



MAERSK

Maersk Line Pilot Fuel Switch Initiative
APM Terminals New Portsmouth VA Marine Terminal



Lee Kindberg
Director, Environment

18 June 2008

Maersk West Coast Air Quality Initiative

Voluntary program reduces air emissions

From Bunker, avg. 2.5% sulfur
To Distillate, avg. 0.1% sulfur

California:

- Auxiliary - 24nm from coast
 - Voluntary to <0.2%
 - More than complied with CA aux. engine rule
- Main engine - 24nm from port

Vancouver & Tacoma:

- Voluntary
- Low sulfur fuel while at dock



Mærsk Mc-Kinney Møller stands on the dock at Pier 400 in Los Angeles with the Sine Maersk at berth behind him. The vessel was the first to perform a fuel switch as part of a Maersk Line pilot environmental initiative in California.

Vessel Fuel Switch

- Why Take This Step?
- Emissions Reductions
- Program Status and Statistics
- Engine Types – Maersk Owned Vessels
- Fuels Carried Onboard and Fuel Availability
- Program Costs
- Crew Training
- Challenges
- Current Emissions Reduction Initiatives
- Contact Details



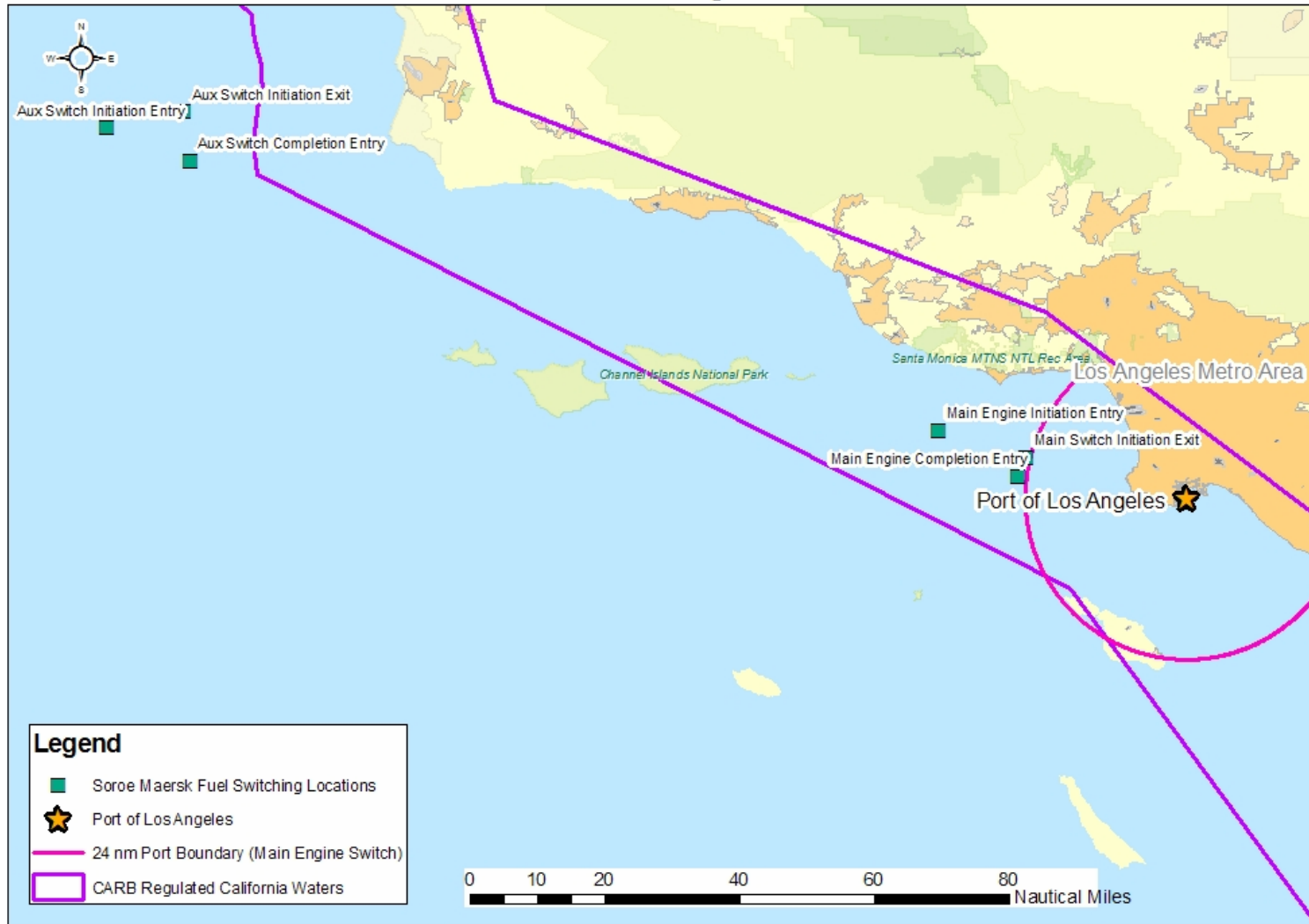


Applicability

- Main & Auxiliary Engines change from 'bunker' fuel to distillate fuel (LSDO) with sulfur content below 0.2%

- All Maersk vessels calling California
 - In and outbound
 - 24 NM from arrival port for main engine
 - 24NM from California baseline (RCW) for auxiliary engines (may be much farther from port)
 - In Port
 - Phase-in started with Sine Maersk March 31, 2006

