



Air Pollution and Greenhouse Gas Emissions from Ships

(name redacted)

Specialist in Environmental Policy

December 23, 2009

Congressional Research Service

7-....

www.crs.gov

RL34548

Summary

This report provides information regarding pollution from ships and port facilities; discusses some of the measures being implemented and considered by local, state, and federal regulatory agencies; discusses the efforts to strengthen Annex VI of the International Convention for the Prevention of Pollution from Ships (MARPOL); and describes legislation in Congress to control emissions from ships, as well as efforts in Congress to address the applicability of proposed EPA regulations to ships on the Great Lakes.

As pollution from cars, trucks, and land-based stationary sources has been more tightly controlled over the last 40 years, the contribution of ships and port operations to air pollution in port cities has become more important. In the same period, foreign trade has grown dramatically; thus, pollution from shipping and port operations is growing as a percentage of total emissions. In many cities, ships are now among the largest sources of air pollution. As Congress and the Administration turn their attention to climate change, there is also a growing recognition that marine vessels are an important source of greenhouse gas (GHG) emissions.

Controlling these sources of both conventional and greenhouse gas pollutants is complicated by the fact that most ocean-going ships are not registered in the United States and may not even purchase the fuel they are using here. Thus, controlling such pollution would seem to lend itself to an international approach. Such efforts have been slow to yield results: in 1997, the United States and most countries signed an international agreement known as MARPOL Annex VI, setting extremely modest controls on air pollution from ships, but the agreement did not enter into force until 2005, and the United States did not enact legislation to implement it until July 21, 2008 (P.L. 110-280). Negotiations to strengthen Annex VI accelerated in 2008, however, and amendments that will strengthen its provisions have received preliminary approval. Discussions regarding GHG emissions have also begun, although without results to date.

While awaiting congressional action and international agreement, the Environmental Protection Agency (EPA), port cities, and states have begun to act on their own. This report discusses a number of these efforts, including EPA measures that will require cleaner fuels and will greatly strengthen emission standards, and measures being implemented in California to reduce pollution from ships and ports.

In the current Congress, greenhouse gas emissions from ships are addressed in H.R. 2454, the Waxman-Markey climate change bill. As passed by the House, the bill would direct EPA to establish emission standards for nonroad vehicles and engines (a category that includes ships), by December 31, 2012.

In other action, Congress added a provision to the FY2010 EPA appropriation (P.L. 111-88) that prohibits FY2010 funds being used to implement cleaner fuel requirements as they apply to Great Lakes ships. Accompanying report language directs EPA to develop provisions to establish waivers of the low sulfur fuel requirements for Great Lakes ships if the fuel is not available or in cases of serious economic hardship.

Contents

Introduction	1
MARPOL Annex VI.....	3
Provisions of Annex VI.....	3
Implementing Legislation (P.L. 110-280).....	4
Amendments to Annex VI.....	4
EPA Regulations for Ocean-Going Ships.....	5
Category 3 Engines and Fuels	5
Reaction to the New Standards.....	7
Costs and Benefits of the Proposed Standards.....	8
Great Lakes Ships	8
Category 1 and 2 Engines.....	11
California Emission Reduction Measures	11
Low Sulfur Fuels	12
Emission Controls.....	12
Alternative Power	13
Grants.....	13
Greenhouse Gases.....	15
International Efforts to Address GHGs	15
Shipping vs. Other Transport Modes	16
Measures to Reduce Ships' GHG Emissions.....	16
Conclusion.....	17

Figures

Figure 1. U.S. Ports and Nonattainment Areas	2
Figure 2. Area Proposed for Emission Control Area (ECA) Designation	7
Figure 3. Potential Ambient Reductions of Fine Particulates (PM _{2.5}) from Proposed U.S. ECA, in 2020.....	9

Contacts

Author Contact Information	18
----------------------------------	----

Introduction

Over the last 40 years, air quality in the United States has improved substantially. Since the passage of the Clean Air Act in 1970, annual emissions of the six most widespread (“criteria”) air pollutants have declined 180 million tons (59%), despite major increases in population, motor vehicle miles traveled, and economic activity.¹

Emissions from shipping are a major exception to these trends. Although emission controls have reduced pollution from new cars and trucks by more than 90%, most ocean-going ships operate without any pollution controls at all. New and remanufactured engines on tug boats, ferries, and other smaller ships are subject to emission controls beginning in 2008 and 2009, but most existing engines in vessels of these types remain uncontrolled.

Pollution from ships is also affected by the fuel they use. Marine vessels other than oceangoing ships have been required to use cleaner fuels, but ocean-going ships generally use bunker fuel, a fuel that contains a high level of contaminants: the average fuel used by oceangoing ships contains 27,000 parts per million (ppm) sulfur, for example—almost 2,000 times as much as would be allowed in trucks operating on U.S. roads.

In the Los Angeles-Long Beach area—which is both the nation’s busiest port² and the nation’s most polluted area³—the problem is particularly acute. According to the South Coast [L.A.-Long Beach] Air Quality Management District (AQMD):

- Oceangoing vessels are among the largest sources of nitrogen oxides (NO_x) in the area, emitting more NO_x than all power plants and refineries in the South Coast air basin combined. NO_x reacts with volatile organic compounds in the atmosphere to produce ozone/smog.
- 70% of the area’s emissions of sulfur dioxide (SO₂) come from ships. These emissions need to be cut by over 90%, according to the AQMD, if the area is to attain the national air quality standard for particulates by the 2014 deadline.
- Particulates from marine vessels also create significant cancer risks; more than 700 premature deaths are caused in the Los Angeles area annually by these emissions, according to the AQMD.⁴

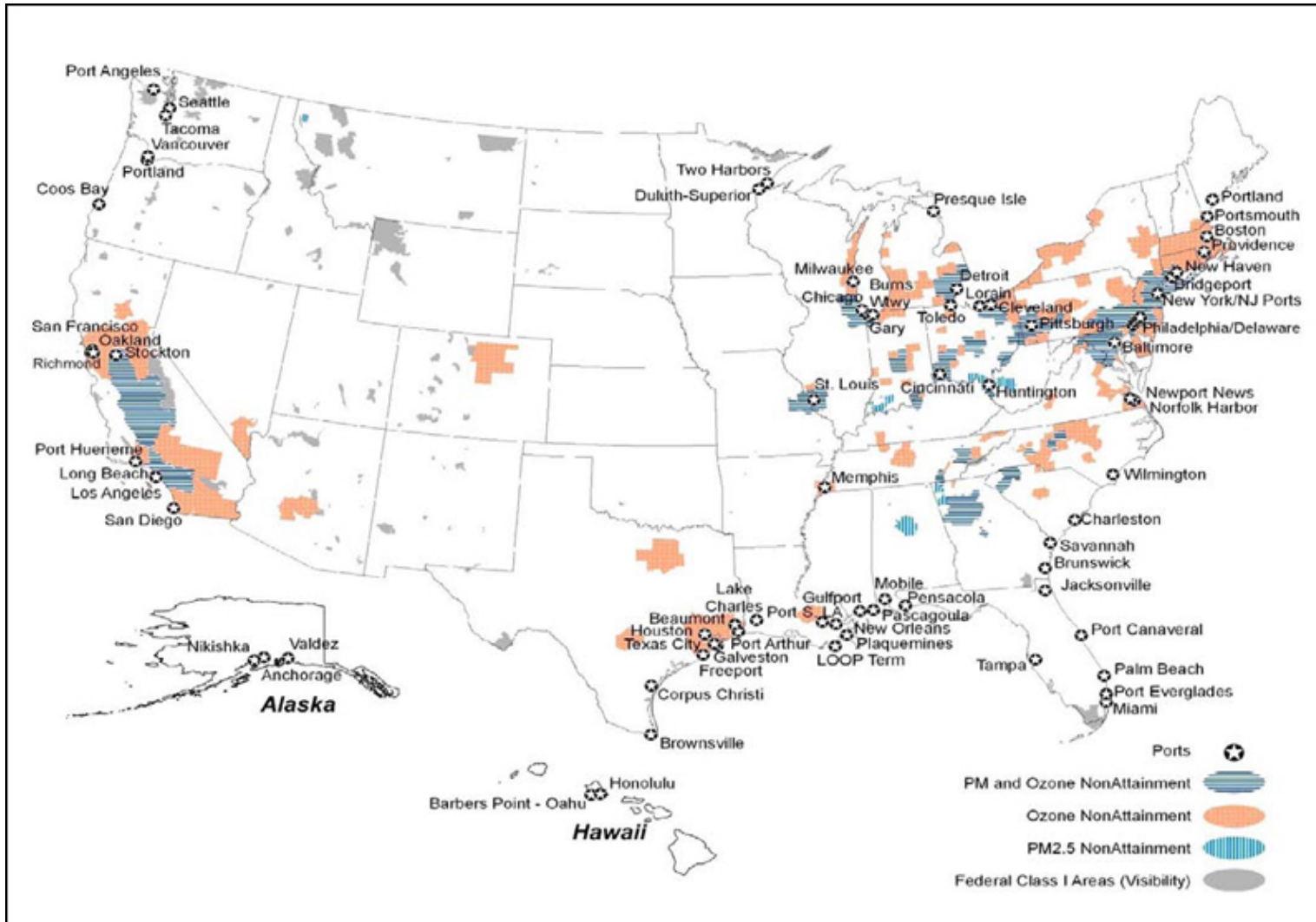
¹ See U.S. EPA, “Air Emissions Summary Through 2005,” at http://www.epa.gov/air/airtrends/2006/emissions_summary_2005.html, updated with data from 2008 in U.S. EPA, “Air Quality Trends,” at <http://www.epa.gov/airtrends/aqtrends.html#comparison>. The six criteria pollutants are ozone, particulate matter, carbon monoxide, sulfur dioxide, nitrogen oxides, and lead.

