

Port of Long Beach

Diesel Emission Reduction Program

2004 AAPA Environmental Improvement Awards Competition



Port of Long Beach, Planning Division

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I. Introduction

The Port of Long Beach (Port) hereby submits its Diesel Emissions Reduction Program (DERP) to the American Association of Port Authorities (AAPA) 2004 Environmental Awards Competition for consideration under the Environmental Enhancement category. The DERP is part of a comprehensive program to reduce Port impacts on air quality by implementing state-of-the-art emissions control technologies and alternative fuels on tenant-owned vehicles operated largely within the Port. This program represents a voluntary, collaborative effort between the Port and terminal operators that goes far beyond the current regulatory framework.

Under the DERP, the Port is providing funding for the installation of emission control equipment, such as Diesel Oxidation Catalysts (DOCs), to achieve long-term and significant reductions of diesel exhaust emissions. The Port has already installed 500



DOCs under the DERP and expects to have approximately 600 installed by the end of July. The DERP has also been used to introduce alternative diesel fuels at Port terminals, providing even greater air quality benefits. To date, the DERP has generated annual emission

reductions of over three tons of diesel particulate matter (DPM) and 21 tons of nitrogen oxides (NO_x). By the end of July, the Port expects the program's annual benefits to reach 16 tons of DPM and 79 tons of NO_x.

II. Goals and Objectives

The Port of Long Beach has enacted a comprehensive Air Quality Improvement Plan (AQIP), the goal of which is to achieve measurable, long-term reductions in air pollutant emissions from Port operations, particularly DPM. The State of California has classified DPM emissions as a toxic air contaminant (TAC) due to concerns about carcinogenic human-health effects.

Regional air quality in and around Long Beach is regulated at the federal, state, and local levels by the United States Environmental Protection Agency (USEPA), the California Air Resources Board (CARB), and the South Coast Air Quality Management District (SCAQMD), respectively. The DERP goes beyond current air pollution regulatory requirements because it aims to reduce emissions from the in-use fleet of tenant-owned vehicles operated largely within the Port – equipment that is less strictly regulated by local, state, and federal agencies.

Funding for the program was provided from multiple sources, including \$1 million from the CARB and a Clean Air Act Section 103 Grant from the USEPA. Additionally, the program's funding was matched with \$1 million in Port monies. Only emission control technologies and alternative fuels that met Port-established operational requirements and were cost effective would be considered for the DERP.

III. Discussion

A. Background

The Port of Long Beach is one of the world's busiest seaports and is the second busiest container port in the United States, with over 4.6 million twenty-foot equivalent

units (TEU¹) moving through the Port in 2003. It is a leading gateway for trade between the United States and Asia. Additionally, the Port is located in a region characterized as having some of the nation's worst air quality. The USEPA and the CARB have responsibility for regulating emissions from mobile sources, including the off-road diesel-fueled equipment used in cargo-handling operations at the Port. Diesel engine exhaust contains forty different substances identified by the CARB as toxic.

Illustrating its commitment to improving air quality, the Port has enacted a comprehensive Air Quality Improvement Plan to achieve measurable, long-term reductions in air quality emissions from Port operations, particularly DPM. The DERP is part of this plan.

The DERP originated with a 2001 study of alternative fuels and emissions control technologies prepared to identify options for controlling emissions from terminal operations at



the Port's Pier T. That evaluation assessed the operational and infrastructure functionality, cost, and the overall effect on emissions of various technologies when compared to a baseline of continued diesel use for three major categories of terminal equipment: yard hustlers, mobile container lifters (e.g., top picks), and rubber-tired gantry cranes (RTGs).

¹ A 40-foot container is equal to 2 TEU.

The Port then extended this work to consider the use of these technologies for virtually all of the cargo handling equipment in the Port. Various scenarios were investigated and several options were identified as viable for use.

