



Putting a EMISSION

Technology sets new standard for the treatment of high-volume stationary source diesel emissions.

Ships at port have long been a frustrating source of air pollution. Larger than many factories, transport ships have a much greater challenge in controlling their emissions than a stationary building. Of course, the ships are not always stationary, and one company believes it has found a solution for at least controlling the diesel emissions at port.

In 2007, The Port of Long Beach handled more than 7.31 million containers, and more than 87 million metric tons of cargo. The ports of Los Angeles and Long Beach account for more than 40 percent of all containers entering the United States.

Idling ships accounted for 1.8 tons per day of diesel particulate matter statewide in 2006, according to the California Air Resources Board. Diesel emissions have been implicated in increased incidences of lung cancer, asthma and respiratory disease.

Cargo ships, some of which can emit more diesel exhaust per day than 12,000 automobiles, are responsible for much of the air pollution in the region. They are a leading source of NO_x, SO_x and particulate matter (PM), which have been linked to premature deaths, respiratory illnesses and global warming in the Los Angeles basin and many other port areas.

Commercial ships, en route and at port, release more SO₂ particulate than all of the world's cars, trucks and buses combined,

according to a study released in March by the International Council on Clean Transportation, and quoted in a *Wall Street Journal* article Nov. 27, 2007. The study further found that ships produced an estimated 27 percent of the world's NO_x emissions.

In November 2007, a peer-reviewed study in the American Chemical Society's journal, *Environmental Science and Technology*, estimated that under-regulated air pollution from ships results in 60,000 deaths from lung cancer and cardiopulmonary disease each year, primarily along trade routes in Asia and Europe.

Particulate pollution from ships in international waters is, after many delays, being addressed by the Marine Environmental Protection Committee, which represents 167 governments.

Coming out

A media event was held on June 19, 2008, to announce the results of tests for cleaning diesel emissions using Cloud Chamber Scrubber technology developed by Tri-Mer Corp., Owosso, Mich. The emissions tests covered all sources originating from ships at dock, including auxiliary engines, boilers and on-board power generators. The announcement featured speeches by Barry Wallerstein, executive director of the South Coast Air Quality Management District, and Wayne Nastri, regional administrator for EPA Region 9.

The scrubber treats PM_{2.5}, fine, submicron, ultrafine and con-

Cap on Emissions

densable particulate, as well as PM10 and more coarse particles. The system also was designed to remove any gas treatable by a wet scrubber, including HCl, NO₂, SO₂, Cl₂, NH₃ as well as HF, H₂SO₄, HNO₃, ammonia and amine compounds.

New discoveries in electrofluidics formed the basis for the system. Such scrubbers can require just 10 watts per 1000 cfm to charge the water droplets, plus moderate pump power for water recirculation. They also operate with low water usage. The scrubbers generate less

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than 1.5 inches w.g. pressure drop across the system. Gas temperature, particle solubility, resistivity and reactivity have minimal affect on performance. The scrubbers accommodate heavy loadings and are not sensitive to load flux.

The test revealed reduction rates that effectively establish a new standard for the treatment of high-volume diesel emissions. Performance efficiencies of the scrubber, detailed at the event, were high for all target pollutants:

- Particulate matter: 98 percent reduction
- SO₂ 98 percent reduction
- NO_x 99 percent reduction

The scrubber uses a patented technology to charge the droplets to remove particulate and SO₂. Diesel particulate is less than 0.1 micron in size and is one of the most difficult particulates to control. The scrubber employs a special pre-conditioning process that allows particles to be captured by the charged droplets while simultaneously removing the SO₂.



A Tri-Mer CCS gathers diesel emissions at the Union Pacific rail yard and Port of Long Beach.

NO_x is treated by a selective catalytic reduction module. PM and sulfur that might otherwise impede catalyst efficiency and service life are removed prior to NO_x treatment, so exceptional results are consistently achievable.

Advanced particulate characterization equipment was used to calibrate the system. The ship exhaust was captured and brought to the dock-side scrubber system using a device developed by ACTI (Rancho Dominguez, Calif.), the environmental company that hosted the media day. The government agencies and other stakeholders at the port contracted with an independent third party testing company and laboratory to provide standard testing and analysis of PM, SO₂, and NO_x for independent verification.

The demonstration test at the Port of Long Beach, and a similar demonstration on diesel locomotive emissions at Union Pacific (Roseville, Calif.), demonstrated consistent high removal efficiencies when operating at the flow volumes typical for large diesel engines. **PE**

For test results, and links to regulatory documents, visit www.tri-mer.com/ccs-case-study-6-diesel-exhaust-emissions.html#diesel, click the links under Case Study #6: Diesel Exhaust Emissions/Locomotive Diesel Pollution. For more information, contact Kevin Moss, kevin.moss@tri-mer.com, (801) 294-5422, or visit www.tri-mer.com.