Summary of Options

This document provides marine port authorities and terminal operators with an overview of strategies that can be implemented to reduce air emissions from daily operations. These strategies are organized to provide a tiered approach to "greening port operations" based on cost and existing infrastructure, beginning with low cost/no cost strategies. EPA's Clean Ports USA program and the Northeast Diesel Collaborative Ports Workgroup are focusing on diesel emissions reductions due to their large potential to improve public health. These efforts are part of a broader effort to increase port sustainability, including programs such as Environmental Management Systems and Portfields (see **www.epa.gov/brownfields/policy/initiatives_sb.htm#pi**).

The Clean Ports USA and Northeast Diesel Collaborative websites provide both national and regional overviews of these and other options, as well as case studies. See **www.epa/gov/cleandiesel/ports/**, **www.epa.gov/cleandiesel/ports/stratapp.htm** and **www.northeastdiesel.org/**

For more information on any of these voluntary options, please contact EPA NE staff:

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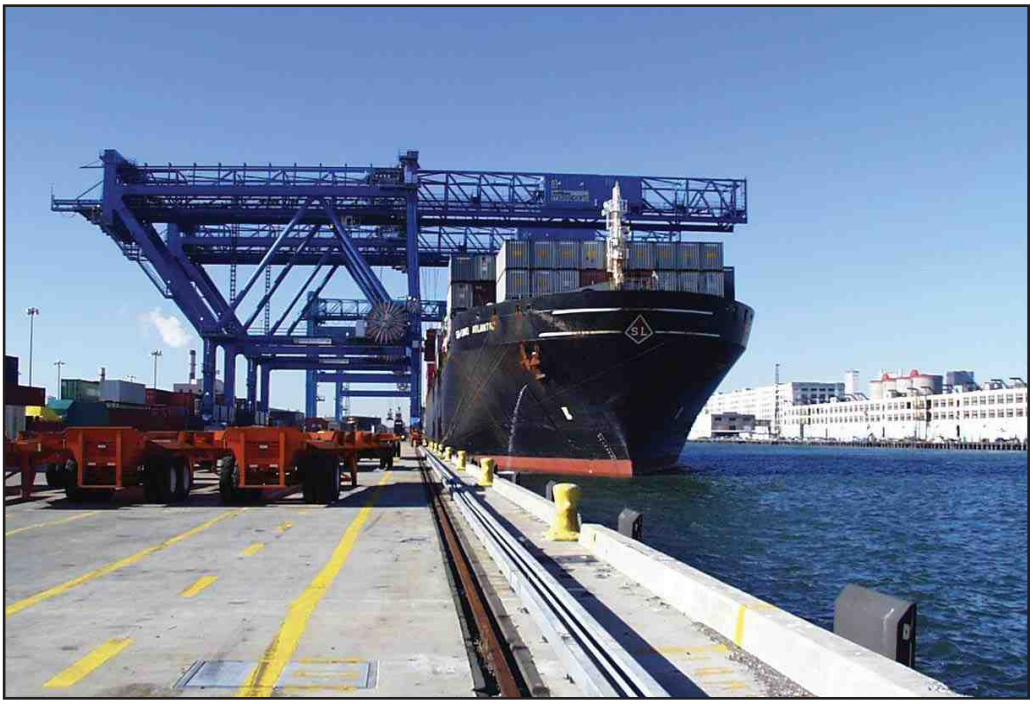
EPA United States Environmental Protection Agency New England

Ports Summary/June 2008

EPA New England

Options for the Marine Ports Sector: Green Strategies for Sustainable Ports



Overview

The engines and equipment used at ports, including cargo handling equipment, trucks, locomotives, tugboats, ferries and ships, can contribute significantly to the levels of fine particulates (PM2.5), sulfur dioxides (SO2) and ozone-forming nitrogen oxides (NOx) and hydrocarbons (HC) in the air. All of these pollutants contribute to PM2.5 pollution, with NOx and HC also contributing to gound-level ozone (smog). Both ozone and PM2.5 can adversely affect human health, especially children and people with asthma or heart disease. All of Connecticut, Massachusetts, and Rhode Island, as well as coastal Maine and New Hampshire, experience days when ground-level ozone concentrations exceed the air quality health standard. Two Connecticut counties, New Haven and Fairfield, are designated nonattainment for the PM2.5 annual standard, and are also violating EPA's 24-hour PM2.5 standard (adopted in 2006). New England asthma rates (above 10% in each state) are among the highest in the country. Reducing exposure to diesel exhaust wherever it occurs, including in and around ports, is an important public health and air quality priority for EPA New England.