B. Objectives and Methodology

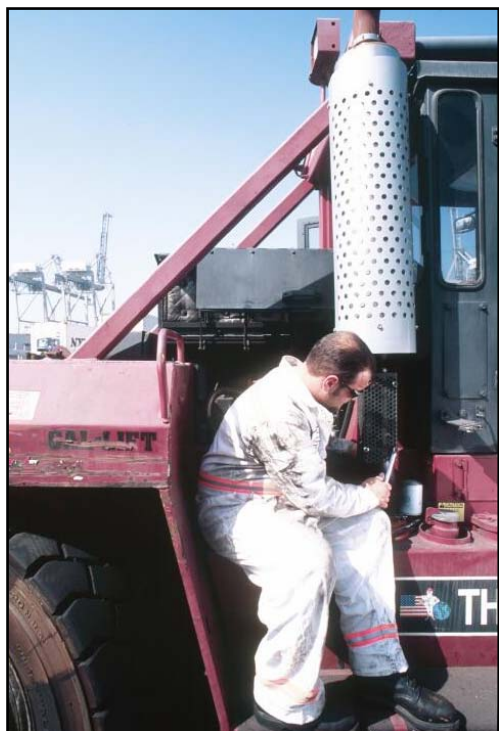
The objective of the DERP is to achieve significant long-term emission reductions (primarily DPM and NO_x) from diesel equipment in a cost effective manner. During the Port's initial studies, basic screening criteria were established with which to evaluate the feasibility of the available emissions control technologies and alternative fuels. Any technology that did not meet these basic requirements was eliminated from further consideration. Additional assessments were made to eliminate technologies incompatible with Port operations. A cost effectiveness assessment was provided for the remaining technologies and fuels.

Equipment specifications were based primarily on information supplied by the Port tenants. The information included the type of equipment, associated horsepower, equipment age, and historical hours of operation. The information was utilized to evaluate the emission reduction potential for criteria pollutants.

Generally, the cost effectiveness methodology from California's Carl Moyer Program (CMP) was used since it is approved by the CARB. However, the Carl Moyer methodology does not account for fuel usage or maintenance costs. Most of the cost analyses for the DERP considered the cost of equipment or device purchase, installations, fuel usage, and maintenance.

Upon completion of the feasibility studies, the resulting options were presented to tenant operators and other fleet managers for use in their respective fleets. The Port provided the interested parties with a full-color brochure containing brief summaries of some of the more popular emission control technologies and alternative fuels identified in the studies.

Any terminal or fleet operator at the Port who desires funding for the procurement and installation of the technologies and fuels under the DERP is required to submit an application detailing the expected emission benefits and the type of



emissions control technologies requested. The purchase and installation of the selected technologies are arranged via discussions between Port staff, terminal and fleet operators, and equipment vendors. Depending on the type of emissions control technology selected, installation is performed by the terminal operator's maintenance personnel with assistance from vendors. Training is provided in regards to proper maintenance during the installation procedure. As

part of the DERP application agreement, regular reports are required for five years after the installation date in order to comply with funding requirements. To complete this reporting, the Port submits an information request to each program participant

requesting operations and maintenance data. The information is used to calculate emission benefits and generate the annual report.

The DERP is currently in its second year and has already achieved significant emission reductions of DPM and NO_x. Due to their relative low cost and ease of installation onto existing engine systems, the most popular emission control technology available under the Port's DERP is the DOC. Two models currently in use are the Donaldson DCM diesel oxidation catalyst mufflers with 6000 Series catalyst formulation plus closed loop crankcase with Donaldson Spiracle™ closed crankcase filtration systems (Donaldson) and the Engine Control Systems AZ30 diesel oxidation catalyst (ECS). The Donaldson DOC is CARB verified to the Level 1 standard with a 25% or greater reduction in emissions of particulate matter. The ECS DOC is used in conjunction with the Lubrizol brand of emulsified diesel, PuriNO_x, and is certified to the Level 2 standard with a 50% or greater reduction in particulate matter emissions and 20% or reduction in NO_x emissions.

C. Fulfillment of the Award Criteria

1. Benefits to the Environmental Quality

This program will benefit environmental quality by achieving significant reductions in Port-related air pollution, thereby improving local and regional air quality. By the end of July, the Port expects to have about 600 DOCs installed yielding annual emission reductions of 16 tons of particulate matter and 79 tons of NO_x. These reductions are in excess of any required under existing federal, state or local law. Particular focus is made to reduce emissions of diesel exhaust particulate matter, which

is considered a toxic air contaminant by the State of California. These emission reductions are beyond the current regulatory framework and will improve the quality of life for Long Beach residents while promoting economic activity at the Port.

