SECTION 1 INTRODUCTION

The Port of Long Beach (the Port or POLB) shares San Pedro Bay with the neighboring Port of Los Angeles (POLA). Together, the two ports comprise a significant regional and national economic engine for California and the United States (U.S.), through which approximately 33% of all containerized trade\(^4\) in the nation flows (15% for POLB alone). Combined, the POLB and POLA’s customs district account for approximately $300 billion in annual trade. Despite a recent worldwide downturn in shipping, economic forecasts suggest that the demand for containerized cargo moving through the San Pedro Bay region will increase over the next two decades\(^5\). The economic benefits of the ports are felt throughout the nation.

The ports recognize that their ability to accommodate the projected growth in trade will depend upon their ability to address adverse environmental impacts (and, in particular, air quality impacts) that result from such trade. In November 2006, the ports of Long Beach and Los Angeles adopted the landmark Clean Air Action Plan (CAAP) that was designed to assist the ports with developing and implementing measures and strategies necessary to reduce air emissions and health risks associated with port operations, while allowing port development, and the job creation and economic activity associated with that development, to continue. The CAAP includes strategies to reduce emissions from port-related mobile source operations such as trucks, locomotives, ships, harbor craft, cranes and yard equipment. On November 22, 2010, the harbor commissioners of the two ports unanimously approved an update to the CAAP that identifies longer-term goals that build upon the commitments made in the original CAAP.

1.1 Reason for Study

In the CAAP, the Port made a commitment to develop annual air emission inventories. Using a baseline year of 2005, the annual emissions inventories serve as the primary tool for the Port to track the progress of CAAP measures and regulations implemented to reduce port-related air emissions. A discussion of regulatory and CAAP measures is provided in Appendix A. The 2010 Air Emissions Inventory (2010 EI) presents estimates of emissions from port-related mobile sources based on activities that occurred in calendar year 2010. A comparison of the 2010 air emissions to relative to 2005 levels is also conducted.

Development of the annual air emissions inventories is coordinated with a technical working group (TWG) comprised of representatives from the ports and air regulatory agencies, including the U.S. Environmental Protection Agency Region 9 (USEPA), California Air Resources Board (CARB), and South Coast Air Quality Management District (SCAQMD). Through collaboration with the TWG, the ports seek the consensus of the air regulatory agencies regarding methodologies and information used to develop the emissions estimates.


\(^5\) San Pedro Bay Container Forecast Update, The Tioga Group, Inc., July 2009
The Port released its first activity-based emissions inventory in April 2004, based on the 2002 calendar year. The 2002 Baseline Air Emissions Inventory\(^6\) evaluated emissions from three Port-related source categories: off-road cargo handling equipment (CHE), rail locomotives (RL) and on-road heavy-duty vehicles (HDVs) that operate within the Port’s boundary. An addendum to the 2002 Inventory\(^7\) was developed concurrently with the 2005 Inventory\(^8\) to evaluate emissions from ocean-going vessels (OGVs), harbor craft, and the off-Port emissions associated with RL and on-road HDVs. As a follow-up to the 2005 inventory, the 2006 Air Emissions Inventory\(^9\) was released in June 2008 and for the first time, included emission estimates for greenhouse gases (GHGs) for Port-related maritime mobile sources. The 2007 and 2008 Inventories were released in January and December of 2009, respectively, and the 2009 Inventory was released in June 2010.\(^10\) \(^11\)\(^12\)

1.2 Scope of Study

The emissions in this report are based on the year of activity, the characterized pollutants, the port-related source of emissions, and the geographic boundaries in which the emissions occur.

1.2.1 Pollutants

The combustion of fuel from the operation of port-related vehicles and equipment result in exhaust emissions of air pollutants, including greenhouse gases. The pollutants estimated in the EI are described below.

