Profile The public port sector[4] consists of 85 port authorities and agencies located along the coasts, on estuaries and rivers, and around the Great Lakes. Port authorities develop and maintain many of the shore-side facilities for the intermodal transfer of cargo between ships, barges, trucks, and railroads. Some ports also build and maintain cruise terminals for the passenger cruise industry. In addition, port authority operations may include other entities, such as airports, bridges, ferries, and railroads. While many port authorities directly operate marine terminals, others instead serve as landlords to tenant operations, providing the underlying land and some infrastructure and water-side access, but leaving operations fully in the hands of private tenants.

Trends In recent years, the U.S. port sector has been accommodating a steadily increasing volume of freight carried by larger and larger vessels.

- In 2003, waterborne imports and exports increased by 4% to nearly 1.4 billion tons.[5] Domestic waterborne commerce totaled approximately 700 million tons.[6]
- Imports and exports of containerized cargo at U.S. ports totaled 21.3 million 20-foot equivalents in 2003, an increase of 8% from 2002.[7] Container traffic at U.S. ports is expected to grow by more than 4% annually, resulting in a doubling in traffic volume within the next 15 years.[8]

Sector At-a-Glance

Number of U.S. Ports:	85[1]
Value of Shipments:	$718 billion[2]
Number of Employees:	57,000[3]

In addition:

- From 2003 to 2004, the number of cruises leaving U.S. ports increased by 10% to more than 4,200. The number of cruise passengers increased by 14% to 9 million in 2004.[9]
- In 2002, ports invested nearly $1.7 billion to update and modernize their facilities, including $140 million for general cargo, about $942 million in investments related to containers, and $241 million on infrastructure improvements. Between 2003 and 2007, public ports predict that they will spend $10.4 billion (a record level).[10]

Key Environmental Opportunities

For ports, the greatest opportunities for environmental improvements are in reducing air emissions, improving water quality, managing dredge material, and minimizing the impacts of growth.

The port sector is working to generate better data on the sector's environmental performance. In December 2004, the American Association of Port Authorities (AAPA) initiated a survey of its U.S. member ports. The survey measured interest in environmental issues and identified metrics for environmental activities that U.S. ports are undertaking, primarily on a voluntary basis. Forty-eight (60%) of AAPA's 85 U.S. member ports responded. The results of the survey are described in more detail throughout this chapter.

Reducing Air Emissions Air emissions from diesel-powered boats, ships, and land-based equipment are a concern because of the proximity of many ports to urban areas with high overall levels of air pollution. As illustrated in the *Locations of U.S. Ports and Areas Exceeding National Ambient Air Quality Standards* figure, nearly 40 of the country's largest ports are located in areas that do not meet EPA National Ambient Air Quality Standards for ozone (8-hour standard). Fourteen of those ports are located in areas that also do not meet EPA's fine particulate matter ($PM_{2.5}$) standards.[11]

Using emission inventories, ports can quantify current emissions and develop strategies to decrease air pollution. This section takes a closer look at efforts to reduce diesel emissions and develop emissions inventories at ports.

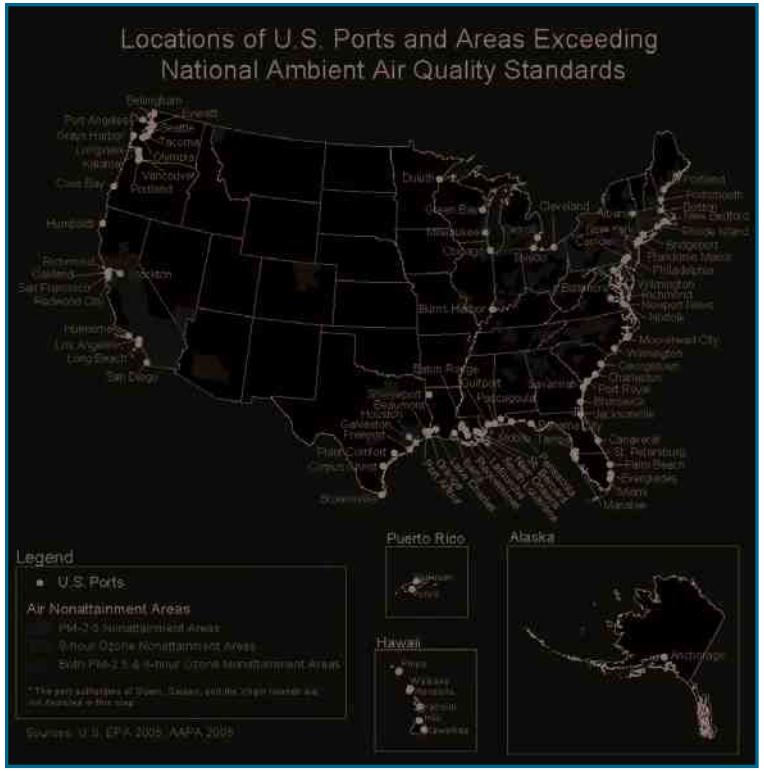
Diesel Emissions Marine vessels, tug-and-tow operations (harborcraft), and land-based cargo-handling equipment, trucks, and trains all contribute to air emissions at ports. Common air pollutants from this transportation equipment, which is primarily diesel-powered, include particulate matter (PM), nitrogen oxides (NO_x), and sulfur oxides (SO_x).