Consistent with EPA's national Clean Ports USA program, EPA New England aims to encourage ports to undertake voluntary emission-reduction measures by providing education, assistance and other incentives. This non-regulatory approach can address emissions from existing diesel engines and nonroad equipment that are not affected by EPA's standards for diesel fuel and newly manufactured diesel engines.

Leading ports around the country are reducing diesel emissions to respond to customer needs, community pressures, and/or their own environmental priorities. Ports such as LA/Long Beach, New York/New Jersey, Boston, Virginia, Charleston, Seattle, Tacoma, and

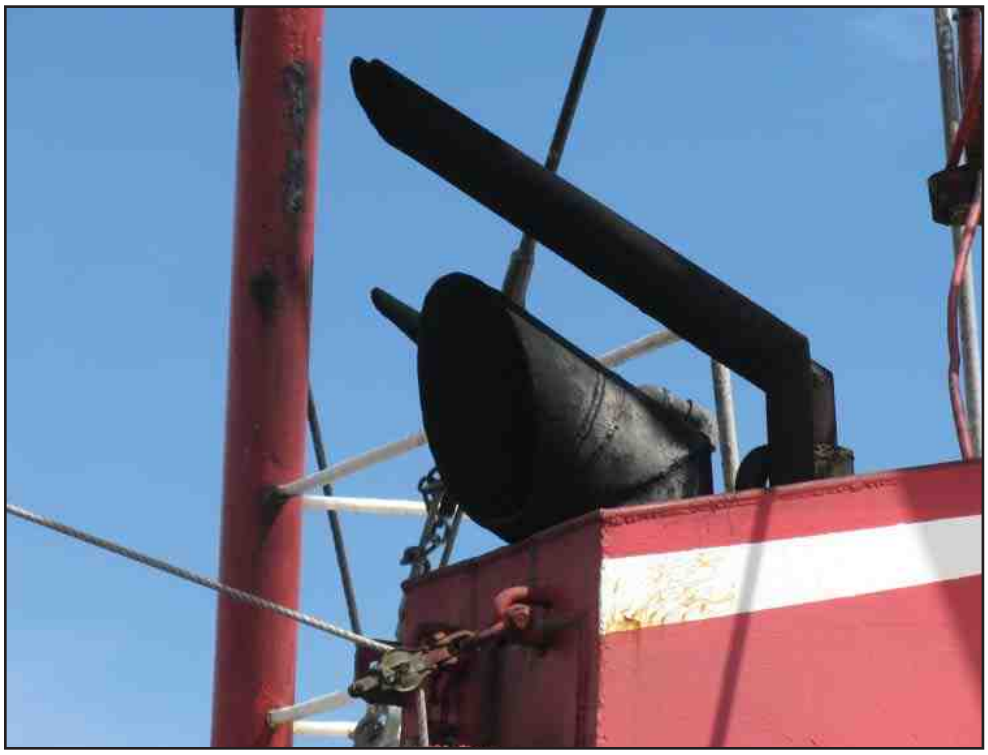
(continued)

(cont.) Overview

many others are stepping forward to work with their tenants and customers to reduce diesel pollution. (Read about their efforts at **www.epa.gov/diesel/ports/casestudies.htm**.) Businesses that move freight are increasingly challenged by shareholders, insurance companies, and customers to reduce their emissions footprints (e.g., the Carbon Disclosure Project).

Business leaders recognize that sustainability equals profitability. The American Association of Port Authorities is working to develop and implement a sustainability framework for its members. Sustainable ports consider their operations in an all-inclusive manner, and air quality is a great place to start because cost-effective, verified technologies and cleaner fuels are available to reduce these emissions.