² According to the *Wall Street Journal*, Los Angeles and Long Beach ranked number 1 and number 2 in the value of cargo handled, with a combined total exceeding \$248.5 billion in 2003-2004. The port of New York and New Jersey ranked third with \$132.4 billion. See “The Busiest U.S. Ports,” March 9, 2006, at <http://americanfuture.net/?p=1447>.

³ The Los Angeles South Coast Air Basin is the only area that EPA considers to be a “Severe 17” nonattainment area for ozone. The area also has the highest readings in the country for fine particulates (PM_{2.5}), and is among only 8 areas classified as “Serious” nonattainment areas for larger particles (PM₁₀). See U.S. EPA, “Green Book,” at <http://www.epa.gov/oar/oaqps/greenbk/index.html>.

⁴ See testimony of Barry R. Wallerstein, Executive Officer, South Coast Air Quality Management District, at “Legislative Hearing on the Marine Vessel Emissions Reduction Act of 2007, S. 1499,” U.S. Senate, Committee on Environment and Public Works, February 14, 2008, p. 1.

Figure I. U.S. Ports and Nonattainment Areas



Source: U.S. EPA, March 2009. Nonattainment areas are areas where concentrations of pollution exceed National Ambient Air Quality Standards. Ozone and PM_{2.5} are the pollutants that most commonly exceed the standards. PM_{2.5} refers to particulate matter with a diameter less than or equal to 2.5 micrometers, often referred to as “fine particles.”

While the Los Angeles-Long Beach area may be the most extreme example, the problem is not limited to L.A. or to California. According to the Environmental Protection Agency (EPA), more than 40 U.S. ports nationwide are located in “nonattainment” areas⁵ for ozone, fine particulates, or both (**Figure 1**).⁶ In addition, according to EPA, “... the problem is not limited to port areas alone. Santa Barbara County, which has no commercial ports, estimates that by 2020, 67 percent of its NOx inventory will come from shipping traffic transiting the California coast...”⁷

Oceangoing ships are perhaps the largest source of port emissions, but they are not the only source. Ports make use of tug boats to guide ships entering and leaving the harbor. Ports make connections to land-based transportation networks, such as railroads, and they generally operate large truck terminals. Ships at rest in the port need a source of power, which often comes from running auxiliary engines. And, in many cases, a harbor is served by substantial local boat or barge traffic, sometimes including ferry service. Thus, addressing the sources of pollution in a port may require a multi-faceted approach.

MARPOL Annex VI

Pollution from ships (not only air pollution, but pollution of all kinds) is governed by the International Convention for the Prevention of Pollution from Ships, first negotiated through the International Maritime Organization (IMO) in 1973. The Convention, known as MARPOL (for “MARine POLLution”) 73/78 (the dates referring to the 1973 Convention and its 1978 amendments), applies to all ships of the flag states that have ratified it. About 150 countries, representing over 98.7% of world shipping tonnage, have done so. The Convention also applies to ships of non-signatory states while they are operating in waters under the jurisdiction of parties to MARPOL. Six annexes to MARPOL 73/78 cover various sources of pollution from ships (oil, noxious liquids, sewage, garbage, etc.) and provide an overarching framework for implementation.

Provisions of Annex VI

Annex VI of the Convention, which was adopted in 1997 but did not enter into force until 2005, addresses the Prevention of Air Pollution from Ships. In its 1997 form, the annex represented a small first step toward controlling such pollution, particularly if one compares it to pollution controls that the United States and other developed countries impose on land-based sources. Annex VI:

- limits the sulfur content of the fuel used in oceangoing ships (bunker fuel) to 4.5% (45,000 parts per million (ppm)). By comparison, highway diesel fuel in the United States is limited to 15 ppm;

⁵ That is, areas where air quality is worse than the health-based standard for ozone, particulates, or both.

⁶ Testimony of Bryan Wood-Thomas, U.S. EPA, Office of Transportation and Air Quality, at “Legislative Hearing on the Marine Vessel Emissions Reduction Act of 2007, S. 1499,” U.S. Senate, Committee on Environment and Public Works, February 14, 2008, p. 2.

⁷ *Ibid.*

- allows special sulfur oxide (SO_x) Emission Control Areas (currently the Baltic Sea, the North Sea, and the English Channel), where the sulfur content of fuel is limited to 1.5% (15,000 ppm) or SO_x emissions are limited;
- limits NO_x emissions from new engines and engines that have undergone major conversions to a range of 9.8-17.0 grams per kilowatt-hour (g/kwh), depending on the rated engine speed. By comparison, power plants in the eastern United States are limited to 0.45-0.73 g/kwh;
- allows the regulation of emissions of volatile organic compounds (VOCs) from tankers by parties to Annex VI in their ports and terminals;
- prohibits emissions of ozone-depleting substances;
- prohibits the incineration on ships of polychlorinated biphenyls (PCBs, a class of toxic chemicals widely used in electrical transformers until the 1970s). In the United States, PCB production and use were banned in 1976, and disposal has been strictly regulated since then; and
- prohibits the incineration of garbage containing more than traces of heavy metals and of refined petroleum products containing halogen compounds.

Implementing Legislation (P.L. 110-280)

- The United States is a party to MARPOL 73/78 and most of its annexes, but did not enact legislation to implement Annex VI until the summer of 2008. The Senate gave its consent to ratification of Annex VI on April 7, 2006,⁸ but Congress needed to enact implementing legislation before the United States could submit the instrument of ratification. The House passed H.R. 802 to implement the annex on March 26, 2007. The Senate passed the bill, with an amendment, June 26, 2008, and the House agreed to the Senate amendment July 8, 2008. The President signed the bill July 21, 2008 (P.L. 110-280).