2. Independent Involvement and Effort by the Port of Long Beach

As part of its efforts to address port-related impacts on the environment, the Port independently conducted the studies which culminated in the DERP. This initiative was later formalized in the Port's AQIP, which states the specific air quality goals to reduce air pollution while facilitating increased trade demand. Funding assistance was provided by the CARB and the USEPA. Since the Port does not operate cargo handling equipment, the DERP required the Port to coordinate activities between its vendors, tenants and the CARB.

3. Program Creativity

The Port of Long Beach's DERP provides a port-wide method for installing the latest emissions control technologies on a variety of diesel-fueled cargo-handling equipment in order to achieve significant, long-term emissions reductions. The DERP provides flexible means of achieving these reductions by allowing fleet operators to select from different technology options. This helps to ensure compliance with DERP requirements in order to maintain maximum emissions reductions. The DERP also monitors compliance by requiring participants to certify annual reports.

4. Program Results

As of the date of this report, approximately 500 DOCs have been installed at seven different terminals yielding annual emission reductions of 12 tons of particulate

matter and 79 tons of NO_x. These emissions reductions are calculated using CARB's methodology for off-road equipment in combination with operational data obtained from the terminal and fleet operators at the Port.

By the end of July, the Port expects to have about 600 DOCs installed yielding annual emission reductions of 16 tons of particulate matter and 79 tons of NO_x. Annual reports are generated by all the program participants to ensure that the equipment are operated in a manner consistent with DERP



regulations and such that the level of emission reductions does not fall off significantly during each successive year. The following table provides a list of the annual emissions benefits separated by pollutant type and the type of equipment.

**Port of Long Beach Diesel Emissions Reduction Program
Projected Annual Emissions Reductions By Off-Road Equipment Type**

Equipment Type	Number	DPM (tons)	NO _x (tons)
Forklifts	25	0.2	1.6
Heavy Lifts	4	0.05	0
RTG Cranes	20	0.5	0
Side Picks	39	0.7	2.7
Top Picks	73	1.6	8.6
Yard Hustlers	435	12.8	66.4
Total	596	15.9	79.2

The following table provides a breakdown of the annual emissions benefits by emissions control technology type. Because of their relative low cost and ease of use, DOCs remain the most popular emissions control technology with participants in the DERP.

Port of Long Beach Diesel Emissions Reduction Program
Projected Annual Emissions Reductions By Emissions Control Technology

Retrofit Equipment	Number	DPM (tons)	NO_x (tons)
ECS DOC	190	10.3	79.2
Donaldson DOC	406	5.5	N/A
Total	596	15.9	79.2

5. Program Cost Effectiveness

The Port's DERP requires cost effectiveness calculations only for reductions of NO_x emissions. This requirement is the same as the CARB's Carl Moyer Memorial Air Standards Attainment Program (CMP). Under the latest revisions of the CMP, projects must meet a cost effectiveness criterion of \$13,600 per ton of NO_x reduced. The cost effectiveness calculations for NO_x emissions are based on CARB's *Methods to Find the Cost Effectiveness of Funding Air Quality Projects, 2003 ed.* This current method uses a discount rate of three percent and a corresponding Capital Recovery Factor of 0.22 for a project life of five years. The calculations are also based on the annual NO_x emissions reductions as summarized in the previous tables. As can be seen from the table below, the cost effectiveness of the DERP surpasses the requirements of the CMP by a wide margin.

Average DERP NO_x Cost Effectiveness

Equipment Type	NO_x Cost Effectiveness (\$/ton)
All Equipment at Participating DERP Terminals	\$8,909

6. Transferability of the Program to the Port Industry

The ideas of the DERP can easily be applied to other Port facilities since much of the diesel-fueled cargo-handling and cargo-related equipment are similar. Much of the program was modeled after the CMP to ensure that all aspects were in agreement with federal, state and local federal regulations.

IV. Conclusion

The Port's DERP has already proven a success by providing voluntary air pollution reduction benefits from Port operations by significant and measurable amounts. By allowing terminal and fleet operators to be involved in the process of selecting their emission control technologies, there is a sense of "buy-in" to the program that helps to ensure the technologies are being used and properly maintained. Together with the support of the Port management and regulatory agencies, the Port can continue this program to improve the quality of life for Long Beach residents while promoting economic activity at the Port.

