IAPH Priority Pollutants Toolbox
Introduction

This Tool Box is constructed with two main sections: air quality and greenhouse gases. These topics are accessible from tabs on the main page. The additional tab, "Integration," describes how and when strategies from each of the toolboxes create "co-benefits;" strategies that accomplish the goals of both subjects. Links embedded among many of the strategies in each toolbox also provide a path for understanding co-benefits

A Call to Action

The Challenge

The increase in goods movement over the past decade has also led to an increase in air emissions from port-related maritime activities as well as local and regional goods-transport. The potential health risk impacts associated with the goods movement sector have extended fully along the network between manufacturer and consumer.

Some of this impact can be seen in and adjacent to port marine terminals because all modes of transport (trucks, ships, cargo handling equipment, harbor craft, and rail locomotives) often meet at these intermodal hubs. When residential communities are located adjacent to port marine terminals, the residents are exposed to emissions from international, regional, and local freight movement sources. National and regional regulations control a subset of the source categories, with little overarching regulation. International regulations, as they stand now, likewise provide limited controls.

There is a special 'call to action' between ports around the world to address international port-related air quality issues. In the last years, within the International Association of Ports and Harbors important discussions have been held between international ports and industries on how to address these issues on both the local and international fronts. This has resulted in the adoption of a resolution on Clean Air Programs for Ports at the 25th World Port Conference in Houston , Texas on 4 May 2007 in which the Members of IAPH have resolved that:

• IAPH reaffirms its recognition of ports' need to adopt clean air programs to better sustain development of the global society and its commitment to promote integrated approaches in such programs.

• IAPH urges ports, members and non-members alike, to take active and effective steps towards clean air programs while stressing the critical need to develop integrated action plans for respective ports and recognizing that no one-size-fits-all solution exists for ports with their large variations in pollution level, emission sources, geographical and meteorological conditions;

• IAPH will continue to provide a unique and effective forum to share best practices and experiences among the world's ports and various parties concerned, and will develop and disseminate guidelines, reference materials and information.

APH will collaborate further with UN agencies and other international organizations such as the International Chamber of Shipping (ICS), the Oil Companies International Marine Forum (OCIMF) and regional Port and Trade Associations to achieve the goal of creating clean air programs thereby assisting in the abatement of global warming.

Case Studies

San Pedro Bay Ports Clean Air Action Plan

Northwest Ports Clean Air Strategy

Port of New York and New Jersey Clean Air Initiatives and Harbor Air Management Plan

Rijnmond Regional Air Quality Action Program Port of Rotterdam

San Pedro Bay Ports Clean Air Action Plan

Located in the South Coast Air Basin (SoCAB) in the state of California, the second largest urban area in the United States of America, the Ports of Los Angeles and Long Beach (collectively, the San Pedro Bay Ports) are situated in an area with the worst air quality in the nation. US regulatory agencies have identified ozone and particulate matter less than 2.5 microns (PM2.5) to be of particular concern with diesel particulate matter (DPM) as a surrogate for total emissions. This poses a serious risk to Southern California residents who live near the Ports, transportation corridors and other areas with high levels of diesel-related activity. The California Air Resources Board predicts that 70 percent of the potential cancer risk from toxic air contaminants in California can be attributed to DPM.

With the need to accommodate the rapid growth in trade and the increased demands of goods movement, the San Pedro Bay Ports recognize the necessity to reduce their "fair share" with respect to other sources in the South Coast Air Basin . In doing so, the Ports would have to address all maritime operations by implementing strategies that would substantially reduce diesel emissions from ocean going vessels, harbor craft, cargo handling equipment, trucks and locomotives.

In March 2006, an important partnership was formed between the Port of Los Angeles and the Port of Long Beach along with the South Coast Air Quality Management District, California Air Resources Board and the United States Environmental Protection Agency Region 9 to work jointly toward solutions to enhance air quality and the quality of life for the residents of Southern California. Collaborating as team, the partnership developed the San Pedro Bay Clean Air Action Plan (CAAP).

The Clean Air Action Plan sets forth an array of control measures and implementation strategies that the Ports will use to reduce public health risk from port/maritime operations. The five-year Action Plan includes performance driven goals, emission reductions, and budgetary needs. In addition, the Ports have created a Technology Advancement Program that will evaluate promising projects and technologies that will demonstrate effectiveness in port-related emission reductions. The Plan also includes a program to evaluate infrastructure and operational efficiencies.

The CAAP began implementation in 2007. Since that time, the Ports have worked with tenants and the railroads to implement the CAAP . To substantially address diesel emissions from trucks, the Ports have initiated the Clean Truck Program whereby older trucks are progressively banned from entering the Ports. By January 1, 2012, all trucks entering the Ports will be required to have 2007-compliant engines. The Ports continue to work with all concerned parties to develop this program and secure adequate funding to make it successful.

One of the most valuable aspects of the CAAP is that both Ports will combine resources and expertise to supplement the actions of the federal, state, and local regulators as necessary to implement cleaner technologies for various source categories.

Northwest Ports Clean Air Strategy

The Ports of Seattle and Tacoma in the Pacific Northwest of the United States and the Vancouver Port Authority in British Columbia, Canada are located in areas that meet federal, state, and local ambient air quality standards. Some areas in the region are expected to have difficulties in the future meeting stricter United States standards for fine particulate matter. To this end, the ports are committed to helping the region maintain compliance to protect the environment and public health.

As maritime operations grow, the Northwest Ports are successfully reducing air emissions by means of a voluntary and collaborative approach. Through the Puget Sound Maritime Forum, the Northwest Ports aim to proactively reduce diesel emissions voluntarily, in order to protect the environment and public health from the potential negative impacts of maritime-related emissions. The three Ports are currently working on the Northwest Ports Clean Air Strategy , a joint plan aimed to substantially reduce diesel particulate matter and greenhouse gas emissions. The plan will utilize the recently comprehensive Puget Sound Maritime Air Emissions Inventory as a baseline. Using proven emission reduction strategies successfully implemented by ports in the region, the plan proposes performance goals to reduce particulate matter by 70 percent from ships at berth and 30 percent from cargo handling equipment by 2010. The Northwest Ports Clean Air Strategy will also address emissions from port-related trucks, locomotives and harbor craft and includes long-term goals for additional emissions reductions.

For cargo and cruise ships that make regularly scheduled calls at the three Ports, the proposed 2010 performance goal calls for a reduction in particulate matter equivalent to what can be achieved by using cleaner distillate fuels while at dock. There is a 2015 performance goal for ocean-going vessels that calls for compliance with standards that the International Maritime Organization (IMO) requires. The Northwest Ports support the United States IMO proposal, to reduce emissions equivalent to a sulfur level of 0.1% or less for fuels burned by ocean-going vessels while operating in the coastal waters of the United States and Canada . If new performance standards are not adopted, the Ports agree to continue to work towards meeting these goals, recognizing that technology and fuel availability will impact shipping lines ability to achieve these goals.

For cargo-handling equipment, the proposed performance goal aims to reduce emissions through the use of ultra low sulfur diesel fuel with no more than 15 parts per million sulfur, a bio-diesel blend in addition to repowering with newer engines and/or through the use of advanced emission control technologies.

The three Ports are encouraging stakeholder groups to help implement emissions reduction measures and formally sign on as partners.

Port of New York and New Jersey Clean Air Initiatives and Harbor Air Management Plan

The Port of New York and New Jersey , the largest port complex on the East Coast of North America, is located in the Atlantic Northeast of the United States within the USEPA-designated New York/New Jersey/Long Island Non-Attainment Area (NYNJLINA) for Nitrogen Oxides (NOx). Portions of the NYNJLINA are unlikely to meet federal ambient air quality standards for fine particulate matter as new stricter US standards come into place.

