Clean Air Action Plan

For the Port of Richmond

July 27, 2010

DRAFT FINAL

City of Richmond

Executive Summary

The goal of the Port of Richmond Clean Air Action Plan (CAAP) is to develop and recommend feasible, cost-effective strategies and programs to reduce air emissions and health risks from operations at the Port of Richmond, while allowing port development to continue bringing revenue and jobs to the City of Richmond. This CAAP builds and expands upon the recent Honda Port of Entry CAAP by: 1) encompassing the Port of Richmond public facility, including the Point Potrero Marine Terminal (PPMT); 2) accounting for new state, federal and international regulations of ocean-going vessels, harborcraft, trucks, rail and cargo-handling equipment operating at California Ports; and 3) identifying specific grant funding and low-cost financing available to the Port from the federal, state and regional agencies for goods movement, air quality and energy efficiency improvements.

Specifically, this CAAP:

- Provides a detailed emission inventory of both criteria pollutant and greenhouse gas (mainly carbon dioxide) emissions from public Port activities. This analysis reveals that ocean-going vessels are responsible for the largest share of emissions.
- Identifies key regulatory emission reduction measures, including:
    - California Air Resources Board (CARB) regulation of ocean-going vessels both at berth in California ports, and at sea off the California coast.
    - Control measures for commercial harborcraft
    - California's Drayage Truck Regulation
- Identifies potential voluntary emission reduction measures, including:
    - Vessel speed reduction
    - Use of exhaust treatment devices for ships
    - On-site renewable energy generation
    - Shore power
- Estimates emissions reductions from both regulatory and potential voluntary emission reduction measures, including
    - Ocean-going vessel fuel sulfur rule
    - Vessel speed reduction
    - Heavy-duty truck idle rule
- Provides an outline for CAAP development and implementation, including
    - A Regulatory Compliance Program
    - Evaluation criteria for emission reduction measures
    - Securing federal and/or state grants and low-cost financing for CAAP initiatives
    - Tracking and Reporting
    - Public Involvement

Comparison Between Public Port of Richmond and Other California Ports

To provide perspective for the air emissions at the Port of Richmond, Table 1 and Figure 1 display the annual air emissions of six major criteria pollutants from the public Port of Richmond compared to the Port of Oakland, Port of Long Beach, and the Port of Los Angeles. The annual emissions from the Port of Richmond are significantly lower than these other port facilities for all six pollutants due to its size, amount and types of activities.

For example, Port of Richmond emissions are 1 to 2 percent of the emissions from either the Port of Long Beach or Los Angeles, and between 3 and 6 percent of the emissions from the Port of Oakland. The annual emissions of greenhouse gases (CO_2) for the Port of Richmond are 1 percent of the values for the other California ports.

Table 1. Estimated Annual Emissions (tons/year) for the Port of Richmond and Other California Ports

Port	ROG	CO	NO_X	PM	SO_2	CO_2
Port of Richmond	8.6	28.1	164	13.4	84.7	11,573
Port of Oakland	248	886	4,005	273	1,427	NA
Port of Long Beach	705	2,938	13,687	882	5,534	1,024,087
Port of Los Angeles	837	4,052	15,223	857	3,804	1,151,983

Sources: SF Bay Area Seaports Air Emission Inventory, Port of Richmond 2005 Emissions Inventory, Bay Planning Coalition, October 2009, Honda Port of Entry at the Point Potrero Marine Terminal Final Environmental Impact Report, September 2008, Revised Port of Oakland 2005 Seaport Air Emissions Inventory, Environ International Corporation, March 14, 2008, Port of Long Beach Air Emissions Inventory – 2008, Starcrest Consulting Group, December 2009, and Port of Los Angeles Air Emissions Inventory – 2008, Starcrest Consulting Group, December 2009.

Figure 1. Estimated Annual Emissions (tons/year) for the Port of Richmond and Other California Ports

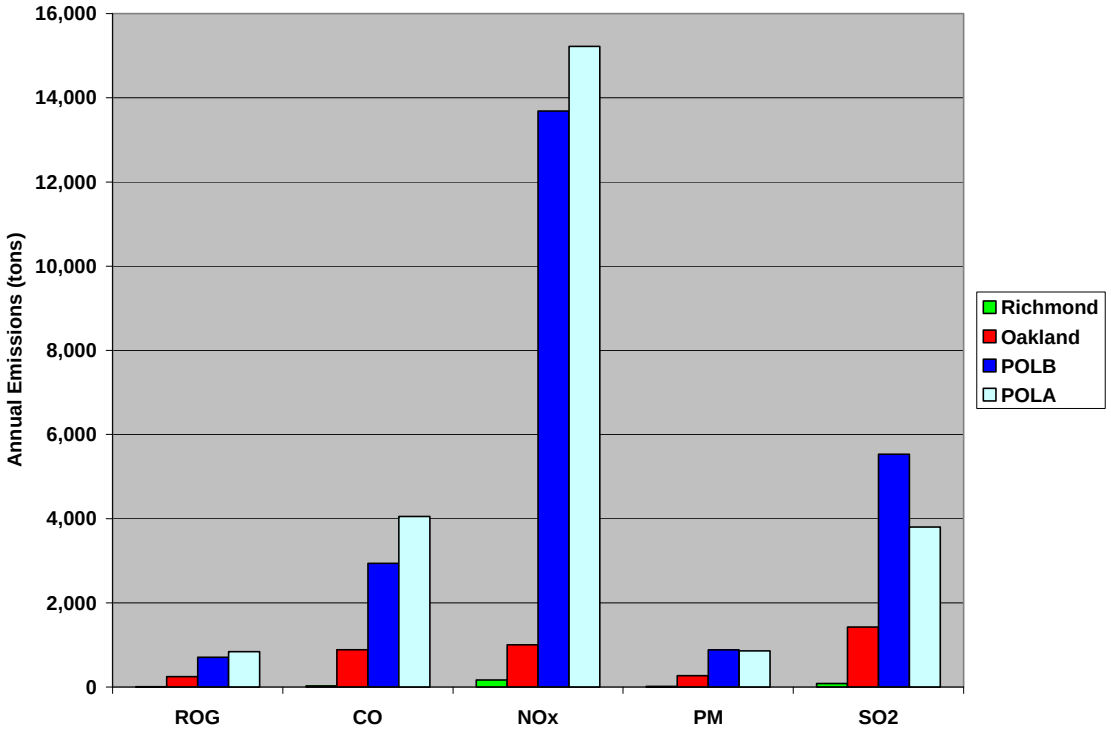


Table of Contents

Section Page

Executive Summary i
Table of Contents iv
Acronyms and Abbreviations vi
Table of Definitions vii
I. Introduction: Goals, Purpose and Structure 1
II. Background: Honda Port of Entry Project, CAAP, and CAAB 2
III. Emissions Inventory 4
a. Ocean-going Vessels 6
b. Harborcraft 7
c. Heavy-Duty Vehicles, Commuting Vehicles, and Port Fleet Vehicles 7
d. Cargo Handling Equipment 7
e. Locomotives 7
f. Electrical Usage 8
IV. Regulatory Emission Reduction Measures 9
a. Fuel Sulfur and Other Operational Requirements for Ocean-going Vessels within California Waters and 24 Nautical miles of the California Baseline (CCR, Title 13, Section 2299.2) 9
b. Airborne Toxic Control Measure for Auxiliary Diesel Engines Operated on Ocean-Going Vessels At-Berth in a California Port (CCR, Title 17, Section 93118.3) 10
c. Airborne Toxic Control Measure Limiting Onboard Incineration on Cruise Ships and Oceangoing Ships 10
d. Airborne Toxic Control Measure for Commercial Harborcraft 10
e. California's Drayage Truck Regulation (CCR, Title 13, Section 2027) 10
f. Mobile Cargo Handling Equipment at Ports and Intermodal Rail Yards 11
g. Heavy-Duty Vehicle Idling Emission Reduction Program 11
h. General Requirements for In-Use Off-Road Diesel Fueled Fleets (CCR, Title 13, Section 2449) 12
i. On-Road Heavy-Duty Diesel Vehicles (In-Use) 12
j. Off-Road Large Spark-Ignition (Gasoline and Propane) Equipment 12
k. California Low Sulfur Diesel Regulations 13
l. Standards for Nonvehicular Diesel Fuel Used in Diesel-Electric Intrastate Locomotives and Harborcraft (CCR Title 13, Section 2299) 13
V. Potential Voluntary and Incentivized Emission Reduction Measures 14
a. Vessel Speed Reduction Program 14
b. Shore Power 15
c. Alternative Fueled Equipment/Vehicles 15
d. Exhaust Treatment Devices 15
e. Equipment/Vehicle Replacement/Retrofit 16
f. On-site Renewable Energy Generation 16
g. Employee Transit and Alternative Transportation 16
VI. Estimated Emission Reductions 17
VII. CAAP Development and Implementation 21
a. Regulatory Compliance Program 21
b. Evaluation Criteria for Emission Reduction Measures 21
c. Federal and State Funding 21
d. Tracking and Reporting 22

e. Public Involvement and Education 22
f. Timeline 22
List of Preparers 26
References 26

Tables

1 Estimated Annual Emissions (tons/year) for the Port of Richmond and Other California Ports ii
2 Estimated Annual Port of Richmond Emissions (tons/year) 5
3 Estimated Annual Port of Richmond OGV Emissions by Source (tons/year) 6
4 Estimated Annual OGV Port of Richmond Emissions by Operational Mode (tons/year) 6
5 Estimated Annual Port Emissions with Emissions Reductions Initiatives (tons/year) 18

Figures

1 Estimated Annual Emissions (tons/year) for the Port of Richmond and Other California Ports iii
2 Relative Contribution to Port of Richmond Emissions by Source Category 5
3 Estimated Annual Port of Richmond NO_X Emissions with Emissions Reductions Initiatives (tons/year) 19
4 Estimated Annual Port of Richmond PM Emissions with Emissions Reductions Initiatives (tons/year) 19