Twelve of the 48 ports that responded to the AAPA survey indicated that they have emission control or reduction strategies, and 14 ports indicated they use low-emission fuel types. Some ports (notably Los Angeles, CA, Long Beach, CA, and Seattle, WA) have installed shore-side power for vessels at berth, which can dramatically reduce emissions by reducing the use of the auxiliary diesel engines that ships use to keep lights, refrigeration, and other equipment and facilities operating.[12]

AAPA and its member ports are involved in a number of cooperative efforts to reduce diesel air emissions. For example, AAPA is working with EPA to establish a national diesel emissions reduction program for ports and related industries called Clean Ports USA. The program offers assistance, grants, and incentives to port authorities to reduce pollution emitted from diesel engines through the implementation of a variety of control strategies.[13]

A related effort on a regional scale is the West Coast Collaborative, which is a partnership among leaders from government, the private sector, and environmental groups in six Western states, Canada, and Mexico who are committed to reducing diesel emissions along the Pacific Coast. The collaborative leverages funds from a variety of sources to implement diesel emissions reduction projects in several industry sectors, including ports. Nine of the 28 projects funded by the collaborative thus far have targeted marine vessels and ports. These projects have reduced air emissions by:

- Increasing the use of ultra-low sulfur diesel, biodiesel, and liquefied natural gas;
- Funding the installation of control technologies such as diesel oxidation catalysts; and
- Educating truckers and equipment operators about strategies to reduce engine idling.[14]



The following case studies illustrate how two ports have reduced PM and NO_X emissions from diesel equipment through the use of control technologies, alternative fueled vehicles, alternative power for ships at dock, and other "green" measures.

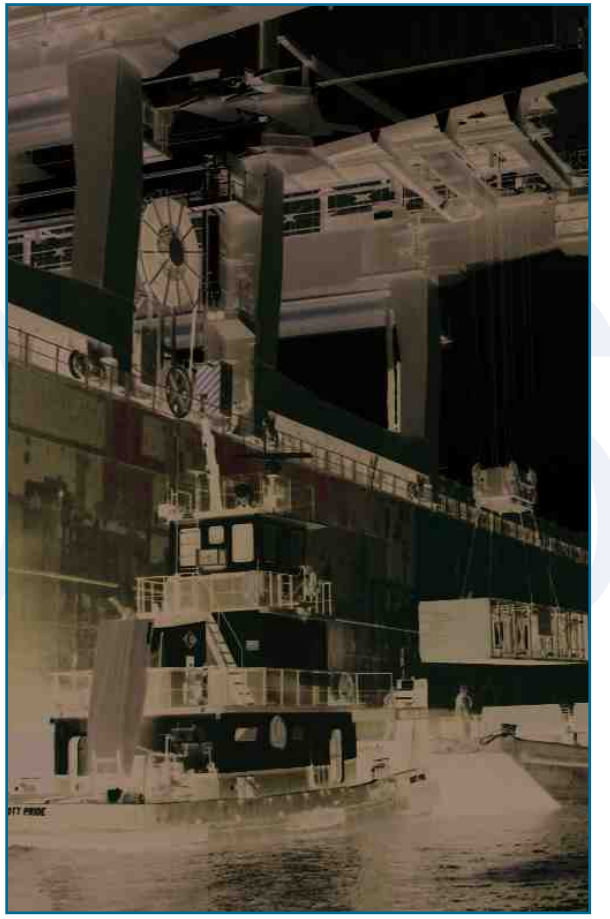
Case Study: Healthy Harbor Long Beach *In 2003, more than 4.6 million containers and other cargo worth $95.9 billion moved through the Port of Long Beach, CA. In order to reduce the impacts of port activity on public health and the environment, the port implemented a series of programs known collectively as Healthy Harbor Long Beach. One of these programs, the Air Quality Improvement Plan, has achieved measurable reductions in air pollutant emissions from port operations, particularly PM from diesel equipment.*