**Particulate Matter**

Particulate matter (PM) is a complex mixture of extremely small particles and liquid droplets made up of a number of components including organic chemicals, metals, acids, and soil or dust particles. PM that are 10 micrometers in diameter or smaller generally pass through the throat and nose and enter the lungs and can affect the heart and lungs and cause serious health effects. PM emissions are grouped into two categories, PM\(_{10}\) and PM\(_{2.5}\).

PM\(_{10}\) emissions are inhalable coarse particles, such as those found near roadways and dusty industries, are larger than 2.5 micrometers and smaller than 10 micrometers in diameter. PM\(_{2.5}\) emissions are fine particles 2.5 micrometers in diameter and smaller.

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\(^12\) Port of Long Beach, *Air Emissions Inventory – 2009*, prepared by Starcrest Consulting Group, June 2010.
Diesel Particulate matter
Diesel particulate matter (DPM) is part of a complex mixture that makes up diesel exhaust. In 1998, California identified diesel exhaust particulate matter as a toxic air contaminant based on its potential to cause cancer, premature death, and other health problems.

Oxides of Nitrogen
Oxides of nitrogen ($\text{NO}_x$) are a group of highly reactive gases produced during the fuel combustion process. $\text{NO}_x$ reacts to form ground-level ozone and smog, and can contribute to respiratory problems.

Oxides of Sulfur
Oxides of sulfur ($\text{SO}_x$) are gases formed when fuel containing sulfur, such as coal and oil, is burned. $\text{SO}_x$ can form particulates in the air and can contribute to respiratory problems.

Hydrocarbons
Fuels such as gasoline and diesel are mixtures of hydrocarbons (HC). HC emissions are fragments of fuel molecules that are only partially burned in the fuel combustion process. HC in the air react with $\text{NO}_x$ and sunlight to contribute to the formation of ground-level ozone and greenhouse gases.

Carbon Monoxide
Carbon monoxide (CO) is a colorless, odorless gas emitted from the fuel combustion process. CO can cause harmful health effects by reducing oxygen delivery to the body's organs (like the heart and brain) and tissues. At extremely high levels, CO can cause death.

Greenhouse Gases
Emissions of greenhouse gases (GHG) carbon dioxide ($\text{CO}_2$), methane ($\text{CH}_4$) and nitrous oxide ($\text{N}_2\text{O}$), which are combustion by-products, are estimated in this inventory. Other GHGs, such as fluorinated gases are not estimated because they are produced as a result of industrial processes not typically found at ports or in the maritime industry.

Since each GHG differs in its ability to absorb heat in the atmosphere, GHG emissions were normalized by multiplying individual GHG pollutant emissions by their respective global warming potentials (GPWs), listed below, and presented in the normalized units of carbon dioxide equivalents ($\text{CO}_2$ Equivalent)\textsuperscript{13}:

- $\text{CO}_2$ – 1
- $\text{CH}_4$ – 21
- $\text{N}_2\text{O}$ – 310

1.2.2 Emission Sources
Emissions are estimated from the following five port-related mobile source categories:

- Ocean-going vessels
- Harbor craft
- Cargo handling equipment
- Railroad locomotives
- Heavy-duty vehicles

The Port is a landlord port; it builds terminal facilities and leases them to shipping lines and stevedoring companies. The Port does not operate the terminals, ships, yard equipment, trucks or trains that move the cargo. Port tenants and shipping lines who own, operate and maintain equipment and own or charter vessels play an essential role in the development of an EI by providing the most accurate activity and operational information available for each of the source categories above. Activity and operational data collected are input into a database and emissions estimates are developed for each source category in a manner consistent with the latest estimating methodologies agreed upon by the Port and the TWG. Specific data collection and analytical approaches unique to each of the five source categories are described in subsequent sections of this report.

1.2.3 Geographical Extent
The 2010 EI includes emissions from equipment and vehicles that operate on Port-owned and privately-owned land within the Port of Long Beach Harbor District to the South Coast Air Basin. For OGVs and commercial harbor craft, the geographical extent of the 2010 EI is based on the same boundary used in previous marine vessel inventories developed for the SCAQMD.