The Port Commerce Department of the Port Authority of New York and New Jersey (PANYNJ) is a landlord for six marine cargo terminals. Dedicated to Environmental Stewardship as one of its key business objectives, the Port Commerce Department is committed to promoting air quality enhancement efforts as it accommodates growing cargo volumes to satisfy the needs of the largest consumer demand region in the United States . In order to be successful, the Port aims to be a sustainable port, by promoting regional prosperity, financial return and the dual imperatives of security and the environment.

PANYNJ has adopted a proactive strategy to improve air quality that involves compliance with existing regulations, exceeding all mitigation requirements and undertaking voluntary initiatives to reduce air emissions. The Port Commerce Department has implemented an Environmental Management System to ensure compliance with air quality laws and regulations. In addition, there are initiatives underway to offset NOx emissions generated during channel-deepening construction that will exceed regulatory requirements. The Port Commerce Department also has several on-going voluntary, collaborative efforts that are evaluated for their ability to reduce air emissions and cost effectiveness.

For example, a cargo handling equipment (CHE) emissions inventory undertaken to assess the impact of our container terminal tenants' voluntary modernization of CHE and use of cleaner burning fuels showed a greater emission reductions across the full spectrum of pollutants despite a 25% increase in cargo handled. A subsequent emission inventory of vessels dwelling at these same facilities showed that they contributed a small percentage of overall pollutants in the non-attainment area.

In order to meet growing cargo demands, the Port Commerce Department is investing nearly two billion dollars over the next decade to reconfigure existing terminals, deepen the harbor's channels and berths and improve inland access by rail and barge. This investment will create an efficient and cost-effective port, while also reducing local congestion, enhancing air quality and conserving energy. Improvements include installing infrastructure to support electric-regenerative cranes, and significantly enhancing on-dock and regional rail capabilities. In addition, our marine tenants are investing heavily in gate improvements, electric cranes, yard equipment modernization and use of cleaner fuels, all of which enhance air quality. The Port Commerce Department, along with its tenants, public agencies and private partners collaborate on voluntary efforts to field test new off road technologies and develop clean equipment prototypes, such as active diesel particulate filters and hybrid yard tractors. Collaborative efforts that go beyond the immediate port area include working with the EPA, state regulators and port members of the Northeast Diesel Collaborative to develop voluntary regional strategies and USEPA's Clean Ports Program to help develop voluntary industry wide initiatives.

Rijnmond Regional Air Quality Action Program Port of Rotterdam

Air quality in Rijnmond among other regions in the Netherlands , has improved over the last 30 years. However, according to recent figures, emissions have increased beyond their limit values. The increase in emissions poses a serious risk to spatial and economic development and can adversely affect public health. Projections show that emissions for particulate matter (PM) and oxides of nitrogen (NOx) in the Rijnmond region will exceed European air quality standards set for 2010 if actions are not taken to reduce air pollution.

To address Rijnmond's growing air quality problems, the ROM Rijnmond Executive Council (BOR) has united in a partnership with administrative authorities to develop a package of measures to mitigate air pollution in the Rijnmond region. Better known as the Rijnmond Regional Air Quality Action Program, the program builds upon existing clean air programs. The combination of air quality programs include; Rotterdam's Approach to Air Quality, the Air Quality Master Plan developed by BOR, the Air Quality Plan of Approach by the Rotterdam Metropolitan Region, and the Plan of Approach to Air by the Rotterdam Port Authority.

Through the Top Management Steering Committee on Air, a committee comprised of leaders from all participating parties under BOR, commissioned the DCMR Rijnmond Environmental Agency to develop the Rijnmond Regional Air Quality Action Program. The program is carried out in close coordination with the participating administrative authorities and other parties such as members from the business community. In order to establish greater uniformity for measuring and calculating control measures, the Top Management Steering Committee on Air organized five task groups to focus on different source categories. The five task groups were divided into the following groups; road traffic, shipping, railway, industry and households. Each of the sources identified by the Committee, account for 90% of the emissions in the region.

Clean air strategies were evaluated by the impact on air quality, costs, feasibility, side effects, and time frame. Efforts from the five task groups resulted in 100 different strategies of which 34 were selected as most promising. The proposed strategies aim to impact air quality both in a local and regional manner. Local measures included strategies such as shore side power for ocean-going vessels and low emission zones in urban centers. Regional measures included pushing for stronger EU regulations. The 34 promising strategies are prioritized for implementation through a phased approach, which include: immediate, near-term and long term implementation.

There are a number of recommended strategies that aim to reduce emissions related to goods movement. The following strategies relate to port/maritime activities.

Shipping:
- Support for existing and future policies and legislation;
- Shore side electricity; and
- Development and implementation of emission control technologies.

Trucks and Road Haulage:
• Intelligent loading;
• Clean vehicles; and
• Clean vehicle technology.

Rail:
• Conversion of diesel to electric long haul locomotives and
• Cleaner EU emission standards for locomotives

The consultation in the task groups has contributed to creating support among the parties involved. Consultation between the parties has also contributed to a better mutual understanding and provided tools for reaching joint agreements more quickly. The Rijnmond Regional Air Quality Action Plan also includes a communications and outreach approach to encourage the public to participate in environmentally friendly practices that promote cleaner air.

Improving Air Quality Through Effective Strategies

Similar to the approaches identified in the case studies, you can develop your own Clean Air Program that will help address diesel emissions at your own port. The following is an overview of effective strategies that can be taken to address diesel emissions for each maritime operation.

Ocean Going Vessels
- Vessel Speed Reduction
- Operational Improvements
- Clean Fuels
- Emission Control Technologies
- Shore Power

Harbor Craft
- Engine Replacement with Engines Meeting Cleaner Standards
- Clean Fuels
- Emission Control Technologies
- Electrification (including Shore Power and Hybridization

Cargo Handling Equipment
- Equipment Replacement with Engines Meeting Cleaner Standards
- Operational Improvements
- Clean Fuels
- Emission Control Technologies

Heavy Duty Vehicles – Trucks
- Equipment Replacement
- Operational Improvements
- Clean Fuels
- Emission Control Technologies
- Idle-Reduction Technologies

Light Duty Vehicles
- Equipment Replacement
- Operational Improvements
- Clean Fuels
- Emission Control Technologies
- Idle-Reduction Technologies

Locomotives and Rail
- Equipment Replacement
- Operational Improvements
- Clean Fuels
- Emission Control Technologies
- Idle-Reduction Technologies

Construction Equipment
- Equipment Replacement
- Operational Improvements
- Clean Fuels
- Emission Control Technologies
- Idle-Reduction Technologies

Now, take a look at a more detailed approach to reduce diesel emissions from each maritime operation. It should be recognized that the order of operations and/or strategies does not in any way imply weight or preference.

Ocean Going Vessels

• Vessel Speed Reduction

• Operational Improvements

• Clean Fuels

• Emission Control Technologies

• Shore Power

Strategies
Here are some effective strategies that can be applied to address emissions from Ocean-Going Vessels (OGV):

Vessel Speed Reduction (VSR)

Strategy – A VSR program is aimed to reduce NOx from OGVs by slowing vessel speeds as OGVs approach a port. This would include a speed reduction possibly down to 12 knots or lower when OGVs are within the coastal waters of a port or within the port area.

Technical Consideration – No operational changes are required of the engine. Technical considerations may include updating existing radars and communication devices to communicate with local navigation and communication centers. Vessel speed at which emissions are lowest is based on limited data and likely to vary with engine.