Acronyms and Abbreviations

AMECS	Advanced Maritime Emissions Control System
ARRA	American Recovery and Reinvestment Act
ATCM	Airborne Toxic Control Measure
BAAQMD	Bay Area Air Quality Management District
BNSF	Burlington–Northern Santa Fe
CAA	federal Clean Air Act
CAAB	Clean Air Advisory Board
CAAP	Clean Air Action Plan for the Port of Richmond
CAEATFA	California Alternative Energy and Advanced Transportation Financing Authority
CARB	California Air Resources Board
CARE	Community Air Risk Evaluation
CI	compression ignition
CO	Carbon monoxide
CO_2	carbon dioxide
CSI	California Solar Initiative
CTC	California Transportation Commission
DPM	diesel particulate matter
ECAA	Energy Conservation Assistance Account
EIR	Environmental Impact Report
FEIR	Final Environmental Impact Report
GHG	greenhouse gas
GSE	Ground support equipment
Honda CAAP	Honda Port of Entry Clean Air Action Plan
IMO	International Maritime Organization
LSI	large spark-ignition
LNG	Liquid natural gas
MMRP	Mitigation Monitoring and Reporting Program
NAAQS	National Ambient Air Quality Standards
NO_X	Nitrogen oxides
NREC	National Railway Equipment Company
OAL	Office of Administrative Law
OGV	ocean going vessels
PM	particulate matter
PM_{10}	Particulate matter measuring 10 micrometers and smaller
$PM_{2.5}$	Particulate matter measuring 2.5 micrometers and smaller
POLA	Port of Los Angeles
POLB	Port of Long Beach
PPMT	Point Potrero Marine Terminal
ppmw	Parts per million by weight
ROG	Reactive Organic Gases
SIP	State Implementation Plan
SO_2	Sulfur dioxide
SO_X	sulfur oxides
U.S. EPA	U.S. Environmental Protection Agency
VMT	vehicle miles traveled
VSR	vessel speed reduction

Table of Definitions

Auto Carrier – A Self-propelled dry-cargo vessel that carries containerized automobiles.

Breakwater – The breakwater is the geographic marker for the change from open ocean to inland waterway (usually a bay or river).

Carbon Monoxide – A colorless, odorless toxic gas produced by the incomplete combustion of organic materials used as fuels.

Cargo Handling Equipment – A variety of equipment such as bucket loader, forklift, generator, container handler, crane, and tractor to assist in the movement of cargo.

Cold Ironing – Cold ironing uses shore power to provide electricity to the ship instead of using the auxiliary engines.

Criteria Pollutants – The six pollutants listed in the CAA that are regulated by the EPA through the NAAQS because of their health and/or environmental effects. The criteria pollutants are nitrogen dioxide, sulfur dioxide, carbon monoxide, ozone, particulate matter, and lead.

Cruise Mode – Time at service speed (also called sea speed or normal cruising speed) usually considered to be 94 percent of maximum speed.

Emission Factor – The rate at which a pollutant is emitted into the atmosphere by a source.

Emission Inventory – A complete list of sources and rates of pollutant emissions within a specific area and time interval.

Feasible Measure – Capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors.

Heavy-duty Truck – On-road (typically diesel) trucks used extensively to move cargo into and out of ports.

Harborcraft – Help vessels maneuver in the harbor during arrival and departure and shifts from berth. Also known as tugboats.

Hotelling Mode – Hotelling is the time at pier/wharf/dock or anchorage when the vessel is operating auxiliary engines only or is cold ironing. Auxiliary engines are operating at some load conditions the entire time the vessel is manned, but peak loads will occur after the propulsion engines are shut down. The auxiliary engines are then responsible for all onboard power or are used to power off-loading equipment, or both.

Hydrocarbons – Compounds of hydrogen and carbon including methane and ethane. Gases that are generated by unburned and wasted fuel and come from incomplete combustion of fossil fuels and from evaporation of liquid fuels.

Maneuvering Mode – Maneuvering within a port generally occurs at 5 to 8 knots on average, with slower speeds maintained as the ship reaches berth or anchorage. Even with tug assist, the propulsion engines are still in operation.

National Ambient Air Quality Standard (NAAQS) – Air quality standards established by U.S. EPA to protect human health (primary standards) and to protect property, the environment, and aesthetics (secondary standards).

Nitrogen Oxides (NO_X) – A poisonous and highly reactive gas produced when fuel is burned at high temperatures causing some of the ambient nitrogen in the air to burn also.

Ozone – A colorless, toxic gas formed by the photochemical reactions in the atmosphere of VOC with nitrogen oxides.

Particulate Matter (PM) – Particulate matter is made up of small solid particles and liquid droplets (aerosols). Suspended particulates refer to particles of approximately 100 micrometers or less in diameter.

$PM_{2.5}$ – Particulate matter of 2.5 micrometers or less in diameter.

PM_{10} – Particulate matter of 10 micrometers or less in diameter.

Pollutant – Substance in air, water, or soil that can cause disease or harm to the environment.

Roll On/Roll Off (RORO) – A Self-propelled vessel that handles cargo that is rolled on and off the ship, including ferries.

State Implementation Plan – The strategy to be used by a state to control air pollution in order that NAAQS violations will be eliminated.

Slow Cruise Mode – A speed less than cruise and greater than maneuvering. This is the maximum safe speed the vessel uses to traverse distances within a waterway leading to a port. Reduced speeds can be as high as 15 knots in the open water, but tend to be more in the order of 9 to 12 knots in most other areas.

Sulfur Dioxide (SO_2) – A corrosive gas produced mainly from the burning of fuels containing sulfur compounds.

Tanker – A Self-propelled liquid-cargo vessels including chemical tankers, petroleum product tankers, liquid food product tankers, etc.

Volatile Organic Compounds (VOC) – A general class of compounds, containing various levels of hydrogen and carbon that are chemically active in the atmosphere. VOC are created when fuels or organic materials are burned or evaporate into the atmosphere.

I. Introduction: Goals, Purpose and Structure

The goal of the Port of Richmond Clean Air Action Plan (CAAP) is to build and expand upon the Honda Port of Entry CAAP to develop and recommend feasible, cost-effective emissions reduction strategies while allowing port development to continue bringing revenue and jobs to the City of Richmond. The primary mechanism to achieve these emissions reductions involves implementation of new state, federal and international regulations, principally pertaining to ocean-going vessels and trucks (see Section IV) that operate at California ports. Beyond these new regulations, the Port will also explore a number of voluntary emission reductions measures (see Section V).

In October 2008 the Richmond City Council approved the Honda Port of Entry Project. While this project would bring much-welcome jobs and revenue to the City of Richmond and would both improve operations and reduce emissions from the existing automobile import facility at the Port's Point Potrero Marine Terminal (PPMT), the Honda Port of Entry project would result in an emissions increase from an increase in ships calling at the PPMT. To mitigate these increased emissions, the Port of Richmond committed to developing a Clean Air Action Plan for the Honda Port of Entry (Honda CAAP) as part of that project's Final Environmental Impact Report (FEIR). In accordance with Mitigation Measure 6-2 in the Honda Port of Entry FEIR, the Port of Richmond completed the Clean Air Action Plan for the Honda Port of Entry in 2009.

This CAAP builds and expands upon the Honda CAAP by: 1) encompassing the entire Port of Richmond public facility, including the PPMT; 2) leveraging post-2008 state, federal and international regulations of ocean-going vessels, harborcraft, trucks, rail and cargo-handling equipment operating at California Ports; and 3) identifying specific grant funding and low-cost financing available to Ports from the federal, state and regional agencies for goods movement, air quality and energy efficiency improvements. As with the Honda CAAP, the goal of this port-wide CAAP is to develop and recommend feasible, cost-effective strategies and programs to reduce air emissions and health risks while allowing port development to continue bringing revenue and jobs to the City of Richmond.

The past several years have seen a heightened focus on the environmental impact of goods movement and ports in California. This CAAP strives to leverage this recent activity by the California Air Resources Board (CARB) and others. Accordingly, this CAAP relies on implementation of new state regulations, principally pertaining to ocean-going vessels and trucks, to achieve the greatest improvements in air quality and reduction in health risks.

The structure of this CAAP is as follows: 1) an emission inventory; 2) discussion of current and pending regulatory emission reduction measures; 3) discussion of potential voluntary emission reduction measures; 4) analysis of estimated emission reductions; and 5) discussion of next steps to develop and implement this CAAP.

II. Background: Honda Port of Entry Project, CAAP, and CAAB

In October 2008, the Richmond City Council approved the Honda Port of Entry Project to expand and improve the existing automobile import and processing facility at the Port of Richmond's Point Potrero Marine Terminal (PPMT). Principal among the improvements is the provision of on-site rail services to service both the existing (KIA and Hyundai, also known as Glovis operations) and new (Honda) car-carrying ships, allowing the imported automobiles to be loaded directly onto rail cars without the current intermediary step of shuttling them to the Burlington–Northern Santa Fe (BNSF) rail yard. Minor improvements to one of the existing ship berths will also occur, consisting of repairs to the concrete deck pavement, installation of new bull rail at the edge of the berth, and installation of new rubber dock fenders on the side of the berth.

The objectives of the Honda Port of Entry Project are to:

- Maximize economic benefit from underutilized real estate assets in the Port of Richmond (Richmond City Council in Resolution 100-07, September 11, 2007);
- Promote long-term industrial distribution opportunities within the Port of Richmond that enhance the Port's financial condition and support community goals of environmentally responsible economic development;
- Improve rail operations between the BNSF Richmond Yard and all rail-served industries within the Canal Boulevard industrial corridor, by reducing peak-hour blockages at grade crossings, and using environmentally efficient locomotives and improved rail operational practices; and
- Establish a modern, efficient on-site rail loading capability within the Port of Richmond. This will reduce traffic, noise and pollution by eliminating the need to shuttle 70,000 vehicles along Canal and Cutting Boulevards each year (City of Richmond, 2008).

