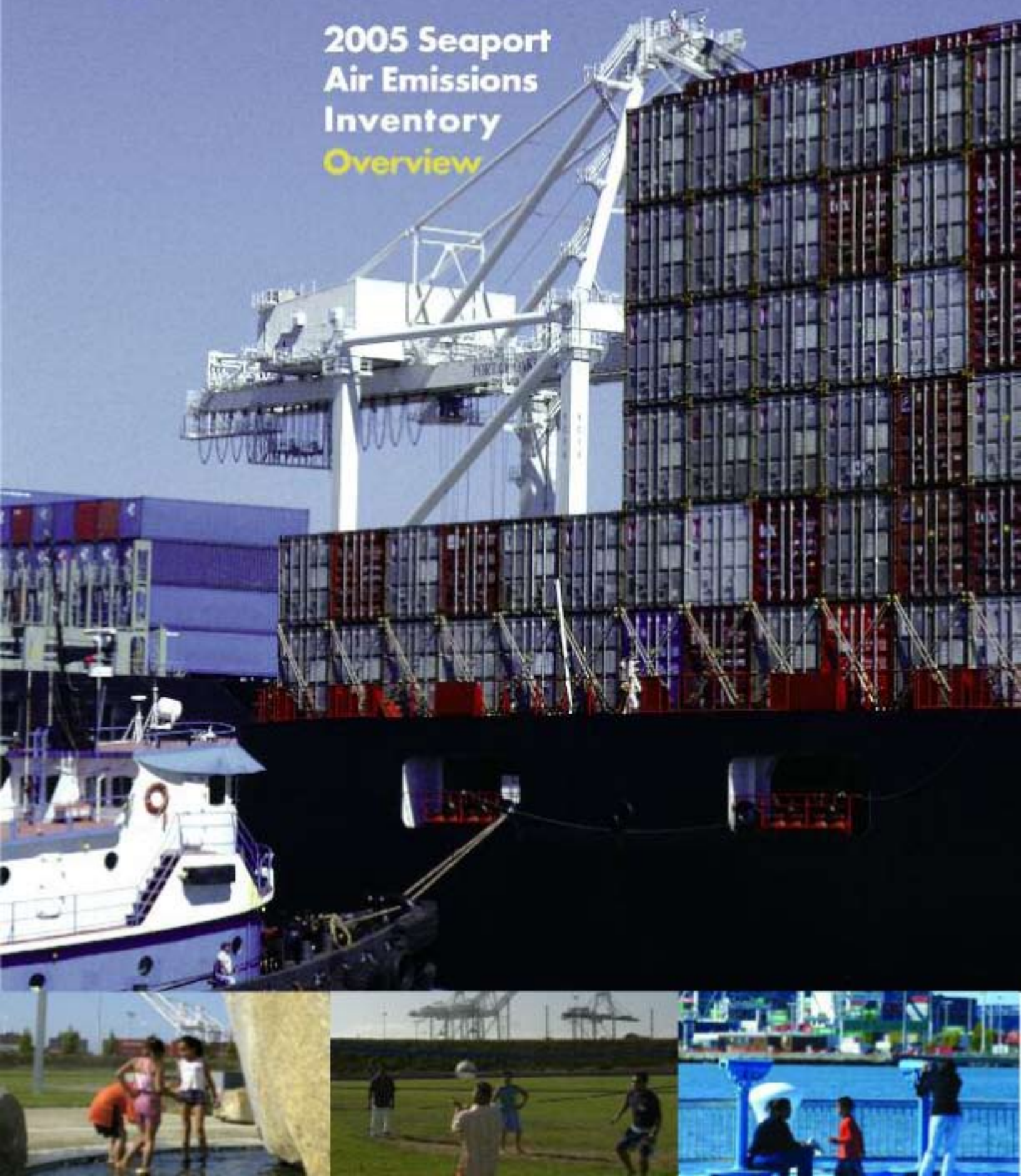


PORT OF OAKLAND

2005 Seaport Air Emissions Inventory Overview





Port of Oakland 2005 Seaport Air Emissions Inventory Overview

As part of its commitment to help reduce air pollution from the operations of our seaport tenants, the Port of Oakland has prepared a 2005 Seaport Air Emissions Inventory ("inventory"). This inventory estimates the amounts of certain types of air pollutants generated by the ships, trucks, trains, harbor craft, and cargo handling equipment at its seaport during 2005. The inventory will:

- 1) allow the Port of Oakland to more accurately understand emissions sources related to seaport activities
- 2) help the Port, its tenants and the community to prioritize emissions reduction efforts to get the biggest impact from its air quality investments, and
- 3) provide the Port, its tenants and the community a baseline of emissions for tracking progress in reducing pollution.