Ports and terminal operators can choose from a number of strategies for reducing truck and bus idling.



Tier I: Environmental Stewardship - Idle Reduction, Cleaner Fuels, Environmental Management Systems, and Vessel Speed Control

The following options can save ports and their customers money while reducing emissions.

1. Reduce Idling Time and Optimize Terminal Layout — Reducing idling time of vehicles, vessels and equipment operating in, near, or around port terminals provides immediate and measurable local reductions of harmful pollution at little to no cost to the port authority or terminal operator.

By reducing unnecessary truck or bus idling, a driver can save several gallons of fuel per day (significant at today's high fuel prices, and low profit margins for drayage companies), and ports gain the benefit of improved community relations. Improved gate control can both reduce idling time and increase security.

The following are divided into (a) strategies for addressing existing traffic; and (b) strategies for addressing traffic associated with expansion of facilities.

a. Existing truck and bus traffic: Idling can be reduced via
   i. Policy
   ii. Signage
   iii. Outreach
   iv. Policing/enforcement
   v. Gate management and terminal appointment systems
   vi. Waiting areas for drivers and passengers

b. Port and facility upgrades: In the strategic/master planning phase, examine how people and cargo will move into, out of and within the port, and what new on-dock equipment will be required.

Consider:
   i. Facility layout, flow and access
   ii. Gate control and scheduling
   iii. Software to maximize efficiency in container exchange and intermodal transfers (e.g., eModal's Virtual Container Yard)
   iv. Waiting rooms for drivers and passengers
   v. Idling policy, signage, outreach, and enforcement strategies
   vi. Equipment powering options, including hybrid, variable idle speed, and electric "shore power" (easier to integrate into plans for new facilities than to retrofit into existing facilities)

Port authorities may want to consider including anti-idle provisions in tenant leases when making any adjustments to leases. EPA NE is glad to assist port authorities and terminal operators in crafting policies and signage consistent with best practices and state idle limits. EPA NE, via the SmartWay Transport Partnership, provides information on how to reduce idling, including drayage control strategies (gate management, scheduling, etc.) and shipper strategies that apply to port terminals (driver waiting areas, etc.). SmartWay also provides partner shipper, carrier, logistics and affiliate organizations with valuable individualized technical assistance and public recognition. See **www.epa.gov/otaq/smartway/smartway_shippers_strategies.htm, www.epa.gov/otaq/smartway/swresources.htm#drayage** and **www.epa.gov/smartway/partnerships.htm**

2. Cleaner Fuels — Early transition to cleaner low or ultra-low sulfur diesel fuels provides immediate and substantial emissions reductions from port operations as a drop-in solution. Many major terminal operators and shipping lines (e.g., Maersk/APM Terminals, Husky, SSA Marine, K-Line) have received very favorable press regarding their switch to cleaner fuels, enhancing their public image.