Options for Implementation – Assure compliance through tariff reduction incentives, lease requirements for renewed lease agreements, or voluntary programs. Create a memorandum of understanding with shipping companies, ports and regulatory agencies.

Pros and Cons – VSR has many benefits. In addition to NOx, PM and GHGs are also reduced. There may also be a fuel economy benefit but there can be additional operational costs. Some VSR programs have been put in place on the East Coast of the United States to protect endangered species.

Operational Improvements

Strategy - Reconfigure existing terminals, deepen channels and berths and improve inland access by rail and barge; install infrastructure to support electric-regenerative cranes; significantly enhance on-dock and regional rail capabilities; invest in gate improvements; and speed up vessel loading and unloading time. The latter further enhances air quality by reducing vessel dwelling time.

Technical Considerations – Design must be incorporated that will provide a reasonable return on investment through operational efficiencies.

Options for Implementation – Appropriate design will support a business case, and thus, voluntary action.

Pros and Cons – If designed properly to support the business case, the result is higher efficiency and lower emissions, a win-win scenario.

Clean Fuels

Strategy – Require the use of lower sulfur distillate fuels in auxiliary and/or propulsion engines of OGVs within the coastal waters of a port. A substantial reduction in DPM can be achieved if OGVs use distillate fuels that have a sulfur content of < 0.2 S.

Technical Considerations – Consider an on-board fuel tank for lower sulfur fuels. Work with ports, fuel suppliers, shipping lines, and others to ensure low sulfur fuel availability.

Options for Implementation – Implementation strategies may include the use of lease requirements and tariff changes.

Pros and Cons – Positive emission reduction benefits for NOx, PM and GHGs. Challenges may arise with low sulfur fuel availability and putting in place an on-board tank/fueling station. Fuel contamination may be another drawback. Fuel tank cleaning may be required for ultra-low sulfur diesel fuels.

Emission Control Technologies

Strategy – Improvements to main and auxiliary engines help reduce DPM, NOx and SOx emissions. Measures for main engine improvements may include; slide valves, seawater scrubbing as well and engine upgrades. Measures for auxiliary engines include; Selective Catalytic Reduction (SCR) and engine upgrades or repowers.

Technical Considerations – Operational and feasibility testing is required to ensure the function and appropriateness of an emissions control technology on marine applications. In particular, many ECTs require exhaust gas temperature analysis by conducting exhaust gas temperature datalogging to measure exhaust gas temperatures. Many ECTs have exhaust temperature thresholds that are required for the operation and effectiveness of the technology. Emission control technologies which have been certified or verified by regulatory agencies (such as those programs at the US Environmental Protection Agency and the California Air Resources Board) are most likely to deliver the claimed benefits

Options for Implementation – Implement strategy through lease requirements, tariff charges, and incentives. Design a Technology Advancement Program that would demonstrate feasibility of ECTs on marine applications. The Technology Advancement Program would consider use of newer technologies.

Pros and Cons – Positive emission reduction benefits. Challenges may occur with technology feasibility.

Shore Power

Strategy – Shore Power focuses on reducing dwelling (hotelling) emissions from OGVs while at berth. This strategy has two approaches 1) shore-power (transferring the electrical generation needs for OGVs while at berth – power generated by regulated/controlled stationary sources) and 2) hotelling emissions reduction requirements through alternative technologies for ships that do not fit the shore power model. Shore power is best for OGVs that make multiple calls at a particular terminal for multiple years. The best candidates for shore power are container ships, reefer ships, and cruise ships.

Technical Considerations – Provide shore power infrastructure on-dock and on-board vessels. Determine necessary power needed and ensure adaptability. It is important to consider the local power company that is providing the electrical power to the terminal. Some power companies operate coal-burning power plants without the use of scrubbers and other types of emission control technologies. Ensure that the local power company is using a cleaner source of energy with use of emission control technologies. In some cases, it may be better not to use shore power if the local power company has dirty polluting power plants.

Options for Implementation – Implementation strategies include lease requirements, incentives, tariff changes and capital funding.

Pros and Cons – Positive emission reduction benefits while at port with shore power. Challenges occur with infrastructure cost and shore power hook up. Shore power requires extensive infrastructure improvements. Additionally, shore power only addresses local port emission reduction benefits only during the period when the vessel is at berth and does not address OGV voyage emissions.

Harbor Craft

- Engine Replacement with Engines Meeting Cleaner Standards
- Clean Fuels
- Emission Control Technologies
- Electrification (including Shore Power and Hybridization

Strategies
Here are some effective strategies that can be applied to address emissions from Harbor Craft (HC). Some of the strategies can also apply to dredging equipment.

Engine Replacement

Strategy – Repower HC main and auxiliary engine with cleaner engines that meet newest national air quality standards. For example, the United States has diesel engines that meet U.S. EPA Tier II and Tier III engine standards. Replacing a Tier 0 engine with a Tier II engine will reduce NOx up to 47%. Tier III engines will reduce NOx and PM up to 90%. The European Commission has an equivalent engine that meets Stage IIIA engine standards.

Technical Considerations – Ensure technical feasibility. Strategy will involve the careful removal of the original engine and replacing it with a newer, cleaner engine.

Options for Implementation – Implementation through voluntary programs, incentives, and/or lease renewals/renegotiations.

Pros and Cons – Replacing main-propulsion engines with cleaner engines will provide great emission benefits. Cleaner engines are costly and may cause an economic burden. Technology availability may also be a concern. Destroying old engines may increase costs. Ideally, engines should be rendered inoperable so they are not able to continue to pollute.

Clean Fuels

Strategy – Implement the use of cleaner fuels with low sulfur content. Cleaner fuels include; low and ultra low sulfur diesel fuel, emulsified diesel fuels, oxygenated fuel (O2 diesel fuel), and biodiesel.

Technical Considerations – Work with ports and fuel suppliers on the availability and supply of clean fuels. Depending on the type of clean fuel used, cleaning of the fuel tank may be required in order to avoid fuel contamination.

Options for Implementation – Implementation strategies may include the use of lease requirements and tariff changes.

Pros and Cons – Positive emission reduction benefits for NOx, PM and GHGs. The use of biodiesel may present a slight increase in NOx. Challenges may arise with fuel availability.

Emission Control Technologies

Strategy – Retrofit HC with the best available engine controls, fuel additives and aftertreatment emission control technologies (ECTs). Depending on the appropriate application of ECT, ECTs can include exhaust aftertreatment devices such as; diesel oxidation catalyst (DOC), diesel particulate filter (DPF), or selective catalytic reduction (SCR) or engine and fuel efficiency technologies such as modern injectors, computer controls and software upgrades, which result in more efficient engine air fuel mixtures and fuel savings. The engine manufacturers and distributors of emission control technologies can provide technical guidance to HC owners and operators in the selection of appropriate ETCs for their vessel. While evaluating different emission control technologies, consider ECTs that have had proven success with HC similar to the HC under evaluation. To further improve emission reductions from auxiliary engines, retrofit cleaner engines with ECTs.

Technical Considerations – Operational and feasibility testing is required to ensure the function and applicability of an emissions control technology on marine applications. In particular, many ECTs require exhaust gas temperature analysis by conducting exhaust gas temperature datalogging to measure exhaust gas temperatures. Many ECTs have exhaust temperature thresholds that are required for the operation and effectiveness of the technology. Emission control technologies which have been certified or verified by regulatory agencies (such as those programs at the US Environmental Protection Agency and the California Air Resources Board) are most likely to deliver the claimed benefits

Options for Implementation – Implement strategy through lease requirements, tariff charges, and incentives. Design a Technology Advancement Program that would demonstrate feasibility and effectiveness (this comment should be included in all of the sections which discuss emission control technologies) of ECTs on marine applications. The Technology Advancement Program would consider use of newer technologies.

