02	Container	Bananas	8513479	0
12-0554	Richmond, Ca	Japan	2/6/2012 6:32	2/6/2012 16:00	9.47	Berth 24-05	Auto Carrier	Vehicles	9553115	0
12-0555	Hilo, Hawaii	Honolulu, HI	2/7/2012 7:04	2/8/2012 14:00	30.93	Berth 24-02	Auto Carrier	Vehicles	9233167	0
12-0558	New Minister,B.C.	Benecia, CA	2/11/2012 5:33	2/11/2012 16:00	10.45	Berth 24-05	Auto Carrier	Vehicles	9494905	0
12-0559	Puerto Quetzal, Guatemala	Guayaquil, Equador	2/11/2012 17:20	2/14/2012 19:25	74.08	Berth 10-02	Container	Bananas	8900323	0
12-0518	Puerto Vallarta, Mx	Cabo San Lucas, Mx	2/12/2012 6:26	2/12/2012 16:17	9.85	B - Berth 01	Cruise Ship	Passengers	9188647	0
12-0560	Port Hueneme, CA	Yokohama,Japan	2/12/2012 7:40	2/12/2012 15:32	7.87	Berth 24-10	Auto Carrier	Vehicles	8709145	0
12-0561	Ulsan, Korea	Port Hueneme, CA	2/14/2012 8:19	2/14/2012 15:56	7.62	Berth 24-05	Auto Carrier	Vehicles	8608145	0
12-0562	Los Angeles, CA	Yokohama,Japan	2/15/2012 2:00	2/15/2012 12:56	10.93	Berth 24-10	Auto Carrier	Vehicles	9153549	0
12-0563	Port Hueneme, CA	Lazaro Cardenas, Mexico	2/15/2012 6:58	2/15/2012 14:56	7.97	Berth 24-05	Auto Carrier	Vehicles	9431836	0
12-0564	San Diego, CA	Kota Kinabalu	2/15/2012 16:12	2/22/2012 10:03	161.85	Berth 10-07	General Cargo	Project Cargo	9290050	0
12-0565	Long Beach, CA	Japan	2/16/2012 3:00	2/16/2012 16:12	13.20	Berth 24-10	Auto Carrier	Vehicles	9335933	0
12-0566	Japan	Richmond, Ca	2/17/2012 1:16	2/17/2012 13:56	12.67	Berth 24-10	Auto Carrier	Vehicles	9542283	0
12-0519	Cabo San Lucas, Mx	Cabo San Lucas, Mx	2/17/2012 6:27	2/17/2012 18:17	11.83	B- Berth 04	Cruise Ship	Passengers	9188647	0
12-0525	Cabo San Lucas, Mx	Puerto Vallarta, Mx	2/17/2012 6:55	2/17/2012 16:39	9.73	B - Berth 02	Cruise Ship	Passengers	8919245	0
12-0567	Canada	Japan	2/18/2012 1:50	2/18/2012 15:50	14.00	Berth 24-05	Auto Carrier	Vehicles	8712324	0
12-0522	Cabo San Lucas, Mx	Puerto Vallarta, Mx	2/18/2012 6:05	2/18/2012 17:00	10.92	B - Berth 01	Cruise Ship	Passengers	9221281	0
12-0568	Port Hueneme, CA	Acapulco, Mexico	2/18/2012 6:35	2/18/2012 13:00	6.42	Berth 24-10	Auto Carrier	Vehicles	9177026	0
12-0580	Guatemala	Ecuador	2/19/2012 5:22	2/23/2012 20:00	110.63	Berth 10-02	Container	Bananas	9454759	0
12-0582	Uslan, Korea	Port Hueneme, CA	2/20/2012 19:40	2/21/2012 16:00	20.33	Berth 24-10	Auto Carrier	Vehicles	9289908	0
12-0583	Hilo, Hawaii	Honolulu, HI	2/21/2012 7:06	2/22/2012 14:37	31.52	Berth 24-02	Auto Carrier	Vehicles	9233167	0
12-0585	Los Angeles, CA	Japan	2/22/2012 6:39	2/22/2012 13:50	7.18	Berth 24-05	Auto Carrier	Vehicles	9372327	0
12-0587	Ulsan, Korea	Port Hueneme, CA	2/24/2012 21:10	2/25/2012 14:55	17.75	Berth 24-10	Auto Carrier	Vehicles	9289910	0
12-0523	Cabo San Lucas, Mx	Hilo, Hawaii	2/25/2012 6:44	2/25/2012 16:55	10.18	B - Berth 01	Cruise Ship	Passengers	9221281	7.75
12-0588	new brunswick, Georgia	Japan	2/26/2012 5:50	2/26/2012 17:00	11.17	Berth 24-05	Auto Carrier	Vehicles	9539171	0
12-0520	Cabo San Lucas, Mx	Cabo San Lucas, Mx	2/26/2012 6:35	2/26/2012 16:39	10.07	B - Berth 01	Cruise Ship	Passengers	9188647	0
12-0589	Puerto Quetzal, Guatemala	Guayaquil, Equador	2/26/2012 20:20	2/28/2012 23:50	51.50	Berth 10-02	Container	Bananas	8513479	0
12-0590	Tacoma,Wa	Los Angeles, CA	2/28/2012 1:40	2/28/2012 11:37	9.95	Berth 24-05	Auto Carrier	Vehicles	9448140	0
12-0591	New Minister,B.C.	Japan	2/28/2012 4:40	2/28/2012 15:13	10.55	Berth 24-10	Auto Carrier	Vehicles	9544918	0
12-0598	Richmond, Ca	Japan	2/29/2012 6:47	2/29/2012 17:50	11.05	Berth 24-10	Auto Carrier	Vehicles	8506751	0

Trip Ref.	Last Port of Call	Next Port of Call	Arrived	Sailed	Hrs.	Berth	Vessel Type	Commodity	IMO#	Shore Pwr Time (hrs)
12-0599	Port Hueneme, CA	Japan	2/29/2012 7:00	2/29/2012 15:45	8.75	Berth 24-05	Auto Carrier	Vehicles	9412567	0
12-0601	Singapore	Unknown	2/29/2012 13:15	3/3/2012 23:16	82.02	Berth 10-07	General Cargo	Project Cargo	9431434	0
12-0702	Chiba, Japan	Richmond, Ca	3/1/2012 18:34	3/2/2012 14:53	20.32	Berth 24-10	Auto Carrier	Vehicles	8708244	0
12-0569	Cabo San Lucas, Mx	Cabo San Lucas, Mx	3/2/2012 6:42	3/2/2012 16:50	10.13	B - Berth 01	Cruise Ship	Passengers	9188647	0
12-0607	Topolobambo, Mexico	Unknown	3/2/2012 18:40	3/7/2012 4:55	106.25	Berth 10-03	Bulk	Pottasium Nitrate	9380829	0
12-0703	Uslan, Korea	Port Hueneme, CA	3/2/2012 21:51	3/3/2012 16:56	19.08	Berth 24-10	Auto Carrier	Vehicles	8708907	0
12-0705	Long Beach, CA	Japan	3/3/2012 6:49	3/3/2012 15:48	8.98	Berth 24-05	Auto Carrier	Vehicles	9283887	0
12-0578	Nuku Hiva	Hilo, Hawaii	3/4/2012 6:08	3/4/2012 17:00	10.87	B - Berth 01	Cruise Ship	Passengers	9473468	0
12-0610	Puerto Quetzal, Guatemala	Paita, Peru	3/4/2012 12:25	3/6/2012 17:58	53.55	Berth 10-02	Container	Bananas	8900323	0
12-0706	New Westminster, B.C.	Japan	3/6/2012 4:47	3/6/2012 16:10	11.38	Berth 24-05	Auto Carrier	Vehicles	9519092	0
12-0653	Hilo, Hawaii	Hawaii	3/6/2012 7:05	3/7/2012 14:20	31.25	Berth 24-02	Auto Carrier	Vehicles	9233167	0
12-0707	Los Angeles, CA	Yokohama,Japan	3/7/2012 3:50	3/7/2012 12:08	8.30	Berth 24-05	Auto Carrier	Vehicles	8313324	0
12-0708	Yokohama,Japan	Los Angeles, CA	3/9/2012 18:55	3/10/2012 12:10	17.25	Berth 24-10	Auto Carrier	Vehicles	9355185	0
12-0574	Ensenada, Mexico	Puerto Vallarta, Mx	3/10/2012 6:00	3/10/2012 16:55	10.92	B - Berth 01	Cruise Ship	Passengers	9221281	8.14
12-0620	Puerto Quetzal, Guatemala	Guayaquil, Equador	3/10/2012 11:55	3/13/2012 18:00	78.08	Berth 10-02	Container	Bananas	8513467	0
12-0709	Ulsan, Korea	Port Hueneme, CA	3/11/2012 5:51	3/11/2012 16:00	10.15	Berth 24-10	Auto Carrier	Vehicles	8709119	0
12-0570	Cabo San Lucas, Mx	Cabo San Lucas, Mx	3/11/2012 6:34	3/11/2012 16:31	9.95	B - Berth 01	Cruise Ship	Passengers	9188647	0
12-0710	New Minister,B.C.	Japan	3/12/2012 5:48	3/12/2012 15:52	10.07	Berth 24-05	Auto Carrier	Vehicles	9392339	0
12-0711	South Hampton, UK	Port Hueneme, CA	3/14/2012 5:55	3/14/2012 17:57	12.03	Berth 24-10	Auto Carrier	Vehicles	8913514	0
12-0627	Lazaro Cardenas, Mexico	Los Angeles, CA	3/15/2012 6:50	3/16/2012 16:10	33.33	Berth 10-07	General Cargo	Project Cargo	9509619	0
12-0571	Cabo San Lucas, Mx	Manzanillo, Mexico	3/16/2012 6:36	3/16/2012 17:08	10.53	B- Berth 04	Cruise Ship	Passengers	9188647	0
12-0579	Cabo San Lucas, Mx	Puerto Vallarta, Mx	3/16/2012 7:01	3/16/2012 17:44	10.72	B - Berth 02	Cruise Ship	Passengers	8919245	0
12-0629	New Minister,B.C.	Yokohama,Japan	3/17/2012 5:32	3/17/2012 16:09	10.62	Berth 24-05	Auto Carrier	Vehicles	9539212	0
12-0575	Cabo San Lucas, Mx	Hilo, Hawaii	3/17/2012 7:09	3/17/2012 17:22	10.22	B - Berth 01	Cruise Ship	Passengers	9221281	0
12-0630	Puerto Quetzal, Guatemala	Guayaquil, Equador	3/17/2012 13:30	3/20/2012 18:00	76.50	Berth 10-02	Container	Bananas	8513479	0
12-0641	Ulsan, Korea	Port Hueneme, CA	3/19/2012 9:51	3/19/2012 17:58	8.12	Berth 24-10	Auto Carrier	Vehicles	8013613	0
12-0642	Hilo, Hawaii	Hawaii	3/20/2012 5:59	3/21/2012 16:10	34.18	Berth 24-02	Auto Carrier	Vehicles	9233167	0
12-0644	Los Angeles, CA	Tacoma,Wa	3/21/2012 2:09	3/21/2012 11:58	9.82	Berth 24-05	Auto Carrier	Vehicles	9153549	0
12-0648	Port Hueneme, CA	Richmond, Ca	3/24/2012 6:05	3/24/2012 13:57	7.87	Berth 24-10	Auto Carrier	Vehicles	9325439	0
12-0649	Port Hueneme, CA	Lazaro Cardenas, Mexico	3/24/2012 6:30	3/24/2012 15:03	8.55	Berth 24-05	Auto Carrier	Vehicles	9177040	0
12-0650	Puerto Quetzal, Guatemala	Guayaquil, Equador	3/25/2012 4:43	3/27/2012 18:55	62.20	Berth 10-02	Container	Bananas	8900323	0
12-0572	Cabo San Lucas, Mx	Cabo San Lucas, Mx	3/25/2012 6:06	3/25/2012 16:23	10.28	B - Berth 01	Cruise Ship	Passengers	9188647	0
12-0652	Lazaro Cardenas, Mexico	Los Angeles, CA	3/25/2012 6:18	3/26/2012 8:04	25.77	Berth 10-04	Bulk	Fertilizer	9071569	0
12-0651	New Minister,B.C.	Japan	3/25/2012 7:42	3/25/2012 16:42	9.00	Berth 24-05	Auto Carrier	Vehicles	8712324	0
12-0654	China	Cartagena, Colombia	3/27/2012 13:30	3/29/2012 4:40	39.17	Berth 10-07	General Cargo	Soda Ash	9583055	0
12-0656	Manzanillo, Mexico	Los Angeles, CA	3/29/2012 2:10	3/30/2012 19:58	41.80	Berth 10-04	Bulk	Fertilizer	9182978	0
12-0743	San Francisco, CA	Ensenada, Mexico	3/29/2012 7:17	3/29/2012 17:58	10.68	B - Berth 01	Cruise Ship	Passengers	9228186	0
12-0573	Ensenada, Mexico	Manzanillo, Mexico	3/30/2012 6:25	3/30/2012 16:32	10.12	B - Berth 01	Cruise Ship	Passengers	9188647	0
12-0657	Tacoma,Wa	Yokohama,Japan	3/30/2012 8:35	3/30/2012 15:15	6.67	Berth 24-05	Auto Carrier	Vehicles	9267699	0
12-0658	Long Beach, CA	Japan	3/30/2012 13:54	3/31/2012 2:23	12.48	Berth 24-10	Auto Carrier	Vehicles	9339818	0

Trip Ref.	Last Port of Call	Next Port of Call	Arrived	Sailed	Hrs.	Berth	Vessel Type	Commodity	IMO#	Shore Pwr Time (hrs)
12-0576	Ensenada, Mexico	TBN	3/31/2012 6:07	3/31/2012 17:10	11.05	B - Berth 01	Cruise Ship	Passengers	9221281	5.98
12-0659	Korea	Port Hueneme, CA	3/31/2012 7:50	3/31/2012 17:55	10.08	Berth 24-10	Auto Carrier	Vehicles	9289910	0
12-0751	Los Angeles, CA	Ensenada, Mexico	4/1/2012 7:45	4/1/2012 18:22	10.62	B - Berth 01	Cruise Ship	Passengers	9228186	0
12-0663	Puerto Quetzal, Guatemala	Guayaquil, Equador	4/1/2012 17:55	4/3/2012 19:00	49.08	Berth 10-02	Container	Bananas	8513467	0
12-0664	Richmond, Ca	Yokohama,Japan	4/1/2012 21:50	4/2/2012 12:59	15.15	Berth 24-10	Auto Carrier	Vehicles	8506751	0
12-0635	TBN	Puerto Vallarta, Mx	4/3/2012 6:58	4/3/2012 17:16	10.30	B - Berth 01	Cruise Ship	Passengers	9473468	0
12-0668	Hawaii	Hawaii	4/3/2012 7:06	4/4/2012 15:15	32.15	Berth 24-02	Auto Carrier	Vehicles	9233167	0
12-0669	Korea	Port Hueneme, CA	4/3/2012 9:18	4/3/2012 17:20	8.03	Berth 24-05	Auto Carrier	Vehicles	8319689	0
12-0672	Chiba, Japan	Richmond, Ca	4/4/2012 18:26	4/5/2012 13:10	18.73	Berth 24-10	Auto Carrier	Vehicles	8708244	0
12-0633	Ensenada, Mexico	Honolulu, HI	4/5/2012 14:21	4/5/2012 23:58	9.62	B - Berth 01	Cruise Ship	Passengers	9072446	0
12-0730	Korea	Port Hueneme, CA	4/7/2012 7:35	4/7/2012 16:58	9.38	Berth 24-05	Auto Carrier	Vehicles	8708907	0
12-0631	TBN	TBN	4/8/2012 6:36	4/8/2012 16:16	9.67	B - Berth 01	Cruise Ship	Passengers	9188647	0
12-0681	Puerto Quetzal, Guatemala	Guayama, Puerto Rico	4/8/2012 11:49	4/10/2012 17:38	53.82	Berth 10-02	Container	Bananas	8513479	0
12-0683	Manzanillo, Panama	Long Beach, CA	4/9/2012 6:33	4/9/2012 16:00	9.45	Berth 24-05	Auto Carrier	Vehicles	9441568	0
12-0634	Cabo San Lucas, Mx	Cabo San Lucas, Mx	4/10/2012 5:07	4/10/2012 17:05	11.97	B - Berth 01	Cruise Ship	Passengers	9189421	0
12-0685	Tacoma,Wa	Los Angeles, CA	4/10/2012 13:29	4/10/2012 18:46	5.28	Berth 24-10	Auto Carrier	Vehicles	9561289	0
12-0686	New Minister,B.C.	Japan	4/10/2012 18:15	4/11/2012 16:30	22.25	Berth 24-05	Auto Carrier	Vehicles	8612251	0
12-0687	Yokohama,Japan	Los Angeles, CA	4/10/2012 19:56	4/11/2012 11:52	15.93	Berth 24-04	Auto Carrier	Vehicles	9247572	0
12-0688	Richmond, Ca	Japan	4/11/2012 7:12	4/11/2012 15:30	8.30	Berth 24-10	Auto Carrier	Vehicles	9604940	0
12-0752	Cabo San Lucas, Mx	San Francisco, CA	4/11/2012 7:42	4/11/2012 17:51	10.15	B- Berth 04	Cruise Ship	Passengers	9192363	0
12-0746	Los Angeles, CA	Ensenada, Mexico	4/12/2012 7:44	4/12/2012 18:09	10.42	B - Berth 01	Cruise Ship	Passengers	9228186	0
12-0700	Long Beach, CA	Japan	4/13/2012 2:00	4/13/2012 17:30	15.50	Berth 24-10	Auto Carrier	Vehicles	9403217	0
12-0632	Cabo San Lucas, Mx	Hawaii	4/13/2012 5:30	4/13/2012 16:00	10.50	B- Berth 04	Cruise Ship	Passengers	9188647	0
12-0639	Cabo San Lucas, Mx	Puerto Vallarta, Mx	4/13/2012 6:41	4/13/2012 17:00	10.32	B - Berth 02	Cruise Ship	Passengers	8919245	0
12-0701	Ulsan, Korea	Port Hueneme, CA	4/13/2012 6:48	4/13/2012 15:00	8.20	Berth 24-05	Auto Carrier	Vehicles	9431836	0
12-0704	Puerto Quetzal, Guatemala	Guayaquil, Equador	4/15/2012 5:48	4/17/2012 15:55	58.12	Berth 10-02	Container	Bananas	8900323	0
12-0673	Ensenada, Mexico	Port Angeles, WA	4/15/2012 6:11	4/15/2012 17:16	11.08	B - Berth 01	Cruise Ship	Passengers	9221281	0
12-0713	New Westminster, B.C.	Yokohama,Japan	4/16/2012 22:40	4/17/2012 16:40	18.00	Berth 24-10	Auto Carrier	Vehicles	9338826	0
12-0714	Hawaii	Hawaii	4/17/2012 7:22	4/18/2012 14:18	30.93	Berth 24-02	Auto Carrier	Vehicles	9233167	0
12-0674	Ensenada, Mexico	Hilo, Hawaii	4/20/2012 5:40	4/20/2012 17:15	11.58	B - Berth 01	Cruise Ship	Passengers	9072446	0
12-0715	Ulsan, Korea	Port Hueneme, CA	4/20/2012 6:00	4/20/2012 16:16	10.27	Berth 24-05	Auto Carrier	Vehicles	9434319	0
12-0716	Puerto Quetzal, Guatemala	Guayaquil, Equador	4/21/2012 22:05	4/24/2012 17:43	67.63	Berth 10-02	Container	Bananas	8513467	0
12-0717	South Hampton, UK	Port Hueneme, CA	4/23/2012 5:59	4/23/2012 17:25	11.43	Berth 24-10	Auto Carrier	Vehicles	9303211	0
12-0719	Korea	Port Hueneme, CA	4/24/2012 20:48	4/26/2012 16:08	43.33	Berth 24-10	Auto Carrier	Vehicles	8018168	0
12-0722	Ulsan, Korea	Port Hueneme, CA	4/28/2012 5:50	4/28/2012 18:08	12.30	Berth 24-05	Auto Carrier	Vehicles	9382102	0
12-0675	Ensenada, Mexico	Vancouver, B.C. Canada	4/28/2012 6:00	4/28/2012 16:37	10.62	B - Berth 01	Cruise Ship	Passengers	9188647	0
12-0723	Cabo San Lucas, Mx	San Francisco, CA	4/29/2012 13:10	4/29/2012 22:45	9.58	B - Berth 02	Cruise Ship	Passengers	9064126	0
12-0724	Puerto Quetzal, Guatemala	Guayaquil, Equador	4/29/2012 15:42	5/1/2012 17:00	49.30	Berth 10-02	Container	Bananas	8513479	0
12-0731	Hilo, Hawaii	Hawaii	5/1/2012 7:25	5/2/2012 15:08	31.72	Berth 24-02	Auto Carrier	Vehicles	9233167	0
12-0732	Los Angeles, CA	Yokohama,Japan	5/2/2012 2:45	5/2/2012 16:03	13.30	Berth 24-10	Auto Carrier	Vehicles	8709145	0

Trip Ref.	Last Port of Call	Next Port of Call	Arrived	Sailed	Hrs.	Berth	Vessel Type	Commodity	IMO#	Shore Pwr Time (hrs)
12-0694	Hilo, Hawaii	Ensenada, Mexico	5/2/2012 7:48	5/3/2012 21:58	38.17	By- Berth 02	Cruise Ship	Passengers	9183518	0
12-0733	Japan	Irago, JPN	5/3/2012 4:55	5/3/2012 17:49	12.90	Berth 24-10	Auto Carrier	Vehicles	9381665	0
12-0695	San Francisco, CA	Ensenada, Mexico	5/3/2012 7:37	5/3/2012 18:07	10.50	B - Berth 01	Cruise Ship	Passengers	9228186	0
12-0734	Vancouver, Wa	Japan	5/3/2012 21:01	5/4/2012 14:55	17.90	Berth 24-05	Auto Carrier	Vehicles	9426350	0
12-0736	Pyungyaek, Korea	Port Hueneme, CA	5/4/2012 19:49	5/5/2012 18:00	22.18	Berth 24-05	Auto Carrier	Vehicles	9053505	0
12-0691	Ensenada, Mexico	Catalina Island, CA	5/5/2012 5:34	5/5/2012 16:12	10.63	B - Berth 01	Cruise Ship	Passengers	9072446	0
12-0737	Manzanillo, Mexico	Stockton,California	5/6/2012 5:15	5/12/2012 0:05	138.83	Berth 10-03	Bulk	Potassium Nitrate	9262560	0
12-0696	Los Angeles, CA	Ensenada, Mexico	5/6/2012 7:27	5/6/2012 18:26	10.98	B - Berth 01	Cruise Ship	Passengers	9228186	0
12-0738	Weipa, Australia	Redwood City, Ca	5/6/2012 9:49	5/10/2012 10:27	96.63	Berth 10-07	Bulk	Bauxite	7104714	0
12-0739	Lianyangang, China	TBN	5/6/2012 18:28	5/8/2012 15:10	44.70	Berth 10-05	General Cargo	Project Cargo	9317705	0
12-0740	Chiba, Japan	Richmond, Ca	5/7/2012 2:35	5/8/2012 1:05	22.50	Berth 24-10	Auto Carrier	Vehicles	8708244	0
12-0741	Puerto Quetzal, Guatemala	Guayaquil, Equador	5/7/2012 14:05	5/10/2012 0:28	58.38	Berth 10-02	Container	Bananas	8900323	0
12-0692	Cabo San Lucas, Mx	Seattle Washington	5/8/2012 5:00	5/8/2012 16:33	11.55	By- Berth 01	Cruise Ship	Passengers	9189421	0
12-0698	Cabo San Lucas, Mx	Vancouver, B.C. Canada	5/8/2012 6:18	5/8/2012 16:45	10.45	B - Berth 01	Cruise Ship	Passengers	9226891	7.42
12-0699	Puerto Vallarta, Mx	Port Angeles, WA	5/8/2012 6:30	5/8/2012 17:00	10.50	B- Berth 04	Cruise Ship	Passengers	9221279	0
12-0742	Long Beach, CA	Unknown	5/9/2012 18:45	5/10/2012 17:22	22.62	Berth 24-10	Auto Carrier	Vehicles	9553115	0
12-0744	Tacoma,Wa	Los Angeles, CA	5/10/2012 22:34	5/11/2012 12:57	14.38	Berth 24-05	Auto Carrier	Vehicles	9153549	0
12-0745	Korea	Port Hueneme, CA	5/11/2012 11:24	5/11/2012 17:59	6.58	Berth 24-10	Auto Carrier	Vehicles	8608145	0
12-0689	TBN	Puerto Vallarta, Mx	5/13/2012 6:09	5/13/2012 17:10	11.02	By- Berth 02	Cruise Ship	Passengers	8919245	0
12-0690	Cabo San Lucas, Mx	Victoria, B.C.	5/13/2012 6:50	5/13/2012 16:55	10.08	B - Berth 01	Cruise Ship	Passengers	9188037	0
12-0748	Puerto Quetzal, Guatemala	Guayaquil, Equador	5/14/2012 19:20	5/16/2012 4:06	32.77	Berth 10-02	Container	Bananas	8513467	0
12-0749	Hawaii	Hawaii	5/15/2012 7:03	5/16/2012 12:07	29.07	Berth 24-02	Auto Carrier	Vehicles	9233167	0
12-0753	Korea	Unknown	5/19/2012 5:48	5/19/2012 16:00	10.20	Berth 24-05	Auto Carrier	Vehicles	8319689	0
12-0754	Houston, Texas	Busan, Korea	5/19/2012 15:45	5/20/2012 0:03	8.30	Berth 10-04	RoRo	Project Cargo	9112557	0
12-0755	Puerto Quetzal, Guatemala	Guayaquil, Equador	5/20/2012 9:45	5/22/2012 18:13	56.47	Berth 10-02	Container	Bananas	8513479	0
12-0756	Los Angeles, CA	Yokohama,Japan	5/22/2012 3:15	5/22/2012 11:15	8.00	Berth 24-04	Auto Carrier	Vehicles	8102115	0
12-0758	Brunswick, Georgia	Long Beach, CA	5/22/2012 6:43	5/22/2012 16:59	10.27	Berth 24-10	Auto Carrier	Vehicles	9402718	0
12-0757	Port Hueneme, CA	Mexico	5/22/2012 7:35	5/22/2012 16:30	8.92	Berth 24-05	Auto Carrier	Vehicles	9427940	0
12-0759	Port Hueneme, CA	Japan	5/22/2012 12:40	5/22/2012 14:57	2.28	Berth 24-04	Auto Carrier	Vehicles	9078220	0
12-0761	Corinto, Nicaragua	Los Angeles, CA	5/22/2012 17:34	5/24/2012 21:02	51.47	Berth 10-04	General Cargo	Fertilizer	9310513	0
12-0762	Korea	Port Hueneme, CA	5/23/2012 19:35	5/24/2012 16:11	20.60	Berth 24-10	Auto Carrier	Vehicles	9184940	0
12-0763	Portland	TBN	5/25/2012 6:04	5/26/2012 18:02	35.97	Berth 10-07	General Cargo	Soda Ash	9487031	0
12-0693	Cabo San Lucas, Mx	San Francisco, CA	5/27/2012 6:20	5/27/2012 17:05	10.75	B - Berth 01	Cruise Ship	Passengers	9189419	0
12-0764	Long Beach, CA	Japan	5/27/2012 6:55	5/27/2012 16:12	9.28	Berth 24-05	Auto Carrier	Vehicles	9477921	0
12-0765	Puerto Quetzal, Guatemala	Guayaquil, Equador	5/28/2012 12:00	5/29/2012 19:54	31.90	Berth 10-02	Container	Bananas	8900323	0
12-0767	Hawaii	Hawaii	5/29/2012 18:30	5/30/2012 22:57	28.45	Berth 24-02	Auto Carrier	Vehicles	9233167	0
12-0768	Korea	Port Hueneme, CA	5/31/2012 23:45	6/1/2012 16:00	16.25	Berth 24-10	Auto Carrier	Vehicles	9382102	0
12-0772	Lianyangang, China	Unknown	6/2/2012 3:57	6/3/2012 20:57	41.00	Berth 10-07	General Cargo	Project Cargo	9530319	0
12-0773	Puerto Quetzal, Guatemala	Guayaquil, Equador	6/3/2012 6:20	6/5/2012 16:40	58.33	Berth 10-02	Container	Bananas	8513467	0
12-0775	Los Angeles, CA	Vancouver, B.C.	6/4/2012 0:20	6/5/2012 15:06	38.77	Berth 10-05	General Cargo	Steel Coils	9497335	0