The Annex VI standards apply to: any oceangoing vessel that is registered in the United States; ships of any registry in ports, shipyards, terminals, or the internal waters of the United States; ships of any registry bound for or departing from the United States, while they are located in the navigable waters of the United States or designated emission control areas; and ships bearing the flag of any country that has ratified Annex VI traveling through U.S. waters or designated emission control areas, even if they are not bound for or departing from a U.S. destination. To the extent consistent with international law, the Annex also applies to any other ship in the U.S. exclusive economic zone.

Amendments to Annex VI

The United States has participated in negotiations to strengthen Annex VI, and more stringent limits on both fuels and emissions were approved by the IMO, October 10, 2008:

⁸ The Senate consented to ratification through Treaty Document 108-7.

- The new limits cut the allowable sulfur content of bunker fuel to 3.5% (35,000 ppm) starting January 1, 2012, with a further drop to 0.5% (5,000 ppm) on January 1, 2020. This provision will have little effect prior to 2020, since bunker fuel currently averages 27,000 ppm sulfur, substantially cleaner than the 2012 requirements.
- New limits will also apply in Sulfur Emission Control Areas—currently the Baltic Sea, North Sea, and English Channel, but potentially including other areas. Sulfur content in those areas, currently capped at 1.5% (15,000 ppm), will be capped at 1.0% (10,000 ppm) effective July 1, 2010, and 0.10% (1,000 ppm) effective January 1, 2015.
- IMO also agreed to reductions in nitrogen oxide (NO_x) emissions from marine engines, with the new standards to be phased in. For engines installed on ships constructed after January 1, 2011, but before 2016, NO_x limits would be reduced about 20% to a range of 7.7 to 14.4 grams per kilowatt-hour, depending on the rated engine speed. For engines installed on ships constructed after January 1, 2016, the limits would be reduced about 80%, to a range of 2.0 to 3.4 g/kWh while ships are operating in designated emission control areas. Outside emission control areas, the prior limit (7.7 to 14.4 g/kWh) would apply.⁹

EPA Regulations for Ocean-Going Ships

Before Congress enacted the Annex VI implementing legislation in 2008, EPA had already promulgated regulations under the Clean Air Act that were as stringent as the 1997 Annex VI standards, and shipping companies were already generally meeting the standards. In addition, the agency has promulgated standards for smaller engines.

EPA groups ship engines in three categories. The largest of these engines—the main engines on oceangoing ships—are diesel engines with a per-cylinder displacement at or above 30 liters. These are referred to as “Category 3” or “C3” engines. Category 1 and 2 engines (those smaller than 7 liters per cylinder, and those from 7 to 30 liters per cylinder, respectively), are used in boats or smaller ships—tugs, ferries, some Great Lakes freighters, fishing boats, and recreational boats, for example.

Category 3 Engines and Fuels

EPA began addressing emissions from Category 3 engines about a decade ago, and two steps the agency took in 2009 will significantly strengthen its regulations. But it is important to bear three factors in mind, as one considers the potential impact of the new regulations. First, the new EPA emission standards will only apply to engines installed on vessels flagged or registered in the United States. In 2007, only 6.7% of the world’s ocean-going ships (and only 1.2%, if measured by carrying capacity) were registered in the United States.¹⁰ Thus, EPA’s emission standards for

⁹ “International Maritime Panel Sets Limits on Ships’ Sulfur, Nitrogen Oxide Emissions,” *Daily Environment Report*, October 14, 2008, p. A-6. For a copy of Annex VI as revised by the October 10, 2008 agreement, see the IMO website at http://www.imo.org/includes/blastDataOnly.asp/data_id%3D23760/176%2858%29.pdf.

¹⁰ United Nations Conference on Trade and Development, *Review of Maritime Transport 2007*, p. 36, at http://www.unctad.org/en/docs/rmt2007_en.pdf.

C3 engines by themselves (i.e., apart from the similar Annex VI rules) will have little effect on the overall level of pollution from ocean-going ships. Second, when the more stringent requirements do take effect, they will apply only to new and remanufactured engines, so improvements resulting from the standards will be gradual. Third, EPA will be able to achieve more substantial emission reductions through standards for marine fuel. These will affect emissions from both new and existing engines, and from both U.S.- and foreign-flagged ships. The new C3 standards will require substantially cleaner fuel, a point to which we will return after describing the existing and proposed rules in more detail.

Current C3 engine standards were promulgated February 28, 2003, and went into effect in 2004.¹¹ These standards mirrored the relatively lenient requirements of Annex VI, adopted by the IMO in 1997. In October 1999, EPA also established a voluntary certification program so that engine manufacturers could show that their new engines were compliant with Annex VI. EPA believes that all marine Category 3 diesel engines sold in the United States since January 1, 2000, have met Annex VI requirements.

When the 2003 standards were promulgated, EPA set itself a deadline of April 2007 to promulgate stronger standards for C3 engines. EPA subsequently reset this deadline to December 2009: the Administrator signed new regulations December 18. Thus, 2009 has seen several developments that will strengthen emission standards for ships and expand the use of cleaner fuels. The new standards are in line with the Annex VI amendments that were negotiated in 2008. EPA has also proposed to add U.S. waters to those areas designated as Emission Control Areas under the annex. Specifically:

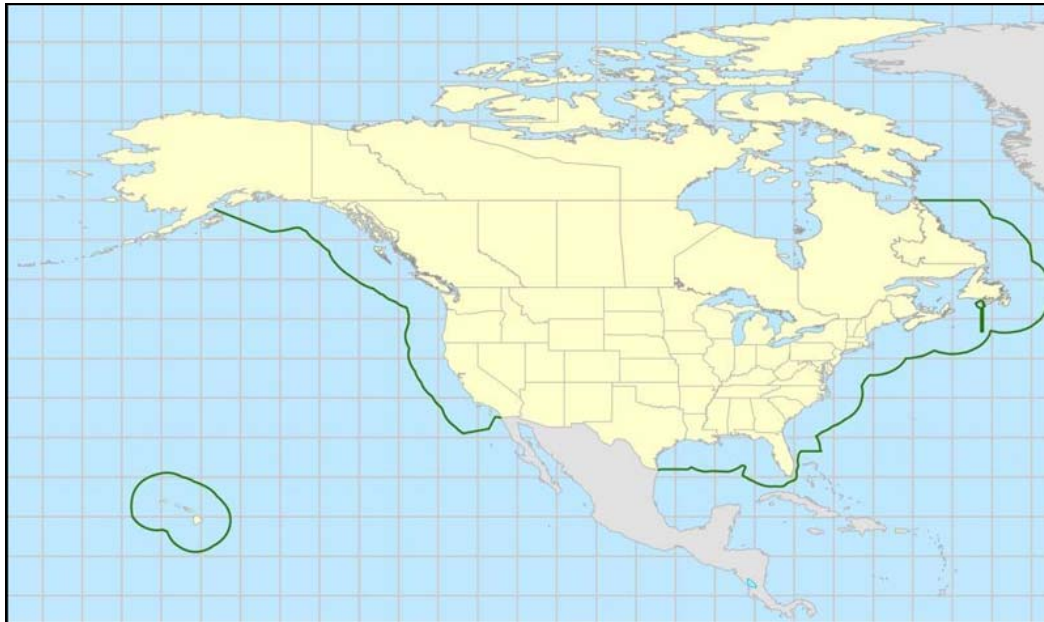
- On March 27, 2009, EPA proposed that the entire U.S. coastline except portions of Alaska be designated by the IMO as an Emission Control Area (ECA), subject to the lower sulfur limits in bunker fuel discussed above. As shown in **Figure 2**, the proposed ECA includes the entire coastline of the contiguous 48 states, Southeastern Alaska, and the main Hawaiian Islands, extending to a distance of 200 nautical miles from shore. EPA anticipates that this amendment will be adopted at the next IMO Marine Environment Protection Committee meeting (MEPC 60) which is scheduled for March 2010. Adoption of the ECA will set sulfur limits of 10,000 ppm as early as August 2012, and 1,000 ppm effective January 1, 2015.
- On July 1, 2009, EPA proposed regulations that will strengthen emission standards for new C3 marine engines and will implement the low sulfur fuel requirements that apply in ECAs starting in 2015. These regulations were finalized, with relatively minor changes on December 18, 2009.¹² New marine engines will be required to meet these standards in two phases: Tier 2, which would apply to new engines beginning in 2011, would require “more efficient use of current engine technologies, including engine timing, engine cooling, and advanced computer controls,” resulting in a 15% to 25% reduction in NOx emissions, compared to Tier 1 standards; Tier 3, effective in 2016, would reduce

¹¹ 68 *Federal Register* 9746, February 28, 2003.