Pros and Cons – Applying ECTs prove to have positive emission benefits in reducing particulate matter (PM), Oxides of Nitrogen (NOx), carbon monoxide (CO) and hydrocarbon (HC). Not all ECTs reduce all pollutants. Retrofitting HC with ECTs can be challenging, careful evaluation and analysis is a must.

Electrification (including Shore Power and Hybridization)

Strategy – Reduce harbor craft hotelling emissions by hybridization and providing shore power hook up . Similar to OGV, HC can utilize shore-power by transferring the electrical generation needs for HC while at berth to power generated by regulated/controlled stationary sources. can be utilized by HC at berth. Hybridization is best for HC that are in constant transit mode.

Technical Considerations – Provide shore power infrastructure on-dock and on-board HC. Determine necessary power needed and ensure adaptability. Again, it is important to consider the local power company that is providing the electrical power to the terminal. Some power companies operate coal-burning power plants without the use of scrubbers and other types of emission control technologies. Ensure that the local power company is using a cleaner source of energy along with emission control technologies. In some cases, it is better not to use shore power if the local power company has dirty polluting power plants. Evaluate the HC engine and duty cycles to determine whether the vessel is a good candidate for hybridization which is currently being developed and used on tugboats and ferries. Substantial fuel savings can be realized in addition to lowering emissions by use of hybrid technology

Options for Implementation – Implementation strategies include lease requirements, incentives, tariff changes and capital funding.

Pros and Cons – Positive emission reduction benefits while at port with shore power. Challenges occur with infrastructure cost and shore power hook up. Shore power requires extensive infrastructure improvements.

Cargo Handling Equipment

- Equipment Replacement with Engines Meeting Cleaner Standards
- Clean Fuels
- Emission Control Technologies

Strategies
Here are some effective strategies that can be applied to address diesel emissions from Cargo Handling Equipment (CHE):

Equipment Replacement with Engines Meeting Cleaner Standards

In some cases, cargo handling equipment (CHE) fleet managers prefer to buy new equipment with new engines rather than repower old cargo handling equipment with new engines. The cost of the CHE is a small fraction of the overall life cycle costs relative to operations and maintenance costs. The labor costs for terminal maintenance shops to repower CHE also need to be factored into the decision-making process. New CHE would come with warranties which could lower maintenance costs. Each fleet manager will need to consider the relative costs and benefits for their operation. The emissions benefits would be similar in either case.

Strategy – Replace older off-road yard tractors, top picks, forklifts, reach stackers, RTGs, and straddle carriers <750 hp with new equipment that meet cleaner on-road and off-road engine standards. Replace CHE with >750 hp with new equipment that meet cleaner off-road engine standards.

For example; the San Pedro Bay Ports Clean Air Action Plan will require the replacement of older CHE with new clean engines over a specific time period. The Ports aim to implement the cleanest available NOx alternative-fueled engine or the cleanest available NOx diesel-fueled engine that will meet 0.01 g/bhp-hr for particulate matter (PM). If there are no engines that meet the 0.01 g/bhp-hr for PM, then the CAAP recommends the purchase of the cleanest available engine along with the best available emissions control technology that would meet the 0.01 g/bhp-hr for PM. The European Commission has similar clean engine standards, Euro III, IV, and V.

In the Port of New York and New Jersey , the major container terminal operators are systematically replacing yard tractors, at the end of their five to ten-year duty cycle, with brand-new equipment that come equipped with the cleanest available, on-road engines, and are doing this voluntarily because there is a business case to do so. These terminal operators are also investing heavily to replace older diesel- powered gantry cranes with pieces that feature regenerative electric capabilities, which likewise are supported by a strong business case.

Technical Considerations – Ensure technical feasibility. Strategy will involve the careful removal of original engine and replacing it with newer-cleaner engine. Equipment which includes regenerative electric capabilities (e.g. some of the new Rubber Tire Gantry (RTG) and Rail Mounted Gantry Cranes) will increase fuel efficiency and further reduce emissions.

Options for Implementation – Implementation through voluntary programs, incentives, and/or lease renewals/renegotiations.

Pros and Cons – The purchase of newer cargo handling equipment that meet cleaner on-road or off-road engine standards will demonstrate great emission reduction benefits and, under the right conditions, make a good business case. The challenge may be the availability of cleaner engines internationally.

Clean Fuels

Strategy – Implement the use of cleaner fuels with low sulfur content. Cleaner fuels include; low to ultra low sulfur diesel fuel, emulsified diesel fuels, oxygenated fuel (O2 diesel fuel), and biodiesel. Additional clean fuel options for CHE include LNG and CNG.

Technical Considerations – Work with ports and fuel suppliers on the availability and supply of clean fuels. Depending on the type of clean fuel used, cleaning of the fuel tank may be required in order to avoid fuel contamination.

Options for Implementation – Implementation strategies may include the use of lease requirements and tariff changes.

Pros and Cons – Positive emission reduction benefits for NOx, PM and GHGs. The use of biodiesel may present a slight increase in NOx. Challenges may arise with fuel availability. Cleaner fuels often cost more than standard ones.

Emission Control Technologies

Strategy – Retrofit CHE with the best available emission control technologies (ECTs). Depending on the appropriate application of ECT, ECTs can include; diesel oxidation catalyst (DOC), diesel particulate filter (DPF), or selective catalytic reduction (SCR). While evaluating different emission control technologies, consider ECTs that have had proven success with CHE similar to the CHE under evaluation. To further improve emission reductions, retrofit cleaner CHE engines with ECTs.

Technical Considerations – Operational and feasibility testing is required to ensure the function and applicability of an emissions control technology on CHE. In particular, many ECTs require exhaust gas temperature analysis by conducting exhaust gas temperature datalogging to measure exhaust gas temperatures. Many ECTs have exhaust temperature thresholds that are required for the operation and effectiveness of the technology. Emission control technologies which have been certified or verified by regulatory agencies (such as those programs at the US Environmental Protection Agency and the California Air Resources Board) are most likely to deliver the claimed benefits.

Options for Implementation – Implement strategy through lease requirements, tariff charges, and incentives. Design a Technology Advancement Program that would demonstrate feasibility of ECTs on CHE. The Technology Advancement Program would consider use of newer technologies.

Pros and Cons – Applying ECTs has proved to have positive emission benefits in reducing particulate matter (PM), Oxides of Nitrogen (NOx), carbon monoxide (CO) and hydrocarbon (HC). Retrofitting CHE with ECTs can be challenging, careful evaluation and analysis is a must.

Heavy Duty Vehicles – Trucks

• Equipment Replacement

• Operational Improvements

• Clean Fuels

• Emission Control Technologies

• Idle-Reduction Technologies

Strategies
Here are some effective strategies that can be applied to address emissions from Heavy-Duty Vehicles – Trucks:

Equipment Replacement

Strategy – Maximize emission reductions by replacing frequent and semi-frequent caller older trucks that service the port with newer trucks that meet cleaner engine standards. For example, the San Pedro Bay Ports Clean Air Action Plan is encouraging trucks with model years 1992 and older to meet cleaner on-road emission standards (0.01 g/bhp-hr for PM) and the cleanest available NOx technology at time of replacement.