Trip Ref.	Last Port of Call	Next Port of Call	Arrived	Sailed	Hrs.	Berth	Vessel Type	Commodity	IMO#	Shore Pwr Time (hrs)
		Canada								
12-0776	New Westminster, B.C.	Japan	6/4/2012 6:42	6/4/2012 17:03	10.35	Berth 24-05	Auto Carrier	Vehicles	9303209	0
12-0778	New Westminster, B.C.	Benecia, CA	6/5/2012 5:58	6/5/2012 16:25	10.45	Berth 24-10	Auto Carrier	Vehicles	9536961	0
12-0779	Long Beach, CA	Japan	6/6/2012 6:52	6/6/2012 16:08	9.27	Berth 24-10	Auto Carrier	Vehicles	9367607	0
12-0781	Korea	Port Hueneme, CA	6/7/2012 10:52	6/7/2012 17:27	6.58	Berth 24-05	Auto Carrier	Vehicles	8211514	0
12-0784	Puerto Quetzal, Guatemala	Guayaquil, Equador	6/10/2012 0:40	6/12/2012 16:15	63.58	Berth 10-02	Container	Bananas	8513479	0
12-0785	Chiba, Japan	Unknown	6/11/2012 2:55	6/11/2012 15:07	12.20	Berth 24-10	Auto Carrier	Vehicles	8708244	0
12-0786	Port Hueneme, CA	Lazaro Cardenas, Mexico	6/11/2012 6:37	6/11/2012 14:41	8.07	Berth 24-05	Auto Carrier	Vehicles	9431836	0
12-0787	Hawaii	Hawaii	6/12/2012 14:32	6/14/2012 12:31	45.98	Berth 24-02	Auto Carrier	Vehicles	9233167	0
12-0783	Ensenada, Mexico	Catalina Island, CA	6/13/2012 7:26	6/17/2012 23:40	112.23	B- Berth 05	Cruise Ship	Passengers	9219331	0
12-0788	New Orleans, Louisiana	South Korea	6/13/2012 17:00	6/15/2012 19:05	50.08	Berth 10-07	General Cargo	Project Cargo	9265926	0
12-0789	Canada	Los Angeles, CA	6/13/2012 20:26	6/14/2012 16:52	20.43	Berth 24-10	Auto Carrier	Vehicles	8709145	0
12-0790	Canada	Japan	6/16/2012 2:20	6/16/2012 16:07	13.78	Berth 24-05	Auto Carrier	Vehicles	9561289	0
12-0791	Puerto Quetzal, Guatemala	Guayaquil, Equador	6/17/2012 2:45	6/19/2012 16:00	61.25	Berth 10-02	Container	Bananas	8900323	0
12-0794	Port Hueneme, CA	Japan	6/20/2012 7:08	6/20/2012 18:03	10.92	Berth 24-10	Auto Carrier	Vehicles	8913514	0
12-0795	Long Beach, CA	Unknown	6/22/2012 4:20	6/22/2012 18:00	13.67	Berth 10-04	General Cargo	Project Cargo	9330678	0
12-0796	Port Hueneme, CA	Korea	6/23/2012 6:55	6/23/2012 16:00	9.08	Berth 24-10	Auto Carrier	Vehicles	8506749	0
12-0797	Puerto Quetzal, Guatemala	Guayaquil, Equador	6/23/2012 23:08	6/26/2012 17:37	66.48	Berth 10-02	Container	Bananas	8513467	0
12-0798	New Westminster, B.C.	Japan	6/25/2012 5:56	6/25/2012 15:55	9.98	Berth 24-05	Auto Carrier	Vehicles	9498602	0
12-0801	Korea	Port Hueneme, CA	6/25/2012 19:10	6/26/2012 15:29	20.32	Berth 24-05	Auto Carrier	Vehicles	8709157	0
12-0802	Los Angeles, CA	Yokohama,Japan	6/26/2012 1:00	6/26/2012 12:02	11.03	Berth 24-04	Auto Carrier	Vehicles	9432880	0
12-0803	Brunswick, Georgia	Unknown	6/26/2012 6:40	6/26/2012 16:42	10.03	Berth 24-10	Auto Carrier	Vehicles	9498597	0
12-0805	Hawaii	Hawaii	6/27/2012 1:55	6/28/2012 12:24	34.48	Berth 24-02	Auto Carrier	Vehicles	9233167	0
12-0807	New Minister,B.C.	Japan	6/27/2012 15:44	6/28/2012 1:32	9.80	Berth 24-05	Auto Carrier	Vehicles	9536959	0
12-0810	Los Angeles, CA	Unknown	6/30/2012 5:25	7/1/2012 5:10	23.75	Berth 10-05	General Cargo	Steel Coils	8011330	0
12-0811	Puerto Quetzal, Guatemala	Guayaquil, Equador	6/30/2012 23:30	7/3/2012 17:43	66.22	Berth 10-02	Container	Bananas	8513479	0
13-0001	Benecia, CA	Manzanillo, Mexico	7/1/2012 6:37	7/1/2012 9:48	3.18	Berth 24-05	Auto Carrier	Vehicles	9325439	0
13-0004	Los Angeles, CA	Unknown	7/3/2012 13:54	7/3/2012 16:06	2.20	Berth 24-05	Auto Carrier	Vehicles	9432892	0
13-0005	Topolobambo, Mexico	Vancouver, B.C. Canada	7/3/2012 20:07	7/8/2012 21:06	120.98	Berth 10-03	Bulk	Potassium Nitrate	9380817	0
13-0007	Long Beach, CA	Japan	7/4/2012 6:30	7/4/2012 15:30	9.00	Berth 24-10	Auto Carrier	Vehicles	9213818	0
13-0006	Port Hueneme, CA	Lazaro Cardenas, Mexico	7/4/2012 6:35	7/4/2012 15:17	8.70	Berth 24-05	Auto Carrier	Vehicles	9177040	0
13-0008	Pyungyaek, Korea	Port Hueneme, CA	7/6/2012 6:46	7/6/2012 19:07	12.35	Berth 24-10	Auto Carrier	Vehicles	7917551	0
13-0010	Puerto Quetzal, Guatemala	Guayaquil, Equador	7/8/2012 13:55	7/10/2012 16:30	50.58	Berth 10-02	Container	Bananas	8900323	0
13-0011	New Minister,B.C.	Japan	7/9/2012 5:33	7/9/2012 17:18	11.75	Berth 24-05	Auto Carrier	Vehicles	9293595	0
13-0012	Japan	Unknown	7/9/2012 20:16	7/10/2012 16:04	19.80	Berth 24-10	Auto Carrier	Vehicles	8708244	0
13-0013	mokpo, korea	Port Hueneme, CA	7/10/2012 19:43	7/11/2012 16:02	20.32	Berth 24-05	Auto Carrier	Vehicles	8513560	0
13-0014	Hawaii	Hawaii	7/12/2012 6:39	7/13/2012 18:00	35.35	Berth 24-02	Auto Carrier	Vehicles	9233167	0
13-0015	Longview,Wa	Nicaragua	7/13/2012 5:05	7/15/2012 0:14	43.15	Berth 10-05	General Cargo	Project Cargo	9534444	0

Trip Ref.	Last Port of Call	Next Port of Call	Arrived	Sailed	Hrs.	Berth	Vessel Type	Commodity	IMO#	Shore Pwr Time (hrs)
13-0016	Lianyangang, China	Unknown	7/14/2012 0:20	7/15/2012 17:06	40.77	Berth 10-03	General Cargo	Project Cargo	9268083	0
13-0017	Colombia	Unknown	7/15/2012 21:45	7/16/2012 17:58	20.22	Berth 24-05	Auto Carrier	Vehicles	9539169	0
13-0018	Mizushima, Japan	Port Hueneme, CA	7/16/2012 3:35	7/16/2012 17:35	14.00	Berth 24-04	Auto Carrier	Vehicles	9325764	0
13-0019	Pyungyaek, Korea	Port Hueneme, CA	7/16/2012 6:17	7/16/2012 15:02	8.75	Berth 24-10	Auto Carrier	Vehicles	8708907	0
13-0020	Lianyangang, China	Tacoma,Wa	7/16/2012 13:15	7/18/2012 3:06	37.85	Berth 10-05	General Cargo	Project Cargo	9272773	0
13-0021	Puerto Quetzal, Guatemala	Guayaquil, Equador	7/16/2012 13:28	7/18/2012 0:08	34.67	Berth 10-02	Container	Bananas	8513467	0
13-0022	New Westminster, B.C.	Yokohama,Japan	7/17/2012 4:05	7/17/2012 15:38	11.55	Berth 24-05	Auto Carrier	Vehicles	9519121	0
13-0025	Port Hueneme, CA	Lazaro Cardenas, Mexico	7/20/2012 6:18	7/20/2012 15:58	9.67	Berth 24-05	Auto Carrier	Vehicles	9427940	0
13-0026	Uslan, Korea	Port Hueneme, CA	7/22/2012 6:43	7/22/2012 15:58	9.25	Berth 24-05	Auto Carrier	Vehicles	8608133	0
13-0027	Puerto Quetzal, Guatemala	Guayaquil, Equador	7/22/2012 23:32	7/24/2012 18:08	42.60	Berth 10-02	Container	Bananas	8513479	0
13-0028	Long Beach, CA	Japan	7/24/2012 6:35	7/24/2012 17:15	10.67	Berth 24-10	Auto Carrier	Vehicles	9441568	0
13-0030	Los Angeles, CA	Yokohama,Japan	7/26/2012 2:34	7/26/2012 13:58	11.40	Berth 24-05	Auto Carrier	Vehicles	8709145	0
13-0032	Long Beach, CA	Japan	7/27/2012 6:10	7/27/2012 16:05	9.92	Berth 24-05	Auto Carrier	Vehicles	9553103	0
13-0033	Ulsan, Korea	Port Hueneme, CA	7/27/2012 6:47	7/27/2012 15:30	8.72	Berth 24-10	Auto Carrier	Vehicles	9361823	0
13-0035	Hawaii	Hawaii	7/27/2012 9:25	7/28/2012 18:05	32.67	Berth 24-02	Auto Carrier	Vehicles	9233167	0
13-0038	Vancouver, Wa	Irago, JPN	7/30/2012 5:25	7/30/2012 15:53	10.47	Berth 24-05	Auto Carrier	Vehicles	9174490	0
13-0039	Puerto Quetzal, Guatemala	Guayaquil, Equador	7/30/2012 10:17	7/31/2012 23:59	37.70	Berth 10-02	Container	Bananas	8900323	0
13-0041	Acapulco, Mexico	Greys Harbor, WA	8/1/2012 7:56	8/1/2012 16:00	8.07	Berth 24-05	Auto Carrier	Vehicles	9427940	0
13-0044	Lazaro Cardenas, Mexico	Los Angeles, CA	8/1/2012 14:54	8/2/2012 12:00	21.10	Berth 10-04	Bulk	Project Cargo	9182978	0
13-0045	New Westminster, B.C.	Port Hueneme, CA	8/2/2012 2:28	8/2/2012 16:32	14.07	Berth 24-05	Auto Carrier	Vehicles	9536959	0
13-0046	Portland	Unknown	8/2/2012 6:10	8/2/2012 15:23	9.22	Berth 24-10	Auto Carrier	Vehicles	8506751	0
13-0049	Long Beach, CA	Japan	8/4/2012 6:53	8/4/2012 16:00	9.12	Berth 24-10	Auto Carrier	Vehicles	9303211	0
13-0050	Ulsan, Korea	Port Hueneme, CA	8/4/2012 19:24	8/5/2012 16:00	20.60	Berth 24-05	Auto Carrier	Vehicles	8319689	0
13-0051	Puerto Quetzal, Guatemala	Guayaquil, Equador	8/4/2012 23:15	8/7/2012 17:58	66.72	Berth 10-02	Container	Bananas	8513467	0
13-0052	Unknown	Unknown	8/7/2012 6:48	8/7/2012 11:00	4.20	Berth 24-05	Auto Carrier	Vehicles	9150339	0
13-0053	Los Angeles, CA	Unknown	8/9/2012 2:24	8/9/2012 11:05	8.68	Berth 24-04	Auto Carrier	Vehicles	9432907	0
13-0056	Port Hueneme, CA	Lazaro Cardenas, Mexico	8/10/2012 6:39	8/10/2012 15:03	8.40	Berth 24-05	Auto Carrier	Vehicles	9431836	0
13-0057	Hawaii	Hawaii	8/10/2012 16:37	8/15/2012 16:17	119.67	Berth 24-02	Auto Carrier	Vehicles	9233167	0
13-0058	Puerto Quetzal, Guatemala	Guayaquil, Equador	8/12/2012 4:15	8/14/2012 18:43	62.47	Berth 10-02	Container	Bananas	8513479	0
13-0059	Tacoma,Wa	Yokohama,Japan	8/12/2012 19:35	8/13/2012 16:30	20.92	Berth 24-05	Auto Carrier	Vehicles	9293595	0
13-0060	Ulsan, Korea	Port Hueneme, CA	8/14/2012 2:00	8/14/2012 15:59	13.98	Berth 24-10	Auto Carrier	Vehicles	9318515	0
13-0061	Port Hueneme, CA	Japan	8/15/2012 9:15	8/15/2012 18:02	8.78	Berth 24-10	Auto Carrier	Vehicles	9308895	0
13-0065	Puerto Quetzal, Guatemala	Guayaquil, Equador	8/20/2012 2:22	8/21/2012 17:27	39.08	Berth 10-02	Container	Bananas	8900323	0
13-0066	Los Angeles, CA	Yokohama,Japan	8/21/2012 1:48	8/21/2012 13:32	11.73	Berth 24-05	Auto Carrier	Vehicles	9267675	0
13-0067	Port Hueneme, CA	Japan	8/21/2012 6:54	8/21/2012 9:55	3.02	Berth 24-04	Auto Carrier	Vehicles	9325776	0
13-0068	new brunswick, Georgia	Long Beach, CA	8/23/2012 6:55	8/23/2012 17:32	10.62	Berth 24-10	Auto Carrier	Vehicles	9464455	0
13-0069	Richmond, Ca	Yokohama,Japan	8/24/2012 6:04	8/24/2012 15:38	9.57	Berth 24-10	Auto Carrier	Vehicles	8708244	0
13-0070	Puerto Quetzal, Guatemala	Guayaquil, Equador	8/25/2012 17:15	8/28/2012 17:57	72.70	Berth 10-02	Container	Bananas	8513467	0
13-0071	Hawaii	Hawaii	8/28/2012 14:47	8/30/2012 4:06	37.32	Berth 24-02	Auto Carrier	Vehicles	9233167	0

Trip Ref.	Last Port of Call	Next Port of Call	Arrived	Sailed	Hrs.	Berth	Vessel Type	Commodity	IMO#	Shore Pwr Time (hrs)
13-0072	Long Beach, CA	Japan	8/30/2012 7:22	8/30/2012 16:32	9.17	Berth 24-10	Auto Carrier	Vehicles	9531741	0
13-0074	China	Galveston, Texas	8/30/2012 21:30	8/31/2012 16:40	19.17	Berth 10-02	General Cargo	Project Cargo	9397705	0
13-0075	Corinto, Nicaragua	Los Angeles, CA	8/31/2012 9:20	9/2/2012 5:50	44.50	Berth 10-04	Bulk	Calcium Nitrate	9324667	0
13-0078	Puerto Quetzal, Guatemala	Guayaquil, Equador	9/1/2012 18:19	9/4/2012 18:00	71.68	Berth 10-02	Container	Bananas	8513479	0
13-0080	Los Angeles, CA	Japan	9/3/2012 20:17	9/4/2012 11:53	15.60	Berth 24-05	Auto Carrier	Vehicles	8709145	0
13-0084	Benecia, CA	Lazaro Cardenas, Mexico	9/6/2012 6:33	9/6/2012 15:20	8.78	Berth 24-05	Auto Carrier	Vehicles	9325764	0
13-0086	Richmond, Ca	Japan	9/6/2012 18:27	9/7/2012 14:51	20.40	Berth 24-05	Auto Carrier	Vehicles	9476733	0
13-0087	Uslan, Korea	Port Hueneme, CA	9/8/2012 19:28	9/9/2012 17:00	21.53	Berth 24-10	Auto Carrier	Vehicles	8608080	0
13-0088	Puerto Quetzal, Guatemala	Guayaquil, Equador	9/8/2012 23:20	9/11/2012 18:10	66.83	Berth 10-02	Container	Bananas	8900323	0
13-0095	Canada	Japan	9/11/2012 3:45	9/11/2012 16:30	12.75	Berth 24-05	Auto Carrier	Vehicles	9338840	0
13-0096	Hilo, Hawaii	Hawaii	9/12/2012 2:50	9/13/2012 4:44	25.90	Berth 24-02	Auto Carrier	Vehicles	9233167	0
13-0098	Santos, Brazil	Puerto Bolivar, Colombia	9/12/2012 23:00	9/15/2012 14:15	63.25	Berth 10-07	Bulk	Project Cargo	9506746	0
13-0100	Port Hueneme, CA	Unknown	9/13/2012 7:59	9/13/2012 16:27	8.47	Berth 24-10	Auto Carrier	Vehicles	9381249	0
13-0102	Charleston, S.C.	Charleston, S.C.	9/13/2012 22:00	9/14/2012 13:05	15.08	Berth 10-01	General Cargo	stores	7119678	0
13-0105	Puerto Quetzal, Guatemala	Guayaquil, Equador	9/16/2012 15:57	9/18/2012 18:07	50.17	Berth 10-02	Container	Bananas	8513467	0
13-0106	Unknown	Unknown	9/17/2012 1:50	9/17/2012 12:00	10.17	Berth 24-05	Auto Carrier	Vehicles	9519121	0
13-0107	Korea	Unknown	9/18/2012 5:57	9/18/2012 15:56	9.98	Berth 24-10	Auto Carrier	Vehicles	8608133	0
13-0108	Richmond, Ca	Japan	9/18/2012 6:54	9/18/2012 17:06	10.20	Berth 24-05	Auto Carrier	Vehicles	9174490	0
13-0109	New Westminster, B.C.	Yokohama,Japan	9/18/2012 23:20	9/19/2012 16:45	17.42	Berth 24-05	Auto Carrier	Vehicles	9293595	0
13-0110	Port Hueneme, CA	Lazaro Cardenas, Mexico	9/19/2012 11:34	9/19/2012 16:34	5.00	Berth 24-04	Auto Carrier	Vehicles	9325439	0
13-0111	Lazaro Cardenas, Mexico	Los Angeles, CA	9/21/2012 6:35	9/21/2012 19:00	12.42	Berth 10-07	General Cargo	Yachts	9071557	0
13-0184	San Francisco, CA	Ensenada, Mexico	9/21/2012 7:37	9/21/2012 19:52	12.25	By- Berth 01	Cruise Ship	Passengers	9126819	7.38
13-0090	Monterey , Calif.	Cabo San Lucas, Mx	9/22/2012 6:17	9/22/2012 18:08	11.85	B - Berth 02	Cruise Ship	Passengers	9189419	0
13-0113	Port Hueneme, CA	Unknown	9/22/2012 17:05	9/23/2012 2:35	9.50	Berth 24-10	Auto Carrier	Vehicles	9427940	0
13-0114	Puerto Quetzal, Guatemala	Guayaquil, Equador	9/22/2012 22:05	9/25/2012 19:16	69.18	Berth 10-02	Container	Bananas	8513479	0
13-0115	Canada	Unknown	9/25/2012 1:50	9/25/2012 16:00	14.17	Berth 24-10	Auto Carrier	Vehicles	9283875	0
13-0117	Kahului, Hawaii	Hawaii	9/26/2012 1:36	9/27/2012 4:10	26.57	Berth 24-02	Auto Carrier	Vehicles	9233167	0
13-0091	Victoria, B.C.	Puerto Vallarta, Mx	9/27/2012 5:30	9/27/2012 16:54	11.40	By- Berth 02	Cruise Ship	Passengers	8919245	0
13-0185	San Francisco, CA	Ensenada, Mexico	9/28/2012 6:34	9/28/2012 20:00	13.43	By- Berth 01	Cruise Ship	Passengers	9126819	9.14
13-0126	Chiba, Japan	Richmond, Ca	9/29/2012 5:45	9/29/2012 15:30	9.75	Berth 24-10	Auto Carrier	Vehicles	8708244	0
13-0127	Puerto Quetzal, Guatemala	Guayaquil, Equador	9/30/2012 3:20	10/2/2012 16:58	61.63	Berth 10-02	Container	Bananas	8900323	0
13-0129	Long Beach, CA	Japan	9/30/2012 18:40	10/1/2012 16:37	21.95	Berth 24-10	Auto Carrier	Vehicles	9357327	0
13-0130	New Westminster, B.C.	Japan	9/30/2012 19:15	10/1/2012 17:05	21.83	Berth 24-05	Auto Carrier	Vehicles	9381665	0
13-0131	Ulsan, Korea	Port Hueneme, CA	9/30/2012 21:48	10/1/2012 23:10	25.37	Berth 24-04	Auto Carrier	Vehicles	8708907	0
13-0141	Bremerhaven	Long Beach, CA	10/3/2012 7:40	10/3/2012 16:37	8.95	Berth 24-05	Auto Carrier	Vehicles	9553115	0
13-0142	Long Beach, CA	Japan	10/4/2012 3:45	10/4/2012 12:01	8.27	Berth 24-05	Auto Carrier	Vehicles	9088249	0
13-0121	San Francisco, CA	Cabo San Lucas, Mx	10/4/2012 6:25	10/4/2012 16:54	10.48	B- Berth 04	Cruise Ship	Passengers	9221279	0
13-0120	Astoria, OR	Hawaii	10/4/2012 6:30	10/4/2012 18:18	11.80	B - Berth 01	Cruise Ship	Passengers	9226891	8.25

Trip Ref.	Last Port of Call	Next Port of Call	Arrived	Sailed	Hrs.	Berth	Vessel Type	Commodity	IMO#	Shore Pwr Time (hrs)
13-0197	Ensenada, Mexico	San Francisco, CA	10/4/2012 7:34	10/4/2012 18:55	11.35	B - Berth 01	Cruise Ship	Passengers	9192363	0
13-0119	Alaska	Honolulu, HI	10/5/2012 5:55	10/5/2012 17:01	11.10	B - Berth 01	Cruise Ship	Passengers	9072446	0
13-0199	San Francisco, CA	Los Angeles, CA	10/5/2012 6:30	10/5/2012 18:03	11.55	B- Berth 04	Cruise Ship	Passengers	9228186	0
13-0209	San Francisco, CA	Ensenada, Mexico	10/5/2012 7:57	10/5/2012 20:00	12.05	By- Berth 01	Cruise Ship	Passengers	9126819	9.5
13-0144	Ulsan, Korea	Port Hueneme, CA	10/6/2012 19:35	10/7/2012 16:05	20.50	Berth 24-10	Auto Carrier	Vehicles	9289908	0
13-0145	Puerto Quetzal, Guatemala	Guayaquil, Equador	10/7/2012 4:55	10/9/2012 17:40	60.75	Berth 10-02	Container	Bananas	8513467	0
13-0146	Topolobambo, Mexico	Long Beach, CA	10/9/2012 8:08	10/12/2012 16:30	80.37	Berth 10-03	Bulk	Potassium Nitrate	9277486	0
13-0147	New Minister,B.C.	Yokohama,Japan	10/10/2012 0:50	10/10/2012 17:00	16.17	Berth 24-05	Auto Carrier	Vehicles	9397987	0
13-0148	Hawaii	Hawaii	10/10/2012 1:45	10/11/2012 6:44	28.98	Berth 24-02	Auto Carrier	Vehicles	9233167	0
13-0200	Catalina Island, CA	Ensenada, Mexico	10/11/2012 7:38	10/11/2012 17:25	9.78	B- Berth 04	Cruise Ship	Passengers	9228186	3.81
13-0210	San Francisco, CA	Ensenada, Mexico	10/12/2012 7:39	10/12/2012 20:03	12.40	By- Berth 01	Cruise Ship	Passengers	9126819	6.50
13-0149	Los Angeles, CA	Yokohama,Japan	10/12/2012 8:24	10/12/2012 13:31	5.12	Berth 24-05	Auto Carrier	Vehicles	7927415	0
13-0152	Puerto Quetzal, Guatemala	Guayaquil, Equador	10/14/2012 6:45	10/16/2012 16:45	58.00	Berth 10-02	Container	Bananas	8513479	0
13-0153	mokpo, korea	Port Hueneme, CA	10/16/2012 7:10	10/16/2012 15:56	8.77	Berth 24-10	Auto Carrier	Vehicles	8211514	0
13-0158	Brunswick, Georgia	Long Beach, CA	10/17/2012 6:25	10/17/2012 17:05	10.67	Berth 24-05	Auto Carrier	Vehicles	9355214	0
13-0159	Port Hueneme, CA	Lazaro Cardenas, Mexico	10/17/2012 6:53	10/17/2012 13:57	7.07	Berth 24-10	Auto Carrier	Vehicles	9431836	0
13-0161	Santos, Brazil	Santos, Brazil	10/17/2012 22:20	10/19/2012 22:00	47.67	Berth 10-07	General Cargo	Project Cargo	9267297	0
13-0162	Port Hueneme, CA	Japan	10/18/2012 5:44	10/18/2012 11:00	5.27	Berth 24-05	Auto Carrier	Vehicles	9338632	0
13-0201	Catalina Island, CA	Ensenada, Mexico	10/18/2012 7:46	10/18/2012 17:00	9.23	B- Berth 04	Cruise Ship	Passengers	9228186	6.36
13-0233	Cabo San Lucas, Mx	Cabo San Lucas, Mx	10/19/2012 5:45	10/19/2012 16:59	11.23	B - Berth 01	Cruise Ship	Passengers	9116876	0
13-0164	Mexico	San Francisco, CA	10/19/2012 18:48	10/20/2012 15:50	21.03	B- Berth 04	Cruise Ship	Passengers	9156527	0
13-0140	Ensenada, Mexico	Kahului, Hawaii	10/20/2012 5:43	10/20/2012 16:59	11.27	B - Berth 01	Cruise Ship	Passengers	9072446	0
13-0166	Puerto Quetzal, Guatemala	Guayaquil, Equador	10/21/2012 3:30	10/23/2012 15:59	60.48	Berth 10-02	Container	Bananas	8900323	0
13-0157	Ensenada, Mexico	Hilo, Hawaii	10/22/2012 1:40	10/22/2012 12:10	10.50	B - Berth 01	Cruise Ship	Passengers	9189419	0
13-0167	Unknown	Unknown	10/22/2012 5:37	10/22/2012 17:30	11.88	Berth 24-10	Auto Carrier	Vehicles	9561253	0
13-0156	Cabo San Lucas, Mx	Cabo San Lucas, Mx	10/23/2012 5:30	10/23/2012 17:28	11.97	B - Berth 01	Cruise Ship	Passengers	9189421	0
13-0169	Hawaii	Hawaii	10/23/2012 17:12	10/25/2012 3:15	34.05	Berth 24-02	Auto Carrier	Vehicles	9233167	0
13-0170	South Hampton, UK	Port Hueneme, CA	10/23/2012 19:20	10/24/2012 16:27	21.12	Berth 24-05	Auto Carrier	Vehicles	9308883	0
13-0173	Santos, Brazil	Houston, Texas	10/24/2012 8:40	10/26/2012 0:05	39.42	Berth 10-07	General Cargo	Project Cargo	9407598	0
13-0155	Cabo San Lucas, Mx	Puerto Vallarta, Mx	10/26/2012 7:05	10/26/2012 16:49	9.73	B - Berth 02	Cruise Ship	Passengers	8919245	0
13-0175	Los Angeles, CA	Yokohama,Japan	10/27/2012 2:43	10/27/2012 16:06	13.38	Berth 24-05	Auto Carrier	Vehicles	9177052	0
13-0154	Cabo San Lucas, Mx	Hilo, Hawaii	10/27/2012 5:30	10/27/2012 17:15	11.75	B - Berth 01	Cruise Ship	Passengers	9156527	0
13-0186	Puerto Quetzal, Guatemala	Guayaquil, Equador	10/28/2012 2:57	10/30/2012 19:08	64.18	Berth 10-02	Container	Bananas	8513467	0
13-0187	Uslan, Korea	Port Hueneme, CA	10/28/2012 6:20	10/28/2012 16:27	10.12	Berth 24-10	Auto Carrier	Vehicles	8605167	0
13-0188	Topolobambo, Mexico	Vancouver, B.C. Canada	10/29/2012 11:45	11/4/2012 18:05	150.33	Berth 10-03	Bulk	Potassium Nitrate	9585651	0
13-0189	Weipa, Australia	Redwood City, Ca	10/29/2012 15:42	11/2/2012 13:23	93.68	Berth 10-07	Bulk	Bauxite	9500091	0
13-0191	Vancouver, Wa	Japan	11/1/2012 19:10	11/2/2012 16:40	21.50	Berth 24-10	Auto Carrier	Vehicles	9441520	0
13-0192	New Minister,B.C.	Japan	11/1/2012 19:28	11/3/2012 0:57	29.48	Berth 24-05	Auto Carrier	Vehicles	9442873	0
13-0182	TBN	Puerto Vallarta, Mx	11/3/2012 6:26	11/3/2012 17:00	10.57	B - Berth 01	Cruise Ship	Passengers	9226891	7.55