As noted, after extensive review and several public hearings, the Richmond City Council certified the Honda Port of Entry FEIR in October of 2008. Among other analyses, the FEIR includes a health risk assessment of the health impacts (determined to be less than significant) of the Port expansion. As noted in the FEIR, the project will improve air quality in and around the Port of Richmond through:

- Reducing 70,000 local auto trips each year;
- Using clean, environmentally efficient railroad locomotives and equipment;
- Improving rail operational practices;
- Minimizing idling time by locomotives, trucks and other equipment (City of Richmond, 2008)

The air quality analysis of the Honda Port of Entry project identified one significant and unavoidable impact of the proposed project. Daily emissions of nitrogen oxides (NO_X) from ships transiting to the Port of Richmond from 24 miles west of the Golden Gate were found to exceed the Bay Area Air Quality Management District's (BAAQMD's) threshold of significance. All other environmental impacts of this project have been determined to be less than significant or will be mitigated as specified in the FEIR.

A Mitigation Monitoring and Reporting Program (MMRP) has been adopted as part of the EIR process. The MMRP identifies the need to reduce emissions associated with the Honda Port of Entry project and requires the Port of Richmond to develop and implement a CAAP. The CAAP was finalized prior to construction of the Honda Project, and

implementation shall begin with the commencement of Honda Project operations. Key elements of this plan include measures to reduce emissions from:

- Ocean-going vessels (e.g., auto carriers, tankers);
- Locomotives (e.g., switching and line haul rail locomotives);
- Heavy-duty diesel-fueled vehicles (e.g., large on-road diesel trucks);
- Automobiles; and
- General Practices.

The Port of Richmond bears primary implementation responsibility for the Port-of-Entry CAAP, with consultation from outside sources. In a broad program to reduce emissions on the Richmond waterfront, the City and the Port of Richmond also agreed to develop a CAAP for the public Port and to create a Clean Air Action Advisory Board ("Advisory Board" or CAAB) to make recommendations to the City Manager and the Port on the development and implementation of a CAAP for the public Port Area ("Port Clean Air Action Plan").

The Advisory Board consists of seven volunteer members: two each from the surrounding industry, the surrounding neighborhoods, and the Port staff, and one additional at-large member. All Advisory Board members are appointed by, and serve at the discretion of, the Port Executive Director. The members of the Advisory Board are:

a. Jim Matzorkis, Port Director (port)
b. Norman Chan, Port Administrator (port)
c. Bill Terry, CEO, Eagle Aggregates, Inc. (industry)
d. Katrinka Ruk, Executive Director, Council of Industries (industry)
e. Jim McMillan, former Richmond City Council member & resident (neighborhood)
f. Fred Arm, Petitioner & resident (neighborhood)
g. Jeff Ritterman, Cardiologist and Richmond City Council member (at-large position)

III. Emissions Inventory

The foundation of the Port of Richmond's air quality strategy is a detailed inventory of port emissions. Historically, the Bay Planning Coalition developed a 2005 emissions inventory for the public Port of Richmond in October 2009[1]. In addition, an emissions inventory was developed for the Honda Port of Entry Project[2]. The emissions inventory presented is this document is the 2005 actual operations inventory plus estimated emissions from the Honda Port of Entry project. This inventory includes the following source categories:

- Ocean-going vessels (e.g., auto carriers, tankers)
- Harbor vessels (e.g., assist tugs and tugboats, push or tow barges)
- Cargo handling equipment (e.g., yard tractors, forklifts)
- Locomotives (e.g., switching and line haul rail locomotives)
- Heavy-duty diesel-fueled vehicles (e.g., large on-road diesel trucks)

The primary air emission sources evaluated are associated with operational equipment used at terminals, trucks and locomotives serving the terminals, and ships and harbor vessels calling on the terminals. The area included in these emissions inventories includes the public port of Richmond, specifically tanker and cargo handling as well as auto carriers. Private operations, such as the Chevron refinery are not included in this inventory nor covered in this CAAP. Port fleet and commuter passenger vehicle emissions, including those licensed for operation of public roadways, are not included in the emissions inventory. Maintenance operations, Port and tenant office energy consumption, terminal and street lighting, electrified cargo handling equipment, building heating, ventilating, and air conditioning, and other ancillary sources are also not included. Such sources typically constitute less than 5 to 10 percent of total port-related emissions, and hence are not reported here.

The inventory addresses the EPA-criteria pollutant emissions, as well as emissions of carbon dioxide (CO_2), the most prevalent greenhouse gas (GHG) in terms of human activity:

- Reactive Organic Gases (ROG, precursors to the EPA criteria pollutant ozone)
- Nitrogen oxides (NO_X), consisting primarily of nitrogen dioxide with lesser amounts of nitric oxide and other oxides of nitrogen (a precursor to the formation of ozone)
- Carbon monoxide (CO)
- Particulate matter measuring 10 micrometers and smaller (PM_{10}), as a subset of particulate matter
- Particulate matter measuring 2.5 micrometers and smaller ($PM_{2..5}$) , as a subset of particulate matter
- Sulfur dioxide (SO_2)

Figure 2 and Table 2 depict the Port of Richmond emissions inventory results. Notably, emissions of PM_{10} and $PM_{2.5}$ have been reported simply as particulate matter (PM). As shown, ocean-going vessels and heavy-duty trucks comprise the bulk of the port emissions. The ocean-going vessel emissions are separated by tanker operations, Glovis operations (Kia and Hyundai), as well as the Honda operations.

[1] SF Bay Area Seaports Air Emission Inventory, Port of Richmond 2005 Emissions Inventory, Bay Planning Coalition, October 2009.

[2] Honda Port of Entry at the Point Potrero Marine Terminal Final Environmental Impact Report, September 2008.

Figure 2. Relative Contribution to Port of Richmond Emissions by Source Category

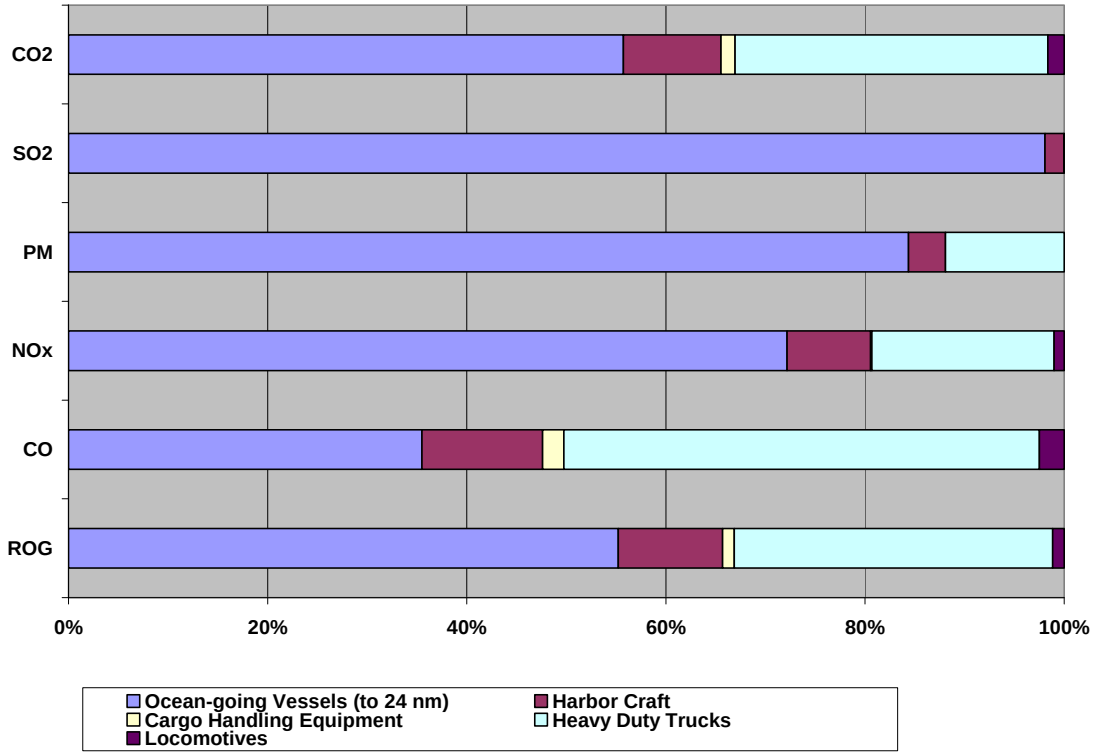


Table 2. Estimated Annual Port of Richmond Emissions (tons/year)

Source	ROG	CO	NO_X	PM	SO_2	CO_2
Ocean-going Vessels (to 24 nm)						
Tanker Operations	0.4	0.8	9.50	0.8	5.6	544
Glovis Operations	2.4	5.2	58.5	5.1	34.7	3,347
Honda Operations	2.0	3.9	50.2	5.3	42.5	2,530
Harborcraft	0.9	3.4	13.8	0.5	1.6	1,135
Cargo Handling Equipment (On-site)	0.1	0.6	0.2	0.0	0.0	163
Heavy Duty Trucks (On-site)	2.7	13.4	30.1	1.6	0.0	3,638
Locomotives (On-site)	0.1	0.7	1.7	0.0	0.0	190
Total	**8.6**	**28.1**	**164**	**13.4**	**84.7**	**11,573**

Sources: SF Bay Area Seaports Air Emission Inventory, Port of Richmond 2005 Emissions Inventory, Bay Planning Coalition, October 2009 and Honda Port of Entry at the Point Potrero Marine Terminal Final Environmental Impact Report, September 2008.

a. Ocean-going Vessels

For ocean going vessels (OGV), emissions were calculated by multiplying emission factors by vessel-specific activity parameters such as in-use horsepower and hours of operation**.** Additional calculations were performed to adequately characterize the complicated activities of marine vessels (e.g., separate calculations were made for vessel transit of cruise and slow cruise, maneuvering, and hotelling activities for propulsion engines, auxiliary engines, and auxiliary boilers). In 2005, there were 103 port calls: 15 tankers and 88 auto carriers. The Honda Port of Entry estimates an additional 75 port calls for auto carrier marine vessels. An average sulfur content of 2.7 percent (i.e. typical of residual oil) was assumed, which is pertinent given the sulfur fuel regulations described in Section IV.