Technical Considerations – Retire older equipment that has visible dark soot coming from the exhaust. Sometimes the color of the exhaust can depict several operational conditions that are of concern such as the need for filter replacement, oil changes, and engine upgrades. Frequent maintenance of newer trucks is very important to maintain clean operation in addition to extending sustainable use of vehicle.

Options for Implementation – Implementation strategies may include; lease requirements, tariffs, and incentives.

Pros and Cons – Positive emission reduction benefits for PM. Consider NOx reduction technologies such as SCRs or Lean NOx Catalyst (LNC). The costs of replacing engines and/or vehicles may be prohibitive.

Operational Improvements

Strategy – Repower frequent to semi-frequent caller trucks with cleaner on-road engines. Redevelop infrastructure and use technology, such as radio frequency identification (RFID) and optical character readers (OCR), to enhance the efficiency of gates and terminals, relieve congestion and reduce emissions. Extended/off-peak terminal hours and moving more cargo to rail and water (via short sea shipping) where feasible can also reduce congestion and air pollution.

Technical Considerations – Ensure technical feasibility. Cost of technology versus benefit achieved should be a consideration in assessing potential improvements

Options for Implementation – Implementation through voluntary programs, incentives, and/or lease renewals/renegotiations.

Pros and Cons – Some of these options involve capital investment; others could increase terminal operating costs. However, if designed and planned properly, can result in a significant return on investment due to enhanced operational efficiencies.

Clean Fuels

Strategy – Implement the use of cleaner fuels. Cleaner fuels include; ultra low sulfur diesel fuel, emulsified diesel fuels, oxygenated fuel (O2 diesel fuel), and biodiesel. Additional clean fuel options for trucks include LNG and CNG.

Technical Considerations – Work with ports and fuel suppliers on the availability and supply of clean fuels. Depending on the type of clean fuel used, cleaning of the fuel tank may be required in order to avoid fuel contamination.

Options for Implementation – Implementation strategies may include the use of lease requirements and tariff changes.

Pros and Cons – Positive emission reduction benefits for NOx, PM and GHGs. The use of biodiesel may present a slight increase in NOx. Challenges may arise with fuel availability depending on international location. Cleaner fuels tend to be more costly.

Emission Control Technologies

Strategy – Retrofit model years 1993 to 2003 and newer with emission control technologies that are less polluting. Consider technologies that have demonstrated a history of effectiveness and durability. Emission control technologies may include but are not limited to; diesel particulate filters (active and passive), diesel oxidation catalyst (50% PM reduction or more), selective catalytic reduction (SCR), Lean NOx Catalyst (LNC), Gas Recirculation (EGR), closed crankcase ventilation systems (CCV) and or a combination of the above.

Technical Considerations – Operational and feasibility testing is required to ensure the function and applicability of an emissions control technology on the truck. In particular, many ECTs require exhaust gas temperature analysis by conducting exhaust gas temperature datalogging to measure exhaust gas temperatures. Many ECTs have exhaust temperature thresholds that are required for the operation and effectiveness of the technology. Considerations must include duty cycle, exhaust temperatures, and preventative maintenance schedules. Emission control technologies which have been certified or verified by regulatory agencies (such as those programs at the US Environmental Protection Agency and the California Air Resources Board) are most likely to deliver the claimed benefits.

Options for Implementation – Implement strategy through lease requirements, tariff charges, and incentives. Design a Technology Advancement Program that would demonstrate feasibility of ECTs on trucks. The Technology Advancement Program would consider use of newer technologies.

Pros and Cons – Positive PM, NOx, HC and CO emission reduction benefits. Challenges may occur while assessing appropriate technologies. Some technologies such as DPFs have strict exhaust temperature requirements. Retrofitting may include exhaust reconfiguration and cutting of the exhaust pipe. DPFs require annual cleaning depending on the technology and can be costly. SCRs require urea dosing units and may acquire an increase in fuel cost with urea + diesel. Emission control technologies and/or vehicles vary in cost and can be expensive.

Idle-Reduction Technologies

Strategy – Reduce idling emissions by using idle-reduction technologies. Stationary idle-reduction technologies include shore power for trucks also known as "Truck-Stop-Electrification" (TSE). TSE provides cab power for the truck while a truck is stationed in an area for a period of time. Mobile idle-reduction technologies include; automatic shut down and star up systems, battery power, auxiliary power units, and diesel driven heating systems. These mobile idle-reduction technologies are on-board technologies that help provide power to the cab of the truck. These technologies could also be used for reefer trucks.

Technical Considerations – Test feasibility of idle-reduction technology.

Options for Implementation – Implement strategy through lease requirements, tariff charges, and incentives.

Pros and Cons – Eliminating idling time by using an idle-reduction technology greatly reduces emissions that would be generated from idling. International availability may create a challenge for some ports.

Light Duty Vehicles

• Equipment Replacement

• Operational Improvements

• Clean Fuels

• Emission Control Technologies

• Idle-Reduction Technologies

Strategies
Here are some effective strategies that can be applied to address emissions from Light-Duty Vehicles

Equipment Replacement

Strategy – Maximize emission reductions by replacing light duty trucks serving the port with new equipment that meets cleaner engine standards. Prioritize vehicle modernization by first replacing vehicles with the highest vehicle miles traveled or usage levels to get the biggest emission reduction benefit for the investment.

Technical Considerations – Retire older equipment that has higher emissions and more miles per year of operation, especially any that emits visible smoke which indicates the need for repairs such as the need for filter replacement, oil changes, and engine upgrades. Frequent maintenance of light duty vehicles and buses is very important to maintain clean operation in addition to extending sustainable use of vehicle. Inexpensive emissions testing equipment is available to periodically verify that fleet maintenance practices to minimize emissions are effective and identify equipment that have excess repairable emissions.

Options for Implementation – Implementation strategies may include; technical support, lease requirements, tariffs, and incentives.

Pros and Cons – Positive emission reduction benefits for air toxics, VOCs, NOx and PM. The costs of replacing engines and/or vehicles may be substantial.

Operational Improvements

Strategy – Encourage more efficient use of light duty vehicles.

Technical Considerations – Evaluate current usage patterns and identify opportunities for vehicle miles traveled reductions through schedule revisions, ridesharing, and other alternatives.

Options for Implementation – Implementation through voluntary programs, incentives, and/or lease renewals/renegotiations.

Pros and Cons – Light duty vehicles are relatively cleaner than heavy duty diesel equipment so the total emissions from these engines at ports are relatively small. Emissions of toxic air pollution and volatile organic compounds from gasoline-fueled engines can be significant. Some of this equipment is diesel-fueled and could be addressed by strategies similar to those outlined for heavy duty diesel equipment. As mentioned earlier, replacing older engines and vehicles with newer cleaner equipment can improve emission reductions. However, international availability may be a concern. The costs of replacing engines and/or vehicles may be prohibitive.

Clean Fuels

Strategy – Implement the use of cleaner fuels. Hybrid and all electric vehicles are good choices for on terminal light duty vehicles. Cleaner fuels to consider include; biodiesel, natural gas, propane, ethanol blends, ultra low sulfur diesel fuel, emulsified diesel fuels, and oxygenated gasoline and diesel fuels (O2 diesel fuel).

Technical Considerations – Work with ports and fuel suppliers on the availability and supply of clean fuels, vehicles, and refueling stations. Depending on the type of clean fuel used, cleaning of the fuel tank may be required in order to avoid fuel contamination. This is particularly true for fuels containing ethanol or biodiesel.

Options for Implementation – Implementation strategies may include the use of lease requirements and tariff changes.