- All vessels at dock in Vancouver and Tacoma
 - Started in 2007

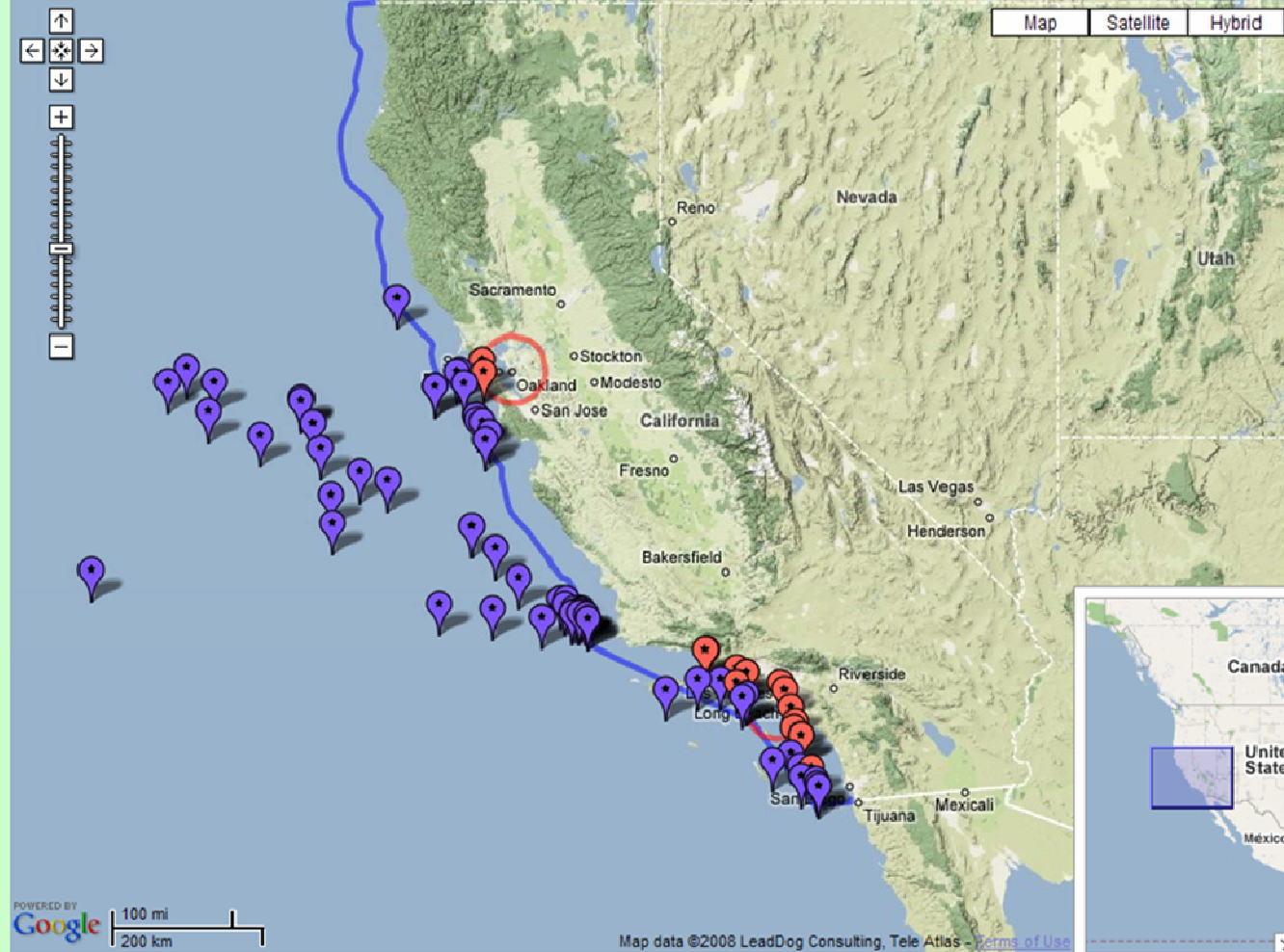


Maersk Fuel Switching Locations - California Regulated Waters

Choose a voyage from the drop-down menu to see fuel switch path: 05/05/2007 - NEDLLOYD DRAKE - (549)



MAERSK Fuel Switch Locations: Auxiliary Engine Entry



Auxiliary Engine Fuel Switch Locations



Meets fuel switch location requirement



Does not meet fuel switch location requirement