Ocean-going vessels represent 55 percent of ROG emissions, 35 percent of CO, 72 percent of NO_X, 84 percent of PM, 98 percent of SO_2, and 56 percent of CO_2 occurring due to public Port of Richmond operations. Moreover, main engine operation represents the greatest portion of the ocean-going vessel emissions (see Table 3). Emissions from cruise, slow cruise and hotelling generally contribute comparable amounts of pollutant emissions within the OGV category, when compared to one another (see Table 4)

Table 3. Estimated Annual Port of Richmond OGV Emissions by Source (tons/year)

Source	ROG	CO	NO_X	PM	SO_2	CO_2
Main Engines	3.8	7.1	82.3	7.9	54.1	4,384
Auxiliary Engines	0.9	2.7	35.3	3.2	23.1	1,728
Boilers	0.0	0.3	1.0	0.2	5.9	336
Total	**4.7**	**10.0**	**119**	**11.3**	**83.1**	**6,448**

Sources: SF Bay Area Seaports Air Emission Inventory, Port of Richmond 2005 Emissions Inventory, Bay Planning Coalition, October 2009 and Honda Port of Entry at the Point Potrero Marine Terminal Final Environmental Impact Report, September 2008.

Table 4. Estimated Annual OGV Port of Richmond Emissions by Operational Mode (tons/year)

Source	ROG	CO	NO_X	PM	SO_2	CO_2
Cruise	1.8	3.9	49.4	5.0	37.6	2,410
Slow Cruise	1.8	3.2	34.5	3.0	18.2	2,000
Maneuvering	0.4	0.6	6.1	0.6	4.3	389
Hotelling	0.7	2.3	28.6	2.7	23.0	1,649
Total	**4.7**	**10.0**	**119**	**11.3**	**83.1**	**6,448**

Sources: SF Bay Area Seaports Air Emission Inventory, Port of Richmond 2005 Emissions Inventory, Bay Planning Coalition, October 2009 and Honda Port of Entry at the Point Potrero Marine Terminal Final Environmental Impact Report, September 2008.

b. Harborcraft

Emissions were calculated by multiplying emission factors by an appropriate measure of activity (such as annual hours of operation). As shown on Figure 2, Harborcraft represent 10 percent of the total port ROG emissions, 12 percent of CO, 8 percent of NO_X, 4 percent of PM, 2 percent of SO_2, and 10 percent of CO_2.

c. Heavy-Duty Vehicles, Commuting Vehicles, and Port Fleet Vehicles

Heavy-duty truck activity estimated in the emissions inventory relates to the number of truck, employee and auto shuttling trips, and the estimated miles traveled within the Bay Area Air Quality Management District. This combination of the vehicles, trips and miles traveled is known as vehicle miles traveled (VMT). Emissions were determined based on the vehicle- and speed-specific emissions factors (typically in grams per mile) derived from CARB's emission factor model EMFAC2007. Emissions from auto carrier trucks include idling and moving within the facility and traveling to/from their destination beyond the facility boundaries.

The Port of Richmond does not have facility-specific vehicle age distribution data and thus default age distributions for Contra Costa County were used, resulting in a likely overestimation of older model year vehicles. Older model year trucks emit significantly higher amounts of air pollutants; and therefore, this methodology tends to be conservative in that it overestimates emissions. In 2005, annual auto carrier truck trips were estimated at 6,200. Assuming operation from the Glovis and the Honda Port of Entry, annual auto carrier truck trips were estimated at 14,780. As shown on Figure 2, heavy-duty trucks represent 32 percent of the total port ROG emissions, 48 percent of CO, 18 percent of NO_X, 12 percent of PM, less than 1 percent of SO_2, and 31 percent of CO_2.

d. Cargo Handling Equipment

The Port of Richmond operates a limited number of cargo-handling equipment. According to the 2005 inventory, these comprise two propane powered forklifts (operating for 810 hours per year) and three diesel-fueled general industrial equipment such as tractors (operating for 60 hours per year). Figure 2 illustrates that cargo handling equipment represent 1 percent of total port ROG emissions, 2 percent of CO, and less than 1 percent of the remaining pollutants.

e. Locomotives

Railroad operations are typically described in terms of two different types of operation: line haul and switching. Line haul operations involve long-distance transportation between the Port and points across the country; whereas switching is the local movement of railcars to prepare them for line haul transportation, or to distribute them to destination terminals upon their arrival in port.

The types of information available for these two types of activity differ – for the on-port switching locomotives, information on each locomotive and its activity (e.g., fuel use and throttle notch setting frequency) can be used to estimate emissions, whereas for the line haul locomotives the information is more general (e.g., in terms of fuel use per ton of cargo and total tons of cargo carried). Published emissions information for switch and line haul locomotive operations in both throttle notch and fuel consumption modes was applied to facility operational data to estimate emissions. The Honda Port of Entry project includes installation of a low emission National Railway Equipment Company (NREC) Genset Switcher locomotive.

In total, locomotives represent 1 percent of ROG port emissions, 2 percent of CO, 1 percent of NO_X, less than 1 percent of PM and SO_2, and 2 percent of CO_2 (Figure 2).

f. Electrical Usage

In 2009, the Port of Richmond used approximately 560,000 kilowatts of electricity to support operations. Based on an emission intensity from the California Climate Action Registry of 724 pounds of CO_2 per megawatt[3], the Port of Richmond generated 205 tons of CO_2. This CO_2 emissions is equivalent to one percent of the Carbon Dioxide emissions of either the Port of Los Angeles or Port of Long Beach, may be mitigated by on-site renewable energy generation being evaluated by the Port of Richmond.

[3] PG&E reports a CO2 per MW emission rate of 524, http://www.pge.com/about/environment/calculator/assumptions.shtml

IV. Regulatory Emission Reduction Measures

The U.S. Environmental Protection Agency (U.S. EPA) is responsible for implementing a myriad of regulations and programs established under the federal Clean Air Act (CAA), such as establishing and reviewing the National Ambient Air Quality Standards (NAAQS) and judging the adequacy of State Implementation Plans (SIPs). However, U.S. EPA has delegated the authority to implement many of the federal programs to individual states, while retaining an oversight role to ensure that the programs continue to be implemented.

The CARB is responsible for establishing and reviewing California's air quality standards, compiling the California SIP, securing approval of this plan from U.S. EPA, and identifying toxic air contaminants. CARB also regulates mobile emissions sources in California, such as construction equipment, ships, trains, trucks, and automobiles, and oversees the activities of air quality management districts, which are organized at the county and/or regional level.

Local councils of governments, county transportation agencies, cities and counties, and various non–governmental organizations also join in the efforts to improve air quality through a variety of programs. These programs include the adoption of regulations and policies, as well as implementation of extensive education and public outreach programs. The Bay Area Air Quality Management District (BAAQMD) is the CARB-appointed regional agency with jurisdiction over the Port of Richmond. The BAAQMD is responsible for bringing the area into compliance and/or maintaining air quality within federal and State air quality standards. This includes the responsibility to monitor ambient (i.e. "outdoor") air pollutant levels and to develop and implement attainment strategies to ensure that future emissions are within federal and State standards.

A number of regulations and rules promulgated by CARB and others with direct application of emission sources within ports, in general, and the Port of Richmond, specifically, are discussed in the following sections.

a. Fuel Sulfur and Other Operational Requirements for Ocean-going Vessels within California Waters and 24 Nautical miles of the California Baseline (CCR, Title 13, Section 2299.2)

Adopted by CARB in 2008, this regulation requires the use of low sulfur marine distillate fuels in order to reduce emissions of PM, diesel particulate matter (DPM), nitrogen dioxides (NO_X) and sulfur oxides (SO_X) from the use of auxiliary diesel and diesel-electric engines, main propulsion diesel engines, and auxiliary boilers on ocean-going vessels within any regulated California waters. This rule, which became effective on July 1, 2009, limits fuel sulfur content for auxiliary and main diesel engines to 1.5 percent by weight for marine gas oil and 0.5 percent by weight for marine diesel oil. In addition, by January 1, 2012, fuel sulfur content for auxiliary and main diesel engines shall be limited to 0.1 percent by weight for both marine gas oil and marine diesel oil.

On December 22, 2009, EPA announced final emission standards under the Clean Air Act for new marine diesel engines with per-cylinder displacement at or above 30 liters (called Category 3 marine diesel engines) installed on U.S.-flagged vessels. The final engine standards are equivalent to those adopted in the amendments to Annex VI to the International Convention for the Prevention of Pollution from Ships. The emission standards apply in two stages: near-term standards for newly-built engines will apply beginning in 2011, and long-term standards requiring an 80 percent reduction in NO_X will begin in 2016.

On March 26, 2010, the International Maritime Organization (IMO) officially designated waters off North American coasts as an area in which stringent international emission standards will apply to ships. These standards will

dramatically reduce air pollution from ships and deliver substantial air quality and public health benefits that extend hundreds of miles inland.

b. Airborne Toxic Control Measure for Auxiliary Diesel Engines Operated on Ocean-Going Vessels At-Berth in a California Port (CCR, Title 17, Section 93118.3)

This regulation is aimed at reducing NO_X and DPM emissions from auxiliary engines on container vessels, passenger vessels, and refrigerated cargo vessels by limiting their operation while they are docked at berth at a California port. It will reduce emissions by limiting the time that auxiliary diesel engines are operated on the regulated vessels while such vessels are docked at-berth in a California port, as well as by applying other requirements. This section implements provisions of the Goods Movement Emission Reduction Plan, adopted by CARB in April 2006, to reduce emissions and health risk from ports and the movement of goods in California, and also helps achieve the goals specified in the California Global Warming Solutions Act of 2006, established under California law by Assembly Bill 32.

The regulation provides vessel fleet operators visiting these ports two options to reduce at-berth emissions from auxiliary engines: 1) turn off auxiliary engines while in port and connect the vessel to some other source of power (i.e., grid-based shore power); or 2) use alternative control technique(s) that achieve equivalent emission reductions.