A key component of this effort is the Diesel Emission Reduction Program, which introduced state-of-the-art emissions control technologies and alternative fueled vehicles. The port has installed nearly 600 diesel oxidation catalysts – a pollution-control device installed in the exhaust system, much like a muffler, that removes particulates from exhaust – on all terminal equipment, including utility trucks, forklifts, and cranes. As exhaust gases pass through the honeycomb structure of the catalysts, pollutants are oxidized to water vapor and carbon dioxide. To date, the Diesel Emission Reduction Program has reduced total annual emissions from the port by more than 14 tons of PM and 43 tons of NO_X.[15]

Case Study: Port of Los Angeles' Alternative Maritime Power Program *As the busiest port in the country, the Port of Los Angeles, CA, strives to balance its operations, growth, and development with its role as an environmental steward. In October 2001, the port developed the Alternative Maritime Power (AMP) program to help meet its goal of "no net increase" in air emissions despite the port's continued growth. Rather than using onboard auxiliary diesel engines while at dock, AMP ships "plug in" to shore-side electrical power, which is less polluting. AMP ships eliminate an estimated 1 ton of NO_X and PM emissions per day while in port compared to ships using diesel fuel.*

In June 2004, the Port of Los Angeles and China Shipping Container Line opened the China Shipping Terminal, the first container terminal in the world to use AMP. Five other shipping lines at the Port of Los Angeles have signed memoranda of understanding to implement AMP at their terminals in the future. NYK Shipping Line built the first new vessel to include AMP specifications.

Additionally, the Los Angeles Harbor Commission selected P&O Nedlloyd Container Line's competitive bid to develop the first "green terminal" at the Port of Los Angeles. The agreement requires P&O Nedlloyd, the tenant, to include technology aimed at reducing air pollution in its terminal operations. For example, the tenant will incorporate shore-side power for vessels, rail access that will reduce the number of truck trips, use of low-sulfur or alternative fuel, clean yard equipment, and other programs consistent with the port's environmental management system.[16]



Emissions Inventories Emissions inventories enable port authorities, those doing business at ports, and other interested parties to understand the air quality impacts of current port operations, as well as port expansion projects and projected growth in port activities. An inventory also provides a baseline from which to create and implement emissions reduction strategies and to track performance over time.

Eleven of 48 ports that responded to the AAPA survey indicated that they have conducted an air emissions inventory, and 13 others anticipated conducting an inventory in the coming year. Ports such as Corpus Christi, TX, and those in the Greater Puget Sound region (including the Ports of Seattle, Tacoma, and Everett, WA) are proactively conducting emissions inventories even though they are located in areas that currently meet national air quality standards.[17]

Of the ports that have conducted air emissions inventories, 10 included yard equipment, 10 included marine vessels, 6 included tenant equipment, and 10 included other sources, such as port-related truck and rail traffic, auto emissions from roll-on/roll-off operations (i.e., a type of ferry, cargo ship, or barge that carries wheeled cargo such as automobiles, trailers, or railway carriages), or an adjacent power plant.[18]

With AAPA's assistance, EPA recently prepared a document entitled *Current Methodologies and Best Practices in Preparing Port Emissions Inventories*.[19] This report is intended to help port authorities and others who want to prepare a port emissions inventory.

The following case study highlights one port authority's success in using its inventory to quantify emissions reductions following off-road fleet modernization.

Case Study: Port Authority of New York and New Jersey's Emissions Inventory *In 2004, the Port Authority of New York and New Jersey conducted an update of its emissions inventory of the cargo-handling equipment owned and operated by its five terminal operators. For this effort, they received AAPA's 2005 Environmental Award.*

The goal of the inventory update was to determine whether air emissions from the off-road fleets in the five terminals had improved since originally measured in 2002. After the initial inventory in 2002, terminal operators modernized their off-road fleet with new machines powered by EPA-certified on-road engines.

Results of the inventory update are very encouraging. Even though the size of the operators' off-road fleets had increased by 19% since 2002, average operating hours had increased by 5%, and the total number of containers had risen by 25%, overall emissions estimates for key pollutants decreased significantly. Emissions of NO_x, volatile organic compounds, carbon monoxide, PM_{10}, and sulfur dioxide (in tons per year) decreased by 31%, 32%, 32%, 32%, and 35%, respectively.[20]

Improving Water Quality To improve the quality of surrounding waters, some ports have enhanced stormwater management and explored new technologies to reduce the impact of invasive species.

Stormwater Stormwater management is increasingly important in improving water quality near port facilities. As illustrated in the case study on the next page, most large ports have hundreds of acres of paved waterfront property for cargo handling, where stormwater runoff may pick up various pollutants before entering waterways. Most stormwater discharges at ports are considered point sources and require a National Pollutant Discharge Elimination System (NPDES) permit. For some ports, the neighboring municipality holds the NPDES permit; in other cases, the port or tenant holds the permit.