Reasons

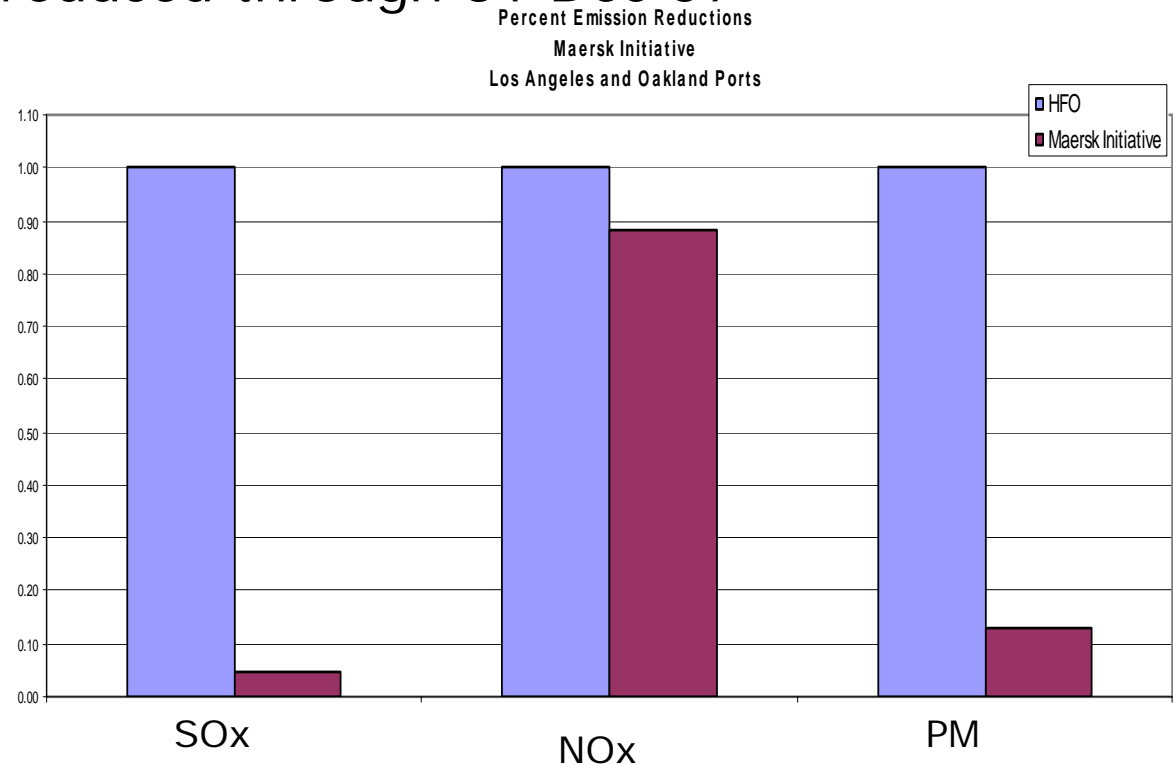
- Maersk Line's response to increased pressure to install Cold Ironing
- Immediate emission reductions for the Ports of Los Angeles & Oakland
- Mobile solution, rapid implementation
- No expensive shore infrastructure required
- Does not shift emissions to other power sources or locations
- Part of Maersk's ongoing evaluation of initiatives for environmentally responsible operation