Specifically, the inventory will be used for two immediate purposes:

First, it will assist the Maritime Air Quality Improvement Plan Stakeholder Task Force -- a collaboration of industry, environmental justice, labor, government and resident groups -- craft a Maritime Air Quality Improvement Plan for the Port of Oakland.

Second, the Emissions Inventory will be used by state and regional air quality agencies as a technical basis for a West Oakland Health Risk Assessment. That report will identify health risks from multiple sources and allow prioritization of pollution reduction efforts.

What is an emissions inventory?

An emissions inventory is an estimate of the quantity of pollutants that a group of sources produces in a given area, over a defined period of time.

In the Port's case, the emissions inventory presents tons in 2005 of five different pollutants:

- Particulate matter (including diesel) (**PM**)
- Nitrogen oxides (**NOx**)
- Sulfur dioxide (**SO2**)
- Reactive organic gas (**ROG**)
- Carbon monoxide (**CO**)

To learn more about these pollutants, see Section 1 (Introduction) of the Emissions Inventory Report, available at www.portofoakland.com/environm/.

The inventory calculated the amounts of these emissions produced by the seaport operations of the Port and its tenants within the seaport area during the calendar year 2005.

The inventory estimates emissions from the Port's, tenants' and other seaport operations. Tenants include shipping lines, marine terminal operators, and the railyard operator. Non-tenant maritime operations for which emissions were estimated include trucking, dredging, tug boats, and other assist vessels.

The inventory focuses on the largest sources of air emissions from seaport operations, including:

- Ships
- Harbor Craft (e.g., tug boats)
- Cargo Handling Equipment
- Trucks
- Locomotives



Why was this inventory prepared?

The inventory is necessary for the Port, its tenants, air quality agencies and the local community to accurately understand pollution sources from seaport-related activity. This information can help prioritize and promote efforts to reduce air pollution.

The Port voluntarily and proactively chose to prepare an air emissions inventory of its seaport as part of its long-standing commitment to reduce air pollution from the operations of its tenants.

Who prepared this inventory?

The Port of Oakland paid for the emissions inventory for its own use, and staff managed its preparation. Because of the highly technical nature of this work, the Port hired ENVIRON, an air quality consulting firm with extensive experience in preparing emissions inventories. The Port worked closely with the California Air Resources Board ("CARB") and Bay Area Air Quality Management District ("BAAQMD") staff to ensure that the resulting inventory would be compatible with other local emissions inventories and with the West Oakland Health Risk Assessment. Community members were invited to comment on the draft emissions inventory methodology in January 2007.

How are emissions measured?

Even a detailed and professionally prepared inventory, such as this one, does not use direct emissions measurements from each vessel, truck or other source being studied. As a result, it was necessary to rely on substitute information, such as published emissions rates, the number of cargo containers moved, the length of time vessels and equipment spent at various speeds and in different modes of operation, and the engine characteristics of equipment and vessels used for seaport operations. To obtain these data, Port, State, and terminal and rail operator records were used, along with special studies, literature reviews, and CARB input data or models (See Table 3, Measures of Seaport Activity Used in the Emissions Inventory). However, since exact measurements are not possible, all of the results are subject to some uncertainty.

What are the results of the emissions inventory?

Port ships constitute the largest source category for all pollutants, producing 80% of estimated particulate matter and the major portion of other pollutants except carbon monoxide. Trucks, harbor craft, and cargo handling equipment each produced 5-8% of the estimated particulate matter within the seaport area. Locomotives from the one rail yard on Port property produced 1%.

The health impacts of the various emissions sources on local community air quality are not always directly proportional to the magnitude of their emissions. For example, the particulate matter emissions from ships in cruising mode, which occur outside the Golden Gate, are likely to have less impact on West Oakland air quality than emissions that occur closer to shore, when ships maneuver into berths or when they are tied up at the dock.



The results of the Port of Oakland 2005 Seaport Air Emissions Inventory are summarized below:

Table 1. Port of Oakland emissions by emission source category – tons in 2005.

Emission Source Category	PM	NO _x	SO ₂	ROG	CO
Ships	220	2,484	1,413	117	235
Harbor Craft	13	345	3	22	83
Cargo Handling Equipment	22	766	7	53	408
Trucks	16	334	2	49	149
Locomotives	2	76	2	7	11
TOTAL	273*	4,005	1,427	248	886

* Most of the PM emissions (261 tons) are from diesel exhaust.

