

Best practices on shipping and port emission control of Port of Oakland

Port of Oakland, California USA

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Port of Oakland Overview

- Air quality goal of 85% Diesel Particulate Matter (DPM) health risk reduction
- Maritime air quality plan & strategies
- Track with seaport emissions inventories for 2005 and 2012
- Methodology, data sources, results, and next steps:
 - ships, harborcraft, cargo handling equipment, locomotives and trucks

Air quality - why do we care?

- DPM is a toxic air contaminant
- State of California adopted regulations for all mobile sources at seaports
- Health risk study of the West Oakland neighborhood with Port of Oakland
 - Seaport responsible for 190 excess cancer cases per million population, representing 16% of overall diesel risk

Port of Oakland's Air Quality Goal

- The Port's Board of Port Commissioners adopted an air quality goal in March 2008:
 - 85% reduction from 2005 to 2020 in community cancer health risks related to exposure to diesel particulate matter emissions from the Port's maritime operations

Maritime Air Quality Plan

- Nine joint meetings with shipping, trucking, rail, community, environmental and government agency representatives, 2007-2008
- Stakeholders helped develop the Port's maritime air quality master plan
- Board of Port Commissioners approved Maritime Air Quality Improvement Plan (MAQIP) in April 2009

Are We Succeeding?

Use emissions inventories to track progress:

- In 2005, 2.3 million TEUs, 1,916 vessel calls
- In 2012, 2.3 million TEUs, 1,812 vessel calls
- Both years, average 21 hours per vessel call

- Greatest concern with diesel PM;
greenhouse gases also reduced
- Important that methodology and results are
accepted by air quality agencies and
community; emission factors from state

Emissions Inventories

ENVIRON International Corporation

- ICF Consulting, Best Practices for Port Emission Inventories, 2006
- California Air Resources Board – guidance in weekly conferences, 2006-2007
- Used records from Port (ship calls, dredging reports), tenants, state, rail operator, special studies, factors in models
- Limited to emissions in Port of Oakland area and out to Sea Buoy, 30 miles at sea
- Difficult to measure operational efficiencies

Ships

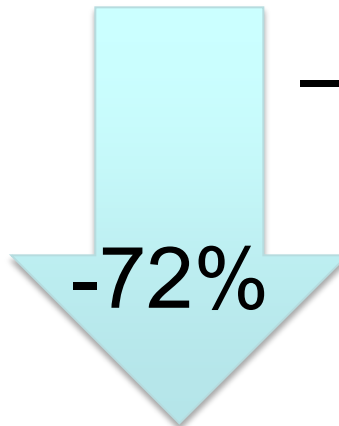


Ships

Emissions based on mode (cruising, maneuvering, hotelling), ship size, engine age & type, load factor, route, reefers

Sources: SF Bar Pilots, Coast Guard

- 2005 – 209 tons of diesel PM
- 2012 – 57 tons of diesel PM

 -72% –Due to auxiliary fuel rule; use 0.5% or lower sulfur within 24 miles of California coast (0.3% average)

Ships – Next Steps

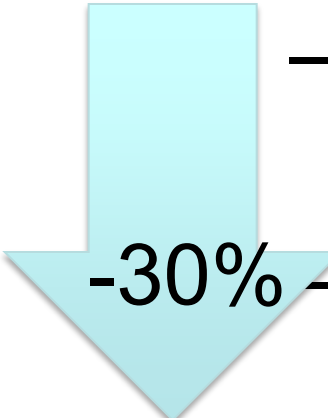
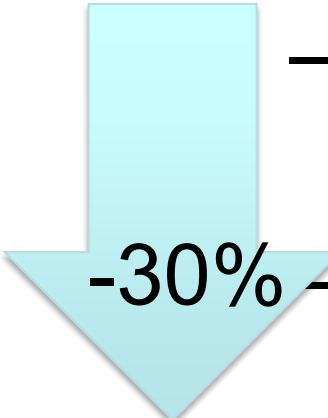
Starting January 1, 2014:
Shore power – ships plug into electric power and shut off engines at berth.
\$60 million – construction of substations, vaults.
Fuel – Ships use 0.1% sulfur fuel.