Emissions Reductions

→ 760 tons vessel-related emission reductions annually with over 1100 tons reduced through 31 Dec 07

- SOx 95 %
- PM 86 %
- NOx 11 %



Data based on Year 2007 Vessel Calls at Los Angeles and Oakland Ports



Number of vessels	105 different vessels (through 31 Dec 07) Owned and charter participate.
Number port calls with fuel switching	577 reported fuel switches (2 Apr 06 - 31 Dec 07)
Consumption of LSDO per Switch – Main & Auxiliary Engines	27.3 MT (<i>Based on fuel consumption 02 Apr 06 – 31 Dec 07</i>)
Fuel sulfur content	averages: HFO 2.50% S LSDO 0.13% S (0.09% recently)
Reductions Achieved compared to burning Residual Fuels	Total Emissions: Approx. 1130 tons through December 31, 2007 PM: 86% SOx: 95% NOx: 11% (from NOx-Reduction mode in Auxiliary Engines) Data analysis by ENVIRON

Main Engines – Maersk Owned Vessels

- MAN B&W
 - 12K90MC
 - 10K90MC-C

- Sulzer Wartsila
 - 12RTA96C
 - 12RT-flex96C
 - 9RTA84C



Auxiliary Engines – Maersk Owned Vessels

- MAN B&W
 - Holeby 7L32/40
 - Holeby 8L28/32
 - Hyundai 8L27/38

- Sulzer Wartsila
 - 6R32E

- Daihatsu
 - 6DK-32

- MAK Caterpillar
 - 6M32C





Fuels Carried Onboard

→ Residual Fuels

- RMH 380 / 700

- RMK 380 / 700

→ Distillate Fuels

- DMX – for Emergency Generator & Lifeboat Engines

- DMA

- DMB

→ Initially MGO was used for the switch; vessels are now allowed to use MDO grade DMB.

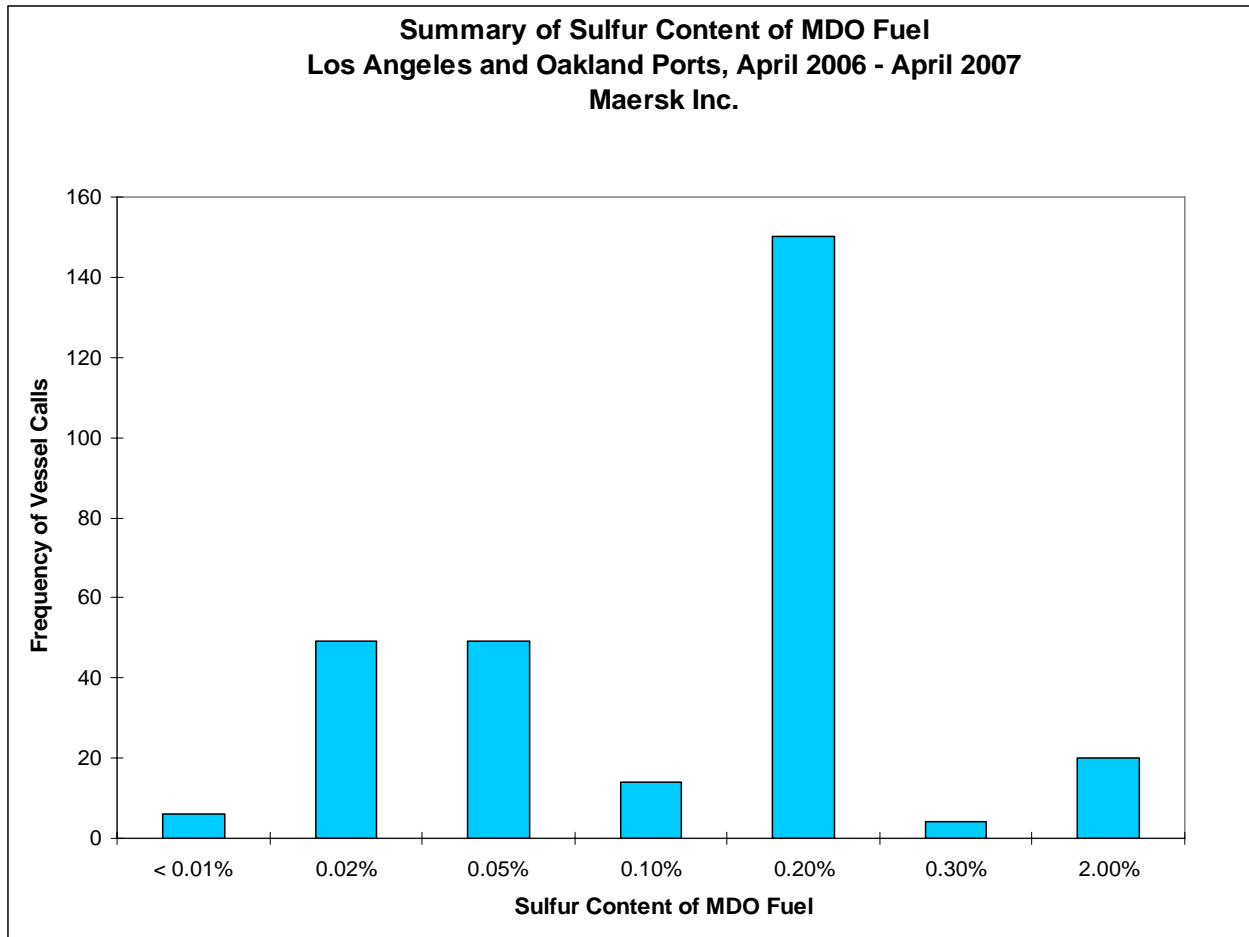
→ Vessels are equipped with separate service tanks for Residual and Distillate fuels