Trip Ref.	Last Port of Call	Next Port of Call	Arrived	Sailed	Hrs.	Berth	Vessel Type	Commodity	IMO#	Shore Pwr Time (hrs)
13-0202	Puerto Quetzal, Guatemala	Guayaquil, Equador	11/4/2012 4:14	11/6/2012 18:20	62.10	Berth 10-02	Container	Bananas	8513479	0
13-0179	Ensenada, Mexico	Hawaii	11/4/2012 5:50	11/4/2012 16:57	11.12	B - Berth 01	Cruise Ship	Passengers	9072446	0
13-0204	Uslan, Korea	Port Hueneme, CA	11/4/2012 19:50	11/5/2012 15:57	20.12	Berth 24-10	Auto Carrier	Vehicles	8608133	0
13-0223	Germany	Japan	11/5/2012 5:30	11/6/2012 14:36	33.10	Berth 24-05	Auto Carrier	Vehicles	9056296	0
13-0206	New Minister,B.C.	Japan	11/6/2012 0:56	11/6/2012 15:49	14.88	Berth 24-10	Auto Carrier	Vehicles	9338864	0
13-0224	San Diego, CA	San Diego, CA	11/6/2012 14:37	11/7/2012 12:09	21.53	Berth 24-05	Auto Carrier	Vehicles	9056296	0
13-0208	Hawaii	Hawaii	11/6/2012 19:05	11/7/2012 23:26	28.35	Berth 24-02	Auto Carrier	Vehicles	9233167	0
13-0176	Ensenada, Mexico	Puerto Vallarta, Mx	11/10/2012 6:25	11/10/2012 17:03	10.63	B - Berth 01	Cruise Ship	Passengers	9156527	0
13-0226	Puerto Quetzal, Guatemala	Guayaquil, Equador	11/11/2012 0:55	11/13/2012 16:27	63.53	Berth 10-02	Container	Bananas	8900323	0
13-0228	Port Hueneme, CA	Lazaro Cardenas, Mexico	11/11/2012 10:05	11/11/2012 17:45	7.67	Berth 24-05	Auto Carrier	Vehicles	9177040	0
13-0231	Unknown	Los Angeles, CA	11/12/2012 19:30	11/13/2012 13:00	17.50	Berth 24-05	Auto Carrier	Vehicles	9185047	0
13-0234	Richmond, Ca	Japan	11/15/2012 7:00	11/15/2012 16:18	9.30	Berth 24-05	Auto Carrier	Vehicles	9110107	0
13-0237	Westminster, B.C.	Los Angeles, CA	11/16/2012 4:55	11/16/2012 16:09	11.23	Berth 24-05	Auto Carrier	Vehicles	9544920	0
13-0238	Benecia, CA	Lazaro Cardenas, Mexico	11/16/2012 7:01	11/16/2012 11:31	4.50	Berth 24-04	Auto Carrier	Vehicles	8611946	0
13-0177	Cabo San Lucas, Mx	Hilo, Hawaii	11/17/2012 6:29	11/17/2012 17:50	11.35	B - Berth 01	Cruise Ship	Passengers	9156527	0
13-0239	Ulsan, Korea	Port Hueneme, CA	11/17/2012 7:20	11/17/2012 16:36	9.27	Berth 24-10	Auto Carrier	Vehicles	8018168	0
13-0240	Puerto Quetzal, Guatemala	Guayaquil, Equador	11/18/2012 4:13	11/20/2012 17:57	61.73	Berth 10-02	Container	Bananas	8513467	0
13-0180	Ensenada, Mexico	Honolulu, HI	11/19/2012 5:31	11/19/2012 17:17	11.77	B - Berth 01	Cruise Ship	Passengers	9072446	0
13-0241	Manzanillo, Mexico	Stockton,California	11/19/2012 12:05	11/26/2012 5:32	161.45	Berth 10-03	General Cargo	Potassium Nitrate	9416434	0
13-0242	Hawaii	Hawaii	11/20/2012 17:00	11/21/2012 22:25	29.42	Berth 24-02	Auto Carrier	Vehicles	9233167	0
13-0181	Cabo San Lucas, Mx	Cabo San Lucas, Mx	11/22/2012 6:00	11/22/2012 17:00	11.00	B - Berth 01	Cruise Ship	Passengers	9189421	0
13-0244	Vlissingen, Netherlands	Los Angeles, CA	11/22/2012 14:45	11/25/2012 13:01	70.27	Berth 10-07	General Cargo	Project Cargo	8420787	0
13-0183	Cabo San Lucas, Mx	Honolulu, HI	11/23/2012 6:30	11/23/2012 16:46	10.27	B - Berth 02	Cruise Ship	Passengers	8919245	0
13-0245	Long Beach, CA	Japan	11/23/2012 7:18	11/24/2012 8:18	25.00	Berth 24-05	Auto Carrier	Vehicles	9367607	0
13-0246	Korea	Port Hueneme, CA	11/23/2012 19:49	11/24/2012 15:53	20.07	Berth 24-10	Auto Carrier	Vehicles	8912663	0
13-0178	Ensenada, Mexico	Los Angeles, CA	11/24/2012 6:35	11/24/2012 16:54	10.32	B - Berth 02	Cruise Ship	Passengers	9066667	0
13-0247	Puerto Quetzal, Guatemala	Guayaquil, Equador	11/25/2012 0:42	11/27/2012 18:03	65.35	Berth 10-02	Container	Bananas	8513479	0
13-0248	Ulsan, Korea	Port Hueneme, CA	11/26/2012 19:40	11/27/2012 16:25	20.75	Berth 24-05	Auto Carrier	Vehicles	8517944	0
13-0251	Port Hueneme, CA	Japan	11/29/2012 4:42	11/29/2012 16:08	11.43	Berth 24-10	Auto Carrier	Vehicles	9250220	0
13-0252	Richmond, Ca	Japan	11/29/2012 5:25	11/29/2012 18:50	13.42	Berth 24-05	Auto Carrier	Vehicles	9339818	0
13-0253	Los Angeles, CA	Japan	11/30/2012 5:05	11/30/2012 13:09	8.07	Berth 24-05	Auto Carrier	Vehicles	9395630	0
13-0256	Richmond, Ca	Japan	12/1/2012 5:50	12/1/2012 15:12	9.37	Berth 24-10	Auto Carrier	Vehicles	8708244	0
13-0213	Ensenada, Mexico	Puerto Vallarta, Mx	12/1/2012 6:28	12/1/2012 17:08	10.67	B - Berth 01	Cruise Ship	Passengers	9156527	0
13-0260	Puerto Quetzal, Guatemala	Guayaquil, Equador	12/2/2012 4:05	12/4/2012 19:34	63.48	Berth 10-02	Container	Bananas	8900323	0
13-0263	Ulsan, Korea	Port Hueneme, CA	12/3/2012 19:48	12/4/2012 16:06	20.30	Berth 24-05	Auto Carrier	Vehicles	9053505	0
13-0292	Ensenada, Mexico	Cabo San Lucas, Mx	12/4/2012 6:00	12/4/2012 16:20	10.33	B - Berth 01	Cruise Ship	Passengers	9072446	0
13-0265	Hilo, Hawaii	Honolulu, HI	12/4/2012 19:42	12/6/2012 0:12	28.50	Berth 24-02	Auto Carrier	Vehicles	9233167	0
13-0266	Canada	Japan	12/5/2012 0:30	12/6/2012 2:52	26.37	Berth 24-05	Auto Carrier	Vehicles	9561253	0
13-0211	Hilo, Hawaii	Puerto Vallarta, Mx	12/5/2012 6:26	12/5/2012 18:13	11.78	B - Berth 01	Cruise Ship	Passengers	9188037	0

Trip Ref.	Last Port of Call	Next Port of Call	Arrived	Sailed	Hrs.	Berth	Vessel Type	Commodity	IMO#	Shore Pwr Time (hrs)
13-0267	Callao,Peru	Long Beach, CA	12/6/2012 6:19	12/6/2012 16:11	9.87	Berth 24-10	Auto Carrier	Vehicles	9303209	0
13-0268	Long Beach, CA	Japan	12/6/2012 7:06	12/6/2012 16:56	9.83	Berth 24-05	Auto Carrier	Vehicles	9604940	0
13-0214	Hilo, Hawaii	Puerto Vallarta, Mx	12/8/2012 5:30	12/8/2012 16:59	11.48	B - Berth 01	Cruise Ship	Passengers	9156527	0
13-0270	Los Angeles, CA	Japan	12/9/2012 2:50	12/9/2012 11:56	9.10	Berth 24-05	Auto Carrier	Vehicles	8014227	0
13-0271	Puerto Quetzal, Guatemala	Guayaquil, Equador	12/9/2012 5:34	12/11/2012 17:30	59.93	Berth 10-02	Container	Bananas	8513467	0
13-0278	Canada	Japan	12/11/2012 20:35	12/12/2012 16:07	19.53	Berth 24-05	Auto Carrier	Vehicles	9338864	0
13-0280	Port Hueneme, CA	Korea	12/12/2012 17:18	12/13/2012 3:12	9.90	Berth 24-10	Auto Carrier	Vehicles	8013613	0
13-0293	Ulsan, Korea	Port Hueneme, CA	12/15/2012 20:05	12/16/2012 16:04	19.98	Berth 24-10	Auto Carrier	Vehicles	9382102	0
13-0295	Puerto Quetzal, Guatemala	Guayaquil, Equador	12/16/2012 5:20	12/18/2012 17:22	60.03	Berth 10-02	Container	Bananas	8513479	0
13-0296	Port Hueneme, CA	Lazaro Cardenas, Mexico	12/16/2012 6:45	12/16/2012 15:23	8.63	Berth 24-05	Auto Carrier	Vehicles	9431836	0
13-0297	Potolobambo, MX	Vancouver, B.C. Canada	12/16/2012 21:48	12/22/2012 3:00	125.20	Berth 10-03	General Cargo	Potassium Nitrate	9380817	0
13-0301	Hawaii	Hawaii	12/19/2012 7:48	12/21/2012 20:13	60.42	Berth 24-02	Auto Carrier	Vehicles	9233167	0
13-0302	Lazaro Cardenas, Mexico	Stockton,California	12/20/2012 4:50	12/21/2012 14:50	34.00	Berth 10-05	General Cargo	Fertilizer	9182954	0
13-0303	Long Beach, CA	Japan	12/20/2012 6:55	12/20/2012 17:16	10.35	Berth 24-10	Auto Carrier	Vehicles	9402718	0
13-0304	Port Hueneme, CA	Long Beach, CA	12/20/2012 21:38	12/20/2012 23:55	2.28	Berth 24-05	Auto Carrier	Vehicles	9442873	0
13-0217	Nuku Hiva	Puerto Vallarta, Mx	12/21/2012 6:34	12/21/2012 17:00	10.43	B - Berth 02	Cruise Ship	Passengers	8919245	0
13-0305	La Libertad, El Salvador	Houston, Texas	12/21/2012 8:43	12/23/2012 22:55	62.20	Berth 10-07	General Cargo	Project Cargo	9358010	0
13-0307	Ulsan, Korea	Port Hueneme, CA	12/21/2012 19:37	12/22/2012 15:55	20.30	Berth 24-05	Auto Carrier	Vehicles	8016548	0
13-0215	Ensenada, Mexico	Puerto Vallarta, Mx	12/22/2012 6:29	12/22/2012 17:00	10.52	B - Berth 01	Cruise Ship	Passengers	9156527	0
13-0308	Puerto Quetzal, Guatemala	Guayaquil, Equador	12/23/2012 5:05	12/26/2012 23:40	90.58	Berth 10-02	Container	Bananas	8900323	0
13-0309	Unknown	Unknown	12/25/2012 18:44	12/26/2012 19:04	24.33	Berth 24-10	Auto Carrier	Vehicles	8610124	0
13-0310	New Westminster, B.C.	Richmond, Ca	12/25/2012 23:40	12/27/2012 0:05	24.42	Berth 24-05	Auto Carrier	Vehicles	9553103	0
13-0311	Los Angeles, CA	Japan	12/27/2012 3:20	12/27/2012 16:00	12.67	Berth 24-10	Auto Carrier	Vehicles	9432892	0
13-0216	Cabo San Lucas, Mx	Puerto Bolivar, Colombia	12/29/2012 6:37	12/29/2012 17:06	10.48	B - Berth 01	Cruise Ship	Passengers	9156527	0
13-0312	Puerto Quetzal, Guatemala	Guayaquil, Equador	12/30/2012 0:15	1/2/2013 17:04	88.82	Berth 10-02	Container	Bananas	8513467	0
13-0313	Ulsan, Korea	Port Hueneme, CA	12/30/2012 19:30	12/31/2012 15:56	20.43	Berth 24-05	Auto Carrier	Vehicles	8709145	0

APPENDIX C

OGV Vessel Transit Activity Profiles

Appendix C. Transit Activity Profiles

Table C-1. Time (hours) in mode by speed bin (knots) for movements south and west.

Analysis Zone	Mode	Vessel Type	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22
Harbor	Man	Cargo	0.021	0.006	0.000	0.000	0.004	0.002	0.002	3.544	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Harbor	Man	Passenger	0.041	0.037	0.035	0.029	0.026	0.015	0.008	0.004	0.006	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Harbor	Man	Vehicle Carrier	0.058	0.106	0.039	0.023	0.007	0.008	0.012	0.007	0.007	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Harbor	Man	Container Ship	0.015	0.688	0.055	0.549	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Harbor	In	Cargo	0.029	1.562	0.050	0.071	0.075	0.058	0.050	0.033	0.042	0.233	0.108	0.087	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Harbor	In	Passenger	0.000	0.000	0.002	0.002	0.012	0.035	0.036	0.046	0.056	0.094	0.101	0.036	0.018	0.006	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Harbor	In	Vehicle Carrier	0.000	0.000	0.000	0.001	0.006	0.019	0.029	0.036	0.058	0.073	0.290	0.232	0.054	0.030	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Harbor	In	Container Ship	0.038	0.043	0.048	0.024	0.026	0.040	0.062	0.081	0.060	0.055	0.102	0.105	0.021	0.026	0.005	0.005	0.000	0.000	0.000	0.000	0.000	0.000
Harbor	Out	Cargo	0.029	0.029	0.025	0.017	0.004	0.004	0.033	0.050	0.117	0.071	0.233	0.062	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Harbor	Out	Passenger	0.000	0.000	0.000	0.000	0.001	0.010	0.013	0.019	0.040	0.080	0.156	0.043	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Harbor	Out	Vehicle Carrier	0.000	0.000	0.000	0.002	0.006	0.003	0.010	0.025	0.115	0.228	0.298	0.148	0.020	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Harbor	Out	Container Ship	0.000	0.844	0.328	0.006	0.019	0.003	0.022	0.047	0.036	0.178	0.192	0.114	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Buoy	In	Cargo	0.017	0.004	0.017	0.017	0.012	0.017	0.008	0.025	0.087	0.079	0.079	0.071	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Buoy	In	Passenger	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.017	0.006	0.002	0.016	0.052	0.063	0.048	0.064	0.013	0.000	0.000	0.000	0.000	0.000	0.000
Buoy	In	Vehicle Carrier	0.771	0.019	0.010	0.010	0.007	0.011	0.004	0.008	0.011	0.034	0.061	0.069	0.135	0.031	0.009	0.005	0.000	0.000	0.000	0.000	0.000	0.000
Buoy	In	Container Ship	0.000	0.000	0.000	0.000	0.000	0.000	0.048	0.019	0.017	0.026	0.076	0.038	0.043	0.036	0.040	0.010	0.000	0.000	0.000	0.000	0.000	0.000
Buoy	Out	Cargo	0.058	0.037	0.012	0.000	0.000	0.000	0.000	0.008	0.025	0.150	0.017	0.071	0.029	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Buoy	Out	Passenger	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.010	0.029	0.042	0.040	0.028	0.022	0.029	0.020	0.056	0.018	0.013	0.002	0.000	0.000	0.000
Buoy	Out	Vehicle Carrier	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.036	0.042	0.060	0.084	0.044	0.021	0.026	0.008	0.006	0.001	0.000	0.000	0.000	0.000	0.000
Buoy	Out	Container Ship	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.011	0.019	0.086	0.075	0.017	0.008	0.011	0.044	0.014	0.014	0.003	0.000	0.000	0.000	0.000
VSR	In	Cargo	0.000	0.000	0.000	0.000	0.025	0.325	0.117	0.087	0.037	0.225	0.079	0.062	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
VSR	In	Passenger	0.000	0.000	0.001	0.004	0.007	0.064	0.067	0.190	0.133	0.098	0.040	0.061	0.043	0.029	0.025	0.021	0.010	0.001	0.001	0.000	0.000	0.000
VSR	In	Vehicle Carrier	0.036	0.004	0.012	0.019	0.023	0.041	0.122	0.171	0.050	0.068	0.076	0.135	0.044	0.029	0.034	0.026	0.048	0.011	0.008	0.021	0.017	0.021
VSR	In	Container Ship	0.000	0.000	0.007	0.014	0.010	0.021	0.110	0.090	0.062	0.181	0.060	0.045	0.017	0.024	0.060	0.012	0.002	0.024	0.000	0.000	0.000	0.000
VSR	Out	Cargo	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.017	0.071	0.133	0.312	0.083	0.325	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Analysis Zone	Mode	Vessel Type	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22
VSR	**Out**	Passenger	0.047	0.037	0.007	0.002	0.001	0.001	0.000	0.010	0.118	0.001	0.002	0.025	0.001	0.003	0.026	0.012	0.037	0.017	0.075	0.071	0.004	0.007
VSR	**Out**	Vehicle Carrier	0.044	0.130	0.000	0.005	0.003	0.004	0.009	0.004	0.004	0.005	0.028	0.040	0.034	0.074	0.039	0.060	0.115	0.074	0.056	0.004	0.000	0.000
VSR	**Out**	Container Ship	0.000	0.000	0.000	0.003	0.006	0.017	0.000	0.003	0.000	0.011	0.000	0.000	0.000	0.000	0.050	0.031	0.061	0.053	0.067	0.019	0.000	0.000
Outer	**In**	Cargo	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Outer	**In**	Passenger	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.092	0.042	0.083	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Outer	**In**	Vehicle Carrier	0.000	0.000	0.000	0.002	0.001	0.003	0.002	0.005	0.002	0.006	0.000	0.000	0.005	0.006	0.003	0.000	0.001	0.000	0.000	0.000	0.005	0.013
Outer	**In**	Container Ship	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.021	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Outer	**Out**	Cargo	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.092	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Outer	**Out**	Passenger	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.056	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Outer	**Out**	Vehicle Carrier	0.093	0.088	0.002	0.002	0.002	0.002	0.001	0.002	0.001	0.001	0.001	0.001	0.006	0.007	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Outer	**Out**	Container Ship	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table C-2. Time (hours) in mode by speed bin (knots) for movements north.

Analysis Zone	Mode	Vessel Type	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20
Harbor	**Man**	Cargo	0.509	0.012	0.003	0.004	0.004	0.462	0.003	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Harbor	**Man**	Passenger	0.000	0.023	0.033	0.047	0.033	0.010	0.020	0.003	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Harbor	**Man**	Vehicle Carrier	0.156	0.066	0.032	0.014	0.007	0.007	0.008	0.002	0.002	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Harbor	**In**	Cargo	0.000	0.025	0.022	0.089	0.061	0.053	0.042	0.061	0.114	0.144	0.100	0.072	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Harbor	**In**	Passenger	0.000	0.000	0.000	0.000	0.000	0.028	0.017	0.050	0.056	0.228	0.061	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Harbor	**In**	Vehicle Carrier	0.002	0.000	0.013	0.018	0.024	0.038	0.054	0.034	0.031	0.207	0.187	0.192	0.029	0.022	0.000	0.000	0.001	0.000	0.000	0.000
Harbor	**Out**	Cargo	0.000	0.024	0.000	0.026	0.002	0.000	3.417	0.026	0.060	0.274	0.093	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Harbor	**Out**	Passenger	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.150	0.025	0.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Harbor	**Out**	Vehicle Carrier	0.001	0.017	0.000	0.002	0.006	0.010	0.029	0.031	0.069	0.223	0.313	0.094	0.026	0.004	0.000	0.000	0.000	0.000	0.000	0.000
Buoy	**In**	Cargo	0.000	0.000	0.000	0.000	0.000	0.031	0.003	0.006	0.067	0.067	0.078	0.036	0.158	0.008	0.000	0.000	0.000	0.000	0.000	0.000
Buoy	**In**	Passenger	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.083	0.033	0.017	0.428	0.044	0.000	0.000	0.000	0.000	0.000	0.000
Buoy	**In**	Vehicle Carrier	1.414	0.009	0.010	0.006	0.010	0.038	0.020	0.009	0.019	0.047	0.108	0.056	0.034	0.040	0.011	0.006	0.000	0.000	0.000	0.000
Buoy	**Out**	Cargo	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.064	0.076	0.105	0.050	0.010	0.050	0.005	0.000	0.000	0.000	0.000	0.000	0.000
Buoy	**Out**	Passenger	0.000	0.000	0.000	0.000	0.000	0.017	0.008	0.208	0.075	0.008	0.000	0.000	0.058	0.000	0.008	0.008	0.000	0.000	0.000	0.000
Buoy	**Out**	Vehicle Carrier	0.000	0.000	0.000	0.000	0.000	0.001	0.009	0.024	0.033	0.072	0.069	0.036	0.023	0.048	0.016	0.004	0.000	0.000	0.000	0.000
VSR	**In**	Cargo	0.000	0.000	0.003	0.006	0.003	0.067	0.231	0.094	0.086	0.122	0.211	0.369	0.014	0.042	0.022	0.014	0.128	0.036	0.000	0.000
VSR	**In**	Passenger	0.600	0.089	0.039	0.022	0.017	0.089	0.044	0.289	0.300	0.017	0.028	0.028	0.539	0.000	0.000	0.000	0.000	0.000	0.000	0.000
VSR	**In**	Vehicle Carrier	0.046	0.020	0.016	0.026	0.023	0.059	0.034	0.048	0.021	0.033	0.152	0.170	0.114	0.070	0.067	0.068	0.118	0.111	0.072	0.027
VSR	**Out**	Cargo	0.000	0.012	0.017	0.000	0.002	0.002	0.012	0.290	0.055	0.012	0.138	0.017	0.024	0.393	0.114	0.212	0.052	0.055	0.000	0.000
VSR	**Out**	Passenger	0.000	0.000	0.000	0.000	0.000	0.000	0.117	0.133	0.392	0.475	0.208	0.200	0.025	0.000	0.000	0.000	0.000	0.058	0.125	0.033
VSR	**Out**	Vehicle Carrier	0.000	0.000	0.000	0.002	0.011	0.003	0.001	0.003	0.013	0.002	0.008	0.028	0.047	0.048	0.134	0.104	0.108	0.288	0.148	0.006
Outer	**In**	Cargo	0.000	0.000	0.000	0.003	0.000	0.025	0.025	0.019	0.053	0.022	0.000	0.017	0.008	0.000	0.000	0.000	0.003	0.014	0.000	0.000
Outer	**In**	Passenger	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.461	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Outer	**In**	Vehicle Carrier	0.000	0.000	0.000	0.002	0.002	0.006	0.001	0.008	0.009	0.011	0.008	0.017	0.004	0.001	0.008	0.037	0.074	0.151	0.041	0.002
Outer	**Out**	Cargo	0.000	0.000	0.002	0.014	0.005	0.000	0.002	0.217	0.238	0.007	0.005	0.005	0.007	0.305	0.226	0.150	0.007	0.162	0.000	0.000
Outer	**Out**	Passenger	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.183	0.775	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Outer	**Out**	Vehicle Carrier	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.011	0.008	0.002	0.000	0.002	0.006	0.007	0.011	0.147	0.082	0.073	0.201	0.000

APPENDIX D

VSR Top Speed for Each Movement

Appendix D. VSR Top Speed for Each Movement

IMO#	Operator	Vessel Type	Date	Inbound/ Outbound	Top Speed [knots]
8900323	Dole Ocean Cargo Express	Container	1/1/2012	Inbound	12.7
9610391	Mitsui OSK Lines Ltd	Auto Carrier	1/2/2012	Inbound	13.2
8900323	Dole Ocean Cargo Express	Container	1/3/2012	Outbound	13.7
9153549	Mitsui OSK Lines Ltd	Auto Carrier	1/3/2012	Outbound	17.4
9553103	Nippon Yusen Kaisha	Auto Carrier	1/3/2012	Outbound	11.4
9153549	Mitsui OSK Lines Ltd	Auto Carrier	1/3/2012	Inbound	17.3
9553103	Nippon Yusen Kaisha	Auto Carrier	1/3/2012	Inbound	11.4
9473468	Holland America Line Inc.	Cruise Ship	1/4/2012	Outbound	20
9610391	Mitsui OSK Lines Ltd	Auto Carrier	1/4/2012	Outbound	12.7
9473468	Holland America Line Inc.	Cruise Ship	1/4/2012	Inbound	14.7
9446881	Mitsui OSK Lines Ltd	Auto Carrier	1/5/2012	Outbound	14.8
9446881	Mitsui OSK Lines Ltd	Auto Carrier	1/5/2012	Inbound	12.8
9432907	Zodiac Maritime Agencies Ltd	Auto Carrier	1/6/2012	Outbound	16.3
9432907	Zodiac Maritime Agencies Ltd	Auto Carrier	1/6/2012	Inbound	13.6
9221281	Holland America Line Inc.	Cruise Ship	1/7/2012	Outbound	13.2
9221281	Holland America Line Inc.	Cruise Ship	1/7/2012	Inbound	16.6
8819926	Chartworld Shipping Corp	Container	1/8/2012	Inbound	17.5
9476733	Nippon Yusen Kaisha	Auto Carrier	1/9/2012	Inbound	11.6
9476733	Nippon Yusen Kaisha	Auto Carrier	1/10/2012	Outbound	12
9233167	Pasha Group	Auto Carrier	1/10/2012	Inbound	11.9
8819926	Chartworld Shipping Corp	Container	1/11/2012	Outbound	18.5
9233167	Pasha Group	Auto Carrier	1/11/2012	Outbound	12.1
9432880	Zodiac Maritime Agencies Ltd	Auto Carrier	1/11/2012	Outbound	12.7
9103130	Grieg Star Shipping AS	General Cargo	1/11/2012	Inbound	12.4
9432880	Zodiac Maritime Agencies Ltd	Auto Carrier	1/11/2012	Inbound	13.5
9103128	Grieg Star Shipping AS	General Cargo	1/13/2012	Inbound	12
9221281	Holland America Line Inc.	Cruise Ship	1/14/2012	Outbound	14.6
9221281	Holland America Line Inc.	Cruise Ship	1/14/2012	Inbound	14.4
8513479	Dole Ocean Cargo Express	Container	1/14/2012	Inbound	12
9103130	Grieg Star Shipping AS	General Cargo	1/15/2012	Outbound	12

IMO#	Operator	Vessel Type	Date	Inbound/ Outbound	Top Speed [knots]
9141211	Eastern Car Liner Ltd ECL	RoRo	1/15/2012	Inbound	13.2
9103128	Grieg Star Shipping AS	General Cargo	1/16/2012	Outbound	13.7
9141211	Eastern Car Liner Ltd ECL	RoRo	1/16/2012	Outbound	14.5
9330616	Hoegh Autoliners AS	Auto Carrier	1/16/2012	Outbound	11.7
9330616	Hoegh Autoliners AS	Auto Carrier	1/16/2012	Inbound	13.4
8513479	Dole Ocean Cargo Express	Container	1/17/2012	Outbound	12.1
9361809	Kawasaki Kisen Kaisha Ltd	Auto Carrier	1/17/2012	Outbound	12.7
9361809	Kawasaki Kisen Kaisha Ltd	Auto Carrier	1/17/2012	Inbound	13
9338632	Kawasaki Kisen Kaisha Ltd	Auto Carrier	1/18/2012	Inbound	14.7
9338632	Kawasaki Kisen Kaisha Ltd	Auto Carrier	1/19/2012	Outbound	17.2
8919245	Holland America Line Inc.	Cruise Ship	1/20/2012	Outbound	17.1
9188647	Carnival Cruise Lines	Cruise Ship	1/20/2012	Outbound	20.9
9355214	Nippon Yusen Kaisha	Auto Carrier	1/20/2012	Outbound	11.8
9448140	Rickmers Reederei GmbH & Cie	Auto Carrier	1/20/2012	Outbound	12.7
8919245	Holland America Line Inc.	Cruise Ship	1/20/2012	Inbound	15.5
9188647	Carnival Cruise Lines	Cruise Ship	1/20/2012	Inbound	21.5
9355214	Nippon Yusen Kaisha	Auto Carrier	1/20/2012	Inbound	11.7
9448140	Rickmers Reederei GmbH & Cie	Auto Carrier	1/20/2012	Inbound	12
8016548	EUKOR Car Carriers Inc	Auto Carrier	1/21/2012	Inbound	13
8016548	EUKOR Car Carriers Inc	Auto Carrier	1/22/2012	Outbound	14.6
8900323	Dole Ocean Cargo Express	Container	1/22/2012	Inbound	11.3
9398917	Costa Crociere SpA	Cruise Ship	1/23/2012	Outbound	12
9177040	Siem Car Carriers AS	Auto Carrier	1/23/2012	Outbound	16.5
9382102	CSC RoRo Logistics Co Ltd	Auto Carrier	1/23/2012	Outbound	14.9
9398917	Costa Crociere SpA	Cruise Ship	1/23/2012	Inbound	14.9
9177040	Siem Car Carriers AS	Auto Carrier	1/23/2012	Inbound	14.3
9382102	CSC RoRo Logistics Co Ltd	Auto Carrier	1/23/2012	Inbound	18
8900323	Dole Ocean Cargo Express	Container	1/24/2012	Outbound	13.7
9233167	Pasha Group	Auto Carrier	1/24/2012	Inbound	11.9
9233167	Pasha Group	Auto Carrier	1/25/2012	Outbound	12.3
9371579	Kahn Scheepvaart BV	General Cargo	1/26/2012	Inbound	16.3
9371579	Kahn Scheepvaart BV	General Cargo	1/27/2012	Outbound	16.8

IMO#	Operator	Vessel Type	Date	Inbound/ Outbound	Top Speed [knots]
8506751	Mitsui OSK Lines Ltd	Auto Carrier	1/27/2012	Outbound	12.3
8506751	Mitsui OSK Lines Ltd	Auto Carrier	1/27/2012	Inbound	11.9
9221281	Holland America Line Inc.	Cruise Ship	1/28/2012	Outbound	15.3
9187887	Princess Cruise Lines Ltd	Cruise Ship	1/28/2012	Outbound	14.2
9221281	Holland America Line Inc.	Cruise Ship	1/28/2012	Inbound	12.7
9187887	Princess Cruise Lines Ltd	Cruise Ship	1/28/2012	Inbound	15.4
5419531	Chartworld Shipping Corp	Container	1/29/2012	Inbound	15.3
8511263	Kawasaki Kisen Kaisha Ltd	Auto Carrier	1/30/2012	Outbound	13.8
9290050	SE Shipping Lines Pte Ltd	General Cargo	1/30/2012	Inbound	10.4
8511263	Kawasaki Kisen Kaisha Ltd	Auto Carrier	1/30/2012	Inbound	13.3
9361823	China Shipping Car Carrier Inc	Auto Carrier	1/31/2012	Outbound	12.2
9361823	China Shipping Car Carrier Inc	Auto Carrier	1/31/2012	Inbound	13.2
9290050	SE Shipping Lines Pte Ltd	General Cargo	2/1/2012	Outbound	Missing in PortVision
9519121	Mitsui OSK Lines Ltd	Auto Carrier	2/1/2012	Outbound	12.2
9519121	Mitsui OSK Lines Ltd	Auto Carrier	2/1/2012	Inbound	12.2
5419531	Chartworld Shipping Corp	Container	2/3/2012	Outbound	19
9473468	Holland America Line Inc.	Cruise Ship	2/3/2012	Outbound	20.2
9426362	Nippon Yusen Kaisha	Auto Carrier	2/3/2012	Outbound	11.9
9473468	Holland America Line Inc.	Cruise Ship	2/3/2012	Inbound	14.4
9426362	Nippon Yusen Kaisha	Auto Carrier	2/3/2012	Inbound	11.7
9221281	Holland America Line Inc.	Cruise Ship	2/4/2012	Outbound	14.5
9188647	Carnival Cruise Lines	Cruise Ship	2/4/2012	Outbound	21.4
9221281	Holland America Line Inc.	Cruise Ship	2/4/2012	Inbound	19
9188647	Carnival Cruise Lines	Cruise Ship	2/4/2012	Inbound	13.1
9539183	Mitsui OSK Lines Ltd	Auto Carrier	2/4/2012	Inbound	12
9539183	Mitsui OSK Lines Ltd	Auto Carrier	2/5/2012	Outbound	16.5
8513479	Dole Ocean Cargo Express	Container	2/5/2012	Inbound	11.5
9553115	Nippon Yusen Kaisha	Auto Carrier	2/6/2012	Outbound	14.8
9553115	Nippon Yusen Kaisha	Auto Carrier	2/6/2012	Inbound	12
8513479	Dole Ocean Cargo Express	Container	2/7/2012	Outbound	12.2
9233167	Pasha Group	Auto Carrier	2/7/2012	Inbound	12.1
9233167	Pasha Group	Auto Carrier	2/8/2012	Outbound	12.4