Harborcraft



Harborcraft

- Type (assist tug, dredge, barge), engine age & HP, hours, number/ship, load factor
 - Sources: interviews, Port vessel records
 - 2005 – 13 tons of diesel PM
 - 2012 – 9 tons of diesel PM
-  –State requires engine replacements to be cleanest available
-  –Fuel with no more than 15 parts per million of sulfur (state & US rule)

Harborcraft – Next Steps

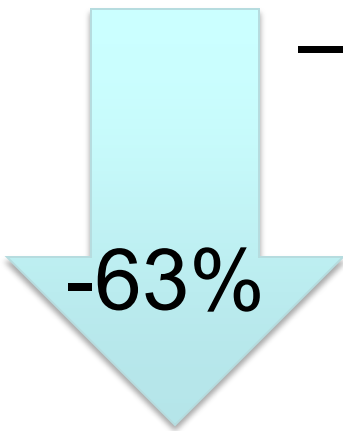
- Replace existing engines with cleaner engines according to adopted schedule (oldest engines, most hours first)

Cargo Handling Equipment



Cargo Handling Equipment

- Engine age, fuel, hours of operation, distance traveled in terminal, load factor
- Sources: terminal & railyard surveys
- 2005 – 21 tons of diesel PM
- 2012 – 8 tons of diesel PM



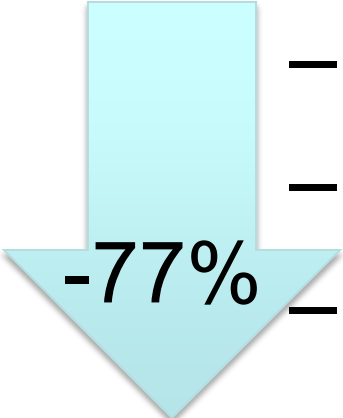
–Due to state regulation requiring phase-in of cleaner equipment (2007 or Tier 4, for on/off road) 2007-2017

Locomotives



Locomotives

- Models (line-haul, switchers), engine characteristics, distance traveled in rail yard, load factor
- Sources: survey, rail operator
- 2005 – 2 tons of diesel PM
- 2012 – 0.5 tons of diesel PM
 - Due to less rail activity
 - New idle reduction program
 - Low sulfur fuel (15 ppm)

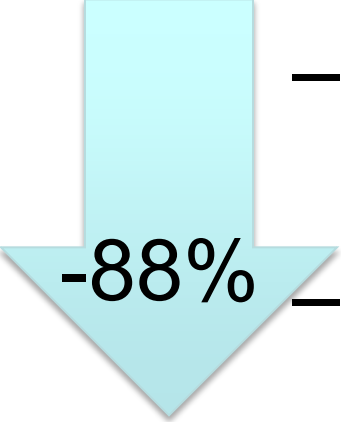


-77%

Port Trucks



Port Trucks

- Engine age, fuel, idling time, distance in Port area & in terminal, trips, load factor
 - Sources: gate count survey, container lifts
 - 2005 – 16 tons of diesel PM
 - 2012 – 2 tons of diesel PM
- 
- Diesel particulate filter on every truck, or banned from terminals
 - 1993 and earlier engines banned
 - Idling restrictions

Port Trucks – Next Steps

Starting January 1, 2014:

- Must meet 2007 US EPA engine standard
 - PM emissions standard = 0.01 g/bhp-hr
 - NOx emissions standard = 1.2-1.5 g/bhp-hr (Family Emission Limit)
- trucks must comply to access terminals

Starting January 1, 2023:

- Must meet 2010 US EPA engine standard
 - PM emissions standard = 0.01 g/bhp-hr
 - NOx emissions standard = 0.20 g/bhp-hr

Summary

- At 70% diesel PM reduction from 2005 to 2012, we are on our way to meeting goal of 85% DPM reduction by 2020
- Air quality plan relies on regulations to meet the goal; that approach is working.
- Emissions inventories rely on surveys, telephoning, standing on the street and counting, along with existing data sources.