LSDO Availability (as of fall 2007)

- Sourcing is handled globally by Maersk Bunker
- US West Coast
 - Mainly Los Angeles & Oakland
 - No Problems in sourcing
 - Good Quality – Inland Distillate
 - Main Supplier – Chemoil – Approx. 80% Volume – Price Driven
 - Average Stem 200 MT
- Far East
 - Japan – Available – Expensive
 - Singapore / Hongkong – Difficult to source
- Europe
 - Rotterdam – Difficult to source – Expensive when available

Fuel Switching Summary



Crew Training

- Crew advised to follow change over procedure as per engine manufacturer instructions
- Change over considered 'Normal Engineering Practice'
- No special training provided
- Maersk crews are trained to ISO 14001 Environmental Management Systems



Challenges

- No significant problems encountered to date on vessels due to fuel switch.
 - Care required in switching
 - Engines run on LSDO for short periods of time
 - Some fuel pump issues

- In case of longer running, manufacturers suggest change over of cylinder lubrication oil with lower base number.

- Timely data collection was especially challenging in the early months, and still represents a challenge.

Costs and Implementation

- No capital investment required – vessel or port
 - Rapid implementation (weeks vs. years)
 - No personnel safety or training issues
- BUT:
- Fuel cost differential is substantial
 - Some care needed in switching



Current Emission Reduction Initiatives

→ Slide valves

- MAN main engines
- Improves the combustion process
- Reduces visible smoke and PM
- Less maintenance
- (less fuel oil consumption/CO2 emission)

→ SIP cylinder lubrication system

- Reduces cylinder oil consumption
- Reduces PM emission

→ Waste Heat Recovery system

- 10% more mechanical energy output
- Large and complex installation
- 10% reduction in all emissions; SO_x, PM, NO_x & CO₂
- Hot exhaust gas -> steam -> electricity -> electric motors

Current Emission Reduction Initiatives

→ Electronically controlled injection in engines

- Improved combustion in low-load condition
- No visible smoke – less PM emission
- Less fuel oil consumption due to better combustion

→ Voyage Efficiency System

- Sharing of sea current data between ships
- Voyage optimization based on input from MET services, sea current and other sources
- Less fuel oil consumption due to less distance traveled at high speed

→ Maersk Ship Performance System

- Monitor propeller and hull efficiency
- Optimize hull and propeller cleaning intervals
- Monitor trim optimization
- Monitor engine performance

Current Emission Reduction Initiatives

→ Selective Catalytic Reduction

- Test installation on one aux. engine in one ship
- Monitored with regard to efficiency in port areas / low load situations
- Mixed results in combination with low-sulphur distillate operation

→ Emission & Energy Saving Project

- Identification of areas where fuel can be saved by optimization of processes
- Significant savings obtained by monitoring buffer time build up during transit



Contact Information

Lee Kindberg

Director, Environment

Health, Safety, Environment & Quality

MAERSK INC.