Many NPDES permits require preparation of a Stormwater Pollution Prevention Plan (SWPPP), which evaluates potential pollutant sources at the site and identifies appropriate measures to prevent or control the discharge of pollutants via stormwater runoff. Thirty-two of the 48 ports that responded to the AAPA survey indicated they have written SWPPPs, and 33 ports noted that they advise tenants periodically on stormwater compliance responsibilities.[21]

Case Study: Managing Stormwater at the Virginia Port Authority *An under-wharf detention basin, believed to be the first of its type in the country, was completed at the Virginia Port Authority's Norfolk International Terminals (NIT) at the end of 2004. The detention basin treats stormwater runoff from approximately 108 acres of NIT. The basin has a 30-hour detention time, which allows nutrients and suspended solids to settle out before the water is discharged. A series of weirs also has been installed to handle overflow during a 10-year storm event. The detention basin will remove 318 pounds of phosphorous per year, thereby reducing NIT's phosphorous discharges by 35%. In addition, a series of drop inlet filters has been installed to remove an additional 55 pounds of pollutants per year, including metals, oils, and greases. The total pollutant removal provided by current and proposed structures at NIT is 1,560 pounds per year. This is 46% greater than the pollutant removal required by the Virginia Department of Conservation and Recreation for this facility.*[22]

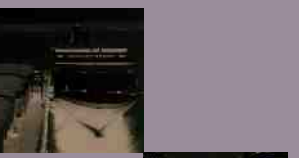
Invasive Species The spread of invasive species is another environmental issue of great concern to the port sector. Ships can inadvertently contribute to the spread of invasive species through their use of ballast water. The port sector is working closely with the U.S. Coast Guard, the International Maritime Organization, and other interested groups to promote effective policies for ballast water management and to develop new technologies for the treatment of ballast water.[23]

Managing Dredge Materials Dredging of navigation channels, harbor access channels, and shipping berths is necessary to reach and maintain the required water depths for vessels, including the newer, larger freighters that are now in operation. The U.S. Army Corps of Engineers removes nearly 300 million cubic yards of dredged material from navigation channels each year, and another 100 million cubic yards are dredged from berths and private terminals.[24]

More than 90% of the nation's top 50 ports involved in foreign waterborne commerce require regular maintenance dredging.[25]

Ports are working to minimize the negative environmental impacts of the disposal of dredged materials, and increasingly they are finding uses for the material that actually benefit the environment. As part of their dredge material management plans, 18 of the 48 ports responding to the AAPA survey had provisions for beneficial reuse (e.g., wetlands creation), and 20 ports had provisions for management of upland disposal areas.[26]

The Port of Oakland, CA, for example, is using dredged material to enhance habitat and restore Bay Area wetlands. The Port of Baltimore, MD, has used an open, science-based process with citizen involvement called the Dredged Material Management Program to develop its long-term dredging placement plans and to identify new deposit sites. This program is focusing on beneficial reuse projects such as rebuilding islands, creating wetlands, or shoring up eroding coastlines.[27]



Minimizing Impacts of Growth To accommodate increased trade volume and the increasing size of freight vessels, many ports must increase their capacity. Although port capacity can be increased through improvements in technology and operational efficiency, many ports also require physical expansion. When planning for expansion, ports must consider how best to minimize and compensate for wetland or habitat loss and to address other impacts of port growth on neighboring communities.

Many ports looking to expand have revitalized nearby abandoned or underutilized brownfield properties, which may have been contaminated by previous industrial activity.

Redeveloping these brownfields in or near ports (called "portfields") can concentrate land-use development, enhance the local economy, and provide environmental benefits. Environmental remediation and habitat restoration are often integral components of redevelopment efforts at or near ports.

Three ports have been participating in pilot projects for two years in the Portfields Initiative, a federal interagency effort to help revitalize ports and improve the nation's marine transportation system while restoring and protecting coastal resources. Lessons learned from these pilot projects at the ports of Bellingham, WA, New Bedford, MA, and Tampa, FL, will be shared with other ports and port communities.[28]

Case Study: Port of Seattle's Phoenix Award *In 2004, the Port of Seattle, WA, won EPA's Phoenix Award for Excellence in Brownfields Redevelopment for its Terminal 18 Redevelopment Project. The port's need to expand cargo-handling facilities led to a redevelopment project on Harbor Island, which had been listed as a Superfund site in 1986. The port worked with EPA and more than 30 existing private property owners on Harbor Island to shape purchase agreements that discounted the property sale price by the amount of estimated cleanup costs. Among other improvements, the 90-acre expansion accomplished cleanup of contaminated soils, reduced runoff and groundwater impacts, and improved vehicle and rail transportation.*[29]