IMO#	Operator	Vessel Type	Date	Inbound/ Outbound	Top Speed [knots]
9494905	CSAV	Auto Carrier	2/11/2012	Outbound	12.5
8900323	Dole Ocean Cargo Express	Container	2/11/2012	Inbound	11.9
9494905	CSAV	Auto Carrier	2/11/2012	Inbound	12.3
9188647	Carnival Cruise Lines	Cruise Ship	2/12/2012	Outbound	21.1
8709145	EUKOR Car Carriers Inc	Auto Carrier	2/12/2012	Outbound	12.1
9188647	Carnival Cruise Lines	Cruise Ship	2/12/2012	Inbound	18.1
8709145	EUKOR Car Carriers Inc	Auto Carrier	2/12/2012	Inbound	12.3
8900323	Dole Ocean Cargo Express	Container	2/14/2012	Outbound	12.8
8608145	EUKOR Car Carriers Inc	Auto Carrier	2/14/2012	Outbound	13.9
8608145	EUKOR Car Carriers Inc	Auto Carrier	2/14/2012	Inbound	14
9431836	Hoegh Autoliners AS	Auto Carrier	2/15/2012	Outbound	17.5
9153549	Mitsui OSK Lines Ltd	Auto Carrier	2/15/2012	Outbound	15.9
9290050	SE Shipping Lines Pte Ltd	General Cargo	2/15/2012	Inbound	Missing in PortVision
9431836	Hoegh Autoliners AS	Auto Carrier	2/15/2012	Inbound	18.2
9153549	Mitsui OSK Lines Ltd	Auto Carrier	2/15/2012	Inbound	17.7
9335933	Nippon Yusen Kaisha	Auto Carrier	2/16/2012	Outbound	11.3
9335933	Nippon Yusen Kaisha	Auto Carrier	2/16/2012	Inbound	11.9
8919245	Holland America Line Inc.	Cruise Ship	2/17/2012	Outbound	16.2
9188647	Carnival Cruise Lines	Cruise Ship	2/17/2012	Outbound	18.2
9542283	Mitsui OSK Lines Ltd	Auto Carrier	2/17/2012	Outbound	11.5
8919245	Holland America Line Inc.	Cruise Ship	2/17/2012	Inbound	15.3
9188647	Carnival Cruise Lines	Cruise Ship	2/17/2012	Inbound	20.6
9542283	Mitsui OSK Lines Ltd	Auto Carrier	2/17/2012	Inbound	11.8
9221281	Holland America Line Inc.	Cruise Ship	2/18/2012	Outbound	13.5
8712324	Mitsui OSK Lines Ltd	Auto Carrier	2/18/2012	Outbound	12.2
9177026	Norwegian Car Carriers ASA	Auto Carrier	2/18/2012	Outbound	16.2
9221281	Holland America Line Inc.	Cruise Ship	2/18/2012	Inbound	13.7
8712324	Mitsui OSK Lines Ltd	Auto Carrier	2/18/2012	Inbound	11.3
9177026	Norwegian Car Carriers ASA	Auto Carrier	2/18/2012	Inbound	14.8
9454759	Seatrade Reefer Chartering NV	Container	2/19/2012	Inbound	18.9
9289908	EUKOR Car Carriers Inc	Auto Carrier	2/20/2012	Inbound	12.1
9289908	EUKOR Car Carriers Inc	Auto Carrier	2/21/2012	Outbound	17.1

IMO#	Operator	Vessel Type	Date	Inbound/ Outbound	Top Speed [knots]
9233167	Pasha Group	Auto Carrier	2/21/2012	Inbound	12.3
9290050	SE Shipping Lines Pte Ltd	General Cargo	2/22/2012	Outbound	13
9233167	Pasha Group	Auto Carrier	2/22/2012	Outbound	12.3
9372337	Nissan Motor Car Carrier	Auto Carrier	2/22/2012	Outbound	17.7
9372337	Nissan Motor Car Carrier	Auto Carrier	2/22/2012	Inbound	13.2
9454759	Seatrade Reefer Chartering NV	Container	2/23/2012	Outbound	16.8
9289910	Zim Integrated Shipping Serv	Auto Carrier	2/24/2012	Inbound	14.4
9221281	Holland America Line Inc.	Cruise Ship	2/25/2012	Outbound	14.8
9289910	Zim Integrated Shipping Serv	Auto Carrier	2/25/2012	Outbound	15
9221281	Holland America Line Inc.	Cruise Ship	2/25/2012	Inbound	16
9188647	Carnival Cruise Lines	Cruise Ship	2/26/2012	Outbound	19.9
9539171	Nippon Yusen Kaisha	Auto Carrier	2/26/2012	Outbound	11
9188647	Carnival Cruise Lines	Cruise Ship	2/26/2012	Inbound	15.5
8513479	Dole Ocean Cargo Express	Container	2/26/2012	Inbound	13.7
9539171	Nippon Yusen Kaisha	Auto Carrier	2/26/2012	Inbound	11.3
8513479	Dole Ocean Cargo Express	Container	2/28/2012	Outbound	12.2
9448140	Rickmers Reederei GmbH & Cie	Auto Carrier	2/28/2012	Outbound	12.4
9544918	Mitsui OSK Lines Ltd	Auto Carrier	2/28/2012	Outbound	13.3
9448140	Rickmers Reederei GmbH & Cie	Auto Carrier	2/28/2012	Inbound	12.8
9544918	Mitsui OSK Lines Ltd	Auto Carrier	2/28/2012	Inbound	13.1
9412567	Nippon Yusen Kaisha	Auto Carrier	2/29/2012	Outbound	11.2
8506751	Mitsui OSK Lines Ltd	Auto Carrier	2/29/2012	Outbound	12.2
9431434	SE Shipping Lines Pte Ltd	General Cargo	2/29/2012	Inbound	13.1
9412567	Nippon Yusen Kaisha	Auto Carrier	2/29/2012	Inbound	11.2
8506751	Mitsui OSK Lines Ltd	Auto Carrier	2/29/2012	Inbound	12.1
8708244	Mitsui OSK Lines Ltd	Auto Carrier	3/1/2012	Inbound	11.2
9188647	Carnival Cruise Lines	Cruise Ship	3/2/2012	Outbound	19.6
8708244	Mitsui OSK Lines Ltd	Auto Carrier	3/2/2012	Outbound	11.3
9188647	Carnival Cruise Lines	Cruise Ship	3/2/2012	Inbound	18.7
9380829	d'Amico Dry Ltd	Bulk	3/2/2012	Inbound	11.7
8708907	Excel Marine Co Ltd	Auto Carrier	3/2/2012	Inbound	11
9431434	SE Shipping Lines Pte Ltd	General Cargo	3/3/2012	Outbound	14.7

IMO#	Operator	Vessel Type	Date	Inbound/ Outbound	Top Speed [knots]
9283887	Nippon Yusen Kaisha	Auto Carrier	3/3/2012	Outbound	11.3
8708907	Excel Marine Co Ltd	Auto Carrier	3/3/2012	Outbound	16.9
9283887	Nippon Yusen Kaisha	Auto Carrier	3/3/2012	Inbound	11.1
9473468	Holland America Line Inc.	Cruise Ship	3/4/2012	Outbound	17.4
9473468	Holland America Line Inc.	Cruise Ship	3/4/2012	Inbound	18.6
8900323	Dole Ocean Cargo Express	Container	3/4/2012	Inbound	11.7
8900323	Dole Ocean Cargo Express	Container	3/6/2012	Outbound	12.6
9519052	Mitsui OSK Lines Ltd	Auto Carrier	3/6/2012	Outbound	13.8
9233167	Pasha Group	Auto Carrier	3/6/2012	Inbound	12.1
9519052	Mitsui OSK Lines Ltd	Auto Carrier	3/6/2012	Inbound	11.9
9380829	d'Amico Dry Ltd	Bulk	3/7/2012	Outbound	12.6
9233167	Pasha Group	Auto Carrier	3/7/2012	Outbound	12
8313324	Mitsui OSK Lines Ltd	Auto Carrier	3/7/2012	Outbound	14.4
8313324	Mitsui OSK Lines Ltd	Auto Carrier	3/7/2012	Inbound	11.8
9355185	Mitsui OSK Lines Ltd	Auto Carrier	3/9/2012	Inbound	12
9221281	Holland America Line Inc.	Cruise Ship	3/10/2012	Outbound	14.2
9355185	Mitsui OSK Lines Ltd	Auto Carrier	3/10/2012	Outbound	11.9
9221281	Holland America Line Inc.	Cruise Ship	3/10/2012	Inbound	13.8
8513467	Dole Ocean Cargo Express	Container	3/10/2012	Inbound	12.5
9188647	Carnival Cruise Lines	Cruise Ship	3/11/2012	Outbound	20.8
8709119	EUKOR Car Carriers Inc	Auto Carrier	3/11/2012	Outbound	13.2
9188647	Carnival Cruise Lines	Cruise Ship	3/11/2012	Inbound	13.5
8709119	EUKOR Car Carriers Inc	Auto Carrier	3/11/2012	Inbound	13.7
9392339	Kawasaki Kisen Kaisha Ltd	Auto Carrier	3/12/2012	Outbound	17
9392339	Kawasaki Kisen Kaisha Ltd	Auto Carrier	3/12/2012	Inbound	11.5
8513467	Dole Ocean Cargo Express	Container	3/13/2012	Outbound	12.8
8913514	Nippon Yusen Kaisha	Auto Carrier	3/14/2012	Outbound	11.9
8913514	Nippon Yusen Kaisha	Auto Carrier	3/14/2012	Inbound	11.1
9509619	Oldendorff Carriers GmbH & Co	General Cargo	3/15/2012	Inbound	12
8919245	Holland America Line Inc.	Cruise Ship	3/16/2012	Outbound	15.4
9188647	Carnival Cruise Lines	Cruise Ship	3/16/2012	Outbound	18.7
9509619	Oldendorff Carriers GmbH & Co	General Cargo	3/16/2012	Outbound	12.9

IMO#	Operator	Vessel Type	Date	Inbound/ Outbound	Top Speed [knots]
8919245	Holland America Line Inc.	Cruise Ship	3/16/2012	Inbound	15.7
9188647	Carnival Cruise Lines	Cruise Ship	3/16/2012	Inbound	17.8
9221281	Holland America Line Inc.	Cruise Ship	3/17/2012	Outbound	14.7
9539212	Mitsui OSK Lines Ltd	Auto Carrier	3/17/2012	Outbound	12.1
9221281	Holland America Line Inc.	Cruise Ship	3/17/2012	Inbound	14.7
8513479	Dole Ocean Cargo Express	Container	3/17/2012	Inbound	12.5
9539212	Mitsui OSK Lines Ltd	Auto Carrier	3/17/2012	Inbound	12.4
8013613	Hoegh Autoliners AS	Auto Carrier	3/19/2012	Outbound	15.6
8013613	Hoegh Autoliners AS	Auto Carrier	3/19/2012	Inbound	17.3
8513479	Dole Ocean Cargo Express	Container	3/20/2012	Outbound	12.3
9233167	Pasha Group	Auto Carrier	3/20/2012	Inbound	11.8
9233167	Pasha Group	Auto Carrier	3/21/2012	Outbound	17.1
9153549	Mitsui OSK Lines Ltd	Auto Carrier	3/21/2012	Outbound	15.6
9153549	Mitsui OSK Lines Ltd	Auto Carrier	3/21/2012	Inbound	16.6
9177040	Siem Car Carriers AS	Auto Carrier	3/24/2012	Outbound	16.4
9325439	Kawasaki Kisen Kaisha Ltd	Auto Carrier	3/24/2012	Outbound	16.3
9177040	Siem Car Carriers AS	Auto Carrier	3/24/2012	Inbound	14.9
9325439	Kawasaki Kisen Kaisha Ltd	Auto Carrier	3/24/2012	Inbound	13.2
9188647	Carnival Cruise Lines	Cruise Ship	3/25/2012	Outbound	19.7
8712324	Mitsui OSK Lines Ltd	Auto Carrier	3/25/2012	Outbound	12.1
9188647	Carnival Cruise Lines	Cruise Ship	3/25/2012	Inbound	11.6
8900323	Dole Ocean Cargo Express	Container	3/25/2012	Inbound	11.2
9071569	Grieg Star Shipping AS	Bulk	3/25/2012	Inbound	11.2
8712324	Mitsui OSK Lines Ltd	Auto Carrier	3/25/2012	Inbound	11.8
9071569	Grieg Star Shipping AS	Bulk	3/26/2012	Outbound	11.7
8900323	Dole Ocean Cargo Express	Container	3/27/2012	Outbound	14.3
9583055	United Bulk Carriers USA	General Cargo	3/27/2012	Inbound	Missing in PortVision
9228186	Princess Cruise Lines Ltd	Cruise Ship	3/29/2012	Outbound	12.5
9583055	United Bulk Carriers USA	General Cargo	3/29/2012	Outbound	11.6
9228186	Princess Cruise Lines Ltd	Cruise Ship	3/29/2012	Inbound	14.6
9182978	Grieg Star Shipping AS	Bulk	3/29/2012	Inbound	11.1
9188647	Carnival Cruise Lines	Cruise Ship	3/30/2012	Outbound	19.2

IMO#	Operator	Vessel Type	Date	Inbound/ Outbound	Top Speed [knots]
9182978	Grieg Star Shipping AS	Bulk	3/30/2012	Outbound	11.7
9267699	Mitsui OSK Lines Ltd	Auto Carrier	3/30/2012	Outbound	17.9
9188647	Carnival Cruise Lines	Cruise Ship	3/30/2012	Inbound	18.9
9267699	Mitsui OSK Lines Ltd	Auto Carrier	3/30/2012	Inbound	11.7
9339818	LMS Shipmanagement Inc	Auto Carrier	3/30/2012	Inbound	11.2
9221281	Holland America Line Inc.	Cruise Ship	3/31/2012	Outbound	14.2
9282910	Zim Integrated Shipping Serv	Auto Carrier	3/31/2012	Outbound	17.1
9339818	LMS Shipmanagement Inc	Auto Carrier	3/31/2012	Outbound	10.5
9221281	Holland America Line Inc.	Cruise Ship	3/31/2012	Inbound	13.5
9282910	Zim Integrated Shipping Serv	Auto Carrier	3/31/2012	Inbound	17.5
9228186	Princess Cruise Lines Ltd	Cruise Ship	04/01/12	Inbound	13.3
8513467	Dole Ocean Cargo Express	Container	04/01/12	Inbound	15.7
8506751	Mitsui OSK Lines Ltd	Auto Carrier	04/01/12	Inbound	12.1
9228186	Princess Cruise Lines Ltd	Cruise Ship	04/01/12	Outbound	14
8506751	Mitsui OSK Lines Ltd	Auto Carrier	04/02/12	Outbound	12.5
9473468	Holland America Line Inc.	Cruise Ship	04/03/12	Inbound	16.1
9233167	Pasha Group	Auto Carrier	04/03/12	Inbound	12.1
8319689	Cido Car Carrier Service Co	Auto Carrier	04/03/12	Inbound	12.3
9473468	Holland America Line Inc.	Cruise Ship	04/03/12	Outbound	16.8
8513467	Dole Ocean Cargo Express	Container	04/03/12	Outbound	12.4
8319689	Cido Car Carrier Service Co	Auto Carrier	04/03/12	Outbound	13.8
8708244	Mitsui OSK Lines Ltd	Auto Carrier	04/04/12	Inbound	13.9
9233167	Pasha Group	Auto Carrier	04/04/12	Outbound	15.2
9072446	Celebrity Cruises Inc.	Cruise Ship	04/05/12	Inbound	18.7
9072446	Celebrity Cruises Inc.	Cruise Ship	04/05/12	Outbound	18.6
8708244	Mitsui OSK Lines Ltd	Auto Carrier	04/05/12	Outbound	12.5
8708907	Excel Marine Co Ltd	Auto Carrier	04/07/12	Inbound	12.1
8708907	Excel Marine Co Ltd	Auto Carrier	04/07/12	Outbound	16.2
9188647	Carnival Cruise Lines	Cruise Ship	04/08/12	Inbound	12.9
8513479	Dole Ocean Cargo Express	Container	04/08/12	Inbound	12.5
9188647	Carnival Cruise Lines	Cruise Ship	04/08/12	Outbound	20.5
9441568	Nippon Yusen Kaisha	Auto Carrier	04/09/12	Inbound	11.4

IMO#	Operator	Vessel Type	Date	Inbound/ Outbound	Top Speed [knots]
9441568	Nippon Yusen Kaisha	Auto Carrier	04/09/12	Outbound	11.7
9189421	Celebrity Cruises Inc.	Cruise Ship	04/10/12	Inbound	20.5
9247572	Mitsui OSK Lines Ltd	Auto Carrier	04/10/12	Inbound	11.3
8612251	Kawasaki Kisen Kaisha Ltd	Auto Carrier	04/10/12	Inbound	11.8
9561289	Mitsui OSK Lines Ltd	Auto Carrier	04/10/12	Inbound	19.6
9189421	Celebrity Cruises Inc.	Cruise Ship	04/10/12	Outbound	21.8
8513479	Dole Ocean Cargo Express	Container	04/10/12	Outbound	12.1
9561289	Mitsui OSK Lines Ltd	Auto Carrier	04/10/12	Outbound	19.1
9192363	Princess Cruise Lines Ltd	Cruise Ship	04/11/12	Inbound	15.1
9604940	Nippon Yusen Kaisha	Auto Carrier	04/11/12	Inbound	11.1
9192363	Princess Cruise Lines Ltd	Cruise Ship	04/11/12	Outbound	15.2
9247572	Mitsui OSK Lines Ltd	Auto Carrier	04/11/12	Outbound	11.2
8612251	Kawasaki Kisen Kaisha Ltd	Auto Carrier	04/11/12	Outbound	12.6
9604940	Nippon Yusen Kaisha	Auto Carrier	04/11/12	Outbound	12.1
9228186	Princess Cruise Lines Ltd	Cruise Ship	04/12/12	Inbound	13.5
9228186	Princess Cruise Lines Ltd	Cruise Ship	04/12/12	Outbound	14
8919245	Holland America Line Inc.	Cruise Ship	04/13/12	Inbound	16.2
9188647	Carnival Cruise Lines	Cruise Ship	04/13/12	Inbound	18.6
9431836	Hoegh Autoliners AS	Auto Carrier	04/13/12	Inbound	15.3
9403217	United Ocean Ship Management	Auto Carrier	04/13/12	Inbound	13
8919245	Holland America Line Inc.	Cruise Ship	04/13/12	Outbound	15.7
9188647	Carnival Cruise Lines	Cruise Ship	04/13/12	Outbound	19.7
9431836	Hoegh Autoliners AS	Auto Carrier	04/13/12	Outbound	16.2
9403217	United Ocean Ship Management	Auto Carrier	04/13/12	Outbound	14
9221281	Holland America Line Inc.	Cruise Ship	04/15/12	Inbound	14.2
8900323	Dole Ocean Cargo Express	Container	04/15/12	Inbound	12.3
9221281	Holland America Line Inc.	Cruise Ship	04/15/12	Outbound	13.7
9338826	Mitsui OSK Lines Ltd	Auto Carrier	04/16/12	Inbound	12.3
9233167	Pasha Group	Auto Carrier	04/17/12	Inbound	11.8
8900323	Dole Ocean Cargo Express	Container	04/17/12	Outbound	12.4
9338826	Mitsui OSK Lines Ltd	Auto Carrier	04/17/12	Outbound	13.9
9233167	Pasha Group	Auto Carrier	04/18/12	Outbound	13.5

IMO#	Operator	Vessel Type	Date	Inbound/ Outbound	Top Speed [knots]
9072446	Celebrity Cruises Inc.	Cruise Ship	04/20/12	Inbound	17.4
9433419	Vroon BV	Auto Carrier	04/20/12	Inbound	14.1
9072446	Celebrity Cruises Inc.	Cruise Ship	04/20/12	Outbound	18.2
9433419	Vroon BV	Auto Carrier	04/20/12	Outbound	16.7
8513467	Dole Ocean Cargo Express	Container	04/21/12	Inbound	11.5
9303211	Nippon Yusen Kaisha	Auto Carrier	04/23/12	Inbound	11.1
9303211	Nippon Yusen Kaisha	Auto Carrier	04/23/12	Outbound	11.5
8018168	EUKOR Car Carriers Inc	Auto Carrier	04/24/12	Inbound	14.8
8513467	Dole Ocean Cargo Express	Container	04/24/12	Outbound	11.8
8018168	EUKOR Car Carriers Inc	Auto Carrier	04/26/12	Outbound	13.4
9188647	Carnival Cruise Lines	Cruise Ship	04/28/12	Inbound	18
9382102	CSC RoRo Logistics Co Ltd	Auto Carrier	04/28/12	Inbound	18.4
9188647	Carnival Cruise Lines	Cruise Ship	04/28/12	Outbound	21.8
9382102	CSC RoRo Logistics Co Ltd	Auto Carrier	04/28/12	Outbound	17
9064126	Regent Seven Seas Cruises Inc	Cruise Ship	04/29/12	Inbound	16.3
8513479	Dole Ocean Cargo Express	Container	04/29/12	Inbound	11.3
9064126	Regent Seven Seas Cruises Inc	Cruise Ship	04/29/12	Outbound	18.8
9233167	Pasha Group	Auto Carrier	05/01/12	Inbound	12.6
8513479	Dole Ocean Cargo Express	Container	05/01/12	Outbound	17.5
8709145	EUKOR Car Carriers Inc	Auto Carrier	05/02/12	Inbound	12.5
9183518	Semester at Sea	Training Ship	05/02/12	Inbound	15.6
9233167	Pasha Group	Auto Carrier	05/02/12	Outbound	12.1
8709145	EUKOR Car Carriers Inc	Auto Carrier	05/02/12	Outbound	12
9228186	Princess Cruise Lines Ltd	Cruise Ship	05/03/12	Inbound	14
9426350	Nippon Yusen Kaisha	Auto Carrier	05/03/12	Inbound	12.1
9381665	Kawasaki Kisen Kaisha Ltd	Auto Carrier	05/03/12	Inbound	12.2
9228186	Princess Cruise Lines Ltd	Cruise Ship	05/03/12	Outbound	13.4
9381665	Kawasaki Kisen Kaisha Ltd	Auto Carrier	05/03/12	Outbound	12.6
9183518	Semester at Sea	Training Ship	05/03/12	Outbound	17.4
9053505	Nippon Yusen Kaisha	Auto Carrier	05/04/12	Inbound	17.5
9426350	Nippon Yusen Kaisha	Auto Carrier	05/04/12	Outbound	16.6
9072446	Celebrity Cruises Inc.	Cruise Ship	05/05/12	Inbound	17.9

IMO#	Operator	Vessel Type	Date	Inbound/ Outbound	Top Speed [knots]
9072446	Celebrity Cruises Inc.	Cruise Ship	05/05/12	Outbound	10.1
9053505	Nippon Yusen Kaisha	Auto Carrier	05/05/12	Outbound	15.6
9228186	Princess Cruise Lines Ltd	Cruise Ship	05/06/12	Inbound	13.7
9262560	Bertling Reederei GmbH FH	Bulk	05/06/12	Inbound	10.8
9317705	Oldendorff Carriers GmbH & Co	General Cargo	05/06/12	Inbound	12.4
7104714	East West Marine	Bulk	05/06/12	Inbound	10.4
9228186	Princess Cruise Lines Ltd	Cruise Ship	05/06/12	Outbound	12.7
8900323	Dole Ocean Cargo Express	Container	05/07/12	Inbound	12.1
8708244	Mitsui OSK Lines Ltd	Auto Carrier	05/07/12	Inbound	11.4
9226891	Holland America Line Inc.	Cruise Ship	05/08/12	Inbound	15.2
9221279	Holland America Line Inc.	Cruise Ship	05/08/12	Inbound	14.1
9189421	Celebrity Cruises Inc.	Cruise Ship	05/08/12	Inbound	17.1
9226891	Holland America Line Inc.	Cruise Ship	05/08/12	Outbound	18.6
9221279	Holland America Line Inc.	Cruise Ship	05/08/12	Outbound	16.1
9317705	Oldendorff Carriers GmbH & Co	General Cargo	05/08/12	Outbound	11.8
8708244	Mitsui OSK Lines Ltd	Auto Carrier	05/08/12	Outbound	13.7
9189421	Celebrity Cruises Inc.	Cruise Ship	05/08/12	Outbound	21.4
9553115	Nippon Yusen Kaisha	Auto Carrier	05/09/12	Inbound	11.3
9153549	Mitsui OSK Lines Ltd	Auto Carrier	05/10/12	Inbound	11.5
8900323	Dole Ocean Cargo Express	Container	05/10/12	Outbound	11.5
7104714	East West Marine	Bulk	05/10/12	Outbound	11.9
9553115	Nippon Yusen Kaisha	Auto Carrier	05/10/12	Outbound	12
8608145	EUKOR Car Carriers Inc	Auto Carrier	05/11/12	Inbound	13.1
9153549	Mitsui OSK Lines Ltd	Auto Carrier	05/11/12	Outbound	16
8608145	EUKOR Car Carriers Inc	Auto Carrier	05/11/12	Outbound	15
9262560	Bertling Reederei GmbH FH	Bulk	05/12/12	Outbound	13.9
9188037	Holland America Line Inc.	Cruise Ship	05/13/12	Inbound	20.9
8919245	Holland America Line Inc.	Cruise Ship	05/13/12	Inbound	16.8
9188037	Holland America Line Inc.	Cruise Ship	05/13/12	Outbound	18.5
8919245	Holland America Line Inc.	Cruise Ship	05/13/12	Outbound	16.3
8513467	Dole Ocean Cargo Express	Container	05/14/12	Inbound	12
9233167	Pasha Group	Auto Carrier	05/15/12	Inbound	11.9

IMO#	Operator	Vessel Type	Date	Inbound/ Outbound	Top Speed [knots]
8513467	Dole Ocean Cargo Express	Container	05/16/12	Outbound	11.9
9233167	Pasha Group	Auto Carrier	05/16/12	Outbound	15.5
9112557	Alkon Holding Inc	RoRo	05/19/12	Inbound	Missing in PortVision
8319689	Cido Car Carrier Service Co	Auto Carrier	05/19/12	Inbound	12.9
8319689	Cido Car Carrier Service Co	Auto Carrier	05/19/12	Outbound	13
8513479	Dole Ocean Cargo Express	Container	05/20/12	Inbound	12.4
9112557	Alkon Holding Inc	RoRo	05/20/12	Outbound	Missing in PortVision
9310513	Grieg Star Shipping AS	General Cargo	05/22/12	Inbound	12.2
8102115	Mitsui OSK Lines Ltd	Auto Carrier	05/22/12	Inbound	12.3
9078220	Kawasaki Kisen Kaisha Ltd	Auto Carrier	05/22/12	Inbound	12.9
9427940	CSAV	Auto Carrier	05/22/12	Inbound	14.7
9402718	Nippon Yusen Kaisha	Auto Carrier	05/22/12	Inbound	11.7
8513479	Dole Ocean Cargo Express	Container	05/22/12	Outbound	13.9
8102115	Mitsui OSK Lines Ltd	Auto Carrier	05/22/12	Outbound	16.3
9078220	Kawasaki Kisen Kaisha Ltd	Auto Carrier	05/22/12	Outbound	15.7
9427940	CSAV	Auto Carrier	05/22/12	Outbound	16.4
9402718	Nippon Yusen Kaisha	Auto Carrier	05/22/12	Outbound	11.6
9184940	Cido Car Carrier Service Co	Auto Carrier	05/23/12	Inbound	11.9
9310513	Grieg Star Shipping AS	General Cargo	05/24/12	Outbound	12
9184940	Cido Car Carrier Service Co	Auto Carrier	05/24/12	Outbound	12.5
9487031	Sinotrans Ship Management Ltd	General Cargo	05/25/12	Inbound	Missing in PortVision
9487031	Sinotrans Ship Management Ltd	General Cargo	05/26/12	Outbound	12.6
9189419	Celebrity Cruises Inc.	Cruise Ship	05/27/12	Inbound	21.5
9477921	Nippon Yusen Kaisha	Auto Carrier	05/27/12	Inbound	11.5
9189419	Celebrity Cruises Inc.	Cruise Ship	05/27/12	Outbound	14.1
9477921	Nippon Yusen Kaisha	Auto Carrier	05/27/12	Outbound	11.1
8900323	Dole Ocean Cargo Express	Container	05/28/12	Inbound	12
9233167	Pasha Group	Auto Carrier	05/29/12	Inbound	18.9
8900323	Dole Ocean Cargo Express	Container	05/29/12	Outbound	13.2
9233167	Pasha Group	Auto Carrier	05/30/12	Outbound	15.5
9382102	CSC RoRo Logistics Co Ltd	Auto Carrier	05/31/12	Inbound	14.5
9382102	CSC RoRo Logistics Co Ltd	Auto Carrier	06/01/12	Outbound	17

IMO#	Operator	Vessel Type	Date	Inbound/ Outbound	Top Speed [knots]
9530319	Oldendorff Carriers GmbH & Co	General Cargo	06/02/12	Inbound	12.7
8513467	Dole Ocean Cargo Express	Container	06/03/12	Inbound	12.2
9530319	Oldendorff Carriers GmbH & Co	General Cargo	06/03/12	Outbound	14.4
9497335	DT-Bereederungs GmbH & Co KG	General Cargo	06/04/12	Inbound	11.8
9303209	Nippon Yusen Kaisha	Auto Carrier	06/04/12	Inbound	11.9
9303209	Nippon Yusen Kaisha	Auto Carrier	06/04/12	Outbound	11.4
9536961	Kawasaki Kisen Kaisha Ltd	Auto Carrier	06/05/12	Inbound	11.6
8513467	Dole Ocean Cargo Express	Container	06/05/12	Outbound	11.9
9497335	DT-Bereederungs GmbH & Co KG	General Cargo	06/05/12	Outbound	12.5
9536961	Kawasaki Kisen Kaisha Ltd	Auto Carrier	06/05/12	Outbound	12.2
9367607	Nippon Yusen Kaisha	Auto Carrier	06/06/12	Inbound	13.1
9367607	Nippon Yusen Kaisha	Auto Carrier	06/06/12	Outbound	13.3
8211514	Doriko Ltd	Auto Carrier	06/07/12	Inbound	11.4
8211514	Doriko Ltd	Auto Carrier	06/07/12	Outbound	10.7
8513479	Dole Ocean Cargo Express	Container	06/10/12	Inbound	12.4
9431836	Hoegh Autoliners AS	Auto Carrier	06/11/12	Inbound	14
8708244	Mitsui OSK Lines Ltd	Auto Carrier	06/11/12	Inbound	14.1
9431836	Hoegh Autoliners AS	Auto Carrier	06/11/12	Outbound	15.8
8708244	Mitsui OSK Lines Ltd	Auto Carrier	06/11/12	Outbound	13.4
9233167	Pasha Group	Auto Carrier	06/12/12	Inbound	11.8
8513479	Dole Ocean Cargo Express	Container	06/12/12	Outbound	12.1
9219331	Wilhelmsen Ship Mgmt Ltd-USA	Cruise Ship	06/13/12	Inbound	12.8
9265926	PACCship UK Ltd	General Cargo	06/13/12	Inbound	11.5
8709145	EUKOR Car Carriers Inc	Auto Carrier	06/13/12	Inbound	12.5
9233167	Pasha Group	Auto Carrier	06/14/12	Outbound	15.1
8709145	EUKOR Car Carriers Inc	Auto Carrier	06/14/12	Outbound	12.8
9265926	PACCship UK Ltd	General Cargo	06/15/12	Outbound	10.8
9561289	Mitsui OSK Lines Ltd	Auto Carrier	06/16/12	Inbound	17.5
9561289	Mitsui OSK Lines Ltd	Auto Carrier	06/16/12	Outbound	20.3
8900323	Dole Ocean Cargo Express	Container	06/17/12	Inbound	10.7
9219331	Wilhelmsen Ship Mgmt Ltd-USA	Cruise Ship	06/17/12	Outbound	13.3
8900323	Dole Ocean Cargo Express	Container	06/19/12	Outbound	12