6000 Carnegie Boulevard

Charlotte NC 28209-4637

e-mail: namenviro@maersk.com

(704) 571-2693

Jai K. Alimchandani

Manager, Regulatory Affairs

Technical Organisation

A.P. Moller – Maersk

50 Esplanaden

DK 1098 Copenhagen

Denmark

jai.alimchandani@maersk.com

(310) 525 9454

+45 2361 3919

APM Terminals

Marine Terminal – Portsmouth Virginia

A Roadmap To The Future





APM Terminals Virginia



- Largest privately owned marine terminal in North America
- A marriage of technological innovation and environmental stewardship
- A partnership with local, state and federal agencies along with surrounding communities
- Will bring an estimated \$6.4 billion dollars into Portsmouth and surrounding communities over next 15 years

Engineering Highlights



- 291-acre facility sits along Virginia's historic Elizabeth River
- 1 million TEUs per year, expandable to 2 million
- Crane fleet features 6 post-panamax, can support up to 12
- 30 rail-mounted, remote-controlled gantries
- On-site rail yard has six tracks, also expandable to 12
- Direct access from main highway (no impact to neighborhoods)

Technological Achievements

Here's a closer look at some of the innovative and energy efficient uses of technology in Virginia...

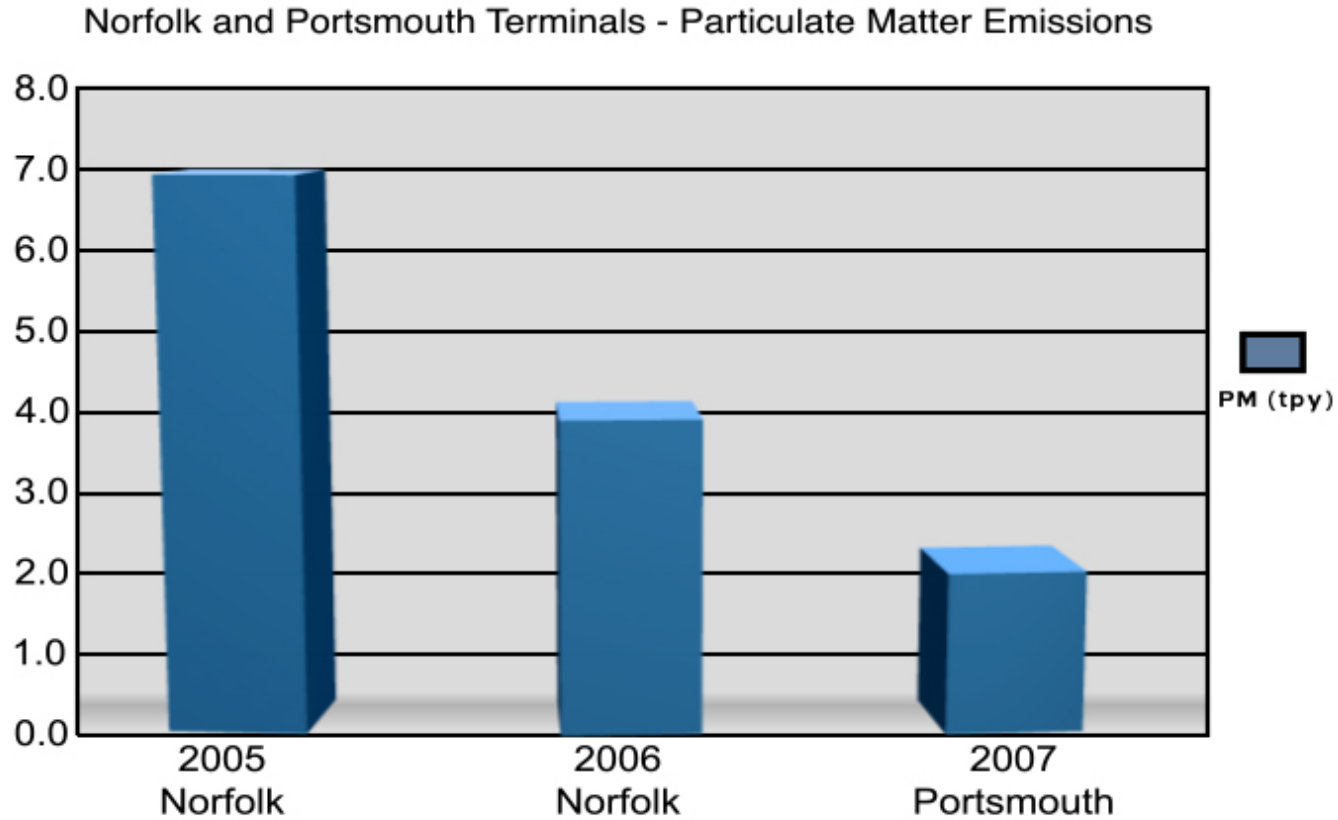
How We Reduced Emissions



- Electrified ship-to-shore cranes
- Automated electric RMGs
- Improved container management and logistics
- Use of yard trucks that meet 2010 emission standards
- Use of ultra low sulfur diesel fuel for container handling equipment
- 40-acre on-dock rail yard