Pros and Cons – Positive emission reduction benefits for air toxics, VOC, SOx, NOx, PM and GHGs. The use of biodiesel may present a slight increase in NOx. Challenges may arise with fuel availability depending on international location. Some options such as natural gas, propane or electricity may require a substantial capital investment in refueling or powering infrastructure.

Emission Control Technologies

Strategy – Retrofit vehicle model years 1993 to 2003 and newer with emission control technologies that are less polluting. Consider technologies that have demonstrated a history of effectiveness and durability. Emission control technologies may include but are not limited to; diesel particulate filters (DPF) (active and passive), diesel oxidation catalyst (DOC) (50% PM reduction or more), selective catalytic reduction (SCR), Lean NOx Catalyst (LNC), Gas Recirculation (EGR), closed crankcase ventilation systems (CCV) and or a combination of the above.

Technical Considerations – Operational and feasibility testing is required to ensure the function and applicability of an emissions control technology on the bus. In particular, many ECTs require exhaust gas temperature analysis by conducting exhaust gas temperature datalogging to measure exhaust gas temperatures. Many ECTs have exhaust temperature thresholds that are required for the operation and effectiveness of the technology. Considerations must include duty cycle, exhaust temperatures, and preventative maintenance schedules. Emission control technologies which have been certified or verified by regulatory agencies (such as those programs at the US Environmental Protection Agency and the California Air Resources Board) are most likely to deliver the claimed benefits.

Options for Implementation – Implement strategy through lease requirements, tariff charges, and incentives. Design a Technology Advancement Program that would demonstrate feasibility of ECTs on buses. The Technology Advancement Program would consider use of newer technologies.

Pros and Cons – Positive PM, NOx, HC and CO emission reduction benefits. Challenges may occur while assessing appropriate technologies. Some technologies such as DPFs have strict exhaust temperature requirements. Retrofitting may include exhaust reconfiguration and cutting of the exhaust pipe. DPFs require annual cleaning depending on the technology and can be costly. SCRs require urea dosing units and may acquire an increase in fuel cost with urea + diesel. The costs of emission control technologies and/or vehicles may be prohibitive.

Idle-Reduction Technologies

Strategy – Reduce idling emissions by using idle-reduction technologies. Mobile idle-reduction technologies include; automatic shut down and start up systems. These mobile idle-reduction technologies are on-board technologies that help provide power to the bus or light duty vehicle. Driver education is a necessary and effective component of idle-reduction programs.

Technical Considerations – Test feasibility of idle-reduction technology.

Options for Implementation – Implement strategy through education and outreach, lease requirements, tariff charges, and incentives.

Pros and Cons – Eliminating idling time by using an idle-reduction technology greatly reduces emissions that would be generated from idling. International availability may create a challenge for some ports. A major advantage of anti-idling programs for light duty vehicles is that they can save fuel costs with very little capital investment.

Locomotives and Rail

• Equipment Replacement

• Operational Improvements

• Clean Fuels

• Emission Control Technologies

• Idle-Reduction Technologies

Strategies

Here are some effective strategies that can be applied to address emissions from Locomotives and Rail:

Equipment Replacement

Strategy – Replace older locomotives with locomotives that meet cleaner engine standards. New and cleaner locomotives could include electric or hybrid locomotives. For example; the San Pedro Bay Ports Clean Air Action Plan requires switch and Class I locomotives to meet EPA Tier II engine standards and when Tier III locomotives when they become more available. The European Union currently has standards for cleaner locomotives, Euro III and IV.

Technical Considerations – Retire older locomotives.

Options for Implementation – Implementation may include setting an operational agreement with the locomotive companies or creating a memorandum of understanding with the port, regulatory agencies and other stakeholders.

Pros and Cons – Replacing old locomotives with newer locomotives has a significant emissions benefit. Locomotive replacement is costly and international availability may be a concern for some ports.

Operational Improvements

Ports should evaluate the feasibility of increased use of on-dock and near dock rail, address rail bottlenecks in and around ports, and use of RFID and OCR at rail yards. Increasing the efficiency how trains are stacked and queued, building trains to reduce drag and/or building longer trains for overall fuel efficiency will also reduce air emissions.

Strategy – Repower older locomotives with cleaner engines.

Technical Considerations – Assess technical feasibility.

Options for Implementation – Implementation may include setting an operational agreement with locomotive companies or creating a memorandum of understanding with the port, regulatory agencies, and other stakeholders.

Pros and Cons – Engine repowers demonstrate great emission reduction benefits. However, locomotive engine replacement is a costly procedure notwithstanding the cost for the cleaner engine itself. Purchasing a new cleaner locomotive may prove to be a better option. International availability may be a concern for some ports.

Clean Fuels

Strategy – Implement the use of cleaner fuels with low sulfur content. Cleaner fuels include; low to ultra low sulfur diesel fuel, emulsified diesel fuels, oxygenated fuel (O2 diesel fuel), LNG and CNG.

Technical Considerations – Work with ports and fuel suppliers on the availability and supply of clean fuels. Depending on the type of clean fuel used, cleaning of the fuel tank may be required in order to avoid fuel contamination. For LNG or CNG locomotives, a fueling infrastructure is required for some ports that may not be near LNG or CNG fueling stations. Railroads interested in using LNG or CNG need to be converted to handle that fuel type.

Options for Implementation – Implementation strategies may include the use of incentives, lease requirements, tariff changes, or a memorandum of understanding.

Pros and Cons – Positive emission reduction benefits for NOx, PM and GHGs. Challenges may arise with fuel availability.

Emission Control Technologies

Strategy – Consider retrofitting locomotives with proven emission control technologies. Some of these technologies include diesel oxidation catalysts (DOCs), diesel particulate filters (DPFs) with PM emission reduction benefits, and selective catalytic reduction (SCR) that reduce NOx. The use of ultra low sulfur diesel fuel (ULSD) is mandatory for locomotives retrofitted with DPFs.

Technical Considerations – Technical and operational feasibility testing is required. Emission control technologies which have been certified or verified by regulatory agencies are most likely to deliver the claimed benefits,

Options for Implementation – Implementation strategies may include the use of incentives, lease requirements, tariff changes, or a memorandum of understanding.

Pros and Cons – There can be positive emission benefits from using emission control technologies. However, retrofitting locomotives with the appropriate ECT can be difficult. Due to various operational constraints, some ECTs may not be appropriate depending on the locomotive. A thorough technical assessment and feasibility study is required to carry out a successful retrofit. It is recommended to retrofit locomotives that have cleaner operating engines.

Idle-Reduction Technologies

Strategy – Reduce idling emissions by putting in place idle-reduction technologies. Technologies include: automatic engine stop-start controls (AESS); auxiliary power unit (APU); diesel-driven heating systems (DDHS); shore power plug-in unit and a hybrid switching locomotive.

Technical Considerations – Test operational feasibility.

Options for Implementation – Implementation strategies may include the use of incentives, lease requirements, tariff changes, or a memorandum of understanding.

Pros and Cons - Eliminating idling time by using an idle-reduction technology greatly reduces emissions that would be generated from regular idling. International availability of idle-reduction technology may present a challenge for some ports. Applying idle-reduction technologies to locomotives can yield significant fuel savings, which results in a significant cost savings.

Construction Equipment

• Equipment Replacement

• Operational Improvements

• Idle-Reduction Technologies

• Clean Fuels

• Emission Control Technologies

Strategies
Here are some effective strategies that can be applied to address diesel emissions from construction equipment.