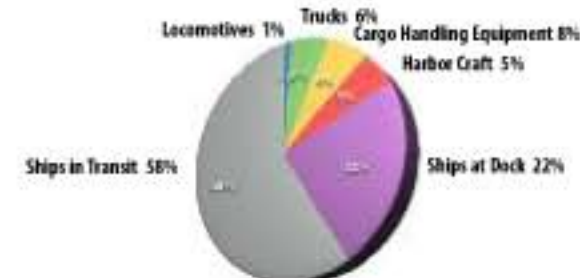
Table 2 shows a more detailed assessment of ship emissions by mode of operation. Most ship emissions occurred in transit, rather than while at dock.

Table 2. Ocean going vessels (OGV) emissions summary by mode – tons in 2005.

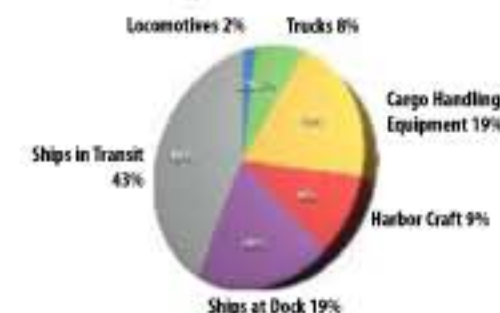
Emission Mode	PM	NO _x	SO ₂	ROG	CO
Ships in Transit					
- Cruise	52	588	383	16	46
- Reduced speed zone	60	647	395	27	63
- Maneuvering	44	458	157	53	58
- At anchorage	2	24	15	1	2
Subtotal	158	1717	950	97	169
Ships at Dock	61	767	464	21	65
Total Ship Emissions	220	2,484	1,413	117	235

The following charts show the percentage that each source contributes to total emissions of a particular pollutant:

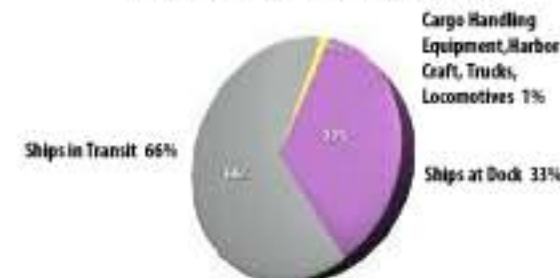
2005 PM Emissions By Source (including diesel)



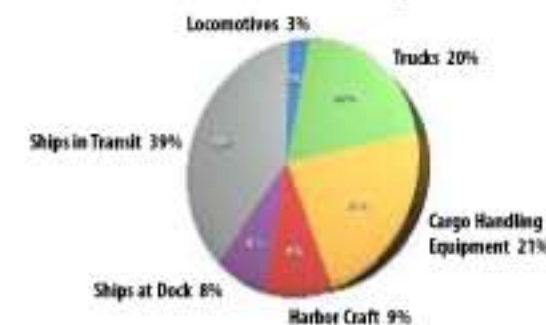
2005 NO_x Emissions By Source



2005 SO₂ Emissions By Source



2005 ROG Emissions By Source



2005 CO Emissions By Source

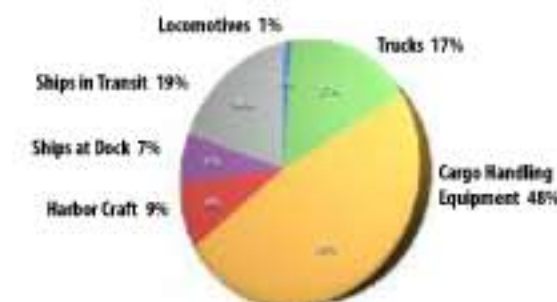
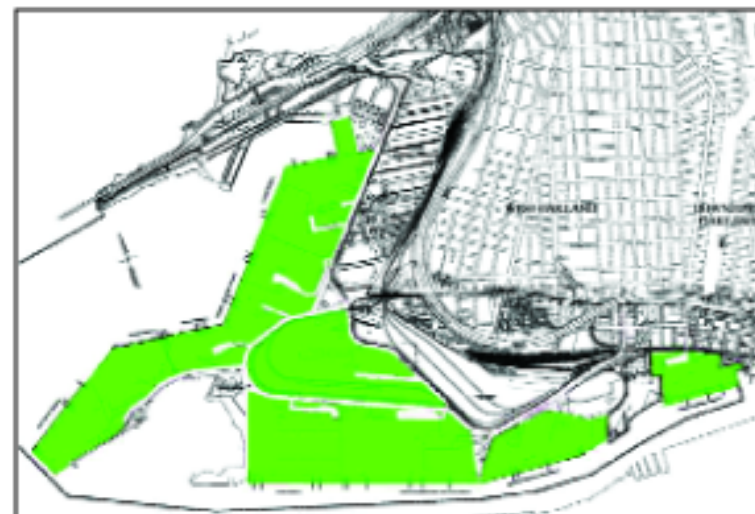