IMO#	Operator	Vessel Type	Date	Inbound/ Outbound	Top Speed [knots]
8913514	Nippon Yusen Kaisha	Auto Carrier	06/20/12	Inbound	12
8913514	Nippon Yusen Kaisha	Auto Carrier	06/20/12	Outbound	11.9
9330678	Oldendorff Carriers GmbH & Co	General Cargo	06/22/12	Inbound	12.3
9330678	Oldendorff Carriers GmbH & Co	General Cargo	06/22/12	Outbound	12.6
8513467	Dole Ocean Cargo Express	Container	06/23/12	Inbound	11.8
8506749	EUKOR Car Carriers Inc	Auto Carrier	06/23/12	Inbound	15.3
8506749	EUKOR Car Carriers Inc	Auto Carrier	06/23/12	Outbound	15.3
9498602	Cido Shipping HK Co Ltd	Auto Carrier	06/25/12	Inbound	11
8709157	EUKOR Car Carriers Inc	Auto Carrier	06/25/12	Inbound	12
9498602	Cido Shipping HK Co Ltd	Auto Carrier	06/25/12	Outbound	12
9432880	Zodiac Maritime Agencies Ltd	Auto Carrier	06/26/12	Inbound	12.5
9498597	Nippon Yusen Kaisha	Auto Carrier	06/26/12	Inbound	11.1
8513467	Dole Ocean Cargo Express	Container	06/26/12	Outbound	12.1
9432880	Zodiac Maritime Agencies Ltd	Auto Carrier	06/26/12	Outbound	14.9
8709157	EUKOR Car Carriers Inc	Auto Carrier	06/26/12	Outbound	16.4
9498597	Nippon Yusen Kaisha	Auto Carrier	06/26/12	Outbound	11.7
9233167	Pasha Group	Auto Carrier	06/27/12	Inbound	12.1
9536959	Kawasaki Kisen Kaisha Ltd	Auto Carrier	06/27/12	Inbound	12
9233167	Pasha Group	Auto Carrier	06/28/12	Outbound	15.5
9536959	Kawasaki Kisen Kaisha Ltd	Auto Carrier	06/28/12	Outbound	12.1
8513479	Dole Ocean Cargo Express	Container	06/30/12	Inbound	9.1
8011330	Grieg Star Shipping AS	General Cargo	06/30/12	Inbound	13.8
8011330	Grieg Star Shipping AS	General Cargo	07/01/12	Outbound	11.8
8513479	Dole Ocean Cargo Express	Container	07/03/12	Outbound	12.6
9325439	Kawasaki Kisen Kaisha Ltd	Auto Carrier	07/01/12	Inbound	18.2
9325439	Kawasaki Kisen Kaisha Ltd	Auto Carrier	07/01/12	Outbound	15.8
9432892	Zodiac Maritime Agencies Ltd	Auto Carrier	07/03/12	Inbound	17.5
9432892	Zodiac Maritime Agencies Ltd	Auto Carrier	07/03/12	Outbound	15.4
9380817	d'Amico Dry Ltd	Bulk Cargo	07/03/12	Inbound	12.5
9177040	Siem Car Carriers AS	Auto Carrier	07/04/12	Inbound	Missing in PortVision
9213818	NYK Line	Auto Carrier	07/04/12	Inbound	11.9
9177040	Siem Car Carriers AS	Auto Carrier	07/04/12	Outbound	Missing in PortVision

IMO#	Operator	Vessel Type	Date	Inbound/ Outbound	Top Speed [knots]
9213818	NYK Line	Auto Carrier	07/04/12	Outbound	16.7
7917551	Wallenius Wilhelmsen Logistics	Auto Carrier	07/06/12	Inbound	12.3
7917551	Wallenius Wilhelmsen Logistics	Auto Carrier	07/06/12	Outbound	16.8
8900323	Dole Ocean Cargo Express	Container	07/08/12	Inbound	11.9
9380817	d'Amico Dry Ltd	Bulk Cargo	07/08/12	Outbound	13.4
9293595	Mitsui OSK Lines Ltd	Auto Carrier	07/09/12	Inbound	12.7
9293595	Mitsui OSK Lines Ltd	Auto Carrier	07/09/12	Outbound	17.9
8708244	Mitsui OSK Lines Ltd	Auto Carrier	07/09/12	Inbound	12.5
8708244	Mitsui OSK Lines Ltd	Auto Carrier	07/10/12	Outbound	13.3
8900323	Dole Ocean Cargo Express	Container	07/10/12	Outbound	12.3
8513560	EUKOR Car Carriers Inc	Auto Carrier	07/10/12	Inbound	15.3
8513560	EUKOR Car Carriers Inc	Auto Carrier	07/11/12	Outbound	13.6
9233167	Pasha Group	Auto Carrier	07/12/12	Inbound	11.9
9534444	CFL Shipmanagement BV	General Cargo	07/13/12	Inbound	14.6
9233167	Pasha Group	Auto Carrier	07/13/12	Outbound	11.7
9268083	Oldendorff Carriers GmbH & Co	General Cargo	07/14/12	Inbound	12.2
9534444	CFL Shipmanagement BV	General Cargo	07/15/12	Outbound	13.4
9268083	Oldendorff Carriers GmbH & Co	General Cargo	07/15/12	Outbound	11.6
9539169	Nippon Yusen Kaisha	Auto Carrier	07/15/12	Inbound	11.5
9325764	Kawasaki Kisen Kaisha Ltd	Auto Carrier	07/16/12	Inbound	11.4
8708907	Excel Marine Co Ltd	Auto Carrier	07/16/12	Inbound	11.7
9272773	Oldendorff Carriers GmbH & Co	General Cargo	07/16/12	Inbound	12
8513467	Dole Ocean Cargo Express	Container	07/16/12	Inbound	11.4
8708907	Excel Marine Co Ltd	Auto Carrier	07/16/12	Outbound	16.1
9325764	Kawasaki Kisen Kaisha Ltd	Auto Carrier	07/16/12	Outbound	11.9
9539169	Nippon Yusen Kaisha	Auto Carrier	07/16/12	Outbound	11.7
9519121	Mitsui OSK Lines Ltd	Auto Carrier	07/17/12	Inbound	11.1
9519121	Mitsui OSK Lines Ltd	Auto Carrier	07/17/12	Outbound	11.9
8513467	Dole Ocean Cargo Express	Container	07/18/12	Outbound	11.9
9272773	Oldendorff Carriers GmbH & Co	General Cargo	07/18/12	Outbound	12.3
9427940	CSAV	Auto Carrier	07/20/12	Inbound	12.3
9427940	CSAV	Auto Carrier	07/20/12	Outbound	12.8

IMO#	Operator	Vessel Type	Date	Inbound/ Outbound	Top Speed [knots]
8608133	EUKOR Car Carriers Inc	Auto Carrier	07/22/12	Inbound	11.3
8608133	EUKOR Car Carriers Inc	Auto Carrier	07/22/12	Outbound	14.6
8513479	Dole Ocean Cargo Express	Container	07/22/12	Inbound	14.4
9441568	Nippon Yusen Kaisha	Auto Carrier	07/24/12	Inbound	12.1
9441568	Nippon Yusen Kaisha	Auto Carrier	07/24/12	Outbound	12.1
8513479	Dole Ocean Cargo Express	Container	07/24/12	Outbound	12
8709145	EUKOR Car Carriers Inc	Auto Carrier	07/26/12	Inbound	12.7
8709145	EUKOR Car Carriers Inc	Auto Carrier	07/26/12	Outbound	17.3
9553103	Nippon Yusen Kaisha	Auto Carrier	07/27/12	Inbound	12.4
9361823	China Shipping Car Carrier Inc	Auto Carrier	07/27/12	Inbound	13
9233167	Pasha Group	Auto Carrier	07/27/12	Inbound	17
9361823	China Shipping Car Carrier Inc	Auto Carrier	07/27/12	Outbound	13.2
9553103	Nippon Yusen Kaisha	Auto Carrier	07/27/12	Outbound	11.7
9233167	Pasha Group	Auto Carrier	07/28/12	Outbound	11.9
9174490	Hachiuma Steamship Co Ltd	Auto Carrier	07/30/12	Inbound	12.7
8900323	Dole Ocean Cargo Express	Container	07/30/12	Inbound	11
9174490	Hachiuma Steamship Co Ltd	Auto Carrier	07/30/12	Outbound	11.1
8900323	Dole Ocean Cargo Express	Container	07/31/12	Outbound	11.9
9427940	CSAV	Auto Carrier	08/01/12	Inbound	12.3
9182978	Grieg Star Shipping AS	Bulk Cargo	08/01/12	Inbound	11.2
9427940	CSAV	Auto Carrier	08/01/12	Outbound	13
9536959	Kawasaki Kisen Kaisha Ltd	Auto Carrier	08/02/12	Inbound	Missing in PortVision
8506751	Mitsui OSK Lines Ltd	Auto Carrier	08/02/12	Inbound	Missing in PortVision
9182978	Grieg Star Shipping AS	Bulk Cargo	08/02/12	Outbound	11.5
8506751	Mitsui OSK Lines Ltd	Auto Carrier	08/02/12	Outbound	Missing in PortVision
9536959	Kawasaki Kisen Kaisha Ltd	Auto Carrier	08/02/12	Outbound	Missing in PortVision
9303211	Nippon Yusen Kaisha	Auto Carrier	08/04/12	Inbound	11.8
9303211	Nippon Yusen Kaisha	Auto Carrier	08/04/12	Outbound	12.3
8319689	Cido Car Carrier Service Co	Auto Carrier	08/04/12	Inbound	11.1
8513467	Dole Ocean Cargo Express	Container	08/04/12	Inbound	12
8319689	Cido Car Carrier Service Co	Auto Carrier	08/05/12	Outbound	14.1
9150339	Mitsui OSK Lines Ltd	Auto Carrier	08/07/12	Inbound	11.1

IMO#	Operator	Vessel Type	Date	Inbound/ Outbound	Top Speed [knots]
9150339	Mitsui OSK Lines Ltd	Auto Carrier	08/07/12	Outbound	11.8
8513467	Dole Ocean Cargo Express	Container	08/07/12	Outbound	12.2
9432907	Zodiac Maritime Agencies Ltd	Auto Carrier	08/09/12	Inbound	12.9
9432907	Zodiac Maritime Agencies Ltd	Auto Carrier	08/09/12	Outbound	17.1
9431836	Hoegh Autoliners AS	Auto Carrier	08/10/12	Inbound	17.4
9431836	Hoegh Autoliners AS	Auto Carrier	08/10/12	Outbound	16.3
9233167	Pasha Group	Auto Carrier	08/10/12	Inbound	11.8
8513479	Dole Ocean Cargo Express	Container	08/12/12	Inbound	Missing in PortVision
9293995	Mitsui OSK Lines Ltd	Auto Carrier	08/12/12	Inbound	10
9293995	Mitsui OSK Lines Ltd	Auto Carrier	08/13/12	Outbound	11.8
9318515	EUKOR Car Carriers Inc	Auto Carrier	08/14/12	Inbound	16.4
9318515	EUKOR Car Carriers Inc	Auto Carrier	08/14/12	Outbound	16.5
8513479	Dole Ocean Cargo Express	Container	08/14/12	Outbound	Missing in PortVision
9308895	Nippon Yusen Kaisha	Auto Carrier	08/15/12	Inbound	11
9233167	Pasha Group	Auto Carrier	08/15/12	Outbound	15.7
9308895	Nippon Yusen Kaisha	Auto Carrier	08/15/12	Outbound	14.1
8900323	Dole Ocean Cargo Express	Container	08/20/12	Inbound	10.8
9267675	Mitsui OSK Lines Ltd	Auto Carrier	08/21/12	Inbound	13.7
9325776	Kawasaki Kisen Kaisha Ltd	Auto Carrier	08/21/12	Inbound	16.2
9325776	Kawasaki Kisen Kaisha Ltd	Auto Carrier	08/21/12	Outbound	17.2
9267675	Mitsui OSK Lines Ltd	Auto Carrier	08/21/12	Outbound	17.4
8900323	Dole Ocean Cargo Express	Container	08/21/12	Outbound	11.6
9464455	Nippon Yusen Kaisha	Auto Carrier	08/23/12	Inbound	10.7
9464455	Nippon Yusen Kaisha	Auto Carrier	08/23/12	Outbound	11.8
8708244	Mitsui OSK Lines Ltd	Auto Carrier	08/24/12	Inbound	11.2
8708244	Mitsui OSK Lines Ltd	Auto Carrier	08/24/12	Outbound	13.7
8513467	Dole Ocean Cargo Express	Container	08/25/12	Inbound	11.7
9233167	Pasha Group	Auto Carrier	08/28/12	Inbound	20.2
8513467	Dole Ocean Cargo Express	Container	08/28/12	Outbound	12.7
9233167	Pasha Group	Auto Carrier	08/30/12	Outbound	18.8
9531741	NYK Line	Auto Carrier	08/30/12	Inbound	13.2
9531741	NYK Line	Auto Carrier	08/30/12	Outbound	12.3

IMO#	Operator	Vessel Type	Date	Inbound/ Outbound	Top Speed [knots]
9397705	China Shipping Intl Shipmgmt	General Cargo	08/30/12	Inbound	11.7
9324667	Sinotrans Ship Management Ltd	Bulk Cargo	08/31/12	Inbound	11.8
9397705	China Shipping Intl Shipmgmt	General Cargo	08/31/12	Outbound	12.3
8513479	Dole Ocean Cargo Express	Container	09/01/12	Inbound	12.2
9324667	Sinotrans Ship Management Ltd	Bulk Cargo	09/02/12	Outbound	13.5
8709145	EUKOR Car Carriers Inc	Auto Carrier	09/03/12	Inbound	12.5
8709145	EUKOR Car Carriers Inc	Auto Carrier	09/04/12	Outbound	16.5
8513479	Dole Ocean Cargo Express	Container	09/04/12	Outbound	12.5
9325764	Kawasaki Kisen Kaisha Ltd	Auto Carrier	09/06/12	Inbound	12
9325764	Kawasaki Kisen Kaisha Ltd	Auto Carrier	09/06/12	Outbound	12.1
9476733	Nippon Yusen Kaisha	Auto Carrier	09/06/12	Inbound	12
9476733	Nippon Yusen Kaisha	Auto Carrier	09/07/12	Outbound	12.4
8608080	Hoegh Autoliners AS	Auto Carrier	09/08/12	Inbound	15.5
8900323	Dole Ocean Cargo Express	Container	09/08/12	Inbound	12.2
8608080	Hoegh Autoliners AS	Auto Carrier	09/09/12	Outbound	16.1
9338840	Mitsui OSK Lines Ltd	Auto Carrier	09/11/12	Inbound	14.9
9338840	Mitsui OSK Lines Ltd	Auto Carrier	09/11/12	Outbound	13.1
8900323	Dole Ocean Cargo Express	Container	09/11/12	Outbound	11.4
9233167	Pasha Group	Auto Carrier	09/12/12	Inbound	16.3
9506746	Intermarine LLC	Bulk Cargo	09/12/12	Inbound	16.2
9233167	Pasha Group	Auto Carrier	09/13/12	Outbound	15.6
9381249	Nippon Yusen Kaisha	Auto Carrier	09/13/12	Inbound	11.5
9381249	Nippon Yusen Kaisha	Auto Carrier	09/13/12	Outbound	11.2
7119678	Stevens Transportation LLC	General Cargo	09/13/12	Inbound	11.8
7119678	Stevens Transportation LLC	General Cargo	09/14/12	Outbound	12.3
9506746	Intermarine LLC	Bulk Cargo	09/15/12	Outbound	16.1
8513467	Dole Ocean Cargo Express	Container	09/16/12	Inbound	11.7
9519121	Mitsui OSK Lines Ltd	Auto Carrier	09/17/12	Inbound	15.4
9519121	Mitsui OSK Lines Ltd	Auto Carrier	09/17/12	Outbound	15.9
8608133	EUKOR Car Carriers Inc	Auto Carrier	09/18/12	Inbound	14.5
9174490	Hachiuma Steamship Co Ltd	Auto Carrier	09/18/12	Inbound	11.5
8608133	EUKOR Car Carriers Inc	Auto Carrier	09/18/12	Outbound	11.5

IMO#	Operator	Vessel Type	Date	Inbound/ Outbound	Top Speed [knots]
9174490	Hachiuma Steamship Co Ltd	Auto Carrier	09/18/12	Outbound	11.6
8513467	Dole Ocean Cargo Express	Container	09/18/12	Outbound	12
9293595	Mitsui OSK Lines Ltd	Auto Carrier	09/18/12	Inbound	11.4
9325439	Kawasaki Kisen Kaisha Ltd	Auto Carrier	09/19/12	Inbound	13.2
9293595	Mitsui OSK Lines Ltd	Auto Carrier	09/19/12	Outbound	10.6
9325439	Kawasaki Kisen Kaisha Ltd	Auto Carrier	09/19/12	Outbound	18.9
9071557	Grieg Star Shipping AS	General Cargo	09/21/12	Inbound	12
9126819	Magical Cruise Co Ltd	Cruise Ship	09/21/12	Inbound	11.7
9071557	Grieg Star Shipping AS	General Cargo	09/21/12	Outbound	12.9
9126819	Magical Cruise Co Ltd	Cruise Ship	09/21/12	Outbound	15.7
9189419	Celebrity Cruises Inc.	Cruise Ship	09/22/12	Inbound	10.5
9427940	CSAV	Auto Carrier	09/22/12	Inbound	14
9189419	Celebrity Cruises Inc.	Cruise Ship	09/22/12	Outbound	21.8
8513479	Dole Ocean Cargo Express	Container	09/22/12	Inbound	11
9427940	CSAV	Auto Carrier	09/23/12	Outbound	14.8
9283875	Nippon Yusen Kaisha	Auto Carrier	09/25/12	Inbound	11.8
9283875	Nippon Yusen Kaisha	Auto Carrier	09/25/12	Outbound	10.7
8513479	Dole Ocean Cargo Express	Container	09/25/12	Outbound	12.4
9233167	Pasha Group	Auto Carrier	09/26/12	Inbound	12
9233167	Pasha Group	Auto Carrier	09/27/12	Outbound	12
8919245	Holland America Line Inc.	Cruise Ship	09/27/12	Inbound	15.4
8919245	Holland America Line Inc.	Cruise Ship	09/27/12	Outbound	15.8
9126819	Magical Cruise Co Ltd	Cruise Ship	09/28/12	Inbound	11.5
9126819	Magical Cruise Co Ltd	Cruise Ship	09/28/12	Outbound	17.8
8708244	Mitsui OSK Lines Ltd	Auto Carrier	09/29/12	Inbound	12
8708244	Mitsui OSK Lines Ltd	Auto Carrier	09/29/12	Outbound	12.7
8900323	Dole Ocean Cargo Express	Container	09/30/12	Inbound	10.7
9357327	Nippon Yusen Kaisha	Auto Carrier	09/30/12	Inbound	12
9381665	Kawasaki Kisen Kaisha Ltd	Auto Carrier	09/30/12	Inbound	17
8708907	Excel Marine Co Ltd	Auto Carrier	9/30/2012	Inbound	13.1
9357327	Nippon Yusen Kaisha	Auto Carrier	10/1/2012	Outbound	11.3
9381665	Kawasaki Kisen Kaisha Ltd	Auto Carrier	10/1/2012	Outbound	16.9

IMO#	Operator	Vessel Type	Date	Inbound/ Outbound	Top Speed [knots]
8708907	Excel Marine Co Ltd	Auto Carrier	10/1/2012	Outbound	16.8
8900323	Dole Ocean Cargo Express	Container	10/2/2012	Outbound	11.8
9553115	Nippon Yusen Kaisha	Auto Carrier	10/3/2012	Inbound	11
9553115	Nippon Yusen Kaisha	Auto Carrier	10/3/2012	Outbound	11.3
9088249	Hoegh Autoliners AS	Auto Carrier	10/4/2012	Inbound	15.7
9221279	Holland America Line Inc.	Cruise Ship	10/4/2012	Inbound	15
9226891	Holland America Line Inc.	Cruise Ship	10/4/2012	Inbound	15.9
9192363	Princess Cruise Lines Ltd	Cruise Ship	10/4/2012	Inbound	14.5
9088249	Hoegh Autoliners AS	Auto Carrier	10/4/2012	Outbound	16.2
9221279	Holland America Line Inc.	Cruise Ship	10/4/2012	Outbound	14.9
9226891	Holland America Line Inc.	Cruise Ship	10/4/2012	Outbound	14.3
9192363	Princess Cruise Lines Ltd	Cruise Ship	10/4/2012	Outbound	15.1
9072446	Celebrity Cruises Inc.	Cruise Ship	10/5/2012	Inbound	11.8
9228186	Princess Cruise Lines Ltd	Cruise Ship	10/5/2012	Inbound	14.4
9126819	Magical Cruise Co Ltd	Cruise Ship	10/5/2012	Inbound	17.7
9072446	Celebrity Cruises Inc.	Cruise Ship	10/5/2012	Outbound	18.6
9228186	Princess Cruise Lines Ltd	Cruise Ship	10/5/2012	Outbound	12.3
9126819	Magical Cruise Co Ltd	Cruise Ship	10/5/2012	Outbound	17.4
9289908	EUKOR Car Carriers Inc	Auto Carrier	10/6/2012	Inbound	13
8513467	Dole Ocean Cargo Express	Container	10/7/2012	Inbound	11.8
9289908	EUKOR Car Carriers Inc	Auto Carrier	10/7/2012	Outbound	14.4
9277486	d'Amico Dry Ltd	Bulk Cargo	10/9/2012	Inbound	13.3
8513467	Dole Ocean Cargo Express	Container	10/9/2012	Outbound	12.3
9397987	Mitsui OSK Lines Ltd	Auto Carrier	10/10/2012	Inbound	12.1
9233167	Pasha Group	Auto Carrier	10/10/2012	Inbound	11.2
9397987	Mitsui OSK Lines Ltd	Auto Carrier	10/10/2012	Outbound	14.5
9233167	Pasha Group	Auto Carrier	10/11/2012	Outbound	15.1
9228186	Princess Cruise Lines Ltd	Cruise Ship	10/11/2012	Inbound	11.8
9228186	Princess Cruise Lines Ltd	Cruise Ship	10/11/2012	Outbound	11.9
9126819	Magical Cruise Co Ltd	Cruise Ship	10/12/2012	Inbound	15.6
7927415	Mitsui OSK Lines Ltd	Auto Carrier	10/12/2012	Inbound	16
7927415	Mitsui OSK Lines Ltd	Auto Carrier	10/12/2012	Outbound	18.4

IMO#	Operator	Vessel Type	Date	Inbound/ Outbound	Top Speed [knots]
9277486	d'Amico Dry Ltd	Bulk Cargo	10/12/2012	Outbound	14.5
9126819	Magical Cruise Co Ltd	Cruise Ship	10/12/2012	Outbound	17.7
8513479	Dole Ocean Cargo Express	Container	10/14/2012	Inbound	15.3
8211514	Doriko Ltd	Auto Carrier	10/16/2012	Inbound	11.1
8211514	Doriko Ltd	Auto Carrier	10/16/2012	Outbound	15.3
8513479	Dole Ocean Cargo Express	Container	10/16/2012	Outbound	12.8
9355214	Nippon Yusen Kaisha	Auto Carrier	10/17/2012	Inbound	11.6
9431836	Hoegh Autoliners AS	Auto Carrier	10/17/2012	Inbound	16.7
9431836	Hoegh Autoliners AS	Auto Carrier	10/17/2012	Outbound	16.1
9355214	Nippon Yusen Kaisha	Auto Carrier	10/17/2012	Outbound	11.7
9267297	HS Schiffahrts GmbH & Co KG	General Cargo	10/17/2012	Inbound	12.7
9338632	Kawasaki Kisen Kaisha Ltd	Auto Carrier	10/18/2012	Inbound	12.1
9228186	Princess Cruise Lines Ltd	Cruise Ship	10/18/2012	Inbound	12.2
9338632	Kawasaki Kisen Kaisha Ltd	Auto Carrier	10/18/2012	Outbound	16.3
9228186	Princess Cruise Lines Ltd	Cruise Ship	10/18/2012	Outbound	11.3
9116876	Royal Caribbean Cruises Ltd	Cruise Ship	10/19/2012	Inbound	18.5
9116876	Royal Caribbean Cruises Ltd	Cruise Ship	10/19/2012	Outbound	18.4
9156527	Holland America Line Inc.	Cruise Ship	10/19/2012	Inbound	14.7
9267297	HS Schiffahrts GmbH & Co KG	General Cargo	10/19/2012	Outbound	13.9
9072446	Celebrity Cruises Inc.	Cruise Ship	10/20/2012	Inbound	13.9
9156527	Holland America Line Inc.	Cruise Ship	10/20/2012	Outbound	18.4
9072446	Celebrity Cruises Inc.	Cruise Ship	10/20/2012	Outbound	18.4
8900323	Dole Ocean Cargo Express	Container	10/21/2012	Inbound	11.3
9189419	Celebrity Cruises Inc.	Cruise Ship	10/22/2012	Inbound	22.2
9561253	Mitsui OSK Lines Ltd	Auto Carrier	10/22/2012	Inbound	11
9189419	Celebrity Cruises Inc.	Cruise Ship	10/22/2012	Outbound	21.8
9561253	Mitsui OSK Lines Ltd	Auto Carrier	10/22/2012	Outbound	11.1
9189421	Celebrity Cruises Inc.	Cruise Ship	10/23/2012	Inbound	19.2
8900323	Dole Ocean Cargo Express	Container	10/23/2012	Outbound	11.5
9233167	Pasha Group	Auto Carrier	10/23/2012	Inbound	11.5
9189421	Celebrity Cruises Inc.	Cruise Ship	10/23/2012	Outbound	22
9308883	Nippon Yusen Kaisha	Auto Carrier	10/23/2012	Inbound	11.6

IMO#	Operator	Vessel Type	Date	Inbound/ Outbound	Top Speed [knots]
9407598	BBC Chartering & Logistic GmbH	General Cargo	10/24/2012	Inbound	Missing in PortVision
9308883	Nippon Yusen Kaisha	Auto Carrier	10/24/2012	Outbound	11.5
9233167	Pasha Group	Auto Carrier	10/25/2012	Outbound	15.3
9407598	BBC Chartering & Logistic GmbH	General Cargo	10/26/2012	Outbound	Missing in PortVision
8919245	Holland America Line Inc.	Cruise Ship	10/26/2012	Inbound	18.4
8919245	Holland America Line Inc.	Cruise Ship	10/26/2012	Outbound	16.5
9177052	Mitsui OSK Lines Ltd	Auto Carrier	10/27/2012	Inbound	12.8
9156527	Holland America Line Inc.	Cruise Ship	10/27/2012	Inbound	16.9
9177052	Mitsui OSK Lines Ltd	Auto Carrier	10/27/2012	Outbound	12
9156527	Holland America Line Inc.	Cruise Ship	10/27/2012	Outbound	19.6
8513467	Dole Ocean Cargo Express	Container	10/28/2012	Inbound	10.9
8605167	EUKOR Car Carriers Inc	Auto Carrier	10/28/2012	Inbound	14.4
8605167	EUKOR Car Carriers Inc	Auto Carrier	10/28/2012	Outbound	15.6
9585651	d'Amico Dry Ltd	Bulk Cargo	10/29/2012	Inbound	11.6
9500091	Gestioni Armatoriali SpA	Bulk Cargo	10/29/2012	Inbound	10.8
8513467	Dole Ocean Cargo Express	Container	10/30/2012	Outbound	11.9
9441520	Nippon Yusen Kaisha	Auto Carrier	11/1/2012	Inbound	11.4
9442873	Shoei Kisen Kaisha Ltd	Auto Carrier	11/1/2012	Inbound	14.8
9500091	Gestioni Armatoriali SpA	Bulk Cargo	11/2/2012	Outbound	11.9
9441520	Nippon Yusen Kaisha	Auto Carrier	11/2/2012	Outbound	14
9442873	Shoei Kisen Kaisha Ltd	Auto Carrier	11/3/2012	Outbound	17.8
9226891	Holland America Line Inc.	Cruise Ship	11/3/2012	Inbound	16
9226891	Holland America Line Inc.	Cruise Ship	11/3/2012	Outbound	16.7
8513479	Dole Ocean Cargo Express	Container	11/4/2012	Inbound	11
9072446	Celebrity Cruises Inc.	Cruise Ship	11/4/2012	Inbound	13.7
9072446	Celebrity Cruises Inc.	Cruise Ship	11/4/2012	Outbound	19.4
9585651	d'Amico Dry Ltd	Bulk Cargo	11/4/2012	Outbound	13.8
8608133	EUKOR Car Carriers Inc	Auto Carrier	11/4/2012	Inbound	11.4
9056296	Sulphur Carriers Inc	Auto Carrier	11/5/2012	Inbound	11
8608133	EUKOR Car Carriers Inc	Auto Carrier	11/5/2012	Outbound	13.1
9338864	Mitsui OSK Lines Ltd	Auto Carrier	11/6/2012	Inbound	11.4
9056296	Sulphur Carriers Inc	Auto Carrier	11/6/2012	Inbound	Missing in PortVision