The Definition of *California Ports* includes the Port of Hueneme, the Port of Los Angeles (POLA) and Port of Long Beach (POLB), the Port of Oakland, the Port of San Diego, and the Port of San Francisco. This regulation is not applicable to the Port of Richmond.

c. Airborne Toxic Control Measure Limiting Onboard Incineration on Cruise Ships and Oceangoing Ships

The Office of Administrative Law has approved the Airborne Toxic Control Measure (ATCM) Amendments Limiting Onboard Incineration practices on Cruise Ships and Oceangoing Ships. Effective November 28, 2007, the ATCM prohibits cruise ships and oceangoing ships from conducting onboard incineration within three nautical miles of the California coast. This regulation is not applicable to the Port of Richmond.

d. Airborne Toxic Control Measure for Commercial Harborcraft

The purpose of this regulation is to reduce DPM, SO_X, and NO_X from diesel propulsion and auxiliary engines on harborcraft operating in any *regulated California waters*. This section implements provisions of the Goods Movement Emission Reduction Plan, adopted by CARB in April 2006, to reduce emissions and health risk from ports and the movement of goods in California. On February 16, 1010, CARB staff drafted amendments to the California's Commercial Harborcraft Regulation which add in-use engine requirements for diesel engines on dredges, barges, and crew and supply boats that operate in regulated California waters.

e. California's Drayage Truck Regulation (CCR, Title 13, Section 2027)

CARB adopted this measure in 2008 to reduce public exposure to DPM emissions, NO_X, and other air contaminants by setting emission standards for in-use, heavy-duty diesel-fueled vehicles that transport cargo to and from California's ports and intermodal rail facilities. Section 2027's definition of *port* specifically includes Port of

Richmond. This regulation requires all drayage trucks that operate at California's ports and intermodal rail yards to meet the following requirements:

1. By December 31, 2009, all drayage trucks must be equipped with:
    - 1994–2003 model year engines certified to California or federal emissions standards and a level 3 Verified Diesel Emission Control Strategy for PM emissions;
    - a 2004 or newer model year engine certified to California or federal emission standards; or
    - a 1994 or newer model year engine that meets or exceeds 2007 year California or federal emission standards.
2. After December 31, 2011, all drayage trucks with 2004 model year engines must be equipped with the highest level of Verified Diesel Emission Control Strategy for PM emissions.
3. After December 31, 2012, all drayage trucks with 2005 and 2006 model year engines must be equipped with the highest level Verified Diesel Emission Control Strategy for PM emissions.
4. After December 31, 2013, all drayage trucks must be equipped with a 1994 or newer model year engine that meets or exceeds 2007 model year California or federal emission standards.

f. Mobile Cargo Handling Equipment at Ports and Intermodal Rail Yards

The purpose of this regulation is to reduce DPM and criteria pollutant emissions from compression ignition (CI) mobile cargo handling equipment in operation at California ports and intermodal rail yards. With certain exemptions, the regulation applies to any person who conducts business in California who sells, offers for sale, leases, rents, purchases, owns or operates any CI mobile cargo handling equipment that operates at any California port or intermodal rail yard.

The Office of Administrative Law approved amendments to the Cargo Handling Equipment Regulation, effective December 3, 2009. The amendments exempt sweepers and mobile cranes (other than rubber-tired gantry cranes) from the *Cargo Handling Equipment Regulation*, placing them under either the *In-Use Off-Road Diesel Vehicle Regulation* or the *In-Use Heavy-Duty Diesel Vehicle Regulation (On-Road Truck and Bus Regulation)*, depending on the engine configuration.

The CARB is undertaking several efforts to reduce the emission impacts of rail yards on local communities. These efforts include an agreement with BNSF Railways to reduce locomotive emissions near rail yards, and the development of new regulations to address on- and off-road vehicles at rail yards.

g. Heavy-Duty Vehicle Idling Emission Reduction Program

Under this rule, 2008 and newer model year heavy-duty diesel engines must either be equipped with a non-programmable engine shutdown system that automatically shuts down the engine after five minutes of idling, or optionally meet a stringent NO_X idling emission standard. The in-use truck requirements require operators of both in-state and out-of-state registered sleeper berth equipped trucks to manually shut down their engine when idling more than five minutes at any location within California.

h. General Requirements for In-Use Off-Road Diesel Fueled Fleets (CCR, Title 13, Section 2449)

Adopted in July 26, 2007, this regulation is intended to reduce emissions of DPM and NO_X from in-use off-road diesel vehicles operating in California. CARB estimates the regulation will significantly reduce DPM and NO_X emissions from the nearly 180,000 off-road diesel vehicles that operate in California, which is necessary to meet state and federal air quality standards. The regulation requires fleet owners to accelerate turnover to cleaner engines and install exhaust retrofits[4]. The regulation also supports the *Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles*, which was adopted by the Board on September 30, 2000. It should be noted that on April 22, 2010, CARB met to consider relaxing certain deadline requirements of CCR, Title 13, Section 2449 for diesel trucks and construction equipment to account for the slumping economy and inaccurate emissions projections.

i. On-Road Heavy-Duty Diesel Vehicles (In-Use)

In addition, on December 12, 2008, CARB approved a new regulation, the *On-Road Heavy-Duty Diesel Vehicles (In-Use) Regulation***,** to substantially reduce emissions from existing on-road diesel vehicles operating in California**.** The regulation requires affected trucks to meet performance requirements between 2011 and 2023. By January 1, 2023 all vehicles must have a 2010 model year engine or equivalent; this includes on-road heavy-duty diesel fueled vehicles with a gross vehicle weight rating greater than 14,000 pounds.[5]

j. Off-Road Large Spark-Ignition (Gasoline and Propane) Equipment

On May 25, 2006, CARB amended the existing emission standards and test procedures for off-road large spark-ignition (LSI) engine powered equipment, *Off-Road Large Spark-Ignition (Gasoline and Propane) Equipment Regulation*, to make them more stringent. The CARB also adopted new regulations requiring emission reductions from existing LSI fleets and prescribing verification procedures for LSI retrofit emission control systems. The new engine emission standards apply to manufacturers of any 25 horsepower or greater off-road LSI engine placed in, but not limited to, ground support equipment (GSE), forklifts, generator sets, sweeper/scrubbers, industrial tugs

[4] The regulation establishes fleet average emission rates for PM and NO_X that decline over time. Each year, the regulation requires each fleet to meet the fleet average emission rate targets for PM or apply the highest level verified diesel emission control system to 20 percent of its horsepower. In addition, large and medium fleets are required each year to meet the fleet average emission rate targets for NO_X or to turn over a certain percent of their horsepower (8 percent in early years, and 10 percent in later years). "Turn over" means repowering with a cleaner engine, rebuilding the engine to a more stringent emissions configuration, retiring a vehicle, replacing a vehicle with a new or used piece, or designating a dirty vehicle as a low-use vehicle. If retrofits that reduce NO_X emissions become available, they may be used in lieu of turnover as long as they achieve the same emission benefits.

[5] In general, the regulation requires owners to reduce emissions in their fleet by upgrading existing vehicles one of three ways. The first option is to install PM retrofits and replace vehicles (or engines) according to a prescribed schedule based on the existing engine model year. The second option is to retrofit a minimum number of engines each year with a high level PM exhaust retrofit and to replace a minimum number of older engines with newer engines meeting the 2010 new engine standards. The third option is to meet a fleet average. With this option, a fleet operator can use PM and NO_X emission factors established by the regulation to calculate the average emissions of the fleet. Then, by the applicable compliance date each year, the owner can demonstrate that the fleet average emissions for PM and NO_X do not exceed the PM and NO_X fleet average emission rate targets set by the regulation.

(tow tractors), and turf care equipment. The fleet requirements only apply to forklifts, sweepers/scrubbers, industrial tow tractors, and GSE.[6]

k. California Low Sulfur Diesel Regulations

In July 2003, CARB promulgated amendments to existing fuel regulations (section 2281 – sulfur content, section 2282 – aromatic hydrocarbon content, and section 2284 – lubricity) stating that diesel fueled equipment and vehicles would reduce fuel sulfur content from 500 to 15 ppmw beginning in 2006. To ensure compliance with the federal regulations, CARB will allow use of emissions control technologies on model year 2007 and later heavy duty engines and vehicles. To prevent excessive engine wear that would occur due to the reduction in fuel sulfur, CARB has also modified existing fuel lubricity standards, requiring that high frequency reciprocating engine rigs are not to possess wear scars greater than 520 microns in diameter due to low sulfur diesel fuel use.

l. Standards for Nonvehicular Diesel Fuel Used in Diesel-Electric Intrastate Locomotives and Harborcraft (CCR Title 13, Section 2299)

CARB defines "intrastate locomotives" as those "operat[ing] within California for which at least 90 percent of [the] annual fuel consumption, annual hours of operation, or annual rail miles traveled occur within California. This definition would typically include, but not be limited to, diesel-electric locomotives used in the following operations: passenger intercity and commuter, short haul, short line, switch, industrial, port and terminal operations." The regulation requires that all nonvehicular diesel fuel sold and supplied for use in intrastate locomotives satisfy the requirements established for sulfur content (section 2281), aromatic hydrocarbon content (section 2282) and lubricity (section 2284), treated as if it were vehicular diesel fuel. Notably, these requirements also apply to fuel supplied to harborcraft typically operating in the Port of Richmond.

[6] The regulation establishes more stringent combined HC and NO_X emission certification standards for engine manufacturers. The regulation also establishes verification procedures for manufacturers of retrofit emission control systems. Engine and retrofit emission control system manufacturers will likely employ advanced automotive-style emission control technologies including electronic fuel/air controllers, three-way catalysts, and oxygen sensors to meet the certification and verification standards, respectively.

V. Potential Voluntary and Incentivized Emission Reduction Measures

Voluntary measures are actions agreed to and undertaken by operators, and are used or implemented by the participants without legal obligation. Examples of voluntary actions that have already been taken by operators that have resulted in a decrease in emissions include procedural efficiency increases, purchase of new lower-emitting equipment, and use of alternative fuels in equipment.