Equipment Replacement

Strategy – Replace older on-road and off-road excavators, tractors, compactors, earth movers and cranes <750 hp with new equipment that meet cleaner on-road and off-road engine standards. Implement the cleanest available NOx and PM alternative-fueled engine or the cleanest available NOx diesel-fueled engine that will meet 0.01 g/bhp-hr for particulate matter (PM). If there are no engines that meet the 0.01 g/bhp-hr for PM, then purchase of the cleanest available engine long with the best available emission control technology that would meet the 0.01 g/bhp-hr for PM.

Technical Considerations – Ensure technical feasibility. Strategy will involve carefully removing the original engine and replacing it with a newer-cleaner engine.

Options for Implementation – Implementation through voluntary programs, incentives, lease renewals/renegotiations and/or contractual agreements.

Pros and Cons – The purchase of newer construction equipment that meet cleaner on-road or off-road engine standards will demonstrate great emission reduction benefits. The challenge may be the availability of cleaner engines internationally.

Operational Improvements

Strategy – Repower construction equipment <750 hp with cleaner on-road and off-road engines. With construction equipment >750 hp, repower engines with cleaner off-road engines

Technical Considerations – Ensure technical feasibility. Strategy will involve carefully removing the original engine and replacing it with a newer-cleaner engine.

Options for Implementation – Implementation through voluntary programs, incentives, lease renewals/renegotiations and/or contractual agreements.

Pros and Cons – As mentioned above, repowering older diesel engines with cleaner on-road or off-road engines can greatly improve emission reductions. However, international availability may be a concern.

Idle-Reduction Strategies

Strategy – Reduce idling emissions by using idle-reduction technologies. Mobile idle-reduction technologies include; automatic shut down and start up systems. These mobile idle-reduction technologies are on-board technologies that help provide power to the equipment. Operator education is a necessary and effective component of idle-reduction programs.

Technical Considerations – Test feasibility of idle-reduction technology on construction equipment.

Options for Implementation – Implement strategy through education and outreach, lease requirements, tariff charges, and incentives.

Pros and Cons – Eliminating idling time by using an idle-reduction policies, education and technology greatly reduces emissions that would be generated from idling. International availability of technology tools such as on board computer systems with anti-idling settings may create a challenge for some ports. A major advantage of anti-idling programs for construction equipment is that they can save fuel costs with very little capital investment.

Cleaner Fuels

Strategy – Implement the use of cleaner fuels with low sulfur content. Cleaner fuels include; low to ultra low sulfur diesel fuel, emulsified diesel fuels, oxygenated fuel (O2 diesel fuel), and biodiesel.

Technical Considerations – Work with ports and fuel suppliers on the availability and supply of clean fuels. Depending on the type of clean fuel used, cleaning of the fuel tank may be required in order to avoid fuel contamination.

Options for Implementation – Implementation strategies may include the use of lease requirements, tariff changes, or through contractual agreements.

Pros and Cons – Positive emission reduction benefits for NOx, PM and GHGs. The use of biodiesel may present a slight increase in NOx. Challenges may arise with fuel availability and cost.

Emission Control Technologies

Strategy – Retrofit construction equipment with the best available emission control technologies (ECTs). Depending on the appropriate application of ECT, ECTs can include; diesel oxidation catalyst (DOC), diesel particulate filter (DPF), or selective catalytic reduction (SCR). While evaluating different emission control technologies, consider ECTs that have had proven success with construction equipment similar to the construction equipment under evaluation. To further improve emission reductions, retrofit cleaner construction equipment engines with ECTs.

Technical Considerations – Operational and feasibility testing is required to ensure the function and applicability of an emissions control technology on construction equipment. In particular, many ECTs require exhaust gas temperature analysis by conducting exhaust gas temperature datalogging to measure exhaust gas temperatures. Many ECTs have exhaust temperature thresholds that are required for the operation and effectiveness of the technology. Emission control technologies which have been certified or verified by regulatory agencies (such as those programs at the US Environmental Protection Agency and the California Air Resources Board) are most likely to deliver the claimed benefits.

Options for Implementation – Implement strategy through lease requirements, tariff charges, incentives and/or contractual agreements.

Pros and Cons – Applying ECTs has proved to have positive emission benefits in reducing particulate matter (PM), Oxides of Nitrogen (NOx), carbon monoxide (CO) and hydrocarbon (HC). Retrofitting construction equipment with ECTs can be challenging, careful evaluation and analysis is a must.

CREATING YOUR CLEAN AIR PROGRAM

Commiting to Clean Air

PLAN – Planning Your Clean Air Program

DO – Implementing Strategies

CHECK – Measuring Results

ACT – Review Your Clean Air Plan

Steps You Can Take

So far, you have learned about the challenges facing ports today with balancing business and environmental needs. You have also learned about the different port activities and the resulting emissions; the potential effects on the environment and public health; and how ports are moving forward to promote clean air through effective strategies. By following the systematic process called 'Plan, Do, Check and Act' cycle, you will be able to create your Clean Air Program that promotes continual improvement.

Creating Your Clean Air Program

Commiting to Clean Air

Case Studies

Creating and Implementing
Your Clean Air Program

Commiting to Clean Air

Before you create your very own Clean Air Program, you have to make a commitment . By making a commitment, you are making a promise to fully carry out the actions necessary to ensure that your Clean Air Program is a success. In addition, you are starting the process of developing the support and dedication from people within your organization to participate in reducing emissions. The size or type of organization does not make a difference; the most important element of a successful Clean Air Program is commitment.

Institute a Clean Air Policy
A Clean Air Policy provides the groundwork for setting performance goals and integrating clean air management into the organization's culture and operations

A Clean Air Policy should include the following
Stated objective
Establishment of accountability
Ensure continuous improvement
Promotion of goals

A Clean Air Policy will ensure senior management support and support among the staff. It also communicates the organization's commitment to the Port, customers, tenants and business partners, stakeholders and the community.

Appoint a Clean Air Director
The Clean Air Director would be responsible for setting goals, tracking progress and promoting the Clean Air Program. An existing staff member can serve in this role. This individual would be someone that is capable of effectively overseeing the creation, management and implementation of a port clean air program.

Establish a Clean Air Team
The Clean Air Team executes clean air management strategies depending on the maritime operation, while ensuring integration of best practices.

The Clean Air Team monitors and tracks progress. Regular reporting is made to the Clean Air Director on program progress.

Clean Air Team members may include staff involved in engineering, operations and maintenance, building/facilities management, environmental health and safety, construction management, and contractors and suppliers.

Coordinate with Stakeholders and Regulatory Agencies
Developing your Clean Air Program with the support of your customers, tenants, business partners, stakeholders and regulatory agencies will ensure the Program's sustainability. In addition, involving your customers, tenants, business partners, stakeholders and regulators in the decision and goal-setting process brings in different perspectives that will give the Clean Air Program more diversity.

Case Studies

San Pedro Bay Ports Clean Air Action Plan
The Port of Los Angeles partnered with its sister port, the Port of Long Beach , and engaged the United States Environmental Protection Agency, California Air Resources Board and the South Coast Air Quality Management District in a partnership to develop the world's first multi-port, comprehensive port-related air management plan – the San Pedro Bay Ports Clean Air Action Plan .

Northwest Ports Clean Air Strategy
The ports of Seattle and Tacoma in the Pacific Northwest of the United States and the Vancouver Port Authority have been working closely with federal, state and local air agencies for years on successful voluntary collaborative approaches to reduce air emissions from maritime-related sources in the region. They are currently working on the Northwest Ports Clean Air Strategy to establish common performance goals and further reduce emissions to protect public health and the environment.