IMO#	Operator	Vessel Type	Date	Inbound/ Outbound	Top Speed [knots]
9056296	Sulphur Carriers Inc	Auto Carrier	11/6/2012	Outbound	Missing in PortVision
9338864	Mitsui OSK Lines Ltd	Auto Carrier	11/6/2012	Outbound	12
8513479	Dole Ocean Cargo Express	Container	11/6/2012	Outbound	12.8
9233167	Pasha Group	Auto Carrier	11/6/2012	Inbound	16.3
9056296	Sulphur Carriers Inc	Auto Carrier	11/7/2012	Outbound	11.2
9233167	Pasha Group	Auto Carrier	11/7/2012	Outbound	17.5
9156527	Holland America Line Inc.	Cruise Ship	11/10/2012	Inbound	13.2
9156527	Holland America Line Inc.	Cruise Ship	11/10/2012	Outbound	16.3
8900323	Dole Ocean Cargo Express	Container	11/11/2012	Inbound	12.6
9177040	Siem Car Carriers AS	Auto Carrier	11/11/2012	Inbound	Missing in PortVision
9177040	Siem Car Carriers AS	Auto Carrier	11/11/2012	Outbound	Missing in PortVision
9185047	Mitsui OSK Lines Ltd	Auto Carrier	11/12/2012	Inbound	13.6
9185047	Mitsui OSK Lines Ltd	Auto Carrier	11/13/2012	Outbound	12.3
8900323	Dole Ocean Cargo Express	Container	11/13/2012	Outbound	11.3
9110107	Mitsui OSK Lines Ltd	Auto Carrier	11/15/2012	Inbound	12.1
9110107	Mitsui OSK Lines Ltd	Auto Carrier	11/15/2012	Outbound	16.1
9544920	Mitsui OSK Lines Ltd	Auto Carrier	11/16/2012	Inbound	13.3
8611946	TB Marine-Hamburg GmbH	Auto Carrier	11/16/2012	Inbound	12.5
8611946	TB Marine-Hamburg GmbH	Auto Carrier	11/16/2012	Outbound	16.1
9544920	Mitsui OSK Lines Ltd	Auto Carrier	11/16/2012	Outbound	17.9
9156527	Holland America Line Inc.	Cruise Ship	11/17/2012	Inbound	14.3
8018168	EUKOR Car Carriers Inc	Auto Carrier	11/17/2012	Inbound	12.9
8018168	EUKOR Car Carriers Inc	Auto Carrier	11/17/2012	Outbound	14.9
9156527	Holland America Line Inc.	Cruise Ship	11/17/2012	Outbound	16
8513467	Dole Ocean Cargo Express	Container	11/18/2012	Inbound	11.3
9072446	Celebrity Cruises Inc.	Cruise Ship	11/19/2012	Inbound	14.3
9416434	Golfo Aranci Srl	General Cargo	11/19/2012	Inbound	12.8
9072446	Celebrity Cruises Inc.	Cruise Ship	11/19/2012	Outbound	17.8
9233167	Pasha Group	Auto Carrier	11/20/2012	Inbound	17.9
8513467	Dole Ocean Cargo Express	Container	11/20/2012	Outbound	11.7
9233167	Pasha Group	Auto Carrier	11/21/2012	Outbound	16.9
9189421	Celebrity Cruises Inc.	Cruise Ship	11/22/2012	Inbound	22.4

IMO#	Operator	Vessel Type	Date	Inbound/ Outbound	Top Speed [knots]
8420787	Grieg Star Shipping AS	General Cargo	11/22/2012	Inbound	9.4
9189421	Celebrity Cruises Inc.	Cruise Ship	11/22/2012	Outbound	19.4
8919245	Holland America Line Inc.	Cruise Ship	11/23/2012	Inbound	16.4
9367607	Nippon Yusen Kaisha	Auto Carrier	11/23/2012	Inbound	11
8919245	Holland America Line Inc.	Cruise Ship	11/23/2012	Outbound	19.8
8912663	OSM Maritime AS	Auto Carrier	11/23/2012	Inbound	11.1
9066667	Crystal Cruises	Cruise Ship	11/24/2012	Inbound	12.6
9367607	Nippon Yusen Kaisha	Auto Carrier	11/24/2012	Outbound	11.1
8912663	OSM Maritime AS	Auto Carrier	11/24/2012	Outbound	14.4
9066667	Crystal Cruises	Cruise Ship	11/24/2012	Outbound	10.4
8513479	Dole Ocean Cargo Express	Container	11/25/2012	Inbound	10.5
8420787	Grieg Star Shipping AS	General Cargo	11/25/2012	Outbound	11.4
9416434	Golfo Aranci Srl	General Cargo	11/26/2012	Outbound	12.9
8517944	EUKOR Car Carriers Inc	Auto Carrier	11/26/2012	Inbound	12
8517944	EUKOR Car Carriers Inc	Auto Carrier	11/27/2012	Outbound	17.6
8513479	Dole Ocean Cargo Express	Container	11/27/2012	Outbound	12.2
9250220	Kawasaki Kisen Kaisha Ltd	Auto Carrier	11/29/2012	Inbound	16.2
9339818	LMS Shipmanagement Inc	Auto Carrier	11/29/2012	Inbound	12.5
9250220	Kawasaki Kisen Kaisha Ltd	Auto Carrier	11/29/2012	Outbound	17
9339818	LMS Shipmanagement Inc	Auto Carrier	11/29/2012	Outbound	11.4
9395630	Stamco Ship Management Co Ltd	Auto Carrier	11/30/2012	Inbound	11.5
9395630	Stamco Ship Management Co Ltd	Auto Carrier	11/30/2012	Outbound	11.9
8708244	Mitsui OSK Lines Ltd	Auto Carrier	12/1/2012	Inbound	13
9156527	Holland America Line Inc.	Cruise Ship	12/1/2012	Inbound	14.1
8708244	Mitsui OSK Lines Ltd	Auto Carrier	12/1/2012	Outbound	11.9
9156527	Holland America Line Inc.	Cruise Ship	12/1/2012	Outbound	16.7
8900323	Dole Ocean Cargo Express	Container	12/2/2012	Inbound	13
9053505	Nippon Yusen Kaisha	Auto Carrier	12/3/2012	Inbound	14.2
9072446	Celebrity Cruises Inc.	Cruise Ship	12/4/2012	Inbound	15.4
9053505	Nippon Yusen Kaisha	Auto Carrier	12/4/2012	Outbound	16.4
9072446	Celebrity Cruises Inc.	Cruise Ship	12/4/2012	Outbound	19.5
8900323	Dole Ocean Cargo Express	Container	12/4/2012	Outbound	12.2

IMO#	Operator	Vessel Type	Date	Inbound/ Outbound	Top Speed [knots]
9233167	Pasha Group	Auto Carrier	12/4/2012	Inbound	16.5
9561253	Mitsui OSK Lines Ltd	Auto Carrier	12/5/2012	Inbound	12.3
9188037	Holland America Line Inc.	Cruise Ship	12/5/2012	Inbound	19.7
9188037	Holland America Line Inc.	Cruise Ship	12/5/2012	Outbound	18.5
9233167	Pasha Group	Auto Carrier	12/6/2012	Outbound	16.2
9561253	Mitsui OSK Lines Ltd	Auto Carrier	12/6/2012	Outbound	11
9303209	Nippon Yusen Kaisha	Auto Carrier	12/6/2012	Inbound	11.5
9604940	Nippon Yusen Kaisha	Auto Carrier	12/6/2012	Inbound	11.1
9303209	Nippon Yusen Kaisha	Auto Carrier	12/6/2012	Outbound	12
9604940	Nippon Yusen Kaisha	Auto Carrier	12/6/2012	Outbound	15.3
9156527	Holland America Line Inc.	Cruise Ship	12/8/2012	Inbound	13.9
9156527	Holland America Line Inc.	Cruise Ship	12/8/2012	Outbound	16.3
8014227	Mitsui OSK Lines Ltd	Auto Carrier	12/9/2012	Inbound	12.2
8513467	Dole Ocean Cargo Express	Container	12/9/2012	Inbound	11.8
8014227	Mitsui OSK Lines Ltd	Auto Carrier	12/9/2012	Outbound	18.1
8513467	Dole Ocean Cargo Express	Container	12/11/2012	Outbound	11.6
9338864	Mitsui OSK Lines Ltd	Auto Carrier	12/11/2012	Inbound	11.5
9338864	Mitsui OSK Lines Ltd	Auto Carrier	12/12/2012	Outbound	12
8013613	Hoegh Autoliners AS	Auto Carrier	12/12/2012	Inbound	12.5
8013613	Hoegh Autoliners AS	Auto Carrier	12/13/2012	Outbound	15.6
9382102	CSC RoRo Logistics Co Ltd	Auto Carrier	12/15/2012	Inbound	13.5
8513479	Dole Ocean Cargo Express	Container	12/16/2012	Inbound	10.8
9431836	Hoegh Autoliners AS	Auto Carrier	12/16/2012	Inbound	13.8
9431836	Hoegh Autoliners AS	Auto Carrier	12/16/2012	Outbound	15.7
9382102	CSC RoRo Logistics Co Ltd	Auto Carrier	12/16/2012	Outbound	17.2
9380817	d'Amico Dry Ltd	General Cargo	12/16/2012	Inbound	12.9
8513479	Dole Ocean Cargo Express	Container	12/18/2012	Outbound	12.6
9233167	Pasha Group	Auto Carrier	12/19/2012	Inbound	15.7
9182954	Grieg Star Shipping AS	General Cargo	12/20/2012	Inbound	11.1
9402718	Nippon Yusen Kaisha	Auto Carrier	12/20/2012	Inbound	11.7
9402718	Nippon Yusen Kaisha	Auto Carrier	12/20/2012	Outbound	12.6
9442873	Shoei Kisen Kaisha Ltd	Auto Carrier	12/20/2012	Inbound	17.7

IMO#	Operator	Vessel Type	Date	Inbound/ Outbound	Top Speed [knots]
9442873	Shoei Kisen Kaisha Ltd	Auto Carrier	12/20/2012	Outbound	12.4
8919245	Holland America Line Inc.	Cruise Ship	12/21/2012	Inbound	16
9358010	BBC Chartering & Logistic GmbH	General Cargo	12/21/2012	Inbound	12
9182954	Grieg Star Shipping AS	General Cargo	12/21/2012	Outbound	12.8
8919245	Holland America Line Inc.	Cruise Ship	12/21/2012	Outbound	15.9
8016548	EUKOR Car Carriers Inc	Auto Carrier	12/21/2012	Inbound	12.7
9233167	Pasha Group	Auto Carrier	12/21/2012	Outbound	15.5
9380817	d'Amico Dry Ltd	General Cargo	12/22/2012	Outbound	13.3
9156527	Holland America Line Inc.	Cruise Ship	12/22/2012	Inbound	15.2
8016548	EUKOR Car Carriers Inc	Auto Carrier	12/22/2012	Outbound	15.6
9156527	Holland America Line Inc.	Cruise Ship	12/22/2012	Outbound	16.8
8900323	Dole Ocean Cargo Express	Container	12/23/2012	Inbound	11.7
9358010	BBC Chartering & Logistic GmbH	General Cargo	12/23/2012	Outbound	12.3
8610124	Mitsui OSK Lines Ltd	Auto Carrier	12/25/2012	Inbound	14.8
9553103	Nippon Yusen Kaisha	Auto Carrier	12/25/2012	Inbound	11.2
8610124	Mitsui OSK Lines Ltd	Auto Carrier	12/26/2012	Outbound	12.8
8900323	Dole Ocean Cargo Express	Container	12/26/2012	Outbound	12.7
9553103	Nippon Yusen Kaisha	Auto Carrier	12/27/2012	Outbound	12.4
9432892	Zodiac Maritime Agencies Ltd	Auto Carrier	12/27/2012	Inbound	14.1
9432892	Zodiac Maritime Agencies Ltd	Auto Carrier	12/27/2012	Outbound	17.5
9156527	Holland America Line Inc.	Cruise Ship	12/29/2012	Inbound	17.5
9156527	Holland America Line Inc.	Cruise Ship	12/29/2012	Outbound	17.2
8513467	Dole Ocean Cargo Express	Container	12/30/2012	Inbound	10.9
8709145	EUKOR Car Carriers Inc	Auto Carrier	12/30/2012	Inbound	12.5
8709145	EUKOR Car Carriers Inc	Auto Carrier	12/31/2012	Outbound	12.5
8513467	Dole Ocean Cargo Express	Container	1/2/2013	Outbound	11.6

APPENDIX E

Harbor Craft Vessel Characteristics and Activity

Appendix E. Harbor Craft Vessel Characteristics and Activity

Type	Main Propulsion Engine			Auxiliary Engine			% Out of Area
	MY	Power (Hp)	Hours	MY	Power (Hp)	Hours	
Ocean-going Tug	1995	3,900	186	1995	195	689	0%
Ocean-going Tug	1977	1,200	596	1977	195	2,554	0%
Assist Tug	2007	208	380	2007	80	500	0%
Push Tug (Tow Boat)	2007	38	100				0%
Work Boat	2013	1,140	250				0%
Ferry	2011	810	5,289	2011	80	5,443	0%
Ferry	2004	100	1,800				0%
Excursion	2011	750	1,779	2011	80	2,054	0%
Excursion	1998	750	1,546	1998	266	3,266	0%
Excursion	2004	850	382	2004	402	1,793	0%
Excursion	1987	1,000	187	1987	80	215	0%
Excursion	2010	850	2,580	2010	266	2,922	0%
Ferry	2012	205	2,013				0%
Ferry	2002	210	1,225				0%
Pilot Boat	1974	410	1,300				0%
Work Boat	1958	400	40				75%
Push Tug (Tow Boat)	1985	300	40				50%
Ocean-going Tug	2008	560	1,740	2008	266	1,520	45%
Push Tug (Tow Boat)	2001	910	5,000	2001	11	700	0%
Crew and Supply	2003	1,200	2,720	2003	80	1,360	0%
Push Tug (Tow Boat)	2001	800	2,500	2001	11	670	0%
Assist Tug	2004	1,230	2,014	2004	13	341	50%
Push Tug (Tow Boat)	2004	950	679	2004	12	210	0%
Push Tug (Tow Boat)	2005	2,200	2,800				0%
Ocean-going Tug	2008	800	1,900	2008	204	1,776	45%
Crew and Supply	2008	1,200	1,590	2008	8	533	0%
Work Boat	1977	800	2,920	1977	21	255	0%
Excursion	2011	1,700	432	2011	912	662	0%
Excursion	2007	1,050	300	2007	405	300	0%
Excursion	1993	2,000	300	1993	443	300	0%

Type	Main Propulsion Engine			Auxiliary Engine			% Out of Area
	MY	Power (Hp)	Hours	MY	Power (Hp)	Hours	
Excursion	2009	700	326	2009	148	372	0%
Excursion	1994	410	326	1994	74	372	0%
Excursion	1986	480	300	1986	475	300	0%
Excursion	1968	400	300	1968	40	300	0%
Assist Tug	1980	1,800	602	1980	338	1,205	0%
Assist Tug	1980	1,800	525	1980	338	926	0%
Assist Tug	2012	3,000	4,367	2012	660	6,435	0%
	1994	3,500	2,061	1988	150	1,047	0%
				1989	150	1,116	0%
Assist Tug				1969	160	51	0%
	1994	3,500	1,908	1986	150	847	0%
				1994	150	950	0%
Assist Tug				1969	160	78	0%
Work Boat	1988	325	675	1988	36	750	33%
Work Boat	1988	325	675	1988	36	750	33%
Other	1984	400	779	1984	22	805	40%
Commercial Fishing (56, default)	1983	268	1,250	1983	33	1,633	57%
Commercial Fishing	1983	268	1,250	1983	33	1,633	50%
Commercial Fishing	1983	268	1,250	1983	33	1,633	42%
Commercial Fishing	1983	268	1,250	1983	33	1,633	25%
Commercial Fishing	1983	268	1,250	1983	33	1,633	75%
Commercial Fishing	1983	268	1,250	1983	33	1,633	50%
Commercial Fishing	1983	268	1,250	1983	33	1,633	75%
Commercial Fishing	1977	246	1,250	1977	33	1,633	57%
Commercial Fishing	1983	268	1,250	1983	33	1,633	16%
Commercial Fishing	1983	336	1,250	1983	33	1,633	57%
Commercial Fishing	1983	268	1,250	1983	33	1,633	75%
Commercial Fishing	1983	268	1,250	1983	33	1,633	25%
Commercial Fishing	2010	268	1,250	1983	33	1,633	57%
Commercial Fishing	1983	207	1,250	1983	33	1,633	57%
Commercial Fishing	1983	280	1,250	1983	33	1,633	57%
Commercial Fishing	1983	269	1,250	1983	33	1,633	57%

Type	Main Propulsion Engine			Auxiliary Engine			% Out of Area
	MY	Power (Hp)	Hours	MY	Power (Hp)	Hours	
Commercial Fishing	1983	268	1,250	1983	33	1,633	50%
Commercial Fishing	1983	268	1,250	1983	33	1,633	75%

APPENDIX F

Harbor Craft Marine Engine Emission Factors

Appendix F Harbor Craft Emission Factors

The POSD (2007) report used the emission factors in Table F-1 prior to California diesel fuel emissions correction. For example, the PM emission factor was 0.3 g/kW-hr (or 0.224 g/hp-hr using a conversion of 1.341 hp-hr/kW-hr) and NOx emission about 10 g/kW-hr (or 13.4 g/hp-hr)) for most engines.

Table F-1. Previous 2006 Emission Inventory Marine Engine Emission Factors (g/kW-hr) (POSD 2007)

Power Minimum	PM	NOx	SOx	CO	HC	CO2	N_2O	CH_4
Tier 0 Engines (before 2000 model year)								
37	0.90	11	0.006	2.0	0.27	690	0.02	0.09
75	0.40	10	0.006	1.7	0.27	690	0.02	0.09
130	0.40	10	0.006	1.5	0.27	690	0.02	0.09
225	0.30	10	0.006	1.5	0.27	690	0.02	0.09
450	0.30	10	0.006	1.5	0.27	690	0.02	0.09
560	0.30	10	0.006	1.5	0.27	690	0.02	0.09
1,000	0.30	13	0.006	2.5	0.27	690	0.02	0.09
Category 2 engines	0.72	13.2	0.006	1.1	0.50	690	0.02	0.09
Tier 1 Engines (2000 model year)								
37	0.90	9.8	0.006	2.0	0.27	690	0.02	0.09
75	0.40	9.8	0.006	1.7	0.27	690	0.02	0.09
130	0.40	9.8	0.006	1.5	0.27	690	0.02	0.09
225	0.30	9.8	0.006	1.5	0.27	690	0.02	0.09
450	0.30	9.8	0.006	1.5	0.27	690	0.02	0.09
560	0.30	9.8	0.006	1.5	0.27	690	0.02	0.09
1,000	0.30	9.8	0.006	2.5	0.27	690	0.02	0.09
Category 2 engines	0.72	9.8	0.006	1.1	0.5	690	0.02	0.09
Tier 2 Engines (2004 – 2007 model year by engine type)								
37	0.40	6.8	0.006	5	0.27	690	0.02	0.09
75	0.30	6.8	0.006	5	0.27	690	0.02	0.09
130	0.30	6.8	0.006	5	0.27	690	0.02	0.09
225	0.30	6.8	0.006	5	0.27	690	0.02	0.09
450	0.30	6.8	0.006	5	0.27	690	0.02	0.09
560	0.30	6.8	0.006	5	0.27	690	0.02	0.09
1,000	0.30	6.8	0.006	5	0.27	690	0.02	0.09
Category 2 engines	0.72	9.8	0.006	5	0.50	690	0.02	0.09

In this study, the emissions factors (EF) for harbor craft marine vessels were calculated using the formula and input factors as described and shown below. (ARB, 2011b)

$$EF = EF_{zh} \times FC \times \left(1 + DE \times \frac{A}{UL}\right)$$

Where:

EF – Emission factor in use [g/hp-hr]

EF_{zh} – Horsepower and model year specific zero-hour emission factor [g/hp-hr]
FC – Fuel correction factors for using low sulfur content diesel fuels
DE – Deterioration rate of the engine
A – Age of the engine as provided by the operators
UL – Useful life of the engine

The emissions factors were calculated with the equation shown for each engine. The input data are shown in Tables F-2 through F-5 (ARB 2011b) for main propulsion engines (ME) and auxiliary engines (AE). Comparing Table F-5 with Table F-1, the revised ROG, CO, and PM Zero-hour emission factors were dramatically higher (by more than a factor of 2) than the fully deteriorated emission factors used in the previous inventory for engine model years 2003 and older. After applying up to a 67% increase due to deterioration, the revised emission factor approach led to higher PM emission factors and emissions for the 2012 inventory despite engine and vessel replacement in the harbor craft fleets. An example calculation comparison is shown here that indicates PM (2 times), NOx (1.1), ROG (4), and CO (1.2) times the emission factors that used in the 2006 emission inventory effort for the same engine:

Example: 2004 Model Year, Tier 1, 1125hp Excursion Engine (8 years old, 20 year average life)

PM emission factor (in use) = 0.361 X (1 + 0.67 X (8/20)) = 0.458 grams PM/hp-hr
NOx emission factor (in use) = 7.31 X (1 + 0.21 X (8/20)) = 7.924 grams PM/hp-hr
ROG emission factor (in use) = 0.68 X (1 + 0.44 X (8/20)) = 0.800 grams PM/hp-hr
CO emission factor (in use) = 1.971 X (1 + 0.25 X (8/20)) = 2.168 grams PM/hp-hr

Table F-2. Fuel correction factors.

Model Years	NOx	PM
<1995	0.93	0.72
1995 – 2010	0.948	0.80
2011 and later	0.948	0.852

Table F-3. Deterioration factors.

HP Range	HC	CO	NOx	PM
25-50	0.51	0.41	0.06	0.31
51-120	0.28	0.16	0.14	0.44
121-175	0.28	0.16	0.14	0.44
176-250	0.28	0.16	0.14	0.44
251-500	0.44	0.25	0.21	0.67
501-750	0.44	0.25	0.21	0.67
>751	0.44	0.25	0.21	0.67
>751	0.44	0.25	0.21	0.67
>751	0.44	0.25	0.21	0.67

Table F-4. Load factors and useful life.

Vessel Type	Type	ME Load	AE Load	ME Useful Life (years)	AE Useful Life (years)
Tow Boats	TOW	0.68	0.43	26	25
Tug Boats[1]	TUG	0.31	0.43	21	22.5
Ferries and Excursion	FRY	0.42	0.43	20	20
Others	OTS	0.52	0.43	23	22
Work Boats	WBT	0.45	0.43	17	23
Pilot Vessels	POV	0.51	0.43	19	25
Crew and Supply	CNS	0.38	0.32	28	28
Charter Fishing	CHF	0.52	0.43	16	15
Commercial Fishing	COF	0.27	0.43	21	15

[1] – Assist tugs shown, ocean going tugs used load factors of 0.5 for ME and 0.31 for AE

Table F-5. Zero Hour Emission Factors (g/hp-hr) (ARB, Harbor Craft Model)

HP Range	HP Cat	Max. HP	Model Year	ME ROG	ME CO	ME NOx	ME PM	AE ROG	AE CO	AE NOx	AE PM	CO_2
25-50 hp	1	50	1968	1.84	3.65	8.142	0.722	2.1896	5.15	6.9	0.6384	587.17204
25-50 hp	1	50	1984	1.84	3.65	8.142	0.722	2.1896	5.15	6.9	0.6384	587.17204
25-50 hp	1	50	1987	1.84	3.65	8.142	0.722	2.1896	5.15	6.9	0.6384	587.17204
25-50 hp	1	50	1988	1.84	3.65	8.142	0.722	2.1896	5.15	6.9	0.6384	587.17204
25-50 hp	1	50	1989	1.84	3.65	8.142	0.722	2.1896	5.15	6.9	0.6384	587.17204
25-50 hp	1	50	1990	1.84	3.65	8.142	0.722	2.1896	5.15	6.9	0.6384	587.17204
25-50 hp	1	50	1991	1.84	3.65	8.142	0.722	2.1896	5.15	6.9	0.6384	587.17204
25-50 hp	1	50	1992	1.84	3.65	8.142	0.722	2.1896	5.15	6.9	0.6384	587.17204
25-50 hp	1	50	1993	1.84	3.65	8.142	0.722	2.1896	5.15	6.9	0.6384	587.17204
25-50 hp	1	50	1994	1.84	3.65	8.142	0.722	2.1896	5.15	6.9	0.6384	587.17204
25-50 hp	1	50	1995	1.84	3.65	8.142	0.722	2.1896	5.15	6.9	0.6384	587.17204
25-50 hp	1	50	1996	1.84	3.65	8.142	0.722	2.1896	5.15	6.9	0.6384	587.17204
25-50 hp	1	50	1997	1.84	3.65	8.142	0.722	2.1896	5.15	6.9	0.6384	587.17204
25-50 hp	1	50	1998	1.8	3.65	8.142	0.722	2.142	5.15	6.9	0.6384	587.17204
25-50 hp	1	50	1999	1.8	3.65	8.142	0.722	2.142	5.15	6.9	0.6384	587.17204
25-50 hp	1	50	2000	1.8	3.65	7.31	0.722	2.142	5.15	6.9	0.6384	587.17204
25-50 hp	1	50	2001	1.8	3.65	7.31	0.722	2.142	5.15	6.9	0.6384	587.17204
25-50 hp	1	50	2002	1.8	3.65	7.31	0.722	2.142	5.15	6.9	0.6384	587.17204
25-50 hp	1	50	2003	1.8	3.65	7.31	0.722	2.142	5.15	6.9	0.6384	587.17204
25-50 hp	1	50	2004	1.8	3.65	7.31	0.722	2.142	5.15	6.9	0.6384	587.17204
25-50 hp	1	50	2005	1.8	3.73	5.32	0.3	2.142	3.73	5.32	0.3	587.17204
25-50 hp	1	50	2006	1.8	3.73	5.32	0.3	2.142	3.73	5.32	0.3	587.17204
25-50 hp	1	50	2007	1.8	3.73	5.32	0.3	2.142	3.73	5.32	0.3	587.17204
25-50 hp	1	50	2008	1.8	3.73	5.32	0.3	2.142	3.73	5.32	0.3	587.17204
25-50 hp	1	50	2009	1.8	3.73	5.32	0.22	2.142	3.73	5.32	0.22	587.17204
25-50 hp	1	50	2010	1.8	3.73	5.32	0.22	2.142	3.73	5.32	0.22	587.17204
25-50 hp	1	50	2011	1.8	3.73	5.32	0.22	2.142	3.73	5.32	0.22	587.17204
25-50 hp	1	50	2012	1.8	3.73	5.32	0.22	2.142	3.73	5.32	0.22	587.17204
25-50 hp	1	50	2013	1.8	3.73	5.32	0.22	2.142	3.73	5.32	0.22	587.17204
25-50 hp	1	50	2014	1.8	3.73	5.32	0.22	2.142	3.73	5.32	0.22	587.17204

HP Range	HP Cat	Max. HP	Model Year	ME ROG	ME CO	ME NOx	ME PM	AE ROG	AE CO	AE NOx	AE PM	CO_2
25-50 hp	1	50	2015	1.8	3.73	5.32	0.22	2.142	3.73	5.32	0.22	587.17204
25-50 hp	1	50	2016	1.8	3.73	5.32	0.22	2.142	3.73	5.32	0.22	587.17204
25-50 hp	1	50	2017	1.8	3.73	5.32	0.22	2.142	3.73	5.32	0.22	587.17204
25-50 hp	1	50	2018	1.8	3.73	5.32	0.22	2.142	3.73	5.32	0.22	587.17204
25-50 hp	1	50	2019	1.8	3.73	5.32	0.22	2.142	3.73	5.32	0.22	587.17204
25-50 hp	1	50	2020	1.8	3.73	5.32	0.22	2.142	3.73	5.32	0.22	587.17204
51-120 hp	2	120	1977	1.44	3.504	15.34	0.798	1.7136	4.944	13	0.7056	580.79522
51-120 hp	2	120	1983	1.44	3.504	15.34	0.798	1.7136	4.944	13	0.7056	583.98363
51-120 hp	2	120	1987	1.44	3.504	15.34	0.798	1.7136	4.944	13	0.7056	587.17204
51-120 hp	2	120	1988	1.44	3.504	15.34	0.798	1.7136	4.944	13	0.7056	587.17204
51-120 hp	2	120	1989	1.44	3.504	15.34	0.798	1.7136	4.944	13	0.7056	587.17204
51-120 hp	2	120	1990	1.44	3.504	15.34	0.798	1.7136	4.944	13	0.7056	587.17204
51-120 hp	2	120	1991	1.44	3.504	15.34	0.798	1.7136	4.944	13	0.7056	587.17204
51-120 hp	2	120	1992	1.44	3.504	15.34	0.798	1.7136	4.944	13	0.7056	587.17204
51-120 hp	2	120	1993	1.44	3.504	15.34	0.798	1.7136	4.944	13	0.7056	587.17204
51-120 hp	2	120	1994	1.44	3.504	15.34	0.798	1.7136	4.944	13	0.7056	587.17204
51-120 hp	2	120	1995	1.44	3.504	15.34	0.798	1.7136	4.944	13	0.7056	587.17204
51-120 hp	2	120	1996	1.44	3.504	15.34	0.798	1.7136	4.944	13	0.7056	587.17204
51-120 hp	2	120	1997	0.99	2.5477	10.325	0.6555	1.1781	3.5947	8.75	0.5796	587.17204
51-120 hp	2	120	1998	0.99	2.5477	10.325	0.6555	1.1781	3.5947	8.75	0.5796	587.17204
51-120 hp	2	120	1999	0.99	2.5477	10.325	0.6555	1.1781	3.5947	8.75	0.5796	587.17204
51-120 hp	2	120	2000	0.99	2.5477	7.31	0.6555	1.1781	3.5947	7.31	0.5796	587.17204
51-120 hp	2	120	2001	0.99	2.5477	7.31	0.6555	1.1781	3.5947	7.31	0.5796	587.17204
51-120 hp	2	120	2002	0.99	2.5477	7.31	0.6555	1.1781	3.5947	7.31	0.5796	587.17204
51-120 hp	2	120	2003	0.99	2.5477	7.31	0.6555	1.1781	3.5947	7.31	0.5796	587.17204
51-120 hp	2	120	2004	0.99	2.5477	7.31	0.6555	1.1781	3.5947	7.31	0.5796	587.17204
51-120 hp	2	120	2005	0.99	3.73	5.32	0.3	1.1781	3.73	5.32	0.3	587.17204
51-120 hp	2	120	2006	0.99	3.73	5.32	0.3	1.1781	3.73	5.32	0.3	587.17204
51-120 hp	2	120	2007	0.99	3.73	5.32	0.3	1.1781	3.73	5.32	0.3	587.17204
51-120 hp	2	120	2008	0.99	3.73	5.32	0.3	1.1781	3.73	5.32	0.3	587.17204
51-120 hp	2	120	2009	0.99	3.73	5.32	0.22	1.1781	3.73	5.32	0.22	587.17204
51-120 hp	2	120	2010	0.99	3.73	5.32	0.22	1.1781	3.73	5.32	0.22	587.17204