Incentive-based measures provide a business incentive for the participant to reduce emissions beyond what is currently required by regulation or lease requirements. Incentive funding is targeted at "buying" emissions reductions ahead of regulation milestones or lease renewals. Incentive funding can come from several sources including the Ports, local and state regulatory programs, federal agency programs and grants, or an additional use fee that generates money to be used to incentivize emissions reductions. An incentive-based approach makes the adoption of the various strategies cost-neutral for the participant, or provides just enough incentive for a participant to enter the program.

a. Vessel Speed Reduction Program

Under the Diesel Risk Reduction Plan, Goods Movement Emissions Reduction Plan, and Assembly Bill 32 – Greenhouse Gas Initiative, implementation of vessel speed reduction (VSR) programs have been identified as an early action plan measure.

Currently ships approaching the Port of Richmond are required to slow down to 15 knots from the Golden Gate to the Port of Richmond. Under a voluntary VSR program, participant vessels would be requested to slow down to 12 knots as they approach or depart the Port of Richmond. The primary objective of a VSR program would be to reduce emissions from ocean-going vessels during vessel transit. When ships slow down, the load on the main engines decreases considerably compared to transiting at higher speeds, leading to a decrease in the total energy required to move the ship through the water. This energy reduction in turn reduces emissions for this segment of the transit. Since the load on the main engines affects power demand and fuel consumption, this strategy significantly reduces all pollutants including PM, NO_X, SO_X, and GHG emissions.

Under the Port of Long Beach Green Flag Program, adopted in 2005, Green Flags are awarded to vessel operators that are 100 percent compliant with the program for the previous year. Carriers with at least 90 percent vessel compliance receive a 15 percent dockage fee reduction. In 2008, the Port of Los Angeles adopted a VSR Incentive Program in the 20 nm zone to provide a financial incentive equivalent to 15 percent of first day dockage to vessel operators who reduce their speed on approach or departure.

At the San Pedro Ports, compliance with the voluntary VSR program has steadily increased over the years since its adoption. Compliance is tracked by individual ship call and reported monthly to the shipping lines. Overall compliance for all calls at the ports during the CAAP baseline year of 2005 was 67 percent. In 2007, the overall VSR compliance rate had increased to 84 percent. In 2008, the compliance rate for all vessels calling at Port of Long Beach was 92 percent and the compliance rate for vessels calling at Port of Los Angeles was 89 percent.

In March 2009, the Port of San Diego began a voluntary vessel speed reduction program to reduce air pollution around San Diego Bay and the tidelands. The period from April through June 2009 marks the first complete quarter since the program was implemented. During this time, 27 cruise and cargo vessels called on the Port and 69 percent of these traveled within the voluntary speed limits during both inbound and outbound trips. In the program, cruise

and cargo vessel operators are asked to reduce their speed when traveling to and from San Diego Bay. The voluntary limits are 12 knots for cargo ships and 15 knots for cruise ships.

Of all the cruise ships that visited the Port during this quarter, 86 percent were compliant with the speed limit. Cargo vessels were 53 percent compliant. During this first quarter, the voluntary vessel speed reduction program has resulted in an estimated 10 percent reduction in emissions from participating vessels. The Port keeps track of the vessel speeds by accessing data that all vessels transmit using automatic identification systems. The data is tracked by a web-based monitoring system.

b. Shore Power

CARB regulation requires 50 percent of all container, cruise and reefer vessels to use shore power by 2014. Use of shore power at-berth will reduce OGV hotelling emissions of DPM, NO_X and SO_X by 95 percent per vessel call. The shore power approach is generally best suited for vessels that make multiple calls per year, require a significant power demand while at berth (a function of hotel load and time at berth), and/or will continue to call at the same terminal for multiple years. The most common ship types that are good candidates for shore power are large string-service containerships, cruise ships, reefer ships, and specially designed crude tankers that have diesel-electric engines. Shore power is being implemented at the Port of Los Angeles and Port of Long Beach as well as other West Coast ports. Given that the majority of vessels at the Port of Richmond are auto carriers with relatively low power demand at berth, shore power is not currently applicable at the Port of Richmond.

However, several new technologies may be applied to vessels that do not fit the shore power model such as:

1) Shore-powered dockside electrical pumps for tankers, which reduce onboard pumping loads (typically these pumps are driven by steam power).

2) Dockside portable distributed generation systems, which utilize LNG generators to supply power.

Clean Air Logix has presented their portable shore power technology to the Port of Richmond.

c. Alternative Fueled Equipment/Vehicles

The Port of Richmond currently operates a number of alternatively-fueled cargo-handling equipment and one hybrid onroad fleet vehicle. The Port will explore funding and other mechanisms to provide additional alternatively-fueled equipment and fleet vehicles, and as fleet vehicles and equipment are retired they will be replaced with hybrid and alternatively-fueled equipment. Replacing diesel equipment with electric, hybrid, or alternative fueled (LNG, CNG, propane) can provide significant reductions in PM and SO_2 emissions.

d. Exhaust Treatment Devices

Advanced Maritime Emissions Control System (AMECS) is a pilot system composed of an Emissions Treatment Subsystem and an Emissions Capture Subsystem. The system contains two emission–removal technologies: a Cloud–Chamber Scrubber for removal of SO_X, PM, and ROG, and a Selective Catalytic Reduction Reactor for the removal of NO_X. The AMECS treats ocean–going vessels while at berth. This system claims to reduce SO_X by up to 97 percent, PM by more than 92 percent, and NO_X by up to 97 percent. The system does not require modification of the ship.

As a result of the successful pilot tests, Port of Long Beach is planning to conduct a more extensive, longer-term demonstration in 2010. The longer-term demonstration testing is intended to evaluate the operational feasibility of the technology on an ongoing basis and establish the operational costs of the system.

The Port of Richmond will evaluate the applicability of AMECS and other exhaust gas scrubbing technologies that capture vessel stack emissions while at berth and "scrubs" exhaust streams either on-shore or on a barge.

e. Equipment/Vehicle Replacement/Retrofit

As detailed in Section VII, the Port of Richmond would develop a program to encourage cleaner auto carrier trucks. A schedule would be developed to achieve 2007 emission standards through the replacement and/or retrofitting of older trucks. The retrofit of diesel particulate matter filters can reduce PM emissions by up to 85 percent with additional reductions of ROG and CO. Further, the retrofit of diesel oxidation catalyst can reduce PM by 50 percent and ROG by 50 percent. The replacement of older truck fleets nearing their useful life with newer models or rebuilt engines typical operate better and emit fewer pollutants.

f. On-site Renewable Energy Generation

Several ports in California (for example, West Sacramento) have begun to produce clean, renewable energy for their own use and that of their tenants. The Port of Richmond will evaluate the feasibility of installing solar photovoltaic panels and other renewable energy generation for the use by the Port and its tenants, including the possibility of becoming the first Port in the world to provide 100 percent of its energy needs from on-site renewable energy generation. To assist in this effort, the Port of Richmond will pursue all available grant funding as well as low-cost financing options, including: American Recovery and Reinvestment Act (ARRA) Federal Stimulus funding through California Energy Commission, the California Solar Initiative (CSI) Rebate program for new municipal systems, low-interest loans from either the California Energy Commission's Energy Conservation Assistance Account (ECAA) Program and/or the California Alternative Energy and Advanced Transportation Financing Authority (CAEATFA) in the State Treasurer's Office.

g. Employee Transit and Alternative Transportation

The Port of Richmond will explore working with the City, port employees, neighboring employers, AC Transit, and BART to provide enhanced transit access, such as free shuttle service for employees of the Port and its tenants between the Port and local transit modes, including the Richmond BART station. The Port will coordinate with AC Transit to extend bus service, if feasible, such as by modifying an existing bus route to better serve the Port and its tenants. The Port and City will continue to encourage and provide incentives for ridesharing and use of public transit for employees of the Port and its tenants.

VI. Estimated Emission Reductions

Generally, emissions reduction initiatives include mandated regulatory measures such as ocean-going vessel sulfur fuel content, and voluntary measures such as vessel speed reductions. The following section provides an estimate of emission reductions tenable through the implementation of these measures. The calculated emission benefits are based on full compliance with the regulatory sulfur fuel measure and participation with the voluntary measures of VSR and heavy-duty truck replacement.

For the emissions inventory, fuel sulfur content was assumed to be 2.7 percent. As of July 1, 2009, the fuel sulfur rule limits marine gas oil sulfur content for auxiliary and main diesel engines to 1.5 percent by weight, marine diesel oil to 0.5 percent by weight. In addition, by January 1, 2012, fuel sulfur content for auxiliary and main diesel engines shall be limited to 0.1 percent by weight for both marine gas oil and marine diesel oil.

The CAAP emission reduction strategies have been quantified relative to the emissions presented in Section V, and compared against the existing conditions to determine the level of potential emissions reductions. Table 5 compares the potential CAAP emission reduction initiatives to the emissions inventory (for Glovis, Honda, and other public Port operations) presented in Section V without the initiatives. Emission reduction initiatives were applied to the public Port of Richmond activities only.

A majority of the ocean-going vessels emission reductions of PM are associated with sulfur fuel requirements, while the sulfur fuel requirements, VSR program, and truck program would each contribute to similar reductions in NOx emissions. Of note, the sulfur fuel requirements would occur across ocean-going vessel operating modes (including hotelling at the berths). In contrast, the VSR program would only reduce emissions from the main engines during cruise and slow cruise modes (which tend to be further from areas of public access). A truck replacement program would also provide emission reductions.

With the implementation of 0.5 percent sulfur fuel only, there would be a 63 percent reduction in PM and an 80 percent reduction in SO_2 compared to estimated emissions without implementation of the program. Of note, the lower sulfur fuel results in slightly higher ROG emissions due to fuel characteristics.

With the Implementation of 0.5 percent sulfur fuel, VSR, and a truck program, there would be a 9 percent reduction in ROG emissions, a 22 percent reduction in CO emissions, a 13 percent reduction in NO_X, a 70 percent reduction in PM, an 82 percent reduction in SO_2, and a 9 percent reduction in GHG emissions compared to emissions without the initiatives.

With the Implementation of 0.1 percent sulfur fuel along with VSR and a truck program, there would be additional reductions of PM and SO_2; a 76 percent reduction in PM and a 95 percent reduction in SO_2 compared to emissions without the initiatives. The 0.1 percent sulfur fuel requirement does not provide any additional reductions in CO, NO_X, or ROG emissions beyond that achieved with the 0.5 percent sulfur fuel.