Port Authority of New York and New Jersey Clean Air Initiatives and Harbor Air Management Plan
The Port Commerce Department of the Port Authority of New York and New Jersey in the Atlantic Northeast of the United States, along with its tenants, public agencies and private partners, collaborate on voluntary efforts to field test new off road technologies and develop clean equipment prototypes. Collaborative efforts are conducted under the Department's participation with the Regional Air Team on the Harbor Air Management Plan, the Northeast Diesel Collaborative and through U.S. EPA's Clean Ports Program.

Rijnmond Regional Air Quality Action Program
ROM Rijnmond Executive Council commissioned the DCMR Rijnmond Environmental Agency to draw up a regional plan through the Top Management Steering Committee on Air, which comprise of leaders from Ministries of Housing, Spatial Planning and the Environment; Transport, Public Works and Water Management; Economic Affairs; Agriculture; Nature and Food Quality; the Province of Zuid-Holland, the city of Rotterdam, Rotterdam Metropolitan Region; and Rotterdam Port Authority. The Rijnmond Regional Air Quality Action Program draws up existing air quality programs and creates a great uniformity of air quality control measures.

Creating and Implementing Your Clean Air Program

Use the 'Plan, Do, Check, and Act' (PDCA) cycle as a tool to create and implement your Clean Air Plan. The PDCA cycle will guide you through the process to develop a program that strives to achieve continual improvement. For Ports which have or are implementing an Environmental Management System (EMS), this approach can be used to make the Clean Air Plan compatible with the Port's overall environmental management program.

Creating Your Clean Air Program
PLAN – Planning Your Clean Air Program

Set Up A Process To Identify Objectives and Targets
• Evaluate clean air programs currently in place.

• Design your Clean Air Program to follow approaches that have demonstrated success in other clean air programs. For example: San Pedro Bay Ports Clean Air Action Plan.

• Create a Clean Air Program that is most suitable to meet your business needs.

Estimate Emission Reduction Potential
• Determine emissions to be reduced.

• Evaluate the strategies needed to bring about your estimated emission reduction potential.

• Design a benchmarking goal to measure emission reduction progress.

Define Goals
• Define set emission reductions.

• Define maritime activity of focus.

• Determine what equipment by identifying the number and types of equipment to be improved.

• Determine the timeline that the Clean Air Program will be carried out.

Determine Technical Approach
• Identify the technical steps to reduce emissions from the selected maritime activity.
For example, here are the types of questions that will help identify what technical steps are needed. The maritime activity in this example is cargo handling equipment.

• How will operational staff schedule selected CHE to be retrofitted with emission control technologies
without creating operational and schedule conflicts?

• What equipment will be retrofitted first?

• What training is required to educate maintenance/operational staff on technical implementation?

• What are the steps needed to retrofit a top loader with a diesel oxidation catalyst (DOC)?

• Once CHE is retrofitted, what maintenance is involved?

Determine Performance Targets
DO – Implementing Strategies
There are two equally important approaches to the "DO" process of the PDCA,

Technical
Approach

Communication Approach

Technical Approach

Conduct an Activity-Based Emissions Inventory
• Depending on the maritime operation (ex: cargo handling equipment), collect data on the type of equipment, the
individual equipment number, the engine type, model, year, hours of activity, fuel use, and whether the
equipment has been upgraded or given a special after-treatment.

• Once you have a detailed list of all of your equipment, assess your older equipment, determine what equipment is
going to be replaced or repowered with a newer engine. Examine what equipment is most actively used on a
daily basis.

• After examining your equipment, calculate the emissions. Determine what the emissions factor is for each
engine type. This is a very important component in the equation.

• A number of port-wide activity-based emission inventories have been conducted at ports in the United States .
The ports that have conducted port-wide emissions inventories include:

• Port of Los Angeles
• Port of Long Beach
• Port of Seattle
• Port of Tacoma
• Port Authority of Houston
• Port Authority of New York and New Jersey

Establish a Baseline and Set a Benchmark
• Using the results of the emissions inventory, set a starting point from which to measure progress.

• Compare performance to other maritime activities and prioritize which activities to focus on.

• Make a qualitative assessment to current in-use practices, such as; preventive maintenance, equipment

replacement schedules, and efficiency practices.

Analysis and Evaluation

• Analyze the results of your emissions inventory by determining what maritime operation is generating the most emissions. Take into consideration the age of the equipment, the hours in operation, the type of fuel, the load in which the equipment is operating under and the maintenance schedule.

• Evaluate over-all performance of your equipment. Meet with the operators of the equipment and inquire on how each piece of equipment operates.

• Evaluate where there is a lack of efficiency in daily operations; for example, trucks waiting more than 15 minutes to enter the gate and/or facility.

• Generate a report on your assessment.

Research Different Emission Control Strategies

• Using the Tool Box for Port Clean Air Programs as a guide, evaluate the strategies recommended for the source category of focus. For example, refer to the strategies recommended for cargo handling equipment (CHE).

• Depending on the strategy, research the various options available that will work best with the identified equipment. For example, research the different emission control technology companies that provide diesel particulate filters (DPFs) for non-road applications such as CHE. There are differences in operational measures, effectiveness, maintenance and cost. The Tool Box provides helpful websites you can use to learn more about DPFs.

• Identify where to improve operational efficiency either through idle-reduction strategies, gate efficiencies and/or better maintenance programs.

Determine Control Strategy(s)

• After researching the various control options for your selected maritime operation, determine the control option(s) that is technically feasible and provides the most environmental benefits.

• Carry out a pilot test to ensure feasibility.

Implement Your Program

• Apply control strategy to maritime operation.
• Follow implementation schedule.

Communication Approach

Communicating Your Program
• Determine how to communicate your Program to your audience. Depending on how your port is organized,
your message may need to be adapted to the different groups of people within your company. The same applies
to communicating to people outside of your port – customers, tenants, business partners, stakeholders and the
port community.

• Create a communication plan that will direct how you will communicate your Program to your audiences.

Raise Awareness (Internal and External)
Identify the different mediums on how to communicate your Clean Air Program. Mediums may include; meetings,
workshops, written materials, campaigns, and the internet (include a program link on your port's webpage).

Capacity Building
Open up opportunities for your employees to learn and share ideas. Training allows for the exchange of helpful
information on best practices. Capacity building will help sustain the success of the program. The more people
are aware of and understand the purpose and benefits of the Clean Air Program, the higher the likelihood that
people will support it.

Motivating Your Team
Motivate your team through incentives. It is very important that people feel like they are a part of something
that is special and important. Recognize staff who have worked hard on the program and staff who have made
achievements while supporting the goals of the Clean Air Program.

Creating Your Clean Air Program
CHECK – Measuring Results

Monitor and Evaluate Progress

- By using your tracking system, monitor the progress of your Clean Air Program.
- Evaluate how well your Program is operating under the measures you've established.
- Measure the results of the control strategy.
- Determine how much emissions have been reduced and where operational performances have improved.

Creating Your Clean Air Program
ACT – Review Your Clean Air Program

Make Improvements to Your Program

- As you evaluate the progress of your Program, identify where improvements can be made.
- Work with your Clean Air Team to update your action plan.

Celebrate Program Achievement

- Recognize and commend the achievements of your staff that have helped make the Clean Air Program a success.
  It is very important to recognize the efforts of your team and the hard work they have put forward to bring the
  Clean Air Program into reality. Determine what criteria you will use to recognize achievements and how to reward
  those recognized.
- Communicate the success of the Clean Air Program to the port community and stakeholders. Share the benefits
  of your program with the public. A great way to share success and receive recognition is to apply for achievement
  or environmental awards. This will help build positive public awareness and support