This section describes the geographic boundaries used for all source categories in the 2010 EI.
Ocean-Going Vessels and Commercial Harbor Craft

The portion of the study area outside the Port’s breakwater is four-sided, and geographically defined by the following coordinates:

- **Northwest (NW) corner:** 34°02'42.4” north (N) latitude by 118°56'41.2” west (W) longitude
- **Southwest (SW) corner:** 33°00'00.0” N latitude by 119°30'00.0” W longitude
- **Southeast (SE) corner:** 32°30'00.0” N latitude by 118°30'00.0” W longitude
- **Northeast (NE) corner:** 33°23'12.7” N latitude by 117°35'46.4” W longitude

**Figure 1.1: OGV and Harbor Vessel Out of Port Geographical Extent**
Cargo Handling Equipment

The geographical scope for CHE is the terminals and facilities on which they operate. Figure 1.2 shows active Port terminals in 2010.

Figure 1.2: Cargo Handling Equipment Geographical Extent Port of Long Beach Map of Terminals

Railroad Locomotives and Heavy-Duty Vehicles

Emissions from switching and line haul RLs are estimated for on-dock rail yards, intermodal yards on Port property, and the rail lines linking these facilities. For HDV associated with the hauling of cargo, emissions from queuing at terminal entry gates, travel and idling within the terminals, and queuing at the terminal exit gates are included in the 2010 EI. In addition to emissions that occur inside the Port facilities, emissions from RLs and HDVs transporting cargo to or from the Port are estimated for activity that occurs within the SoCAB boundaries. Emissions are estimated up to the cargo's first point of rest within the SoCAB or up to the basin boundary, whichever occurred first. First point of rest is defined as the location where cargo, such as a container of goods, is first off-loaded from the transport device (truck or train) after leaving the Port. Examples include cargo transported from the Port by truck to a distribution center or to an off-Port intermodal yard. Figure 1.3 shows the SoCAB boundary for RL and HDV relative to the Port. Since the ports of Long Beach and Los Angeles are interconnected with intermodal transportation linkages, every
effort was made to only account for freight movements originating from or having a destination at the POLB.

Figure 1.3: Railroad Locomotives and Heavy Duty Vehicles Geographical Extent South Coast Air Basin Boundary

1.2.4 Sources Not Included in the Emissions Inventory
The inventory does not include emissions from stationary sources because they are accounted for in stationary source permitting programs administered by the SCAQMD. The inventory also does not include emissions from vessels and equipment used in oil production operations, located either within the port boundary or offshore. The following industrial operations and other emission-producing activities, located on Port property or on private property within the Port boundaries are not included in the 2010 EI:

- Harbor Co-generation
- South East Resource Recovery Facility
- Tidelands Oil Production Company
- THUMS Oil Operations
- Long Beach Generation
These operations and activities are excluded from the 2010 EI because they are not related to the Port’s goods movement activities or operations. Emissions associated with Tidelands and Thums Oil Operations, are included in a separate study conducted to quantify oil industry-related emissions published in 2006\textsuperscript{14}.

1.3 Report Organization

This report presents the emissions and methodologies used for each source category in each of the following sections:

- Section 2 discusses ocean-going vessels
- Section 3 discusses harbor craft
- Section 4 discusses cargo handling equipment
- Section 5 discusses locomotives
- Section 6 discusses heavy-duty vehicles
- Section 7 discusses findings and results
- Section 8 compares 2010 emissions to 2005 emissions
- Section 9 discusses emissions metrics by source category
- Section 10 discusses anticipated impacts of control programs on emissions and improvements to methodologies for estimating emissions

The report also includes:

- Appendix A – Regulatory and San Pedro Bay Ports Clean Air Action Plan Measures
- Appendix B – Ocean-going vessels
- Appendix C – Harbor craft
- Appendix D – Cargo handling equipment
- Appendix E – Heavy-duty vehicles

\textsuperscript{14} \textit{Long Beach Gas and Oil Air Emissions Inventory}, prepared by Starcrest Consulting Group, LLC, October 2006.