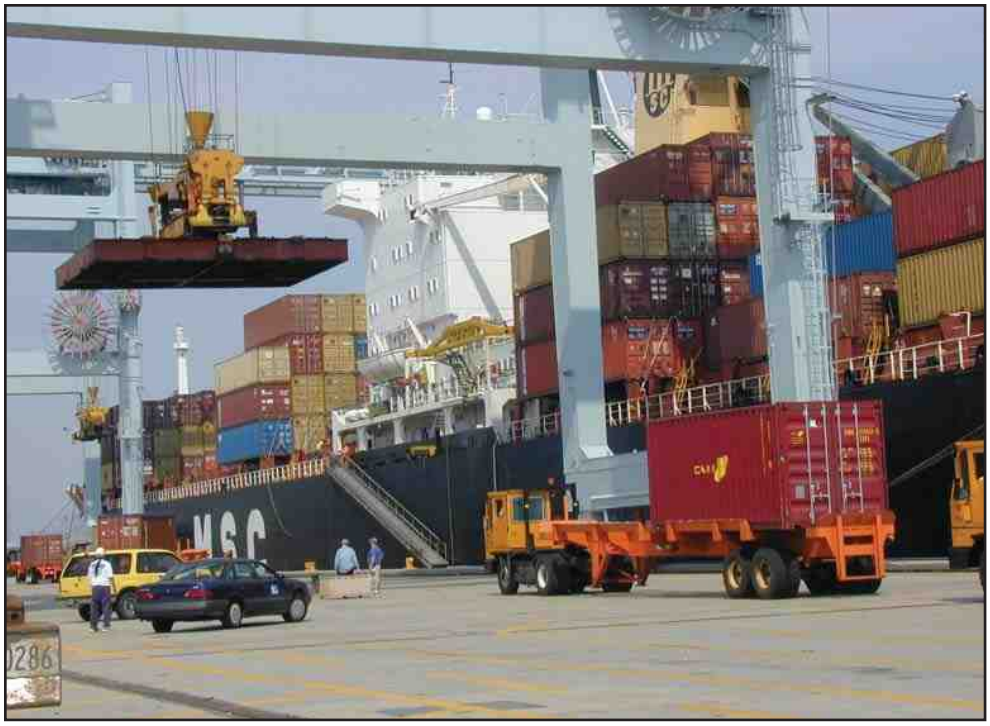
ULSD tends to cost slightly more per gallon than LSD, but this price gap is expected to narrow and disappear as ULSD becomes ubiquitous. This is a relatively low-cost option with the potential for measurable and immediate benefits for workers and neighborhood environments.

Biodiesel, a domestically produced, renewable fuel that can be manufactured from new and used vegetable oils and animal fats, can be blended with petro-diesel. Biodiesel reduces air pollutants such as particulate matter (PM), carbon monoxide (CO), hydrocarbons (HC) and toxics. B5 (5% biodiesel and 95% petroleum diesel) and B20 (the other popular blend) provide about equivalent performance. With higher-bio blends, an additive may be needed for cold-weather operation. While

In addition to setting standards for new engines, EPA has taken steps to reduce the sulfur content of diesel fuel sold for on-road and nonroad use:

- In October 2006, ultra-low sulfur diesel (ULSD) fuel (15 ppm) became available nationwide.

- Beginning in June 2007, EPA's Nonroad Locomotive and Marine Rule (NRLM) requires refiners and importers to begin producing low-sulfur (500 ppm) diesel fuel for use in nonroad, marine and locomotive engines. In June 2010, nonroad diesel fuel—except for marine and locomotive—will transition to ULSD. In June 2012, locomotive and marine fuel will transition to ULSD.



prices fluctuate, biodiesel can cost slightly more per gallon than regular diesel fuel. Increasingly, engine warranties are permitting biodiesel use, and an ASTM standard for biodiesel (D6751) has been developed; for more information see **www.biodiesel.org**.

Emulsified Diesel is a blend of diesel fuel, water, and other additives that reduces emissions of PM as well as NOx. Emulsified diesel can be used in any diesel engine, but the addition of water reduces the energy content of the fuel, so some reduction in power and fuel economy can be expected. Emulsified fuel will stay mixed for a fairly long time, but if a vehicle sits dormant for months at a time the water can settle out of the fuel and possibly cause problems. There is a small price premium over regular diesel.

3. Environmental Management System (EMS) — An EMS is a comprehensive, systematic approach to identifying and managing all environmental aspects of a port's operation. Ports in New England and elsewhere that have invested the time to develop EMSs report that they more than pay for themselves. A port with an EMS is seen as proactive and responsible. Having an EMS provides the appropriate structure for integrating environmental, asset and security programs for easier management. The Plan-Do-Check-Act discipline built into an EMS can be set up to flag opportunities to upgrade equipment and pursue other efficiencies on a routine basis. Knowledge is transferred from individuals to the organization. Some big shippers and carriers are ISO 14001 certified, and are therefore looking to develop relationships with ports that have or are on their way (via EMS) to ISO certification.