Sources

- Port of Oakland air quality documents:
www.portoakland.com/environment/maqip.aspx
- Maritime Air Quality Improvement Plan (MAQIP):
<http://www.portoakland.com/pdf/environment/maqip090515.pdf>
- Port of Oakland 2012 Seaport Emissions Inventory:
www.portoakland.com/pdf/environment/maqip_emissions_inventory.pdf
- Port of Oakland 2005 Seaport Emissions Inventory:
www.portoakland.com/pdf/environment/airEmissions_Inventory.pdf
- California Air Resources Board seaport regulations:
www.arb.ca.gov/ports/ports.htm

2012 Port of Oakland Seaport Emissions Inventory Results and Comparisons

2005 Inventory (in tons)	DPM	NOx	ROG	SO2	CO
Ocean-going vessels	209	2484	117	1413	235
Harbor craft	13	345	22	3	83
Cargo-handling equipment	21	766	53	7	408
Trucks	16	334	49	2	149
Locomotives	2	76	7	2	11
Miscellaneous Off-road Equipment	N/A	N/A	N/A	N/A	N/A
Total	261	4005	248	1427	886

2012 Inventory (in tons)	DPM	NOx	ROG	SO2	CO
Ocean-going vessels	57	2591	176	289	232
Harbor craft	9	235	25	0	95
Cargo-handling equipment	8	413	35	1	207
Trucks	2	135	13	0	49
Locomotives	0	19	1	0	2
Miscellaneous Off-road Equipment	0	4	1	0	4
Total	77	3398	250	290	589

% Change from 2005	DPM	NOx	ROG	SO2	CO
Ocean-going vessels	-72.4%	4.3%	50.2%*	-79.5%	-1.3%
Harbor craft	-30.3%	-31.8%	10.6%	-94.1%	14.2%
Cargo-handling equipment	-62.8%	-46.0%	-33.3%	-92.1%	-49.2%
Trucks	-87.6%	-59.5%	-74.3%	-90.0%	-67.3%
Locomotives	-77.2%	-74.7%	-82.5%	-99.6%	-81.2%
Miscellaneous Off-road Equipment	N/A	N/A	N/A	N/A	N/A
Total	-70.3%	-15.2%	0.8%	-79.7%	-33.5%

Legend	
DPM	Diesel Particulate Matter
NOx	Oxides of Nitrogen
ROG	Reactive Organic Gases
SO2	Sulfur Dioxide
CO	Carbon Monoxide

*denotes a recent revision in CARB's emission factor for ROG, resulting in an increase of calculated emissions

2012 Diesel Particulate Matter (DPM) Results and Future DPM Projections

DPM EMISSIONS (% REDUCTION SINCE 2005)		TEU* Growth Scenario							
		None		Low		Medium		High	
Source Types	2012 Progress to Date	2015	2020	2015	2020	2015	2020	2015	2020
On & Near-Shore	-66.0%	-78.4%	-86.8%	-77.9%	-86.3%	-77.9%	-86.1%	-77.9%	-86.0%
Off-Shore	-76.6%	-81.3%	-81.4%	-81.3%	-81.4%	-81.3%	-81.4%	-81.3%	-81.4%
Total	-70.3%	-79.6%	-84.6%	-79.3%	-84.3%	-79.3%	-84.2%	-79.3%	-84.1%
		No TEU growth 2012-2020		2% annual TEU growth 2012-2020		2% annual TEU growth 2012-2016; 3% annual TEU growth 2017-2020		2% annual TEU growth 2012-2016; 4% annual TEU growth 2017-2020	

DPM EMISSIONS (IN TONS)			TEU Growth Scenario							
			None		Low		Medium		High	
Source Types	2005	2012	2015	2020	2015	2020	2015	2020	2015	2020
On & Near-Shore	155	52	33	20	34	21	34	21	34	21
Off-Shore	106	25	20	20	20	20	20	20	20	20
Total	261	77	53	40	54	41	54	41	54	41
			No TEU growth 2012-2020		2% annual TEU growth 2012-2020		2% annual TEU growth 2012-2016; 3% annual TEU growth 2017-2020		2% annual TEU growth 2012-2016; 4% annual TEU growth 2017-2020	

Key Assumptions:

On and near-shore emissions have the greatest impact to diesel particulate matter health risk exposure. On and near-shore emissions are comprised of emissions from cargo-handling, harbor craft, locomotive, miscellaneous off-road equipment, trucks, and ocean-going vessel maneuvering and berth modes.

Off-shore emissions are comprised of emissions from ocean-going vessel cruise, anchorage, and reduced speed zone modes.

Number of vessel calls remains flat.

Existing regulatory deadlines remain unchanged.

Implementation of future programs may further reduce DPM emissions but is not assumed in this analysis.

*TEU equals twenty foot equivalent unit

Analysis prepared in September 2013. Version 2

Questions?