¹² The proposal appeared in the *Federal Register* August 28, 2009: “Control of Emissions from New Marine Compression-Ignition Engines at or Above 30 Liters per Cylinder,” 74 *Federal Register* 44442. The final regulations had not yet appeared in the *Federal Register* as of this writing, but a pre-publication copy, as signed by the Administrator on December 18, can be found at <http://www.epa.gov/otaq/oceanvessels.htm#regs>.

NOx emissions from new engines 80% below current standards through the application of aftertreatment technology such as selective catalytic reduction (SCR), a technology now widely used at electric power plants.

Figure 2. Area Proposed for Emission Control Area (ECA) Designation



Source: U.S. EPA

Reaction to the New Standards

In general, the Category 3 engine standards and the ECA proposal have been supported by the shipping industry and by environmental groups.¹³ The World Shipping Council (WSC), whose member companies carry over 90% of the United States' international containerized ocean cargo, in its comments on the C3 standards, stated, "... the WSC and its members fully support the proposal to codify and adopt these standards as proposed in the current rulemaking," although they went on to suggest a number of clarifications and technical improvements.¹⁴ Regarding the ECA proposal, a spokesman for the Pacific Marine Shipping Association was quoted as saying, "We've been waiting for this a long time. We're pleased to see everything moving forward as planned."¹⁵

¹³ See "Industry, Environmental Groups Offer Praise for EPA Proposal to Limit Ship Emissions," *Daily Environment Report*, August 5, 2009, p. A-5. Also see "U.S., Canada Propose Areas for Large Cuts in Emissions from Oceangoing Ships," *Daily Environment Report*, March 31, 2009, p. A-5.

¹⁴ See "Comments of the World Shipping Council Submitted on September 28, 2009 to the U.S. Environmental Protection Agency in the Matter of Proposed Rule, Control of Emissions from New Marine Compression-Ignition Engines at or Above 30 Liters per Cylinder," Docket Number: EPA-HQ-OAR-2007-0121, at <http://www.regulations.gov/search/Regs/home.html#docketDetail?R=EPA-HQ-OAR-2007-0121>.

¹⁵ T.L. Garrett, Vice President, Pacific Marine Shipping Association, as quoted in "U.S., Canada Propose Areas for Large Cuts in Emissions from Oceangoing Ships," *Daily Environment Report*, March 31, 2009, p. A-5.

The Clean Air Task Force, and 34 other environmental organizations stated, “EPA’s proposed C3 Marine Engine rule is a substantial step in the right direction.”¹⁶ They would have liked to see the proposed emission standards strengthened to cover all new ships travelling in U.S. waters, no matter where they are registered, and would have liked stronger standards for NOx and particulate matter from the existing fleet of ships. Environmental groups also support the ECA/fuel sulfur proposal, although they would like to see it expanded to include Alaska’s Arctic waters.

Costs and Benefits of the Proposed Standards

EPA estimates that the benefits of its new regulations for C3 engines and fuel will outweigh the costs by at least 30 to 1. The benefits include annually preventing between 12,000 and 31,000 premature deaths, 1,500,000 work days lost, and 9,600,000 minor restricted activity days, which the agency values at between \$99 billion and \$270 billion annually.¹⁷ The reductions in pollution, shown in **Figure 3**, are greatest near the coasts, but more modest reductions would extend a substantial distance inland, according to EPA modeling.

The agency’s estimated cost of the proposals is approximately \$1.85 billion in 2020, increasing to \$3.11 billion in 2030. Of the 2020 costs, nearly 89% are attributable to the use of lower-sulfur fuel in the proposed ECA. These costs are substantial, but they will be spread over such a huge volume of traded goods that they may be little noticed. According to the agency:

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.¹⁸

Great Lakes Ships

Perhaps the most controversial aspect of the ECA and Category 3 rules was their proposed application to the large ships that ply the Great Lakes. The Great Lakes would be included in the proposed ECA and, therefore, ships operating on the lakes would be required to burn low sulfur fuels under the ECA proposal.

More than 100 U.S.- and Canadian-flagged cargo ships operate on the Great Lakes. These ships generally carry bulk cargoes, including iron ore, coal, limestone, agricultural products, and rock salt. The associations that represent the U.S. and Canadian ship owners estimate that they carry as much as 150 million tons of cargo annually.¹⁹

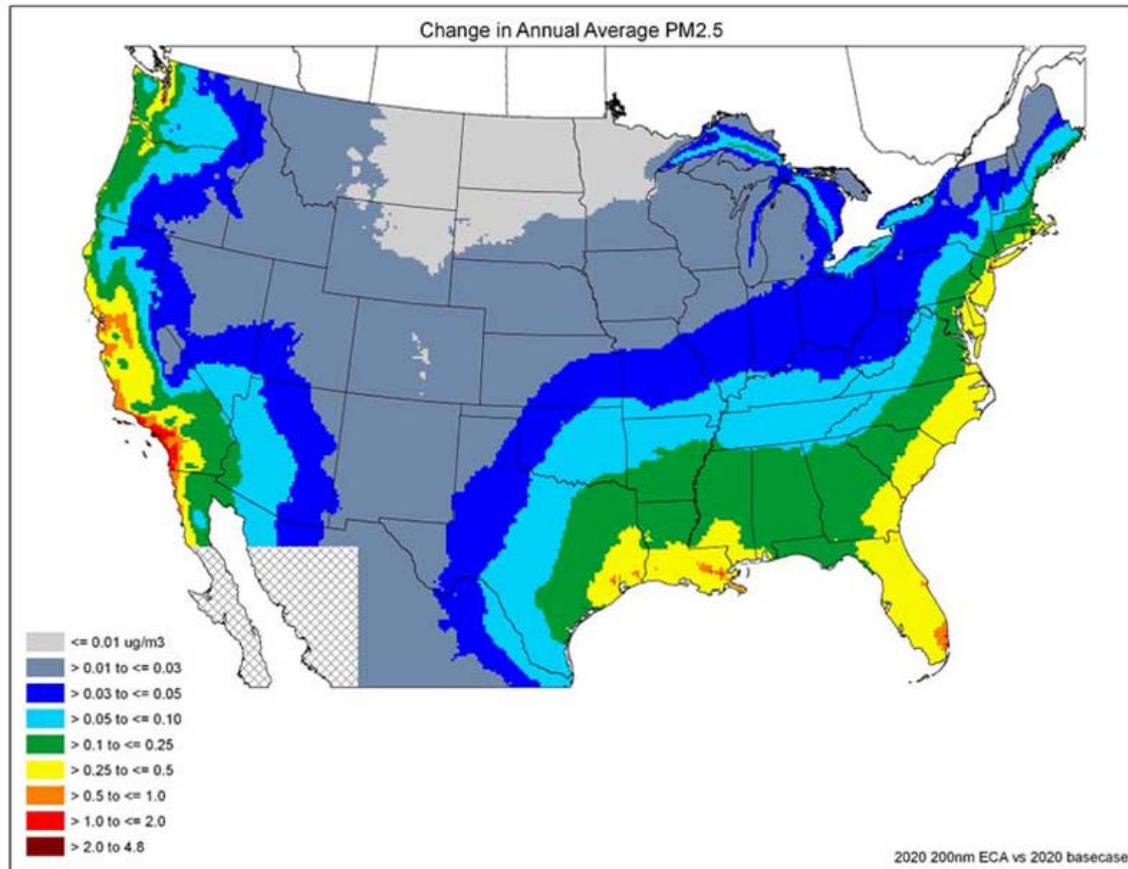
¹⁶ Clean Air Task Force et al., “Comments on Proposed Large Marine Diesel Engine Rule,” September 28, 2009, p. 30, Docket Number: EPA-HQ-OAR-2007-0121at <http://www.regulations.gov/search/Regs/home.html#documentDetail?R=0900006480a3df87>.