HP Range	HP Cat	Max. HP	Model Year	ME ROG	ME CO	ME NOx	ME PM	AE ROG	AE CO	AE NOx	AE PM	CO_2
51-120 hp	2	120	2011	0.99	3.73	5.32	0.22	1.1781	3.73	5.32	0.22	587.17204
51-120 hp	2	120	2012	0.99	3.73	5.32	0.22	1.1781	3.73	5.32	0.22	587.17204
51-120 hp	2	120	2013	0.99	3.73	5.32	0.22	1.1781	3.73	5.32	0.22	587.17204
51-120 hp	2	120	2014	0.99	3.73	5.32	0.22	1.1781	3.73	5.32	0.22	587.17204
51-120 hp	2	120	2015	0.99	3.73	5.32	0.22	1.1781	3.73	5.32	0.22	587.17204
51-120 hp	2	120	2016	0.99	3.73	5.32	0.22	1.1781	3.73	5.32	0.22	587.17204
51-120 hp	2	120	2017	0.99	3.73	5.32	0.22	1.1781	3.73	5.32	0.22	587.17204
51-120 hp	2	120	2018	0.99	3.73	5.32	0.22	1.1781	3.73	5.32	0.22	587.17204
51-120 hp	2	120	2019	0.99	3.73	5.32	0.22	1.1781	3.73	5.32	0.22	587.17204
51-120 hp	2	120	2020	0.99	3.73	5.32	0.22	1.1781	3.73	5.32	0.22	587.17204
121-175 hp	3	175	1969	1.32	3.212	16.52	0.7315	1.5708	4.532	14	0.6468	587.17204
121-175 hp	3	175	1970	1.32	3.212	16.52	0.7315	1.5708	4.532	14	0.6468	587.17204
121-175 hp	3	175	1971	1.1	3.212	15.34	0.627	1.309	4.532	13	0.5544	587.17204
121-175 hp	3	175	1972	1.1	3.212	15.34	0.627	1.309	4.532	13	0.5544	587.17204
121-175 hp	3	175	1973	1.1	3.212	15.34	0.627	1.309	4.532	13	0.5544	587.17204
121-175 hp	3	175	1974	1.1	3.212	15.34	0.627	1.309	4.532	13	0.5544	587.17204
121-175 hp	3	175	1975	1.1	3.212	15.34	0.627	1.309	4.532	13	0.5544	587.17204
121-175 hp	3	175	1976	1.1	3.212	15.34	0.627	1.309	4.532	13	0.5544	587.17204
121-175 hp	3	175	1977	1.1	3.212	15.34	0.627	1.309	4.532	13	0.5544	587.17204
121-175 hp	3	175	1978	1.1	3.212	15.34	0.627	1.309	4.532	13	0.5544	587.17204
121-175 hp	3	175	1979	1	3.212	14.16	0.5225	1.19	4.532	12	0.462	587.17204
121-175 hp	3	175	1980	1	3.212	14.16	0.5225	1.19	4.532	12	0.462	587.17204
121-175 hp	3	175	1981	1	3.212	14.16	0.5225	1.19	4.532	12	0.462	587.17204
121-175 hp	3	175	1982	1	3.212	14.16	0.5225	1.19	4.532	12	0.462	587.17204
121-175 hp	3	175	1983	1	3.212	14.16	0.5225	1.19	4.532	12	0.462	587.17204
121-175 hp	3	175	1984	0.94	3.139	12.98	0.5225	1.1186	4.429	11	0.462	587.17204
121-175 hp	3	175	1985	0.94	3.139	12.98	0.5225	1.1186	4.429	11	0.462	587.17204
121-175 hp	3	175	1986	0.94	3.139	12.98	0.5225	1.1186	4.429	11	0.462	587.17204
121-175 hp	3	175	1987	0.88	3.066	12.98	0.5225	1.0472	4.326	11	0.462	587.17204
121-175 hp	3	175	1988	0.88	3.066	12.98	0.5225	1.0472	4.326	11	0.462	587.17204
121-175 hp	3	175	1989	0.88	3.066	12.98	0.5225	1.0472	4.326	11	0.462	587.17204
121-175 hp	3	175	1990	0.88	3.066	12.98	0.5225	1.0472	4.326	11	0.462	587.17204

HP Range	HP Cat	Max. HP	Model Year	ME ROG	ME CO	ME NOx	ME PM	AE ROG	AE CO	AE NOx	AE PM	CO_2
121-175 hp	3	175	1991	0.88	3.066	12.98	0.5225	1.0472	4.326	11	0.462	587.17204
121-175 hp	3	175	1992	0.88	3.066	12.98	0.5225	1.0472	4.326	11	0.462	587.17204
121-175 hp	3	175	1993	0.88	3.066	12.98	0.5225	1.0472	4.326	11	0.462	587.17204
121-175 hp	3	175	1994	0.88	3.066	12.98	0.5225	1.0472	4.326	11	0.462	587.17204
121-175 hp	3	175	1995	0.88	3.066	12.98	0.5225	1.0472	4.326	11	0.462	587.17204
121-175 hp	3	175	1996	0.68	1.971	9.6406	0.361	0.8092	2.781	8.17	0.3192	587.17204
121-175 hp	3	175	1997	0.68	1.971	9.6406	0.361	0.8092	2.781	8.17	0.3192	587.17204
121-175 hp	3	175	1998	0.68	1.971	9.6406	0.361	0.8092	2.781	8.17	0.3192	587.17204
121-175 hp	3	175	1999	0.68	1.971	9.6406	0.361	0.8092	2.781	8.17	0.3192	587.17204
121-175 hp	3	175	2000	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204
121-175 hp	3	175	2001	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204
121-175 hp	3	175	2002	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204
121-175 hp	3	175	2003	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204
121-175 hp	3	175	2004	0.68	3.73	5.1015	0.22	0.8092	3.73	5.1015	0.22	587.17204
121-175 hp	3	175	2005	0.68	3.73	5.1015	0.22	0.8092	3.73	5.1015	0.22	587.17204
121-175 hp	3	175	2006	0.68	3.73	5.1015	0.22	0.8092	3.73	5.1015	0.22	587.17204
121-175 hp	3	175	2007	0.68	3.73	5.1015	0.22	0.8092	3.73	5.1015	0.22	587.17204
121-175 hp	3	175	2008	0.68	3.73	5.1015	0.22	0.8092	3.73	5.1015	0.22	587.17204
121-175 hp	3	175	2009	0.68	3.73	5.1015	0.22	0.8092	3.73	5.1015	0.22	587.17204
121-175 hp	3	175	2010	0.68	3.73	5.1015	0.22	0.8092	3.73	5.1015	0.22	587.17204
121-175 hp	3	175	2011	0.68	3.73	5.1015	0.22	0.8092	3.73	5.1015	0.22	587.17204
121-175 hp	3	175	2012	0.68	3.73	5.1015	0.22	0.8092	3.73	5.1015	0.22	587.17204
121-175 hp	3	175	2013	0.68	3.73	3.8	0.09	0.8092	3.73	3.8	0.09	587.17204
121-175 hp	3	175	2014	0.68	3.73	3.8	0.09	0.8092	3.73	3.8	0.09	587.17204
121-175 hp	3	175	2015	0.68	3.73	3.8	0.09	0.8092	3.73	3.8	0.09	587.17204
121-175 hp	3	175	2016	0.68	3.73	3.8	0.09	0.8092	3.73	3.8	0.09	587.17204
121-175 hp	3	175	2017	0.68	3.73	3.8	0.09	0.8092	3.73	3.8	0.09	587.17204
121-175 hp	3	175	2018	0.68	3.73	3.8	0.09	0.8092	3.73	3.8	0.09	587.17204
121-175 hp	3	175	2019	0.68	3.73	3.8	0.09	0.8092	3.73	3.8	0.09	587.17204
121-175 hp	3	175	2020	0.68	3.73	3.8	0.09	0.8092	3.73	3.8	0.09	587.17204
176-250 hp	4	250	1968	1.32	3.212	16.52	0.7315	1.5708	4.532	14	0.6468	587.17204
176-250 hp	4	250	1969	1.32	3.212	16.52	0.7315	1.5708	4.532	14	0.6468	587.17204

HP Range	HP Cat	Max. HP	Model Year	ME ROG	ME CO	ME NOx	ME PM	AE ROG	AE CO	AE NOx	AE PM	CO_2
176-250 hp	4	250	1970	1.32	3.212	16.52	0.7315	1.5708	4.532	14	0.6468	587.17204
176-250 hp	4	250	1971	1.1	3.212	15.34	0.627	1.309	4.532	13	0.5544	587.17204
176-250 hp	4	250	1972	1.1	3.212	15.34	0.627	1.309	4.532	13	0.5544	587.17204
176-250 hp	4	250	1973	1.1	3.212	15.34	0.627	1.309	4.532	13	0.5544	587.17204
176-250 hp	4	250	1974	1.1	3.212	15.34	0.627	1.309	4.532	13	0.5544	587.17204
176-250 hp	4	250	1975	1.1	3.212	15.34	0.627	1.309	4.532	13	0.5544	587.17204
176-250 hp	4	250	1976	1.1	3.212	15.34	0.627	1.309	4.532	13	0.5544	587.17204
176-250 hp	4	250	1977	1.1	3.212	15.34	0.627	1.309	4.532	13	0.5544	587.17204
176-250 hp	4	250	1978	1.1	3.212	15.34	0.627	1.309	4.532	13	0.5544	587.17204
176-250 hp	4	250	1979	1	3.212	14.16	0.5225	1.19	4.532	12	0.462	587.17204
176-250 hp	4	250	1980	1	3.212	14.16	0.5225	1.19	4.532	12	0.462	587.17204
176-250 hp	4	250	1981	1	3.212	14.16	0.5225	1.19	4.532	12	0.462	587.17204
176-250 hp	4	250	1982	1	3.212	14.16	0.5225	1.19	4.532	12	0.462	587.17204
176-250 hp	4	250	1983	1	3.212	14.16	0.5225	1.19	4.532	12	0.462	587.17204
176-250 hp	4	250	1984	0.94	3.139	12.98	0.5225	1.1186	4.429	11	0.462	587.17204
176-250 hp	4	250	1985	0.94	3.139	12.98	0.5225	1.1186	4.429	11	0.462	587.17204
176-250 hp	4	250	1986	0.94	3.139	12.98	0.5225	1.1186	4.429	11	0.462	587.17204
176-250 hp	4	250	1987	0.88	3.066	12.98	0.5225	1.0472	4.326	11	0.462	587.17204
176-250 hp	4	250	1988	0.88	3.066	12.98	0.5225	1.0472	4.326	11	0.462	587.17204
176-250 hp	4	250	1989	0.88	3.066	12.98	0.5225	1.0472	4.326	11	0.462	587.17204
176-250 hp	4	250	1990	0.88	3.066	12.98	0.5225	1.0472	4.326	11	0.462	587.17204
176-250 hp	4	250	1991	0.88	3.066	12.98	0.5225	1.0472	4.326	11	0.462	587.17204
176-250 hp	4	250	1992	0.88	3.066	12.98	0.5225	1.0472	4.326	11	0.462	587.17204
176-250 hp	4	250	1993	0.88	3.066	12.98	0.5225	1.0472	4.326	11	0.462	587.17204
176-250 hp	4	250	1994	0.88	3.066	12.98	0.5225	1.0472	4.326	11	0.462	587.17204
176-250 hp	4	250	1995	0.68	1.971	9.6406	0.361	0.8092	2.781	8.17	0.3192	587.17204
176-250 hp	4	250	1996	0.68	1.971	9.6406	0.361	0.8092	2.781	8.17	0.3192	587.17204
176-250 hp	4	250	1997	0.68	1.971	9.6406	0.361	0.8092	2.781	8.17	0.3192	587.17204
176-250 hp	4	250	1998	0.68	1.971	9.6406	0.361	0.8092	2.781	8.17	0.3192	587.17204
176-250 hp	4	250	1999	0.68	1.971	9.6406	0.361	0.8092	2.781	8.17	0.3192	587.17204
176-250 hp	4	250	2000	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204
176-250 hp	4	250	2001	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204

HP Range	HP Cat	Max. HP	Model Year	ME ROG	ME CO	ME NOx	ME PM	AE ROG	AE CO	AE NOx	AE PM	CO_2
176-250 hp	4	250	2002	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204
176-250 hp	4	250	2003	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204
176-250 hp	4	250	2004	0.68	3.73	5.1015	0.15	0.8092	3.73	5.1015	0.15	587.17204
176-250 hp	4	250	2005	0.68	3.73	5.1015	0.15	0.8092	3.73	5.1015	0.15	587.17204
176-250 hp	4	250	2006	0.68	3.73	5.1015	0.15	0.8092	3.73	5.1015	0.15	587.17204
176-250 hp	4	250	2007	0.68	3.73	5.1015	0.15	0.8092	3.73	5.1015	0.15	587.17204
176-250 hp	4	250	2008	0.68	3.73	5.1015	0.15	0.8092	3.73	5.1015	0.15	587.17204
176-250 hp	4	250	2009	0.68	3.73	5.1015	0.15	0.8092	3.73	5.1015	0.15	587.17204
176-250 hp	4	250	2010	0.68	3.73	5.1015	0.15	0.8092	3.73	5.1015	0.15	587.17204
176-250 hp	4	250	2011	0.68	3.73	5.1015	0.15	0.8092	3.73	5.1015	0.15	587.17204
176-250 hp	4	250	2012	0.68	3.73	5.1015	0.15	0.8092	3.73	5.1015	0.15	587.17204
176-250 hp	4	250	2013	0.68	3.73	5.1015	0.15	0.8092	3.73	5.1015	0.15	587.17204
176-250 hp	4	250	2014	0.68	3.73	3.99	0.08	0.8092	3.73	3.99	0.08	587.17204
176-250 hp	4	250	2015	0.68	3.73	3.99	0.08	0.8092	3.73	3.99	0.08	587.17204
176-250 hp	4	250	2016	0.68	3.73	3.99	0.08	0.8092	3.73	3.99	0.08	587.17204
176-250 hp	4	250	2017	0.68	3.73	3.99	0.08	0.8092	3.73	3.99	0.08	587.17204
176-250 hp	4	250	2018	0.68	3.73	3.99	0.08	0.8092	3.73	3.99	0.08	587.17204
176-250 hp	4	250	2019	0.68	3.73	3.99	0.08	0.8092	3.73	3.99	0.08	587.17204
176-250 hp	4	250	2020	0.68	3.73	3.99	0.08	0.8092	3.73	3.99	0.08	587.17204
251-500 hp	5	500	1958	1.26	3.066	16.52	0.703	1.4994	4.326	14	0.6216	587.17204
251-500 hp	5	500	1969	1.26	3.066	16.52	0.703	1.4994	4.326	14	0.6216	587.17204
251-500 hp	5	500	1970	1.26	3.066	16.52	0.703	1.4994	4.326	14	0.6216	587.17204
251-500 hp	5	500	1971	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
251-500 hp	5	500	1972	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
251-500 hp	5	500	1973	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
251-500 hp	5	500	1974	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
251-500 hp	5	500	1975	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
251-500 hp	5	500	1976	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
251-500 hp	5	500	1977	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
251-500 hp	5	500	1978	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
251-500 hp	5	500	1979	0.95	3.066	14.16	0.5035	1.1305	4.326	12	0.4452	587.17204
251-500 hp	5	500	1980	0.95	3.066	14.16	0.5035	1.1305	4.326	12	0.4452	587.17204

HP Range	HP Cat	Max. HP	Model Year	ME ROG	ME CO	ME NOx	ME PM	AE ROG	AE CO	AE NOx	AE PM	CO_2
251-500 hp	5	500	1981	0.95	3.066	14.16	0.5035	1.1305	4.326	12	0.4452	587.17204
251-500 hp	5	500	1982	0.95	3.066	14.16	0.5035	1.1305	4.326	12	0.4452	587.17204
251-500 hp	5	500	1983	0.95	3.066	14.16	0.5035	1.1305	4.326	12	0.4452	587.17204
251-500 hp	5	500	1984	0.9	3.066	12.98	0.5035	1.071	4.326	11	0.4452	587.17204
251-500 hp	5	500	1985	0.9	3.066	12.98	0.5035	1.071	4.326	11	0.4452	587.17204
251-500 hp	5	500	1986	0.9	3.066	12.98	0.5035	1.071	4.326	11	0.4452	587.17204
251-500 hp	5	500	1987	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
251-500 hp	5	500	1988	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
251-500 hp	5	500	1989	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
251-500 hp	5	500	1990	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
251-500 hp	5	500	1991	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
251-500 hp	5	500	1992	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
251-500 hp	5	500	1993	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
251-500 hp	5	500	1994	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
251-500 hp	5	500	1995	0.68	1.971	9.6406	0.361	0.8092	2.781	8.17	0.3192	587.17204
251-500 hp	5	500	1996	0.68	1.971	9.6406	0.361	0.8092	2.781	8.17	0.3192	587.17204
251-500 hp	5	500	1997	0.68	1.971	9.6406	0.361	0.8092	2.781	8.17	0.3192	587.17204
251-500 hp	5	500	1998	0.68	1.971	9.6406	0.361	0.8092	2.781	8.17	0.3192	587.17204
251-500 hp	5	500	1999	0.68	1.971	9.6406	0.361	0.8092	2.781	8.17	0.3192	587.17204
251-500 hp	5	500	2000	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204
251-500 hp	5	500	2001	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204
251-500 hp	5	500	2002	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204
251-500 hp	5	500	2003	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204
251-500 hp	5	500	2004	0.68	3.73	5.1015	0.15	0.8092	3.73	5.1015	0.15	587.17204
251-500 hp	5	500	2005	0.68	3.73	5.1015	0.15	0.8092	3.73	5.1015	0.15	587.17204
251-500 hp	5	500	2006	0.68	3.73	5.1015	0.15	0.8092	3.73	5.1015	0.15	587.17204
251-500 hp	5	500	2007	0.68	3.73	5.1015	0.15	0.8092	3.73	5.1015	0.15	587.17204
251-500 hp	5	500	2008	0.68	3.73	5.1015	0.15	0.8092	3.73	5.1015	0.15	587.17204
251-500 hp	5	500	2009	0.68	3.73	5.1015	0.15	0.8092	3.73	5.1015	0.15	587.17204
251-500 hp	5	500	2010	0.68	3.73	5.1015	0.15	0.8092	3.73	5.1015	0.15	587.17204
251-500 hp	5	500	2011	0.68	3.73	5.1015	0.15	0.8092	3.73	5.1015	0.15	587.17204
251-500 hp	5	500	2012	0.68	3.73	5.1015	0.15	0.8092	3.73	5.1015	0.15	587.17204

HP Range	HP Cat	Max. HP	Model Year	ME ROG	ME CO	ME NOx	ME PM	AE ROG	AE CO	AE NOx	AE PM	CO_2
251-500 hp	5	500	2013	0.68	3.73	5.1015	0.15	0.8092	3.73	5.1015	0.15	587.17204
251-500 hp	5	500	2014	0.68	3.73	3.99	0.08	0.8092	3.73	3.99	0.08	587.17204
251-500 hp	5	500	2015	0.68	3.73	3.99	0.08	0.8092	3.73	3.99	0.08	587.17204
251-500 hp	5	500	2016	0.68	3.73	3.99	0.08	0.8092	3.73	3.99	0.08	587.17204
251-500 hp	5	500	2017	0.68	3.73	3.99	0.08	0.8092	3.73	3.99	0.08	587.17204
251-500 hp	5	500	2018	0.68	3.73	3.99	0.08	0.8092	3.73	3.99	0.08	587.17204
251-500 hp	5	500	2019	0.68	3.73	3.99	0.08	0.8092	3.73	3.99	0.08	587.17204
251-500 hp	5	500	2020	0.68	3.73	3.99	0.08	0.8092	3.73	3.99	0.08	587.17204
501-750 hp	6	750	1969	1.26	3.066	16.52	0.703	1.4994	4.326	14	0.6216	587.17204
501-750 hp	6	750	1970	1.26	3.066	16.52	0.703	1.4994	4.326	14	0.6216	587.17204
501-750 hp	6	750	1971	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
501-750 hp	6	750	1972	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
501-750 hp	6	750	1973	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
501-750 hp	6	750	1974	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
501-750 hp	6	750	1975	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
501-750 hp	6	750	1976	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
501-750 hp	6	750	1977	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
501-750 hp	6	750	1978	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
501-750 hp	6	750	1979	0.95	3.066	14.16	0.5035	1.1305	4.326	12	0.4452	587.17204
501-750 hp	6	750	1980	0.95	3.066	14.16	0.5035	1.1305	4.326	12	0.4452	587.17204
501-750 hp	6	750	1981	0.95	3.066	14.16	0.5035	1.1305	4.326	12	0.4452	587.17204
501-750 hp	6	750	1982	0.95	3.066	14.16	0.5035	1.1305	4.326	12	0.4452	587.17204
501-750 hp	6	750	1983	0.95	3.066	14.16	0.5035	1.1305	4.326	12	0.4452	587.17204
501-750 hp	6	750	1984	0.9	3.066	12.98	0.5035	1.071	4.326	11	0.4452	587.17204
501-750 hp	6	750	1985	0.9	3.066	12.98	0.5035	1.071	4.326	11	0.4452	587.17204
501-750 hp	6	750	1986	0.9	3.066	12.98	0.5035	1.071	4.326	11	0.4452	587.17204
501-750 hp	6	750	1987	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
501-750 hp	6	750	1988	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
501-750 hp	6	750	1989	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
501-750 hp	6	750	1990	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
501-750 hp	6	750	1991	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
501-750 hp	6	750	1992	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204

HP Range	HP Cat	Max. HP	Model Year	ME ROG	ME CO	ME NOx	ME PM	AE ROG	AE CO	AE NOx	AE PM	CO_2
501-750 hp	6	750	1993	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
501-750 hp	6	750	1994	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
501-750 hp	6	750	1995	0.68	1.971	9.6406	0.361	0.8092	2.781	8.17	0.3192	587.17204
501-750 hp	6	750	1996	0.68	1.971	9.6406	0.361	0.8092	2.781	8.17	0.3192	587.17204
501-750 hp	6	750	1997	0.68	1.971	9.6406	0.361	0.8092	2.781	8.17	0.3192	587.17204
501-750 hp	6	750	1998	0.68	1.971	9.6406	0.361	0.8092	2.781	8.17	0.3192	587.17204
501-750 hp	6	750	1999	0.68	1.971	9.6406	0.361	0.8092	2.781	8.17	0.3192	587.17204
501-750 hp	6	750	2000	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204
501-750 hp	6	750	2001	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204
501-750 hp	6	750	2002	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204
501-750 hp	6	750	2003	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204
501-750 hp	6	750	2004	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204
501-750 hp	6	750	2005	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204
501-750 hp	6	750	2006	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204
501-750 hp	6	750	2007	0.68	3.73	5.1015	0.15	0.8092	3.73	5.1015	0.15	587.17204
501-750 hp	6	750	2008	0.68	3.73	5.1015	0.15	0.8092	3.73	5.1015	0.15	587.17204
501-750 hp	6	750	2009	0.68	3.73	5.1015	0.15	0.8092	3.73	5.1015	0.15	587.17204
501-750 hp	6	750	2010	0.68	3.73	5.1015	0.15	0.8092	3.73	5.1015	0.15	587.17204
501-750 hp	6	750	2011	0.68	3.73	5.1015	0.15	0.8092	3.73	5.1015	0.15	587.17204
501-750 hp	6	750	2012	0.68	3.73	5.1015	0.15	0.8092	3.73	5.1015	0.15	587.17204
501-750 hp	6	750	2013	0.68	3.73	3.99	0.08	0.8092	3.73	3.99	0.08	587.17204
501-750 hp	6	750	2014	0.68	3.73	3.99	0.08	0.8092	3.73	3.99	0.08	587.17204
501-750 hp	6	750	2015	0.68	3.73	3.99	0.08	0.8092	3.73	3.99	0.08	587.17204
501-750 hp	6	750	2016	0.68	3.73	3.99	0.08	0.8092	3.73	3.99	0.08	587.17204
501-750 hp	6	750	2017	0.68	3.73	3.99	0.08	0.8092	3.73	3.99	0.08	587.17204
501-750 hp	6	750	2018	0.68	3.73	3.99	0.08	0.8092	3.73	3.99	0.08	587.17204
501-750 hp	6	750	2019	0.68	3.73	3.99	0.08	0.8092	3.73	3.99	0.08	587.17204
501-750 hp	6	750	2020	0.68	3.73	3.99	0.08	0.8092	3.73	3.99	0.08	587.17204
751-1900 hp	7	1900	1969	1.26	3.066	16.52	0.703	1.4994	4.326	14	0.6216	587.17204
751-1900 hp	7	1900	1970	1.26	3.066	16.52	0.703	1.4994	4.326	14	0.6216	587.17204
751-1900 hp	7	1900	1971	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
751-1900 hp	7	1900	1972	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204

HP Range	HP Cat	Max. HP	Model Year	ME ROG	ME CO	ME NOx	ME PM	AE ROG	AE CO	AE NOx	AE PM	CO_2
751-1900 hp	7	1900	1973	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
751-1900 hp	7	1900	1974	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
751-1900 hp	7	1900	1975	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
751-1900 hp	7	1900	1976	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
751-1900 hp	7	1900	1977	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
751-1900 hp	7	1900	1978	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
751-1900 hp	7	1900	1979	0.95	3.066	14.16	0.5035	1.1305	4.326	12	0.4452	587.17204
751-1900 hp	7	1900	1980	0.95	3.066	14.16	0.5035	1.1305	4.326	12	0.4452	587.17204
751-1900 hp	7	1900	1981	0.95	3.066	14.16	0.5035	1.1305	4.326	12	0.4452	587.17204
751-1900 hp	7	1900	1982	0.95	3.066	14.16	0.5035	1.1305	4.326	12	0.4452	587.17204
751-1900 hp	7	1900	1983	0.95	3.066	14.16	0.5035	1.1305	4.326	12	0.4452	587.17204
751-1900 hp	7	1900	1984	0.9	3.066	12.98	0.5035	1.071	4.326	11	0.4452	587.17204
751-1900 hp	7	1900	1985	0.9	3.066	12.98	0.5035	1.071	4.326	11	0.4452	587.17204
751-1900 hp	7	1900	1986	0.9	3.066	12.98	0.5035	1.071	4.326	11	0.4452	587.17204
751-1900 hp	7	1900	1987	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
751-1900 hp	7	1900	1988	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
751-1900 hp	7	1900	1989	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
751-1900 hp	7	1900	1990	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
751-1900 hp	7	1900	1991	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
751-1900 hp	7	1900	1992	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
751-1900 hp	7	1900	1993	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
751-1900 hp	7	1900	1994	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
751-1900 hp	7	1900	1995	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
751-1900 hp	7	1900	1996	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
751-1900 hp	7	1900	1997	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
751-1900 hp	7	1900	1998	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
751-1900 hp	7	1900	1999	0.68	1.971	9.6406	0.361	0.8092	2.781	8.17	0.3192	587.17204
751-1900 hp	7	1900	2000	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204
751-1900 hp	7	1900	2001	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204
751-1900 hp	7	1900	2002	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204
751-1900 hp	7	1900	2003	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204
751-1900 hp	7	1900	2004	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204

HP Range	HP Cat	Max. HP	Model Year	ME ROG	ME CO	ME NOx	ME PM	AE ROG	AE CO	AE NOx	AE PM	CO_2
751-1900 hp	7	1900	2005	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204
751-1900 hp	7	1900	2006	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204
751-1900 hp	7	1900	2007	0.68	3.73	5.529	0.2	0.8092	3.73	5.529	0.2	587.17204
751-1900 hp	7	1900	2008	0.68	3.73	5.529	0.2	0.8092	3.73	5.529	0.2	587.17204
751-1900 hp	7	1900	2009	0.68	3.73	5.529	0.2	0.8092	3.73	5.529	0.2	587.17204
751-1900 hp	7	1900	2010	0.68	3.73	5.529	0.2	0.8092	3.73	5.529	0.2	587.17204
751-1900 hp	7	1900	2011	0.68	3.73	5.529	0.2	0.8092	3.73	5.529	0.2	587.17204
751-1900 hp	7	1900	2012	0.68	3.73	4.085	0.08	0.8092	3.73	4.085	0.08	587.17204
751-1900 hp	7	1900	2013	0.68	3.73	4.085	0.08	0.8092	3.73	4.085	0.08	587.17204
751-1900 hp	7	1900	2014	0.68	3.73	4.085	0.08	0.8092	3.73	4.085	0.08	587.17204
751-1900 hp	7	1900	2015	0.68	3.73	4.085	0.08	0.8092	3.73	4.085	0.08	587.17204
751-1900 hp	7	1900	2016	0.68	3.73	4.085	0.08	0.8092	3.73	4.085	0.08	587.17204
751-1900 hp	7	1900	2017	0.1772946	3.73	1.3	0.03	0.1772946	3.73	1.3	0.03	587.17204
751-1900 hp	7	1900	2018	0.1772946	3.73	1.3	0.03	0.1772946	3.73	1.3	0.03	587.17204
751-1900 hp	7	1900	2019	0.1772946	3.73	1.3	0.03	0.1772946	3.73	1.3	0.03	587.17204
751-1900 hp	7	1900	2020	0.1772946	3.73	1.3	0.03	0.1772946	3.73	1.3	0.03	587.17204
1901-3300 hp	8	3300	1969	1.26	3.066	16.52	0.703	1.4994	4.326	14	0.6216	587.17204
1901-3300 hp	8	3300	1970	1.26	3.066	16.52	0.703	1.4994	4.326	14	0.6216	587.17204
1901-3300 hp	8	3300	1971	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
1901-3300 hp	8	3300	1972	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
1901-3300 hp	8	3300	1973	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
1901-3300 hp	8	3300	1974	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
1901-3300 hp	8	3300	1975	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
1901-3300 hp	8	3300	1976	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
1901-3300 hp	8	3300	1977	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
1901-3300 hp	8	3300	1978	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
1901-3300 hp	8	3300	1979	0.95	3.066	14.16	0.5035	1.1305	4.326	12	0.4452	587.17204
1901-3300 hp	8	3300	1980	0.95	3.066	14.16	0.5035	1.1305	4.326	12	0.4452	587.17204
1901-3300 hp	8	3300	1981	0.95	3.066	14.16	0.5035	1.1305	4.326	12	0.4452	587.17204
1901-3300 hp	8	3300	1982	0.95	3.066	14.16	0.5035	1.1305	4.326	12	0.4452	587.17204
1901-3300 hp	8	3300	1983	0.95	3.066	14.16	0.5035	1.1305	4.326	12	0.4452	587.17204
1901-3300 hp	8	3300	1984	0.9	3.066	12.98	0.5035	1.071	4.326	11	0.4452	587.17204