Port authorities can ease into the process of developing an EMS by drawing the "fenceline" rather narrowly (starting with one facility or operation), and/or by hiring a consultant to facilitate the process. Some ports who have done an EMS recommend doing most of the work in-house to create buy-in and develop staff expertise. The scope of the EMS can be gradually expanded, ideally even to tenant operations.

EPA NE staff (see **www.epa.gov/region1/ems/index.html)** and EPA Ports Sector contact Kathleen Bailey (see **www.epa.gov/sectors/ports/index.html**) are available to help get you started.

Please consider the following in switching to ULSD, biodiesel, or other fuels:

Visually inspect the engine and fuel system (filter, pump, lines) initially and then periodically thereafter to confirm system integrity. Conduct a fuel analysis before and after switching fuel to monitor changes. The fuel analysis should include, at the least, results and specifications for sulfur, cetane, aromatics, lubricity, distillation, and flash point.

Monitor and change fuel filters as necessary, since the new fuel may precipitate residues out of the engine and fuel system. Some equipment managers recommend changing fuel filters after 2 or 3 tanks of fuel.

Tier I

4. Harbor Speed Limits/Marine Vessel Speed Reduction — Developing a voluntary speed reduction (VSR) program is a low cost way to reduce emissions, particularly NOx, in and around the harbor. The Port of Long Beach adopted a Voluntary Commercial Cargo Ship Speed Reduction Program in 2005 that asks vessels traveling in and out of the ports to adhere to speeds at or below 12 knots within 20 nautical miles of the coast. Cooperating operators can qualify for Green Flag recognition and 15% lower docking fees. CARB has estimated NOx reductions of 4-8% are being achieved. For more information, see **www.polb.com/environment/air_quality/emissions.asp**.

Tier I

A port with an Environmental Management System is seen as proactive and responsible.

Tier II: Technology Strategies - Retrofit, Repower, or Rebuild Equipment

Adding verified emissions control devices (retrofitting), repowering or rebuilding engines, or replacing equipment are key strategies for reducing emissions. Many terminal operators are taking advantage of EPA's more stringent engine standards to achieve emissions reductions through early fleet turnover. More information about each strategy can be found at **www.epa.gov/cleandiesel/ports/technologies.htm**.

Tier II

1. Retrofit — Existing diesel engines can be retrofitted with EPA-verified advanced pollution control technology ("aftertreatment" devices) to reduce emissions of PM, HC, CO and NOx. A number of technologies exist for both onroad and nonroad engines, including:

a. Diesel Oxidation Catalyst (DOC)
b. Diesel Particulate Matter Filter (DPF)
c. Selective Catalytic Reduction (SCR)

EPA and the California Air Resources Board (CARB) verify the emissions performance of retrofit technologies. These devices tend to be cost-effective on a dollar-per-pound-

Tier II

of-pollution basis. Workers and others exposed to exhaust from these engines can experience substantial benefit from retrofit devices. DOCs are the least expensive, can be used with either LSD or ULSD fuel, and are verified for use on a wide variety of dockside equipment as well as construction vehicles and trucks. DOCs reduce particulate matter emissions between 20 and 40 percent. DPFs provide approximately 90 percent particulate matter reduction, but are somewhat more expensive, require ULSD and higher operating temperatures, and are also verified for use on a wide variety of dockside and other equipment. Flow-through filters offer good emission performance with expanded temperature operating conditions. Selective Catalytic Reduction devices (SCRs) primarily reduce NOx emissions (unless paired with a DPF or DOC), and are verified for a narrower range of equipment (including some vessels).

2. Repair/Rebuild — Through routine maintenance and repairs, owners and operators can prevent premature engine failure, and ensure that engines are operating at maximum power and efficiency and meeting emissions standards. In addition, timely maintenance can identify opportunities to rebuild engines using cleaner and more efficient components that can help reduce emissions during the remaining useful life of the equipment.