¹⁷ U.S. EPA, “Regulatory Announcement: EPA Proposal for Control of Emissions from New Marine Compression-Ignition Engines at or Above 30 Liters Per Cylinder,” June 2009, at <http://www.epa.gov/otaq/regs/nonroad/marine/ci/420f09029.htm#4>.

¹⁸ U.S. EPA, Office of Transportation and Air Quality, “EPA Proposal for Control of Emissions from New Marine Compression-Ignition Engines at or Above 30 Liters Per Cylinder,” Fact Sheet, p. 4, at <http://www.epa.gov/otaq/regs/nonroad/marine/ci/420f09029.pdf>.

¹⁹ The Lake Carriers’ Association represents 18 American companies that operate 55 vessels on the Great Lakes. These (continued...)

Figure 3. Potential Ambient Reductions of Fine Particulates (PM_{2.5}) from Proposed U.S. ECA, in 2020



Source: U.S. EPA

Many of these ships are old. The Lake Carriers' Association (LCA) identified one U.S.-flagged vessel built in 1906 and 17 others built between 1929 and 1960 that are still in operation. Thirteen of these ships have powerplants that were designed to burn heavy residual fuel. According to the LCA,

It is theoretically possible to switch the fuel supply system for the boilers to distillate fuel. However, it would require modifications including new fuel pumps, bypass of the fuel heating systems, new burners and burner tips, and possibly new air diffusers. A number of upgrades to the automation system would also have to have been done to ensure the proper air to fuel ratio and that the fuel cut off valves are sufficient to ensure that absolutely no diesel fuel enters the boiler in the off position.²⁰

(...continued)

vessels can carry as much as 115 million tons of cargo in a given year, according to the association. The Canadian Shipowners Association represents the owners of 68 Canadian vessels with an annual volume of over 62 million metric tons in 2008, slightly more than half of which were carried between Canada and the United States. See their respective comments on the proposed Category 3 rule at <http://www.regulations.gov>, Docket Number: EPA-HQ-OAR-2007-0121.

²⁰ Comments of the Lake Carriers' Association on the proposed Category 3 rule, September 28, 2009, p. 4, at <http://www.regulations.gov/search/Regs/home.html#documentDetail?R=0900006480a3e004>.

LCA estimated the cost of converting these 13 steamers' powerplants to run on diesel fuel or of converting them to self-unloading barges powered by tugs to be \$20 million to \$27 million each. Another 13 vessels were identified by LCA as facing significant impacts because of higher fuel prices, even though they are able to safely burn low sulfur distillate fuel.

The case made by the Lake Carriers Association and other industry commenters that older Great Lakes ships will face significant impacts appears not to have been considered by EPA when it proposed the ECA and C3 regulations. The Category 3 Regulatory Impact Analysis did indicate, however, that switching from residual fuel to lower sulfur distillate would increase costs borne by shipping companies \$145 per tonne of fuel, or 44%.²¹ For ocean-going ships, this cost increase is not as great as it might seem, since they operate in an ECA only a small percentage of the time and can burn dirtier fuel outside of ECAs. Great Lakes ships, however, operate in the proposed ECA 100% of the time, and thus would face a greater increase in costs.²²

The Great Lakes shipping companies made a sufficiently persuasive case that Congress addressed their concerns. Section 442 of H.R. 2996, the FY2010 appropriations for Interior, Environment, and Related Agencies, signed by the President, October 30, 2009 (P.L. 111-88), provides that:

None of the funds made available for the Environmental Protection Agency in this Act may be expended by the Administrator of the Environmental Protection Agency to issue a final rule that includes fuel sulfur standards applicable to existing steamships that operate exclusively within the Great Lakes, and their connecting and tributary waters.

This prohibition applies only to the period covered by the appropriation, i.e., FY2010. But language in the accompanying Conference Report (H.Rept. 111-316), states that EPA has received comments detailing significant negative economic impacts for carriers that operate Category 3 engine vessels exclusively within the Great Lakes, and the report adds:

Because of these economic impacts, EPA should include waiver provisions similar to those in other EPA rules in the final rule—one to waive the 10,000 ppm sulfur standard for Great Lakes Category 3 diesel engine vessels that burn residual fuel if EPA determines that 10,000 ppm residual fuel is not available; and one to waive fuel requirements for an owner/operator of a Great Lakes Category 3 diesel engine vessel based upon a showing of serious economic hardship. It is important that EPA structure such a waiver provision similar to the other fuels rules, where parties can apply for and receive a waiver in sufficient time prior to the implementation of the requirements. Finally, EPA should perform a study and issue a report

²¹ U.S. EPA, Office of Transportation and Air Quality, "Draft Regulatory Impact Analysis: Control of Emissions of Air Pollution from Category 3 Marine Diesel Engines," June 2009, p. 5-58, available at <http://www.epa.gov/otaq/regs/nonroad/marine/ci/420d09002.pdf>. The RIA found no substantial increase, however, for ships switching from distillate fuel to lower sulfur distillate fuel. For this group, the additional fuel cost was less than \$1.00 per barrel, about 2 cents a gallon.

²² How this cost increase would affect the shipping companies and their customers is a different question. The ships have a large cost advantage over other modes of transportation because they use significantly less fuel per ton-mile: according to the Army Corps of Engineers, Great Lakes carriers use 90% less fuel per ton-mile than trucks, and 66% less than trains. The Corps estimated that Great Lakes shipping annually saves its customers \$3.6 billion in transportation costs compared to the next least expensive mode of transportation. Furthermore, the low sulfur fuel requirements for shipping companies are not happening in a vacuum. Both trucks and trains also face lower sulfur fuel requirements: in both cases, the sulfur limit will be 15 parts per million, as compared to the 1,000 ppm allowed on ships in the proposed ECA. Thus, although Great Lakes ships would undoubtedly incur costs to comply with the C3 and ECA proposals, higher costs would not necessarily eliminate the huge cost advantage they hold over competing modes of transportation. Rather, the impacts on them will depend on the degree to which they can pass on higher costs to their customers and the ability of those customers to do the same, a question that was not analyzed in EPA's RIA.

within six months that evaluates the economic impact of the final rule on Great Lakes carriers.²³

The final C3 rule provides the two Great Lakes waivers discussed in the report language.

Category 1 and 2 Engines

Category 1 and 2 engines (those smaller than 7 liters per cylinder, and those from 7 to 30 liters per cylinder, respectively), are used in boats or ships that operate in U.S. waters—tugs, ferries, smaller Great Lakes freighters, fishing boats, and recreational boats, for example—virtually all of which are registered in the United States. While smaller than Category 3 engines, these engines are still rather large: they generate at least 800 horsepower.

