

## EPA Proposal for Control of Emissions from New Marine Compression-Ignition Engines at or Above 30 Liters Per Cylinder

The U.S. Environmental Protection Agency (EPA) is proposing more stringent exhaust emission standards for the largest marine diesel engines used for propulsion on oceangoing vessels (called Category 3 engines). These Clean Air Act standards are part of a coordinated strategy to address emissions from all oceangoing vessels that affect U.S. air quality. EPA's coordinated strategy also includes implementation of the international emission standards for marine engines and their fuels contained in Annex VI to the International Convention on the Prevention of Pollution from Ships (MARPOL Annex VI). The strategy also includes designation of U.S. coasts as an Emission Control Area through an amendment to MARPOL Annex VI. The proposed standards represent another milestone in EPA's ongoing National Clean Diesel Campaign to reduce harmful emissions from diesel engines of all types.

### Background

Current Clean Air Act (CAA) standards for new Category 3 compression-ignition marine engines (also called marine diesel engines) at or above 30 liters per cylinder displacement are found at 40 CFR Part 94, and have been in effect since January 2004 (68 FR 9745, February 28, 2003). These standards are equivalent to the cur-



rent international standards for marine engines contained in MARPOL Annex VI. These standards rely on engine based technologies to reduce exhaust emissions of nitrogen oxides (NO<sub>x</sub>). EPA is proposing additional emission control standards for these engines because of the opportunity to achieve significant public health benefits, and the improved feasibility of applying high efficiency after-treatment technologies to these engines.

EPA's controls for the sulfur content of marine distillate fuel have been in effect since July 2007 (69 FR 38957, June 29, 2004). These requirements apply to fuel produced or offered for sale in the United States and apply to distillate grades DMX, DMA, and their equivalents. While EPA has not adopted fuel sulfur limits for residual fuel under the CAA, the MARPOL Annex VI fuel sulfur limits apply to marine fuel oil used by any vessel beginning in January 2009. MARPOL Annex VI contains two sets of fuel sulfur limits, consisting of a global cap on fuel sulfur levels and regional requirements for designated Emission Control Areas (ECAs) that set the maximum content of fuel that can be used by vessels while operating in those areas. The United States ratified Annex VI in October 2008, and the requirements became enforceable through the Act to Prevent Pollution from Ships (APPS) in January 2009.

MARPOL Annex VI was recently amended to add new tiers of engine NO<sub>x</sub> emission standards and fuel sulfur limits. The new standards are similar to those advanced by the United States during negotiations to revise the international standards. The amendments consist of a two part program, with stringent global NO<sub>x</sub> and fuel sulfur standards and additional, more stringent NO<sub>x</sub> and fuel sulfur controls that apply in designated ECAs.

## **The Need to Reduce Emissions from Category 3 Marine Diesel Engines**

Category 3 marine diesel engines are significant mobile source emitters. Category 3 marine diesel engines being produced today must meet relatively modest emission requirements and therefore generate significant emissions of fine particulate matter (PM<sub>2.5</sub>), NO<sub>x</sub> and sulfur oxides (SO<sub>x</sub>) that contribute to nonattainment of the National Ambient Air Quality Standards for PM<sub>2.5</sub> and ozone. These engines also emit hydrocarbons (HC), carbon monoxide (CO), and hazardous air pollutants or air toxics that are associated with adverse health effects. Emissions from these engines also cause harm to public welfare, and contribute to visibility impairment and other detrimental environmental impacts across the United States.

Air pollution from large marine diesel engines affects not just populations living near ports and coastlines, but also those living hundreds of miles inland. These engines are significant contributors to our national mobile source emission inventory and their contribution is expected to grow in the future. Without further action, by 2030, NO<sub>x</sub> emissions from ships are projected to more than double, growing to 2.1 million tons a year, while annual PM<sub>2.5</sub> emissions are expected to almost triple to 170,000 tons.

When people breathe this polluted air, their health is adversely affected leading to lost productivity due to increased illnesses, hospitalizations and even premature deaths. EPA believes that diesel exhaust is likely to be carcinogenic to humans by inhalation. Children, people with heart and lung diseases, and the elderly are thought to be most at risk. Reducing emissions from these

large marine diesel engines will lead to significant public health benefits and will help states and localities attain and maintain PM and ozone National Ambient Air Quality Standards.

## **Program to Address oceangoing Vessel Emissions**

EPA's coordinated strategy to address emissions from oceangoing vessels consists of the standards being proposed in today's action, a separate action for ECA designation for U.S. coasts, and implementation of MARPOL Annex VI through APPS. We are also considering a Voluntary Marine Verification Program to address emissions from the legacy fleet of existing vessels.

### **New Clean Air Act Standards for Category 3 Engines**

EPA is proposing to revise the CAA engine program to include two additional tiers of NO<sub>x</sub> standards for new Category 3 marine diesel engines installed on vessels flagged or registered in the United States. The proposed near-term Tier 2 standards for newly built engines would apply beginning in 2011 and would require more efficient use of current engine technologies, including engine timing, engine cooling, and advanced computer controls. The Tier 2 standards would result in a 15 to 25 percent NO<sub>x</sub> reduction below the current Tier 1 levels. The proposed long-term Tier 3 standards would apply beginning in 2016 and would require the use of high efficiency after treatment technology such as selective catalytic reduction to achieve NO<sub>x</sub> reductions 80 percent below the current levels.

In addition to the NO<sub>x</sub> emission limits, EPA is proposing standards for emissions of HC and CO from new Category 3 engines. EPA is not proposing to set a standard for PM emissions for Category 3 engines. However, significant PM emissions benefits will be achieved through the ECA fuel sulfur requirements that will apply to ships that operate in areas that affect U.S. air quality. EPA is also proposing to require engine manufacturers to measure and report PM emissions.