Figure 3 compares the estimated CAAP emission reductions initiatives for NO_X emissions. As shown, the truck program, the sulfur fuel restrictions, and the VSR program would each provide modest reductions in NO_X emissions. Figure 4 compares the estimated CAAP emission reductions initiatives for PM emissions. As shown, the truck program and VSR provide minor reductions in PM emissions, while the sulfur fuel restrictions provide significant reductions in PM emissions; which are directly related to reduction in health risks. Table 5 and Figures 3 and 4 shows

that the sulfur fuel restrictions reduce PM and SO_2 emissions significantly, while VSR program would reduce all pollutants by a modest amount.

Table 5. Estimated Annual Port of Richmond Emissions with Emissions Reductions (tons/year)

Condition	ROG	CO	NO_X	PM	SO_2	CO_2
Estimated Port of Richmond Emissions (Glovis, Honda and other public operations)	8.6	28.1	164	13.4	84.7	11,573
Emissions with 0.5%S OGV Fuel	9.2	27.9	158	5.0	16.8	11,319
Emission Difference	0.6	-0.2	-6.7	-8.4	-67.8	-254
Emission Percent Difference	8%	-1%	-4%	-63%	-80%	-2%
Emissions with VSR	8.0	27.0	151	12.2	76.3	10,750
Emission Difference	-0.5	-1.1	-13.0	-1.2	-8.4	-823
Emission Percent Difference	-6%	-4%	-8%	-9%	-10%	-7%
Emissions with Truck Program	7.8	23.2	161	12.8	84.7	11,573
Emission Difference	-0.8	-4.9	-3.0	-0.6	0.0	0.0
Emission Percent Difference	-9%	-18%	-2%	-4%	0%	0%
Emissions with 0.5%S OGV Fuel, VSR, and Truck Program	7.9	21.9	142	4.1	15.3	10,529
Emission Difference	-0.7	-6.2	-22.0	-9.3	-69.4	-1,044
Emission Percent Difference	-9%	-22%	-13%	-70%	-82%	-9%
Emissions with 0.1%S OGV Fuel, VSR, and Truck Program	7.9	21.9	142	3.2	4.3	10,529
Emission Difference	-0.7	-6.2	-22.0	-10.2	-80.4	-1,044
Emission Percent Difference	-9%	-22%	-13%	-76%	-95%	-9%

Sources: SF Bay Area Seaports Air Emission Inventory, Port of Richmond 2005 Emissions Inventory, Bay Planning Coalition, October 2009 and Honda Port of Entry at the Point Potrero Marine Terminal Final Environmental Impact Report, September 2008.
Truck Program includes idling restrictions and elimination of 1996 or older vehicles.

Figure 3. Estimated Annual Port of Richmond NO_X Emissions with Emissions Reduction Initiatives (tons/year)

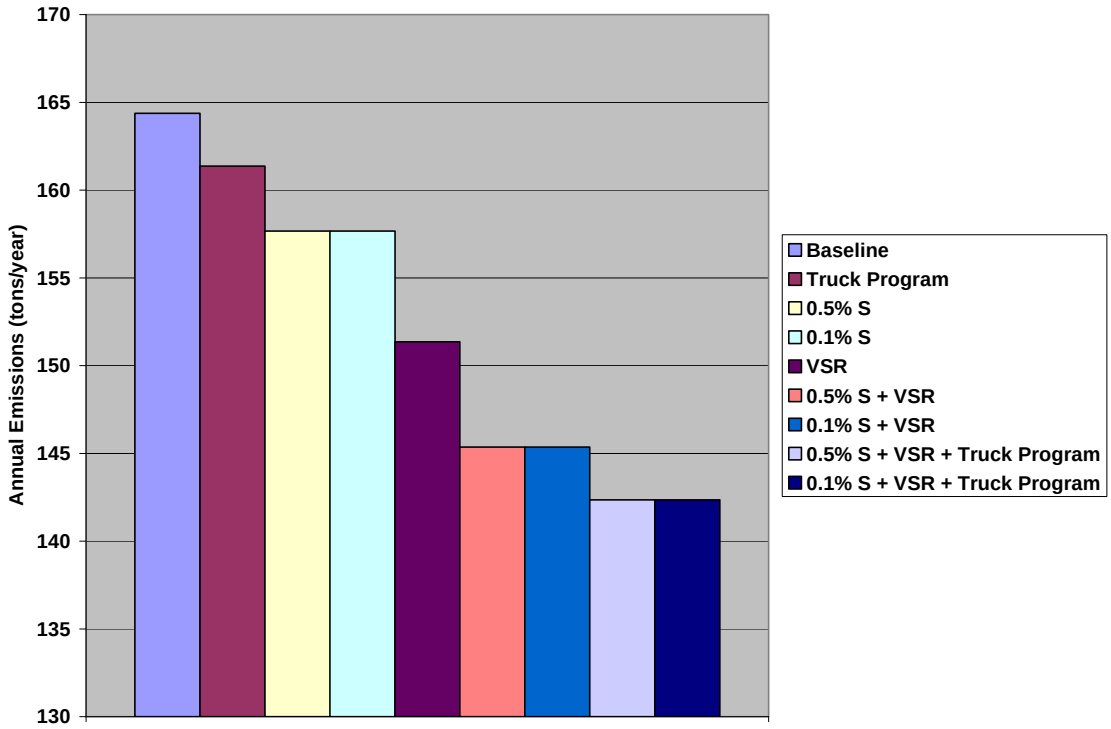
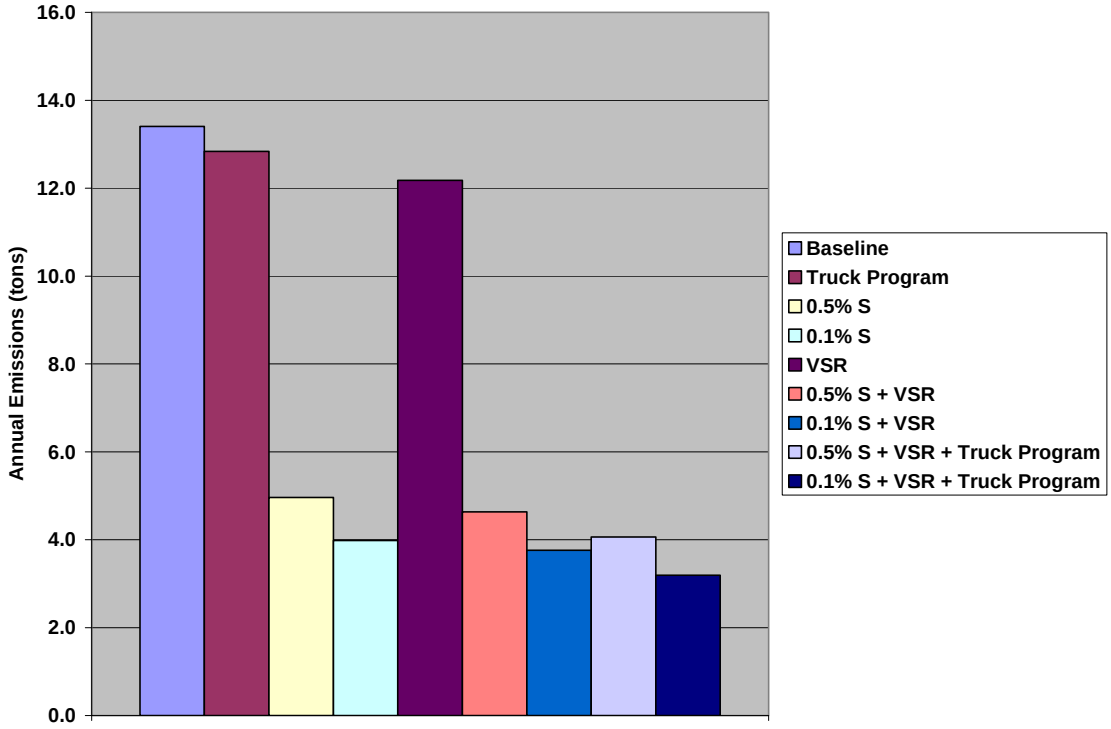


Figure 4. Estimated Annual Port of Richmond PM Emissions with Emissions Reduction Initiatives (tons/year)



One issue affecting the presentation of emission reductions over a multi-year period is the potential growth in port operations and the resulting change in emissions. The growth in emissions is the net change in emissions over time due to changes in port activity (usually an increase) and changes in emissions per unit of activity (an increase or decrease depending on the effectiveness of emission control requirements, fleet turnover, and efficiencies/inefficiencies in operations from one year to the next). It is difficult to reliably estimate the change in emissions related to port operations over the period covered by the CAAP due to significant unknowns such as: new technology and technology implementation rates; operational changes that can affect operating efficiencies; emission reduction programs implemented voluntarily by the private businesses operating within the Port; and other factors.

A second issue in the presentation of project emission reductions is the specific data upon which the calculations are based. The estimated emissions are based on data such as the number of port calls, the type of vessels, the vessel engine size, the operating times per mode (such as hotelling time), and the number of heavy-duty trucks doing business at the port. These data represent a "snapshot" of port activity at the time, and may or may not consistently represent port conditions over the timeframe of the CAAP.

To account for this potential disparity, periodic air emission inventories (see Section VII) will review the basis of estimation and the Port-specific data as part of the tracking and reporting program, and update the estimated emission benefits of the various initiatives accordingly.

Further, emission reductions due to implementation of a renewable energy program, an alternative fuel program, or an employee transit program are highly dependant upon the details and success rate of the program, and thus are not specifically quantified in this CAAP. However, these reductions would be quantified and tracked throughout forthcoming periodic air emission inventories and CAAP updates.