EPA is further along in regulating the emissions of these categories, as compared to Category 3. Regulations that will reduce emissions of NO_x from new or remanufactured engines by 24% and emissions of particulates by 12% when fully implemented, were promulgated in 1999 and began taking effect between 2004 and 2007. More stringent standards were promulgated May 6, 2008, and will take effect between now and 2014.²⁴ The final 2014 standards will require ultra low sulfur diesel fuel (15 ppm sulfur) and high efficiency catalytic emission controls capable of reducing particulate matter emissions by 90% and NO_x emissions by 80%, along with “sizeable reductions” of hydrocarbon, carbon monoxide, and air toxic emissions, according to EPA.²⁵

As with the new Category 3 regulations, EPA estimates that benefits of the May 2008 rule will substantially exceed the costs of compliance – in this case, by a figure of at least 9 to 1. The principal benefits that the agency estimated are health benefits: a reduction of between 1,150 and 1,400 premature deaths, 120,000 work days lost, and approximately 1,000,000 minor restricted-activity days annually. The agency estimates that these benefits will be worth between \$8.4 billion and \$11 billion in 2030, whereas the annual social costs will be approximately \$740 million in that year. The impact of these costs on society is expected to be manageable, with the price of marine transportation services estimated to increase by about 1.1%.²⁶

California Emission Reduction Measures

California, being more adversely affected than most other areas, has also played a leadership role in identifying and implementing emission reduction measures applicable to shipping. The state has focused on port activities, in addition to fuel and emission standards for marine vessels. California’s measures fall into four categories: (1) requiring the use of lower sulfur fuel; (2) requiring emission controls on harbor vessels and shore-side equipment; (3) providing alternative

²³ U.S. Congress, House, “Department of the Interior, Environment, and Related Agencies Appropriations Act, 2010,” Conference Report to Accompany H.R. 2996, October 28, 2009, pp. 109-110.

²⁴ 73 *Federal Register* 25097, May 6, 2008.

²⁵ For information, see U.S. EPA, Office of Transportation and Air Quality, “Diesel Boats and Ships,” at <http://www.epa.gov/oms/marine.htm>.

²⁶ For additional information, see the EPA Regulatory Impact Analysis at <http://www.epa.gov/otaq/regs/nonroad/420r08001a.pdf>.

(electric) power to ships while they are docked at marine terminals; and (4) providing grants for the re-powering of harbor craft and short-haul trucks with cleaner engines.

Low Sulfur Fuels

The California Air Resources Board (CARB), at a July 24, 2008, meeting, approved regulations that required both U.S.- and foreign-flagged vessels sailing within 24 miles of its coast to use low sulfur fuels in both main and auxiliary engines beginning July 1, 2009. Compliant fuels are marine diesel oil with 5,000 ppm or less sulfur or marine gas oil with 15,000 ppm or less sulfur. In January 2012, sulfur in both types of fuel will be limited to 1,000 ppm. The rules replace low sulfur fuel requirements that the state implemented in 2007, but which were overturned by the U.S. Court of Appeals for the Ninth Circuit in February 2008.²⁷ The original rules would have set a 1,000 ppm limit two years earlier, in 2010.

Emission Controls

California has, in general, led the nation in imposing more stringent requirements on diesel engines. In addition, the ports of Los Angeles and Long Beach have developed procedures to require that trucks serving the ports will be replaced by newer, less-emitting models. According to a description of the ports' plan:

... all pre-1989 trucks will be barred from entering the ports' terminals beginning Oct. 1 [2008]. Effective Jan. 1, 2010, all 1989-1993 trucks and any 1994-2003 trucks without certified pollution control equipment will be banned. By Jan. 1, 2012, all trucks entering the port must meet the 2007 federal standard for heavy-duty diesel trucks....

A \$35 gate fee for each 20-foot container unit that passes through the port will generate funds to help underwrite subsidies to upgrade and replace trucks.²⁸

The Port of Los Angeles estimates that truck emissions have been reduced about 70% since October 1, 2008, as a result of these requirements.²⁹

In addition, CARB has adopted regulations for harbor craft, including ferries, tugboats, and tow boats, which will require the replacement of unregulated engines beginning in 2009, and will

²⁷ *Pacific Merchant Marine Ass'n v. Goldstene*, 517 F.3d 1108 (9th Cir. 2008). The court held that the state's Marine Vessel Rules were preempted by the federal Clean Air Act because the regulations set emission standards for marine engines without California having received a waiver from EPA to do so. California has since asked EPA for a waiver to enforce the original rules, in addition to developing the rules applying only to fuels. If the waiver is granted, the original (2007) requirements would be enforced. See "California Air Board Seeks Federal Waiver to Enforce Ship Auxiliary Engine Rules," *Daily Environment Report*, May 13, 2008, p. A-1. See also, CARB, "Advisory on Plans to Implement a Proposed ARB Regulation on Fuel Sulfur and Other Operational Requirements for Ocean-Going Vessels," October 2008, at <http://www.arb.ca.gov/ports/marinevevss/documents/advisory1008.pdf>.

²⁸ "Los Angeles Harbor Commission Approves Program to Replace Older Diesel Trucks," *Daily Environment Report*, March 24, 2008, p. A-9.

²⁹ "January 1, 2010 Truck Restrictions Will Bring More Clean Trucks to Port of Los Angeles, Continue to Reduce Harmful Air Emissions," Port of Los Angeles News Release, December 4, 2009, at http://www.portoflosangeles.org/newsroom/2009_releases/news_120409_ctp_truck_ban.asp.

accelerate the adoption of EPA's Category 1 and Category 2 marine engine pollution controls. These rules became effective November 19, 2008.³⁰

Alternative Power

In June 2004, the Port of Los Angeles opened the world's first Alternative Maritime Power (AMP) terminal for container ships, where cargo ships can plug in to power instead of operating auxiliary engines to generate electricity while at berth. The electrification project was the result of a lawsuit brought by the Natural Resources Defense Council and other groups, who sued the city claiming it failed to fully weigh air quality and other environmental impacts of a new container terminal. As a result of the suit, a state appeals court halted work on the terminal in October 2002, and Los Angeles subsequently agreed to electrify the terminal to cut diesel emissions while ships are at docks, among other measures.³¹ A second terminal was outfitted with AMP capability in 2005. To encourage shippers to use the AMP facilities, in December 2004, the Los Angeles Board of Harbor Commissioners passed a policy resolution to help each existing Port customer underwrite the cost of building or retrofitting their first container or cruise ship to run on electrical power when docked, a cost estimated at \$320,000-\$830,000 per vessel.³² Cruise ship terminals in San Francisco and Seattle are also implementing AMP, and CARB obtained final approval of regulations to require the use of AMP at the state's six largest ports, in December 2008.³³

Grants

CARB, the Ports of Los Angeles and Long Beach, and the South Coast Air Quality Management District also intend to provide substantial amounts of financial support for the replacement of older, high-emitting engines and the conversion to lower emitting power sources. CARB awarded \$247 million in FY2007-FY2008 funds for "goods movement emission reduction" projects (about \$137 million of which was designated for ports); another \$250 million was appropriated in FY2008-FY2009, and a third cycle of \$250 million was appropriated in the FY2009-FY2010 state budget. According to CARB, most requests for the funds came from trucking companies, which would replace older engines or trucks with new models that reduce emissions as much as 90%.³⁴

³⁰ Information on these regulations can be found at <http://www.arb.ca.gov/regact/2007/chc07/chc07.htm>.

³¹ *Natural Resources Defense Council v. City of Los Angeles*, 126 Cal. Rptr. 2d 615 (Cal. App. 2002).

³² See Port of Los Angeles, "Alternative Marine Power," at http://www.portoflosangeles.org/environment/alt_maritime_power.asp. Also see "Alternative Maritime Power "Off and Running," presented by Eric Caris, at <http://www.ffca2006.com/documents/presentations/marine/Eric%20Caris.pdf>.