3. Repower and on-dock supply options — It can make sense to replace a failing or very dirty old engine in a useful chassis with a newer, cleaner diesel engine or one that can use an alternate fuel or source of power (propane, electricity, etc.). Some equipment can be repowered with a cleaner onroad diesel engine. Repowering is most appropriate for equipment that has a useful life much longer than that of the engine. The cost of the new engine is at least partly offset by better fuel efficiency and reliability, easier diagnostics, an extended warranty, and a reduction in maintenance costs. (Crane electrification is a good example of this, and one for which many ports have made an attractive business case.) If the chassis or other components are compromised, it may make more sense to plan for replacement.

Some alternative-fuel engines that show particular promise for fuel savings and are being tested at ports include hybrid diesel/electric or diesel/hydraulic engines (to capture braking power) and variable speed drives (to better adjust power output to load, and minimize fuel use during idle). It can also make sense, particularly in doing facility renovations and expansions, to supply "shore power" for refrigerated trailers and long-haul truck cabs to reduce the need for idling, since increasingly these pieces of equipment may have on-board capacity to use an external source of electricity.

For more information on EPA's verification program and for a current listing of EPA verified technologies, please visit: **www.epa.gov/otaq/retrofit/verif-list.htm**

Tier III

The following options require considerable planning, coordination, and investment; however, the public and environmental health benefits of implementing these strategies should not be overlooked. These strategies are being tested on the West Coast where severe air quality problems have resulted in significant government and private investment. Ports on the East Coast may benefit from ensuing technology refinements and economies of scale.

1. Replacement — If equipment has reached the end of its useful life such that repairing, rebuilding and repowering are not cost-effective or practical, replacement is the logical alternative and does not represent "added" cost. An example of this is replacing worn-out forklifts with propane-fueled models, which emit less NOx.

Where local air quality problems are severe, it can even make sense to retire older equipment or vehicles early in spite of the cost and replace them with newer low-emission equipment. Drayage trucks are typically old and not in great repair, and travel and idle in areas near ports where their emissions can have a relatively large impact. Their owners are typically capital-poor and reluctant to accept even free retrofit devices. Some major port areas with severe air quality problems are undertaking programs to scrap and replace port-dedicated drayage vehicles through heavy subsidies or outright purchase.

2. Intermodal shipping — In New England, almost all transport of goods from port to customer is accomplished via truck, which leads to highway congestion and emission impacts. It may be more efficient to shift a portion of this traffic to rail and short-sea shipping modes where possible. (See **www.marad.dot.gov/MHI/documents/I-95_Corridor_Coalition_First_Full_SSS_report.pdf** and **www.portmod.org/news/press/White%20Paper.htm**)

Tier III

Ports can support the development of improved intermodal options by participating in metropolitan, regional, and state–level planning associations and advisory groups managed by transportation agencies. On their own, they can build on-dock connections to existing rail spurs, contract with shippers that use intermodal facilities, and undertake new barge operations. Ports with on-dock rail should consider idle reduction, hybrid or gen-set engines, cleaner fuels and emission reduction technology options for the locomotives operating there.

For more information, see **www.epa.gov/otaq/smartway/documents/intermodal%20shipping.pdf** and **www.epa.gov/cleandiesel/ports/rail.htm**

3. Cold ironing — Depending on the type of vessels frequenting a port, and the duration of their stay, hotelling emissions from cruise and cargo vessels can represent a significant proportion of total emissions. Working vessels such as tugboats that spend hours at a time idling their engines in harbor can also draw shore power instead. Providing shore power allows compatibly-equipped vessels to "plug in" to meet their energy needs in lieu of running their auxiliary engines while docked. Building the necessary port-side infrastructure is a major undertaking, but it offers an effective mechanism for reducing local air pollution. Increasingly, newly built vessels are equipped to meet cold ironing requirements on the West Coast and in Europe, so they would be ready to accept shore power if provided elsewhere.

Cold ironing is a strategy that New England ports will want to keep in mind in planning for a greener future. Ports and utilities could collaborate on supplying shore power at attractive rates, or developing other incentives to make switching to shore power practical and affordable for vessels berthing and calling here. It may make sense to start with tug boats or ferries. Reducing emissions from ships at and near the dock can make a port more attractive to cruise passengers and area neighbors by reducing emissions.

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