VII. CAAP Development and Implementation

The CAAP process begins with the strategic plan development, which will be finalized in July 2010. The next steps of developing and implementing the CAAP will be an ongoing process. This section outlines the Port of Richmond's approach toward these next steps.

a. Regulatory Compliance Program

The Port of Richmond will comply with regulations and rules promulgated by CARB and other agencies with direct application of emission sources within ports, in general, and the Port of Richmond specifically, as noted in Section VI. As discussed under *f. Timeline*, the Port of Richmond will contact the CARB on a regular basis to ensure they are current with respect to proposed regulations pertaining to the Port of Richmond. In addition, although the Port is not necessarily the responsible party for implementing some of the regulations (e.g., California Ports' Clean Truck Program and state, federal and international regulation of ocean-going vessels), it is within the Port's purview to review practices of port users, notify the responsible parties of their obligations and requirements under the current regulations, and to alert the appropriate enforcement agencies of port users that may be out of compliance.

b. Evaluation Criteria for Emission Reduction Measures

The evaluation criteria (as presented in the Honda Port of Entry CAAP) used to select reduction measures will include estimated potential reductions, cost effectiveness (including capital and operating expense), time for implementation, duration of reductions, life cycle analysis, and practicability. To the extent practicable, each measure will be reduced to a ratio of dollars per ton of pollutant reduced for each affected and/or targeted pollutant. The potential measures will then be ranked to help select the measures with the highest potential, taking care to ensure that reductions of one targeted pollutant do not significantly increase another targeted pollutant, or result in an undesirable and uncontrolled media transfer, for example, from air to waste. As discussed under *f. Timeline*, the Port of Richmond will review the evaluation criteria periodically to ensure the criteria are consistent with current regulations and practices.

c. Federal and State Funding

Grant programs can offer significant encouragement and can be used to spur early action by port operators and users to move forward with replacement, repower, or retrofit projects in advance of regulatory or port requirements. The U.S. EPA, through their National Clean Diesel Funding Assistance Program, has offered funding to local governments, including ports, for diesel emissions reduction projects. Several ports have been successful in receiving funding from this program on behalf of their port operators for cargo handling equipment and harborcraft projects. The state Carl Moyer Program, dispersed by local air agencies like the BAAQMD, has been available since 1998 to provide grants for early emission reductions from diesel sources. Over the years, Carl Moyer Program funding has been used by port operators to replace, retrofit or repower cargo handling equipment, harborcraft and rail switcher locomotives.

In addition, grant funding approved by California voters in Proposition 1B ("Prop 1B funding") is available to California Ports for freight handling improvements through both the California Transportation Commission and the CARB via the regional air quality management districts. The Port of Richmond will pursue Prop 1B grant funding through both the California Transportation Commission (CTC) and CARB/BAAQMD.

d. Tracking and Reporting

To track, monitor, and demonstrate the progress of the CAAP, the following actions should be considered. More specific tracking and reporting actions to be considered by the Port of Richmond are discussed under *f. Timeline.*

i. Updating port-wide air emissions inventories periodically (every three to five years or as warranted by activities levels) to track control measure compliance and emission reductions from the 2005 baseline conditions, to identify improvements to the tracking system, and to evaluate port activities and sources for future emission reduction programs. Calculation of the air emissions inventories should use the latest emissions estimating methodology, activity data, and assumptions.

ii. Forecasting future benefits of emission reduction measures for a number of years to ensure the plan is designed to meet emission reduction targets and standards and updating CAAP as needed.

iii. Tracking CAAP progress on implementation of programs.

iv. Reporting on overall progress of the CAAP to the City Council annually and additionally as required.

v. Posting progress reports prepared for the City Council on the CAAP website.

Progress related to each of the source specific measures should be tracked and monitored to determine CAAP implementation progress. Regular updates to the City Council should be made on the various elements of the program. Upgrades to the emissions inventory and implementation databases should be completed in order to facilitate regular monitoring and to update the Board and public. The CAAP website should provide the status of the implementation progress, links to the port's Annual Emissions Inventories, and other key elements. This website should also be a clearinghouse for CAAP related documents, fact sheets, schedules, and provide links to Board meeting schedules and agendas.

e. Public Involvement and Education

Public input has been provided through the Advisory Board and the Honda Port of Entry EIR process, as briefly described in Section II. The Advisory Board and City Council will review the draft, final, and updated CAAPs and the final and updated CAAPs will go before the City Council for approval. Additionally, the Port will post a draft of this CAAP on the Port and/or City's website prior to City Council Consideration. The County Public Health Department will also review and comment on the draft and updated CAAPs. The Port will also educate the public regarding the contribution of Port activities to the health and economy of the City of Richmond.

f. Timeline

The Port of Richmond should consider the following approaches as potential next steps in the development and implementation of the CAAP.

Within the first six months:

i. Review the 2005 baseline year emission inventory, identify activities and sources for future emission reduction programs, and investigate emission reduction programs targeting these types of activities.

ii. Identify ways and funding to periodically update the port-wide air emissions inventories in order to track control measure compliance and emission reductions and to evaluate port activities and sources for future emission reduction programs. Tasks should include:

   a. Establishing a schedule for updating the emissions inventory regularly (e.g. every two years);

   b. Developing and distributing a voluntary survey for data collection of off-road equipment and trucks such as model year, equipment size, fuel type, gallons used, hours operated, and operating conditions;

   c. Developing and distributing a voluntary survey for data collection of ocean-going vessels such as sulfur fuel percent, equipment size, vessel speed, hotelling time, and operating conditions; and

   d. Exploring funding options for the emissions inventory update and survey (e.g., through the BAAQMD Community Air Risk Evaluation (CARE) program.[7])

iii. Coordinate with the County Public Health Department in:

   1. Reviewing the CAAP;

   2. Identifying potential emission reduction programs to explore;

   3. Seeking funding options;

iv. Create a CAAP website.

v. Request from CARB a list of truck operators in their Drayage Truck Registry that operate at the Port of Richmond.

Within the first year:

i. Continue to explore the option of implementing a demonstration portable shore power project applicable to ships at the Port of Richmond, including applying for grant funding for such a demonstration project.

ii. Continue to implement the energy management plan for docked ships and monitor to determine if modifications are needed for improving the program.

iii. Continue to explore options for developing a solar power generation system.

iv. Monitor the emissions reduction measures implemented by the Honda Port of Entry and evaluate the program in the future to determine if it is an appropriate program for the Port of Richmond to implement. The measures include:

   a. A five-minute idling rule for trucks;

   b. A VSR program for shipping lines;

[7] CARE Program Contact: Phil Martien, Senior Advanced Project Advisor, Planning and Research; (415) 749-4660; http://www.baaqmd.gov/Divisions/Planning-and-Research/CARE-Program.aspx

c. The use of primary propulsion fuel and auxiliary engine fuel with sulfur content no greater than 0.5 percent for all ocean-going vessels by CARB regulation;

d. Tier 2 emissions standards or better for all harborcraft;

v. Explore the science of Advanced Maritime Emissions Control Systems (AMECS) to determine applicability to the Port of Richmond.

vi. Explore the options of providing incentives to reduce emissions while maintaining the needs of the Port of Richmond (e.g., fee structure, preferential treatment, expedited service, funding for vehicle retrofit).

vii. Explore the options of mitigating Port impacts through:

a. Alternative energy generation for the Port's own use and possibly the use of tenants or other neighbors; and

b. Public outreach and education coordination with the County Public Health Department regarding actions the Port of Richmond is taking to reduce port-related emissions;

Annually:

i. Contact CARB annually and additionally as required regarding current and proposed regulations and funding pertaining to port activities.[8]

ii. Follow-up should include:

a. Reviewing current port practices to ensure compliance;

b. Receive an update from CARB of trucking companies in the state Drayage Truck Registry that call on the Port of Richmond.

c. Notifying responsible parties (ship, truck and rail operators and others) of their obligations and requirements under current regulations;

d. Identifying any emissions data collected by CARB that could be used in the Port of Richmond's emissions inventory update; and

e. Identifying funding sources to explore potential emission reduction programs.

iii. Review evaluation criteria periodically to ensure criteria are consistent with current regulations and practices (see Port of Entry CAAP for Guidelines for the Feasibility Review Process).

iv. Review other port reductions measures and identify measures to evaluate further for Port of Richmond consideration.

v. Report overall progress of the CAAP to City Council annually.

vi. Provide educational services to local trucking / transportation companies regarding applying for Carl Moyer grants and other funding opportunities, or arrange for BAAQMD to provide informational workshops.

[8] CARB Contact: Todd Sax, Manager, Truck and Goods Movement Analysis Section; (916) 322-5474; tsax@arb.ca.gov; http://www.arb.ca.gov/diesel/mobile.htm).

vii. Provide informational workshops to businesses regarding updates in transportation/port related regulations.

viii. Post progress reports prepared for City Council on the CAAP website annually.

List of Preparers

Larry Magid, Principal, Public Policy Advising

Paul Miller, Air Quality Specialist, Miller Environmental Consultants

Michael Ratte, Air Quality Specialist, KB Environmental Sciences, Inc.

References

Honda Port of Entry at the Point Potrero Marine Terminal Final Environmental Impact Report, September 2008.

Port of Houston Authority, Clean Air Strategy Plan, August 25, 2009.

Port of Houston Authority, 2007 Goods Movement Air Emissions Inventory at the Port of Houston, January 2009.

Port of Long Beach Air Emissions Inventory – 2008, Starcrest Consulting Group, December 2009.

Port of Los Angeles Air Emissions Inventory – 2008, Starcrest Consulting Group, December 2009.

Port of Oakland 2005 Seaport Air Emissions Inventory (Revised), Environ International Corporation, March 14, 2008.

Puget Sound Maritime Air Forum, Puget Sound Maritime Air Emissions Inventory, Starcrest Consulting Group, April 2007.

San Francisco Bay Area Seaports Air Emission Inventory, Port of Richmond 2005 Emissions Inventory, Bay Planning Coalition, October 2009.

San Diego Unified Port District, 2007 Clean Air Program Draft Report, Environ, December 2007.

San Pedro Ports, Draft 2010 Update San Pedro Bay Ports Clean Air action Plan, April 2010.

South Carolina Ports, 2005 Port of Charleston Baseline Air Emissions inventory, Moffatt & Nickol, September 12, 2008.