Table 3. Measures of Seaport Activity Used in the Emissions Inventory

Type of Activity	Measure of Activity in 2005
Ships in Transit	1,916 ship visits 125 ship anchorages in bay
Ships at Dock	20.7 hours at dock per average ship call
Harbor Craft	6,630 ship tug assists 72 dredging tug assists
Cargo Handling Equipment	556 pieces of yard equipment 522 fueled by diesel (32% retrofitted or repowered) 34 fueled by Liquified Petroleum Gas (65% repowered)
Trucks	2.6 million trips in and out of marine terminals 0.9 million trips in and out of rail terminals
Locomotives	2,190 trains arriving in and departing from rail yard



Where the Emissions are Located (Domain) - Water Sources



Where the Emissions are Located (Domain) - Land Sources

Where are emissions measured?

Two different domains, or areas, are used to estimate the geographic region in which emissions associated with the seaport are located.

- Water-based emissions from ships and harbor craft are measured from dock-side at the Port out to where ships turn towards San Francisco Bay, just beyond the Sea Buoy. This point is about 30 nautical miles away from the Port's Inner Harbor berths, and about 11 nautical miles from the California coast.

- Land-based emissions from cargo handling equipment, trucks and locomotives are measured in the seaport area, within the boundaries of I-80, I-880 and Howard Terminal, adjacent to Jack London Square. This area encompasses the eight marine terminals, one railyard, and the Port-related road traffic between those facilities and the nearest freeway interchanges.

CARB has estimated Port-related truck diesel emissions on surrounding freeways in a separate inventory of other diesel pollution sources likely to affect West Oakland.

How will this information be used in the West Oakland Health Risk Assessment?

As the data gathering effort for this inventory was underway, CARB announced an initiative, in cooperation with BAAQMD, to estimate the health risks from diesel PM in West Oakland and immediate surrounding areas.

The Port learned of the agencies' need for data and offered its emissions database for the study, working to coordinate with CARB and BAAQMD so that the data could serve both the emissions inventory and the West Oakland Health Risk Assessment.

CARB's West Oakland Health Risk Assessment will not be an actual health study, but will estimate public exposure and increased health risks based on computer modeling. Public exposure to diesel PM emissions must be estimated because the technology does not yet exist to directly measure diesel PM in the ambient air where it is mixed with other types of particulate matter. The West Oakland Health Risk Assessment will assume residents are exposed to the 2005 levels of diesel PM for a 70-year lifetime, for 24 hours a day.

What will the West Oakland Health Risk Assessment measure?

The West Oakland Health Risk Assessment will use emissions and toxicity data to estimate the increased risk of health impacts, like cancer and asthma, attributable to diesel particulate matter pollution. The study will assess risk from (1) sources at the Port of Oakland, (2) the Union Pacific Railyard, and (3) other sources of diesel pollution that affect West Oakland, including the Main U.S. Post Office, industries and freeway traffic.



The health risk impact of each source will not be directly proportional to the magnitude of its diesel PM emissions because many other factors influence the West Oakland health risk analysis, including the proximity of an emission source to people.

What's the Port of Oakland doing to reduce air pollution at its seaport?

Since 1999, the Port of Oakland has worked with the community on implementing its Air Quality Improvement Program. The Port and its community stakeholders have worked to replace diesel-fueled equipment with electric, alternative fuel and cleaner equipment. Recently, the Port has replaced or retrofitted:

- 210 pieces of seaport terminal equipment;
- 70 heavy-duty diesel trucks working in the Port area;
- 28 AC Transit buses serving West Oakland; and
- 1 tug boat.

Together, these efforts will remove 21.1 tons of diesel PM emissions from the seaport. That's the equivalent of taking 1,055 heavy-duty diesel trucks off the roads for a year.



Currently, the Port has successfully tested a mobile shore-side power LNG generator that allows ships to turn off their diesel engines or "cold iron". This generator nearly eliminates emissions from ships at dock and can be implemented more quickly than the existing grid-powered alternative. The Port has also approved funding for new low-emission genset locomotive switching engines, two Liquefied

Natural Gas (LNG) fueling stations and 9 heavy-duty LNG-powered trucks.

Finally, the Port of Oakland is working with its community stakeholders to develop a long-term Maritime Air Quality Improvement Plan and a comprehensive Truck Management Program that will improve trucking operations and help local truckers buy cleaner trucks.