HP Range	HP Cat	Max. HP	Model Year	ME ROG	ME CO	ME NOx	ME PM	AE ROG	AE CO	AE NOx	AE PM	CO_2
1901-3300 hp	8	3300	1985	0.9	3.066	12.98	0.5035	1.071	4.326	11	0.4452	587.17204
1901-3300 hp	8	3300	1986	0.9	3.066	12.98	0.5035	1.071	4.326	11	0.4452	587.17204
1901-3300 hp	8	3300	1987	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
1901-3300 hp	8	3300	1988	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
1901-3300 hp	8	3300	1989	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
1901-3300 hp	8	3300	1990	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
1901-3300 hp	8	3300	1991	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
1901-3300 hp	8	3300	1992	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
1901-3300 hp	8	3300	1993	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
1901-3300 hp	8	3300	1994	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
1901-3300 hp	8	3300	1995	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
1901-3300 hp	8	3300	1996	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
1901-3300 hp	8	3300	1997	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
1901-3300 hp	8	3300	1998	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
1901-3300 hp	8	3300	1999	0.68	1.971	9.6406	0.361	0.8092	2.781	8.17	0.3192	587.17204
1901-3300 hp	8	3300	2000	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204
1901-3300 hp	8	3300	2001	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204
1901-3300 hp	8	3300	2002	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204
1901-3300 hp	8	3300	2003	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204
1901-3300 hp	8	3300	2004	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204
1901-3300 hp	8	3300	2005	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204
1901-3300 hp	8	3300	2006	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204
1901-3300 hp	8	3300	2007	0.68	3.73	5.529	0.2	0.8092	3.73	5.529	0.2	587.17204
1901-3300 hp	8	3300	2008	0.68	3.73	5.529	0.2	0.8092	3.73	5.529	0.2	587.17204
1901-3300 hp	8	3300	2009	0.68	3.73	5.529	0.2	0.8092	3.73	5.529	0.2	587.17204
1901-3300 hp	8	3300	2010	0.68	3.73	5.529	0.2	0.8092	3.73	5.529	0.2	587.17204
1901-3300 hp	8	3300	2011	0.68	3.73	5.529	0.2	0.8092	3.73	5.529	0.2	587.17204
1901-3300 hp	8	3300	2012	0.68	3.73	5.529	0.2	0.8092	3.73	5.529	0.2	587.17204
1901-3300 hp	8	3300	2013	0.68	3.73	4.37	0.1	0.8092	3.73	4.37	0.1	587.17204
1901-3300 hp	8	3300	2014	0.68	3.73	4.37	0.1	0.8092	3.73	4.37	0.1	587.17204
1901-3300 hp	8	3300	2015	0.68	3.73	4.37	0.1	0.8092	3.73	4.37	0.1	587.17204
1901-3300 hp	8	3300	2016	0.1772946	3.73	1.3	0.03	0.1772946	3.73	1.3	0.03	587.17204

HP Range	HP Cat	Max. HP	Model Year	ME ROG	ME CO	ME NOx	ME PM	AE ROG	AE CO	AE NOx	AE PM	CO_2
1901-3300 hp	8	3300	2017	0.1772946	3.73	1.3	0.03	0.1772946	3.73	1.3	0.03	587.17204
1901-3300 hp	8	3300	2018	0.1772946	3.73	1.3	0.03	0.1772946	3.73	1.3	0.03	587.17204
1901-3300 hp	8	3300	2019	0.1772946	3.73	1.3	0.03	0.1772946	3.73	1.3	0.03	587.17204
1901-3300 hp	8	3300	2020	0.1772946	3.73	1.3	0.03	0.1772946	3.73	1.3	0.03	587.17204
>3301-5000 hp	9	5000	1969	1.26	3.066	16.52	0.703	1.4994	4.326	14	0.6216	587.17204
>3301-5000 hp	9	5000	1970	1.26	3.066	16.52	0.703	1.4994	4.326	14	0.6216	587.17204
>3301-5000 hp	9	5000	1971	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
>3301-5000 hp	9	5000	1972	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
>3301-5000 hp	9	5000	1973	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
>3301-5000 hp	9	5000	1974	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
>3301-5000 hp	9	5000	1975	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
>3301-5000 hp	9	5000	1976	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
>3301-5000 hp	9	5000	1977	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
>3301-5000 hp	9	5000	1978	1.05	3.066	15.34	0.5985	1.2495	4.326	13	0.5292	587.17204
>3301-5000 hp	9	5000	1979	0.95	3.066	14.16	0.5035	1.1305	4.326	12	0.4452	587.17204
>3301-5000 hp	9	5000	1980	0.95	3.066	14.16	0.5035	1.1305	4.326	12	0.4452	587.17204
>3301-5000 hp	9	5000	1981	0.95	3.066	14.16	0.5035	1.1305	4.326	12	0.4452	587.17204
>3301-5000 hp	9	5000	1982	0.95	3.066	14.16	0.5035	1.1305	4.326	12	0.4452	587.17204
>3301-5000 hp	9	5000	1983	0.95	3.066	14.16	0.5035	1.1305	4.326	12	0.4452	587.17204
>3301-5000 hp	9	5000	1984	0.9	3.066	12.98	0.5035	1.071	4.326	11	0.4452	587.17204
>3301-5000 hp	9	5000	1985	0.9	3.066	12.98	0.5035	1.071	4.326	11	0.4452	587.17204
>3301-5000 hp	9	5000	1986	0.9	3.066	12.98	0.5035	1.071	4.326	11	0.4452	587.17204
>3301-5000 hp	9	5000	1987	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
>3301-5000 hp	9	5000	1988	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
>3301-5000 hp	9	5000	1989	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
>3301-5000 hp	9	5000	1990	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
>3301-5000 hp	9	5000	1991	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
>3301-5000 hp	9	5000	1992	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
>3301-5000 hp	9	5000	1993	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
>3301-5000 hp	9	5000	1994	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
>3301-5000 hp	9	5000	1995	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
>3301-5000 hp	9	5000	1996	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204

HP Range	HP Cat	Max. HP	Model Year	ME ROG	ME CO	ME NOx	ME PM	AE ROG	AE CO	AE NOx	AE PM	CO_2
>3301-5000 hp	9	5000	1997	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
>3301-5000 hp	9	5000	1998	0.84	2.993	12.98	0.5035	0.9996	4.223	11	0.4452	587.17204
>3301-5000 hp	9	5000	1999	0.68	1.971	9.6406	0.361	0.8092	2.781	8.17	0.3192	587.17204
>3301-5000 hp	9	5000	2000	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204
>3301-5000 hp	9	5000	2001	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204
>3301-5000 hp	9	5000	2002	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204
>3301-5000 hp	9	5000	2003	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204
>3301-5000 hp	9	5000	2004	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204
>3301-5000 hp	9	5000	2005	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204
>3301-5000 hp	9	5000	2006	0.68	1.971	7.31	0.361	0.8092	2.781	7.31	0.3192	587.17204
>3301-5000 hp	9	5000	2007	0.68	3.73	5.529	0.2	0.8092	3.73	5.529	0.2	587.17204
>3301-5000 hp	9	5000	2008	0.68	3.73	5.529	0.2	0.8092	3.73	5.529	0.2	587.17204
>3301-5000 hp	9	5000	2009	0.68	3.73	5.529	0.2	0.8092	3.73	5.529	0.2	587.17204
>3301-5000 hp	9	5000	2010	0.68	3.73	5.529	0.2	0.8092	3.73	5.529	0.2	587.17204
>3301-5000 hp	9	5000	2011	0.68	3.73	5.529	0.2	0.8092	3.73	5.529	0.2	587.17204
>3301-5000 hp	9	5000	2012	0.68	3.73	5.529	0.2	0.8092	3.73	5.529	0.2	587.17204
>3301-5000 hp	9	5000	2013	0.68	3.73	5.529	0.2	0.8092	3.73	5.529	0.2	587.17204
>3301-5000 hp	9	5000	2014	0.68	3.73	4.94	0.25	0.8092	3.75	4.94	0.25	587.17204
>3301-5000 hp	9	5000	2015	0.68	3.73	4.94	0.25	0.8092	3.75	4.94	0.25	587.17204
>3301-5000 hp	9	5000	2016	0.1772946	3.73	1.3	0.03	0.1772946	3.75	1.3	0.03	587.17204
>3301-5000 hp	9	5000	2017	0.1772946	3.73	1.3	0.03	0.1772946	3.75	1.3	0.03	587.17204
>3301-5000 hp	9	5000	2018	0.1772946	3.73	1.3	0.03	0.1772946	3.75	1.3	0.03	587.17204
>3301-5000 hp	9	5000	2019	0.1772946	3.73	1.3	0.03	0.1772946	3.75	1.3	0.03	587.17204
>3301-5000 hp	9	5000	2020	0.1772946	3.73	1.3	0.03	0.1772946	3.75	1.3	0.03	587.17204

APPENDIX G

CHE and Other Off-Road Equipment Characteristics and Activity

Appendix G. CHE and Other Off-Road Equipment Characteristics and Activity

Equipment	Engine Make	Engine Model	Equipment Type	Engine Model Year	Fuel	Power (HP)	No.	Hours Per	Total Hours
Aerial Lift	JLG	80HX	Aerial Lifts	1994	D	70	1	240	240
Forklift	Caterpillar	V55B	Forklift	1976	D	70	1	100	100
Forklift	Lull	844	Forklift	1985	D	109	1	100	100
Rubber Tired Loader	Caterpillar	972	Rubber Tired Loaders	1997	D	265	1	240	240
Rubber Tired Loader	Caterpillar	972G	Rubber Tired Loaders	2004	D	265	1	240	240
Sweepers/Scrubbers	Tennant	6500D	Sweepers/Scrubbers	1999	D	34	1	240	240
Forklift	Unknown	N/A	Forklift	1997	D	126	1	701	701
Forklift	Mitsubishi	FD35	Forklift	1984	D	72	7	27	190
Forklift	Mitsubishi	FD70	Forklift	1984	D	72	1	190	190
Forklift	CAT	V300	Forklift	1979	D	137	1	190	190
Forklift	CAT	V300B	Forklift	1981	D	137	2	95	190
Forklift	Mitsubishi	FD150A	Forklift	1984	D	131	2	95	190
Forklift	Taylor	Y-52-WO	Forklift	1970	D	157	1	190	190
Forklift	Taylor	Y-52-48-LC	Forklift	1975	D	157	1	190	190
Top Loader	Taylor	TEC-9501	Container Handling Equipment	1995	D	250	1	190	190
Rail Pusher	Hough	T300-SL	Container Handling Equipment	1988	D	256	1	190	190
Forklift	210 HD	N/A	Forklift	2003	D	155	2	75	150
Forklift	210 HD	N/A	Forklift	2002	D	155	1	150	150
Reach Stacker	Fantuzzi	N/A	Container Handling Equipment	2009	D	400	1	875	875
Reach Stacker	Fantuzzi	N/A	Container Handling Equipment	2008	D	330	2	437.5	875
Forklift	Taylor	N/A	Forklift	1985	D	170	1	400	400
Hustler	Capacity	N/A	Yard Tractor	2007	D	200	15	959.0667	14386
Reach Stacker	Taylor	N/A	Container Handling Equipment	2002	D	330	1	142	142
Forklift	Hyster	N/A	Forklift	2004	LPG	103	1	36	36
Box Van	Isuzu	FRR	Other	1995	D	200	1	399	399
Box Van	Isuzu	NPR/NE1	Other	1997	D	135	1	390	390
Box Van	GMC	W4500	Other	2004	D	135	1	390	390
Ford Pickup	F150	N/A	Other	1992	G	205	1	575	575
Ford Pickup	F150	N/A	Other	1995	G	205	1	580	580
Ford Pickup	F150	N/A	Other	1995	G	150	1	450	450
Chevy Pickup	C10	N/A	Other	2005	G	210	1	1990	1990
Ford Ranger	Ranger	N/A	Other	2010	G	143	1	5075	5075
Toyota Pickup	Tacoma	N/A	Other	2003	G	142	1	725	725
Forklift	N/A	N/A	Forklift	2003	D	143	1	1300	1300
Forklift	N/A	N/A	Forklift	2004	D	143	1	1300	1300
Forklift	N/A	N/A	Forklift	2007	LPG	87	1	1300	1300
Forklift	N/A	N/A	Forklift	2006	D	152	1	1300	1300
Forklift	N/A	N/A	Forklift	2008	D	87	1	1300	1300
Forklift	N/A	N/A	Forklift	2008	D	155	1	1300	1300
Forklift	N/A	N/A	Forklift	2007	LPG	87	1	1300	1300

Equipment	Engine Make	Engine Model	Equipment Type	Engine Model Year	Fuel	Power (HP)	No.	Hours Per	Total Hours
Forklift	N/A	N/A	Forklift	2003	D	143	1	1300	1300
Forklift	Caterpillar 2C6000	N/A	Forklift	2012	LPG	63	2	1400	2800
Forklift	Taylor	N/A	Forklift	1988	D	130	1	56	56
Forklift	Taylor	N/A	Forklift	1986	D	135	2	528	1056
Forklift	Toyota 3FDU70	N/A	Forklift	1986	D	81	3	373.5	1120.5
Forklift	CaterpillarDP 90D	N/A	Forklift	2002	D	131	6	171.8333	1031
Forklift	Caterpillar DP150	N/A	Forklift	2002	D	131	3	143.5	430.5
Forklift	Caterpillar P22000	N/A	Forklift	2011	D	148	1	538	538
Forklift	Caterpillar P33000	N/A	Forklift	2011	D	148	2	538	1076
Forklift	Mitsubishi FD70	N/A	Forklift	2011	D	131	2	533	1066
Forklift	Wiggins	N/A	Forklift	2006	D	173	1	532	532
Forklift	Wiggins	N/A	Forklift	2006	D	173	1	711	711
Reach lift	Genie 844	N/A	Container Handling Equipment	2006	D	99	1	245	245
Forklift	Caterpillar DP 50 K	N/A	Forklift	2006	D	81	1	65	65
Rubber-tired loader	Caterpillar 9626	N/A	Rubber Tired Loaders	2001	D	183	1	812.5	812.5
Forklift	N/A	N/A	Forklift	1997	Elect.	126	1	160	160
Forklift	N/A	N/A	Forklift	1997	Elect.	126	1	160	160
Forklift	N/A	N/A	Forklift	1997	Elect.	126	1	160	160
Forklift	N/A	N/A	Forklift	1997	Elect.	126	1	160	160
Forklift	N/A	N/A	Forklift	1997	Elect.	126	1	160	160
Forklift	N/A	N/A	Forklift	1997	Elect.	126	1	160	160
Forklift	N/A	N/A	Forklift	1997	Elect.	126	1	160	160
Forklift	N/A	N/A	Forklift	1997	Elect.	126	1	160	160
Forklift	N/A	N/A	Forklift	1997	Elect.	126	1	160	160
Forklift	N/A	N/A	Forklift	1997	Elect.	126	1	160	160
Forklift	N/A	N/A	Forklift	1997	Elect.	126	1	160	160
Forklift	N/A	N/A	Forklift	1997	Elect.	126	1	160	160
Forklift	N/A	N/A	Forklift	1997	Elect.	126	1	160	160
Forklift	N/A	N/A	Forklift	1997	Elect.	126	1	160	160
Forklift	N/A	N/A	Forklift	1997	Elect.	126	1	160	160
Forklift	N/A	N/A	Forklift	1997	Elect.	126	1	160	160
Forklift	N/A	N/A	Forklift	1997	Elect.	126	1	160	160
Forklift	N/A	N/A	Forklift	1997	Elect.	126	1	160	160
Forklift	N/A	N/A	Forklift	1997	Elect.	126	1	160	160
Forklift	N/A	N/A	Forklift	1997	Elect.	126	1	160	160
Forklift	N/A	N/A	Forklift	1997	Elect.	126	1	160	160
Forklift	N/A	N/A	Forklift	1997	Elect.	126	1	160	160
Forklift	N/A	N/A	Forklift	1997	Elect.	126	1	160	160
Forklift	N/A	N/A	Forklift	1997	Elect.	126	1	160	160
Forklift	N/A	N/A	Forklift	1997	Elect.	126	1	160	160
Forklift	N/A	N/A	Forklift	1997	Elect.	126	1	160	160
Forklift	N/A	N/A	Forklift	1997	LPG	126	1	160	160
Forklift	N/A	N/A	Forklift	1997	LPG	126	1	160	160
Forklift	N/A	N/A	Forklift	1997	LPG	126	1	160	160
Forklift	N/A	N/A	Forklift	1997	LPG	126	1	160	160

Equipment	Engine Make	Engine Model	Equipment Type	Engine Model Year	Fuel	Power (HP)	No.	Hours Per	Total Hours
Forklift	N/A	N/A	Forklift	1997	LPG	126	1	160	160
Forklift	N/A	N/A	Forklift	1997	LPG	126	1	160	160
Forklift	N/A	N/A	Forklift	1997	LPG	126	1	160	160
Forklift	N/A	N/A	Forklift	1997	LPG	126	1	160	160
Forklift	N/A	N/A	Forklift	1997	LPG	126	1	160	160
Forklift	N/A	N/A	Forklift	1997	LPG	126	1	160	160
Forklift	N/A	N/A	Forklift	1997	LPG	126	1	160	160
Forklift	N/A	N/A	Forklift	1997	Elect.	126	1	160	160

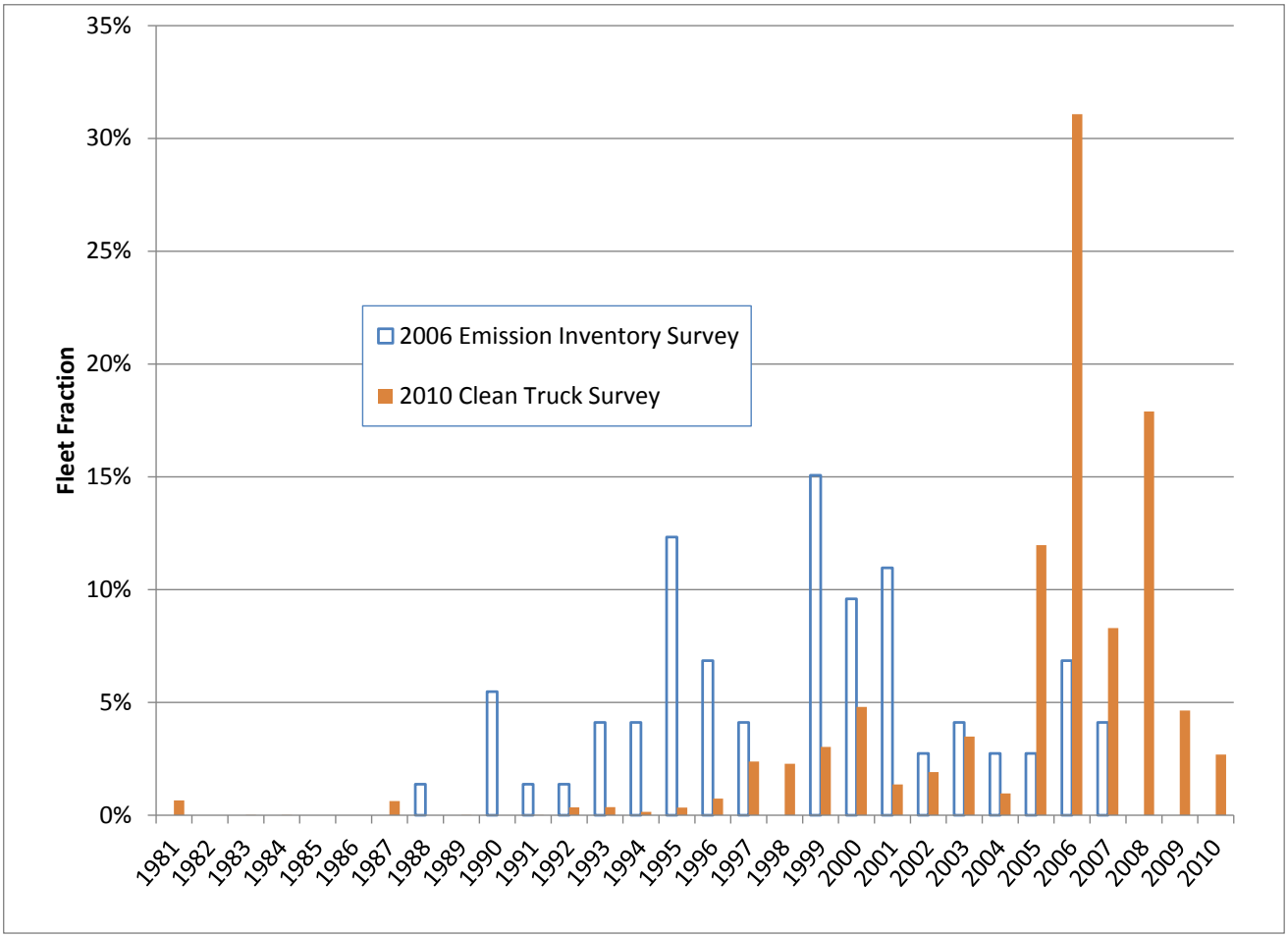
APPENDIX H

Drayage Truck Age Distribution

Appendix H. Ports Clean Air Program Survey

Data was compiled for period 2009 Quarter 4 through 2010 Quarter 3. Duplicate trips were not counted. Duplicate trips are those that occur within 30 minutes of the last gate entry by the same truck.

2006 Emission Inventory (POSD, 2007)			Port's Clean Air Program Survey			Truck Age Distribution Complying with Drayage Truck Rule	
Model Year	Number of Trips	Distribution	Model Year	Number of Trips	Distribution	Model Year	Revised Distribution
1981			1981	159	0.7%	1981	0
1982			1982			1982	0
1983			1983	2	0.0%	1983	0
1984			1984	2	0.0%	1984	0
1985			1985			1985	0
1986			1986			1986	0
1987			1987	150	0.6%	1987	0
1988	1	1.4%	1988			1988	0
1989	0	0.0%	1989	1	0.0%	1989	0
1990	4	5.5%	1990			1990	0
1991	1	1.4%	1991	3	0.0%	1991	0
1992	1	1.4%	1992	83	0.3%	1992	0
1993	3	4.1%	1993	87	0.4%	1993	0
1994	3	4.1%	1994	35	0.1%	1994	0
1995	9	12.3%	1995	81	0.3%	1995	0
1996	5	6.8%	1996	177	0.7%	1996	0
1997	3	4.1%	1997	574	2.4%	1997	0
1998	0	0.0%	1998	548	2.3%	1998	0
1999	11	15.1%	1999	729	3.0%	1999	0
2000	7	9.6%	2000	1156	4.8%	2000	0
2001	8	11.0%	2001	328	1.4%	2001	0
2002	2	2.7%	2002	460	1.9%	2002	0
2003	3	4.1%	2003	838	3.5%	2003	0
2004	2	2.7%	2004	232	1.0%	2004	0
2005	2	2.7%	2005	2884	12.0%	2005	12.0%
2006	5	6.8%	2006	7484	31.1%	2006	31.1%
2007	3	4.1%	2007	1998	8.3%	2007	8.3%
2008		0.0%		4309	17.9%	2008	17.9%
2009		0.0%		1117	4.6%	2009	4.6%
2010		0.0%		648	2.7%	2010	8.7%
						2011	8.7%
						2012	8.7%


35%
30%
25%
20%
15%
10%
5%
0%
Fleet Fraction
2006 Emission Inventory Survey
2010 Clean Truck Survey
1981
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APPENDIX I

Comparison of OGV Emissions Due to Activity, Operational and Regulatory Changes

To better assess the effect of operational differences, regulations, and revised activity profiles and updated methods on the emissions from OGVs in 2012 compared to 2006, a series of tables are presented below which incorporate these changes in a stepwise approach. The original 2006 estimates are provided in Table I-1 by OGV operating mode. Since 2006, data regarding vessel activity has become available to more precisely determine transit speeds and routes of OGVs within the 24 nm water-side boundary. As described in Section 2.4, for the 2012 inventory, revised baseline transit speed distributions were created which proved to be lower than those used to calculate emissions during 2006. In addition, ARB updated OGV auxiliary boiler loads and emissions factors in its statewide emissions inventory since 2006. To provide a better comparison to 2012, the emissions for OGVs during 2006 were recalculated using the more up-to-date transit speed and route information as well as the new methods regarding auxiliary boiler load and emission factors. The revised emissions calculations for 2006 are provided in Table I-2. Comparing Tables I-1 and I-2, the primary differences when applying the revised activity and methods calculations are that the emissions produced during transiting modes are lower than those presented in the original 2006 inventory. These results are primarily attributed to slower speeds for all vessels and routes. In addition, the original 2006 inventory assumed that trips from or to Asian and Northern ports transited 54 nm to the north each way rather than, as evidence suggests, less than 24 nm from and to due west of the Port. The slower speeds and revised shorter routes more accurately depict the spatial and temporal reality of vessels transiting to and from the Port. Hotelling emissions only change slightly due to the change in emissions factors. Overall, the revised 2006 inventory results in a 12% to 50% reduction in criteria pollutant emissions and a 29% reduction in CO_2e.

Low sulfur fuel was mandated within 24 nm of the California coast beginning in 2009. To distinguish the effect on emissions of using lower sulfur fuel the revised 2006 emissions were recalculated substituting the lower 3,000 ppm sulfur fuel as opposed to the 27,000 ppm sulfur fuel which was standard during 2006. Table I-3 showcases the affect low sulfur fuel would have had on OGV emissions during 2006. As shown in the table, the use of low sulfur fuel decreases PM and SO_2 79% and 89%, respectively. Also shown in Table I-3 is that low sulfur would lead to only minimal decreases in the other criteria pollutants and greenhouse gas emissions. ROG would actually increase due to higher emissions factors when accounting for low sulfur fuel.

Lastly, the 2012 estimates are provided in I-4. Compared to the revised 2006 inventory presented in Table I-2, reductions in emissions occurred across all criteria pollutants and greenhouse gases. In summary, evaluating Tables I-2 through I-4, the reduction of emissions between 2012 and 2006 are not attributed to a single factor which drove down all emissions. The reductions in emissions for PM and SO_2 between the two inventories can be credited to regulation which instituted the use of low sulfur fuel. The other reductions demonstrated in 2012 are primarily due to fewer ship calls and decreased berthing times (as discussed in the body of this report). However, other factors including the Port's VSR Program and the use of shorepower at CST also contributed to fewer emissions.

Table I-1. OGV emissions by mode (tons) in the original 2006 emissions inventory.

Original 2006	HC	CO	NO_x	PM_{10}	$PM_{2.5}$	DPM	SO_2	CO_2	CH_4	N_2O	CO_2e
Hotelling[1]	14.0	37.8	500.3	56.3	45.0	49.2	595.5	32,210	0.2	1.7	32,747
Harbor and Maneuvering[2]	3.2	39.8	74.0	8.3	6.6	7.7	66.5	3,834	0.0	0.2	3,895
Transiting at Sea[3]	18.3	42.4	533.4	51.9	41.5	51.9	395.8	23,816	0.2	1.1	24,165
Total	**36**	**120**	**1,108**	**116.4**	**93.1**	**108.7**	**1,056**	**59,860**	**0.3**	**3.0**	**60,806**

[1] – Hotelling includes at berth and at anchor
[2] – Combines all in harbor activity including maneuvering near berth.
[3] – Combines Buoy, VSR, and Outer transiting at sea activity.

Table I-2. OGV emissions by mode (tons) in 2006 with activity and methods updated.

Mode	ROG	CO	NO_x	PM_{10}	$PM_{2.5}$	DPM	SO_2	CO_2	CH_4	N_2O	CO_2e
Hotelling	15.1	35.8	442.2	52.5	48.3	46.8	463.0	29,389	1.7	0.7	29,652
Harbor and Maneuvering	5.6	7.3	77.0	8.4	7.8	7.2	58.0	3,527	0.6	0.1	3,567
Transiting at Sea	10.4	17.4	207.0	21.5	19.8	18.1	160.0	9,646	1.0	0.3	9,745
Total	31.1	60.5	726.2	82.4	75.9	72.1	681.0	42,562	3.3	1.1	42,964
Relative to Original 2006 in Table I-1	-12%	-50%	-34%	-29%	-18%	-34%	-36%	-29%	876%	-64%	-29%

Table I-3. OGV emissions by mode (tons) in 2006 with activity and methods updated and 3,000 ppm sulfur fuel.

Mode	ROG	CO	NO_x	PM_{10}	$PM_{2.5}$	DPM	SO_2	CO_2	CH_4	N_2O	CO_2e
Hotelling	17.0	35.8	424.5	10.9	10.1	9.8	51.6	28,048	1.9	0.7	28,314
Harbor and Maneuvering	6.6	6.7	73.7	1.8	1.6	1.5	6.4	3,450	0.6	0.1	3,492
Transiting at Sea	12.6	16.3	196.9	4.6	4.1	3.8	17.6	9,418	1.2	0.3	9,522
Total	36.2	58.8	695.1	17.3	15.8	15.1	75.6	40,916	3.7	1.1	41,328
Relative to Table I-2	16%	-3%	-4%	-79%	-79%	-79%	-89%	-4%	12%	0%	-4%
Relative to Table I-1	2%	-51%	-37%	-85%	-83%	-86%	-93%	-32%	994%	-64%	-32%

Table I-4. OGV emissions by mode (tons) in 2012 with activity and methods updated and 3,000 ppm sulfur fuel.

Mode	ROG	CO	NO_x	PM_{10}	$PM_{2.5}$	DPM	SO_2	CO_2	CH_4	N_2O	CO_2e
Hotelling	8.6	18.1	213.1	5.7	5.2	4.9	28.0	15,159	0.7	0.4	15,292
Harbor and Maneuvering	4.8	4.8	53.6	1.3	1.2	1.2	4.6	2,440	0.5	0.1	2,482
Transiting at Sea	7.4	8.4	101.3	2.3	2.1	2.2	8.7	4,688	0.7	0.2	4,777
Total	20.9	31.3	368.0	9.3	8.5	8.3	41.2	22,287	1.9	0.7	22,551
Relative to Table I-3	-42%	-47%	-47%	-46%	-46%	-45%	-45%	-46%	-48%	-34%	-45%
Relative to Table I-2	**-33%**	**-48%**	**-49%**	**-89%**	**-89%**	**-89%**	**-94%**	**-48%**	**-42%**	**-34%**	**-48%**
Relative to Table I-1	-41%	-74%	-67%	-92%	-91%	-92%	-96%	-63%	466%	-76%	-63%