³³ See California Air Resources Board, "Rulemaking to Consider Adoption of Proposed Regulations to Reduce Emissions from Diesel Auxiliary Engines on Ocean-Going Vessels While at Berth at a California Port," at <http://www.arb.ca.gov/regact/2007/shorepwr07/shorepwr07.htm>. The December 2008 regulation will require container vessels, passenger vessels, and reefers (refrigerated ships for perishable cargo) to reduce on-board power generation 50% by 2014, 70% by 2017, and 80% by 2020. Tankers, vehicle carriers, and bulk and general cargo ships are not affected by the regulation.

³⁴ See CARB, "Emissions Reduction Plan for Ports and Goods Movement in California: *Update on Implementation*," Staff Presentation, Air Resources Board Meeting, Oakland, CA, April 24, 2008 at <ftp://ftp.arb.ca.gov/carbis/board/books/2008/042408/08-4-7pres.pdf>.

In February 2009, CARB noted that state funding for bond programs had been suspended, pending “effective resolution of the current fiscal year budget crisis and a restoration of the state’s ability to access the bond market.” This affected FY2007-FY2008 funds awarded to local agencies under the Goods Movement Program, as well as the FY2008-FY2009 funds that had not yet been awarded.³⁵ Some funding has since been freed up, but a Department of Finance directive prohibited CARB from making allocations for the second and third installments (\$250 million each) appropriated for this program.

In addition to the CARB funding, the ports of Los Angeles and Long Beach, as noted earlier, will provide subsidies for truck and engine replacement from a fund generated by a \$35 to \$70 per container fee. The grants will provide \$20,000 for the cost of each truck compliant with EPA’s 2007 emission standards used by port concessionaires. The ports began distributing \$44 million in incentive checks in December 2008, for the first 2,200 low-emission trucks purchased under the program.³⁶

These grants have also experienced funding problems. The per-container fees that are to fund the system were to have been collected beginning in November 2008, but implementation was delayed by the Federal Maritime Commission (FMC), which maintained that the ports’ program (referred to as the PortCheck Agreement) is anti-competitive and interferes with interstate commerce. FMC delayed implementation of the fees by requiring two 45-day review periods. These actions delayed the start of fee collection until February 18, 2009.³⁷

The Port of Los Angeles is also collaborating with the South Coast Air Quality Management District to provide up to \$100,000 for each natural gas (LNG or CNG) truck purchased by port concessionaires and up to 80% of the cost of electric trucks. This has led to the purchase of more than 400 alternate fuel trucks. About 8.5% of the cargo moves at the port were being made by these alternative fuel trucks as of October 2009.³⁸

Besides state and local funding, U.S. EPA has become a source of funds for diesel emission reductions at ports. The stimulus package (the American Recovery and Reinvestment Act of 2009, P.L. 111-5) contained \$300 million for diesel emission reduction grants. This money may be used for purposes authorized under Title VII, Subtitle G of the Energy Policy Act of 2005 (P.L. 109-58), including retrofit of diesel trucks, marine engines, and cargo handling equipment, not only in California, but in other states as well. Of the first \$156 million awarded, at least \$29

³⁵ Although funds are appropriated to ARB as part of the state’s budget process, ARB must obtain the cash through the Pooled Money Investment Board. See CARB, “Prop 1B/Goods Movement Update” (e-mail to listserve on February 4, 2009), at http://www.arb.ca.gov/bonds/gmbond/docs/2_4_2009_email_update_to_listserv.pdf. Additional information was provided on July 1 at http://www.arb.ca.gov/bonds/gmbond/docs/july_2009_semi_annual_report_to_dof.pdf.

³⁶ “Port of Los Angeles Begins Estimated \$44 Million Pay-Out Process to Clean Truck Program Concessionaires that Applied for Port’s 2007-Compliant Incentive Program,” Press Release, December 23, 2008, at <http://www.portoflosangeles.org/environment/ctp.asp>.

³⁷ Trucking interests also sued the ports to prevent implementation of PortCheck, focusing on the mechanism it uses (i.e., its requirement that truckers be concessionaires of the ports and submit to numerous administrative, financial, training, maintenance, and insurance requirements, in addition to using cleaner trucks). See *American Trucking Ass’ns Inc. v. City of Los Angeles*, C.D. Cal., No. 08-4920. In April 2009, the U.S. District Court for the Central District of California blocked the ports of Los Angeles and Long Beach from enforcing the concessionaire requirements of the PortCheck program on the grounds that they interfered with interstate commerce. The Port of Long Beach subsequently settled with the trucking associations. See “Port of Long Beach, Calif., Settles Lawsuit Over Clean-Truck Program,” *Daily Environment Report*, October 22, 2009, p. A-3.

³⁸ http://www.portoflosangeles.org/CTP/CTP_Cargo_Move_Analysis.pdf

million went for diesel reduction activities at ports, including \$8 million to California ports. There is an additional \$60 million in diesel emission reduction grant money in P.L. 111-88, the Fiscal Year 2010 Interior, Environment, and Related Agencies Appropriation, signed by the President October 30, 2009.

Greenhouse Gases

Ships are also an important source of greenhouse gas (GHG) pollutants. Although there is a wide range of estimates, the International Maritime Organization's consensus is that international shipping emitted 843 million metric tonnes of carbon dioxide, 2.7% of global CO₂ emissions in 2007. Including domestic shipping and fishing vessels larger than 100 gross tonnes, the amount would increase to 1.019 billion tonnes, 3.3% of global emissions.³⁹ At these levels, only five countries (the United States, China, Russia, India, and Japan) account for a higher percentage of the world total of CO₂ emissions.⁴⁰

In addition to the CO₂ emissions, the low quality fuel (bunker fuel) that ships use and the absence of pollution controls result in significant emissions of black carbon and nitrogen oxides, which also contribute to climate change. The refrigerants used on ships (hydrofluorocarbons and perfluorocarbons—HFCs and PFCs) are also potent greenhouse gases when released to the atmosphere. Thus, the total impact of ships on climate may be somewhat greater than 3%.

International Efforts to Address GHGs

For the most part, these emissions occur in international waters, and the sources are vessels not registered in the United States. Addressing the emissions, therefore, is likely to require international agreement. On the international level, however, there has been disagreement over who should take responsibility to abate GHG emissions. Rather than cover these emissions under the Kyoto Protocol, nations agreed to look to the IMO for sector-specific provisions to reduce GHG emissions from shipping.⁴¹ The IMO's Marine Environment Protection Committee has begun negotiations on the issue, and has stated that the issue is "high on the Committee's agenda." Thus far, however, it has agreed only on voluntary guidelines on ship design and operational efficiency, while continuing to discuss market-based instruments to reduce GHG emissions.⁴² Some in the industry, including shipping industry associations from several European countries, have suggested applying a cap-and-trade scheme to shipping's GHG emissions. At U.N.-sponsored climate negotiations, on the other hand, there has been talk of imposing a tax on bunker fuel.⁴³

³⁹ International Maritime Organization, *Updated Study on Greenhouse Gas Emissions from Ships*, Executive Summary of Phase 1 Report, 1st September 2008, p. 5 at regserver.unfccc.int/seors/attachment/file_storage/6ep77qqvcujba7k.doc. Both estimates exclude emissions from naval vessels. Cited below as "IMO 2008 Update."

⁴⁰ Oceana, *Shipping Impacts on Climate: A Source with Solutions*, p. 2, at http://www.oceana.org/fileadmin/oceana/uploads/Climate_Change/Oceana_Shipping_Report.pdf.

⁴¹ Under the UN Framework Convention on Climate Change, emissions from internationally used fuels (both ships and aviation) are calculated by countries but reported separately from national emissions, such as those subject to the United Nations Kyoto Protocol.

⁴² For information on IMO discussions, see http://www.imo.org/Environment/mainframe.asp?topic_id=1737.