Finally, EPA is proposing a change to the diesel fuel program that would forbid the production and sale of marine fuel oil above 1,000 ppm sulfur for use in the waters within a U.S. ECA and internal U.S. waters, and allow for the production and sale of 1,000 ppm sulfur fuel for use in Category 3 marine vessels.

### **ECA Designation**

On March 27, 2009, the U.S. and Canadian Governments submitted a proposal to amend MARPOL Annex VI to designate North American coastal waters as an ECA.<sup>1</sup> ECA designation would ensure that ships that affect U.S. air quality meet stringent NO<sub>x</sub> and fuel sulfur requirements while operating within 200 nautical miles of U.S. coasts.

### **Annex VI Implementation**

The United States became a party to MARPOL Annex VI by submitting its instrument of ratification to the International Maritime Organization (IMO) on October 8, 2008. This was

preceded by the President signing into law the Maritime Pollution Prevention Act of 2008 (Public Law 110-280) on July 21, 2008, that contains amendments to the Act to Prevent Pollution from Ships (APPS). (33 USC 1901 et seq.) These APPS amendments require compliance with all aspects of Annex VI by all persons subject to the engine and vessel requirements of Annex VI. The amendments also authorize the United States Coast Guard and EPA to enforce the provisions of Annex VI against domestic and foreign vessels and to develop implementing regulations, as necessary. In addition, APPS gives EPA sole authority to certify engines installed on U.S. vessels to the Annex VI requirements. EPA is proposing regulations to implement several aspects of the Annex VI engine and fuel regulations, under that APPS authority.

## Program Costs

The estimated cost of implementing the coordinated strategy is approximately \$1.85 billion in 2020, increasing to \$3.11 billion in 2030. Of the 2020 costs, nearly 86 percent or \$1.64 billion are attributable to the use of higher-cost lower-sulfur fuel in the proposed ECA. The total operational cost is estimated to be \$1.82 billion in 2020. The cost to apply engine controls to U.S. flagged vessels are expected to be \$32.7 million in 2020, increasing to \$48.5 million in 2030 as more ships are built to comply with Annex VI Tier III NO<sub>x</sub> limits.

When attributed by pollutant, at a net present value of 3 percent from 2010 through 2040, the NO<sub>x</sub> controls are expected to cost about \$510 per ton of NO<sub>x</sub> reduced, SO<sub>x</sub> controls are expected to cost about \$930 per ton of SO<sub>x</sub> reduced, and the PM controls are expected to cost about \$8,600 per ton of PM reduced. These costs are comparable to our other recently adopted mobile source programs, and it is one of the most cost effective programs in terms of NO<sub>x</sub> and PM reductions when compared to recent mobile and stationary programs. These costs are expected to be completely passed on to the consumers of ocean transportation. The impacts of these costs on society are estimated to be minimal, resulting in a small increase in the goods transported. For example, EPA estimates it will result in an increase of about \$0.01 for a pair of tennis shoes, and about \$0.03 for a bushel of grain.

## Program Benefits

By 2030, this coordinated strategy to address emissions from oceangoing vessels is expected to reduce annual emissions of NO<sub>x</sub> in the United States by about 1.2 million tons and particulate matter (PM) emissions by about 143,000 tons. When fully implemented, the coordinated strategy will reduce NO<sub>x</sub> emissions by 80 percent and PM emissions by 85 percent, compared to the current limits applicable to these engines. By 2030, the coordinated strategy is expected to yield significant health and welfare benefits, annually preventing between 13,000 and 33,000 premature deaths, 1,500,000 work days lost, and 10,000,000 minor restricted activity days.

The monetized health benefits are projected to range from \$110 billion to \$280 billion, assuming a 3 percent discount rate, or between \$100 billion and \$260 billion, assuming a 7 percent discount rate. These estimated benefits exceed the projected costs by a ratio of at least 30:1.

## Public Participation Opportunities

Comments will be accepted beginning when this Proposed Rule is published in the Federal Register. Additionally, public hearings will be held on August 4, 2009 in New York, NY and August 6, 2009 in Long Beach, CA, at which additional comments will be accepted. For information on how to submit written comments or how to sign up to speak at a hearing, please see the Federal Register Notice. All comments should be identified by Docket ID No. EPA-HQ-OAR-2007-0121 and submitted by one of the following methods:

Internet: [www.regulations.gov](http://www.regulations.gov)

E-mail: [A-and-R-Docket@epa.gov](mailto:A-and-R-Docket@epa.gov)

Mail:

Air and Radiation Docket and Information Center  
U.S. Environmental Protection Agency  
Mailcode 6102T  
1200 Pennsylvania Ave., NW  
Washington, DC 20460

Hand Delivery:

EPA Docket Center  
3334 EPA West Building  
1301 Constitution Ave., NW  
Washington, DC

## For More Information

You can access the Notice of Proposed Rulemaking and other documents related to our coordinated strategy for oceangoing vessels electronically on the EPA's Office of Transportation and Air Quality web site at:

[www.epa.gov/otaq/oceanvessels.htm](http://www.epa.gov/otaq/oceanvessels.htm)

For more information, please contact the Assessment and Standards Division at:

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<sup>1</sup> Proposal to Designate an Emission Control Area for Nitrogen Oxides, Sulphur Oxides and Particulate Matter. Submitted by the United States and Canada. IMO Document MEPC59/6/5, 27 March, 2009. A copy of this document can be found at <http://www.epa.gov/otaq/regs/non-road/marine/ci/mepc-59-eca-proposal.pdf>