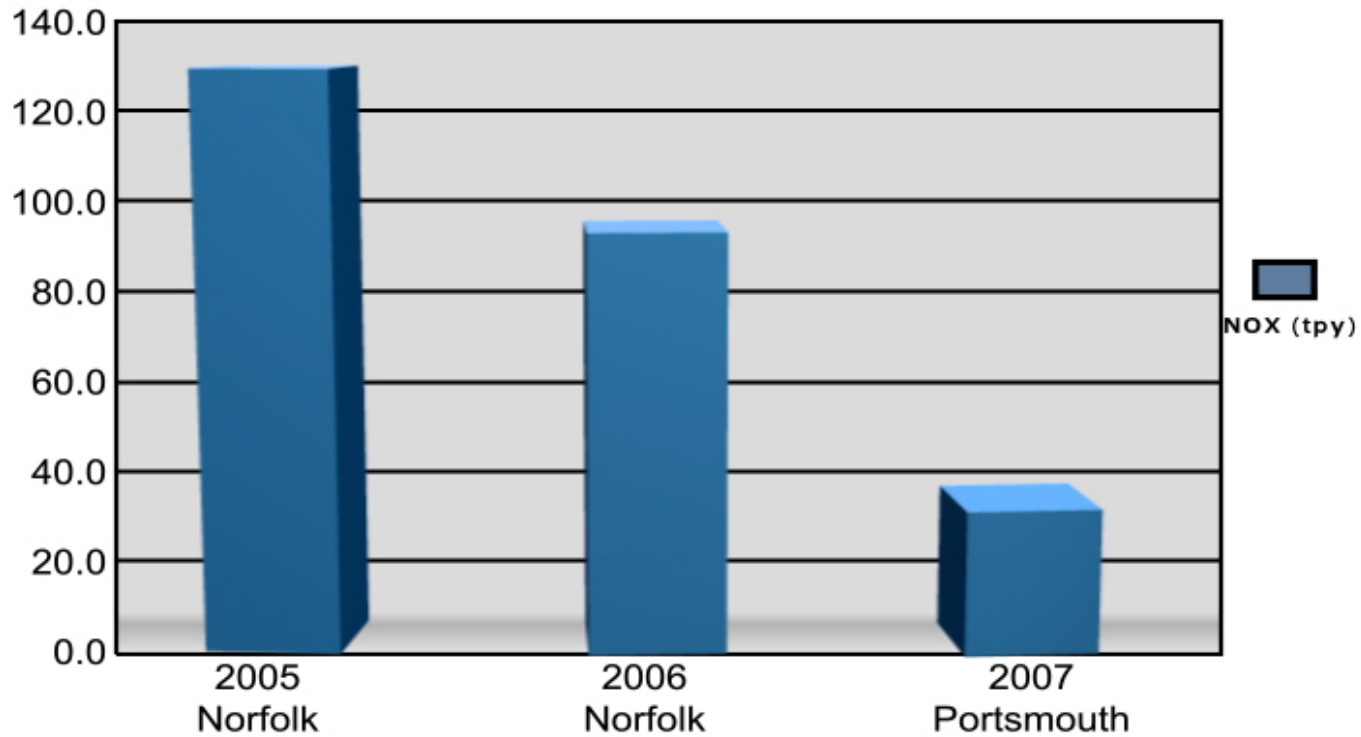
Reduced PM Emissions





Reduced NOx Emissions

Norfolk and Portsmouth Terminals - NOx Emissions

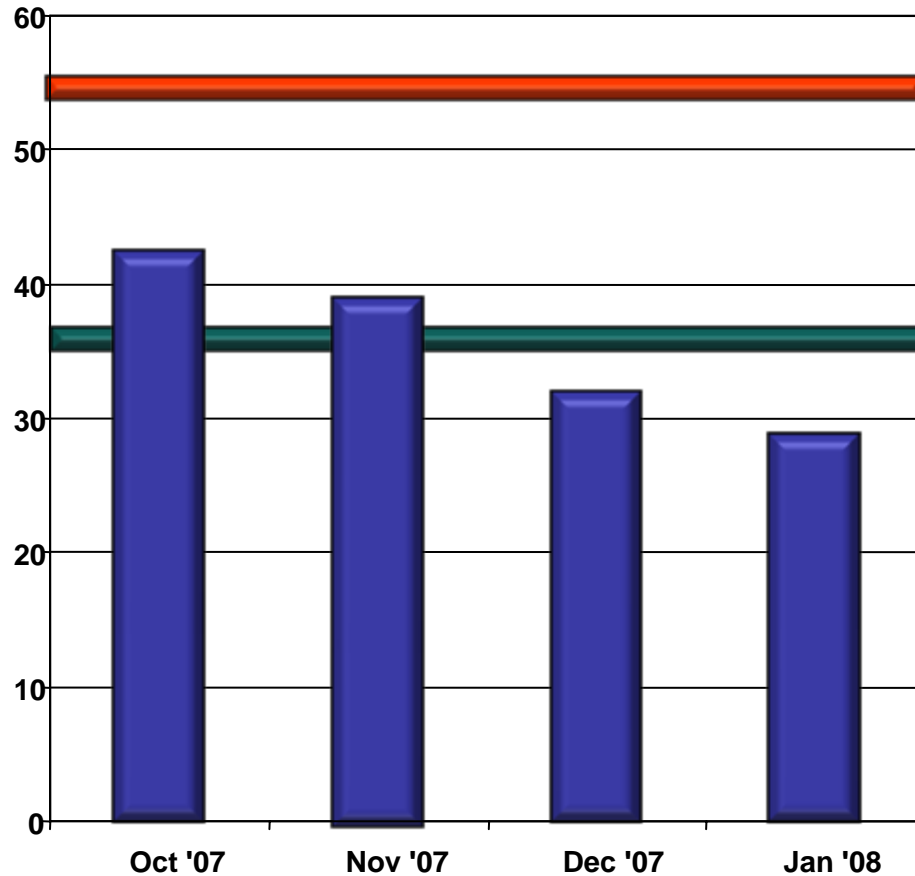


How We Reduced Emissions



- Electrified ship-to-shore cranes
- Automated electric RMGs
- Improved container management and logistics
- Use of yard trucks that meet 2010 emission standards
- Use of ultra low sulfur diesel fuel for container handling equipment
- 40-acre, on-dock rail yard
- Use of RFID technology to reduce queue and idle times for OTR

Reduction in Truck Turn Times



- Los Angeles Turn Time
 - Old Norfolk Turn Time
 - New Portsmouth Turn Time*
- *Truck Turn Times reduced by approximately 50% from Norfolk



Partnerships—The Real Way To Success

Key collaborations with local, state and federal agencies helped to “fast track” our environmental protection plan

- **Army Corps of Engineers**
- **Virginia’s Department of Game and Inland Fisheries**
- **U.S. Coast Guard**
- **Virginia’s Department of Environmental Quality**
- **Governor of Virginia**
- **Mayor of Portsmouth**
- **Local Communities**
- **Elizabeth River Project**
- **Regional Native American Leaders**

Our Commitment To The Environment

- Elizabeth River Project identified restoring healthy river bottom habitats as their highest priority
- Voluntarily established the \$5 million dollar “Living River Restoration Trust” to clean and repair endangered sections of the river
- Trust created a 13-acre oyster reef
- Created 17 acres of tidal wetlands and purchased 13 acres of non-tidal wetland credits
- Permanently conserving 110-acre green belt around the facility



Contact Information – APM Terminals

Blake Harmon
General Manager, Compliance

Lee Kindberg
Director, Environment

APM Terminals North America Inc.
6000 Carnegie Boulevard
Charlotte NC 28209-4637

MAERSK INC.
9300 Arrowpoint Blvd.
Charlotte NC 28273

e-mail: bharmon@apmtnam.com

e-mail: namenviro@maersk.com

(704) 571-5542

(704) 571-2693