⁴³ "U.N. Climate Talks Consider Carbon Tax on Air, Sea Transport; Progress on Draft Text," *Daily Environment Report*, October 7, 2009, p. A-14.

As with many other sectors, the European Union has been a driving force in getting international consideration of controlling the shipping sector's GHG emissions. The EU has considered adding the shipping industry to its cap-and-trade system, the EU Emissions Trading Scheme (ETS), but for now is deferring to the IMO. Approving a broad package of climate measures on December 17, 2008, the European Parliament left shipping out of the package, pending the outcome of the IMO discussions. Satu Hassi, a Finnish lawmaker from the Parliament's Green Group, who oversaw negotiations on emission reduction targets for non-ETS sectors, was quoted as saying the "EU will act unilaterally" should IMO discussions not produce sufficient results.⁴⁴

Shipping vs. Other Transport Modes

Ocean-going ships are already by far the most efficient means of goods movement. As noted by the United Nations Conference on Trade and Development (UNCTAD):

While in absolute terms GHG emissions from international shipping are significant, in relative terms maritime transport – in particular where larger ships are used – surpasses other modes of transport in terms of fuel efficiency and climate friendliness. On a per ton kilometre (km) basis and depending on ship sizes, CO₂ emissions from shipping are lower than emissions from other modes. For example, emissions from rail could be 3 to 4 times higher than emissions from tankers, while emissions from road and air transport could, respectively, be 5 to 150 times and 54 to 150 times higher. Equally, in terms of fuel consumption (kilowatt (kW)/ton/km), a container ship (3,700 twenty-foot equivalent units (TEUs)), for instance, is estimated to consume on average 77 times less energy than a freight aircraft (Boeing 747-400), about 7 times less than a heavy truck and about 3 times less than rail.⁴⁵

But, in general, shipping does not compete with other modes of transport. Only in a small number of cases involving high value or perishable commodities, or relatively short distances between countries that also have land links, are mode shifts between shipping and air, truck, or rail transport possible. Ships move more than 80% of the volume of international trade, and are likely to continue doing so. As the overall volume of trade grows, GHG emissions from shipping are projected to be 2.4 to 3 times the current level by 2050 unless control measures are adopted.⁴⁶

Measures to Reduce Ships' GHG Emissions

A number of measures might be taken to reduce the shipping sector's GHG emissions. One of the more common suggestions is that ships operate at lower speeds. The IMO's 2000 study of GHG emissions from ships concluded that a 10% reduction in speed would result in a 23.3% reduction in emissions.⁴⁷ Slowing speeds is not without problems. According to the 2000 IMO report:

⁴⁴ "European Parliament Gives Final Approval to Far-Reaching Climate Protection Strategy," *Daily Environment Report*, December 18, 2008, p. A-1.

⁴⁵ "Maritime Transport and the Climate Change Challenge," Note by the UNCTAD Secretariat, 9 December 2008, prepared for the Multi-Year Expert Meeting on Transport and Trade Facilitation, Geneva, Switzerland, 16-18 February 2009, at http://www.unctad.org/en/docs/cimem1d2_en.pdf.

⁴⁶ IMO 2008 Update, op. cit., p. 5.

⁴⁷ Norwegian Marine Technology Research Institute – MARINTEK et al., for the International Maritime Organization (IMO), *Study of Greenhouse Gas Emissions from Ships*, March 2000, p. 17, at http://unfccc.int/files/methods_and_science/emissions_from_intl_transport/application/pdf/imoghmain.pdf. This one measure (slow steaming) dwarfed the potential of any of the other technical and operational measures examined in the IMO study: in (continued...)

For most ship engines, running at reduced speed / slow steaming may ... cause problems. Such problems may be vibrations (critical RPM of engine / shaft) and accelerating sooting in the exhausted gas channel. Sooting problems are normally coincident with incomplete combustion and increasing GHG emission per fuel unit consumed. For ships permanently operating at slow speed, however, engine modifications / de-rating may be a solution.⁴⁸

In addition, of course, cargo owners may consider the lost time in reaching the ship's destination to be more valuable than the fuel and GHG savings. Thus, in a competitive market with low fuel costs, ship owners will tend to offer as swift a service as they can safely provide.

Nevertheless, it is possible without changes in technology or fuels to achieve significant GHG emission reductions, and shipping companies have begun to implement slow steaming policies to reduce their emissions. A.P. Moller – Maersk Group, the world's largest container shipper, for example, reports that it reduced fuel consumption in its transport group 6% in 2008 compared to the fuel used for the same level of business activity in 2007. In addition to slow steaming, the company has implemented waste heat recovery systems on 32 ships, has installed software in containers to reduce energy consumption for cooling, and has developed a voyage planning program to identify the most fuel-efficient routes, and a “just in time” steady running strategy that minimizes engine loads.⁴⁹

Cleaner fuels and emission controls could also lower emissions, particularly if one focuses on emissions of black carbon and nitrogen oxides. Like slow steaming, these could be implemented without the need to replace ship engines or the ships themselves.

The use of alternative power in ports may also reduce GHG emissions, if the shore power is derived from low-carbon sources such as natural gas, or no-carbon sources (hydropower, wind, solar, or nuclear).

New ships may be able to reduce emissions further through better hull design, more efficient propulsion, and propeller coatings, among other options. A detailed discussion of options (in the context of Navy ships) is provided in CRS Report RL33360, *Navy Ship Propulsion Technologies: Options for Reducing Oil Use—Background for Congress*, by (name redacted)

Conclusion

As pollution from cars, trucks, and land-based stationary sources has been more tightly controlled over the last 40 years, the contribution of ships and port operations to air pollution in port cities has become more important. Simultaneously, foreign trade has grown dramatically, adding to the burden of pollution from these sources. Thus, pollution from ships and the port operations that serve them is now among the most important sources of sulfur oxides, nitrogen oxides, particulates, and other pollutants in numerous U.S. cities.

(...continued)

the short term (10 years), it accounted for nearly 60% of the total reductions identified; over a 20-year horizon, it still accounted for 43% of potential reductions.

⁴⁸ Ibid., p. 91.

⁴⁹ *Preparing for the Future*, A.P. Moller – Maersk Group's Health, Safety, Security and Environment Report 2008, p. 30, at http://media.maersk.com/da/PressReleases/2009/Documents/Maersk%20HSSE%202008_Final.pdf.

Controlling these sources of pollution is complicated by the fact that most oceangoing ships are registered in foreign countries. As a result, initial efforts at control were focused on international negotiations through the IMO, which established a basic structure (MARPOL Annex VI) that appears likely to be the basis of more stringent future controls. Negotiating, ratifying, and implementing MARPOL agreements has been time-consuming, but now has resulted in significant levels of regulation that will gradually be implemented over the next six years. EPA and state and local agencies (particularly those in California) have also begun to address pollution from ships using the Clean Air Act and comparable state authorities.

Not all pollution from marine vessels comes from foreign ships. Smaller craft, such as ferries, tugboats, and fishing boats do tend to be registered in the United States, and are thus more amenable to control. Even for these smaller craft, the technical issues can be complex, as the vessels include a wide variety of engine sizes and ship configurations. Safety also poses important considerations, as ships must be able to depend on their sources of power in what may be extreme weather conditions and while dealing with a variety of navigational hazards. A particular issue has arisen regarding Great Lakes freighters, many of which were built more than 50 years ago, and might face significant costs in upgrading to burn cleaner fuel. The FY2010 appropriation for EPA has prohibited the expenditure of funds in this fiscal year to issue final fuel sulfur standards applicable to existing steamships operating exclusively within the Great Lakes, and accompanying report language states that EPA should develop waiver provisions available to these ships.

Because ships and port operations are now such significant sources of air pollution, and because of the importance of shipping to the national and world economy, implementation of the emissions regulations for ships and ports, including the cleaner fuels requirements, may continue to be of interest to Congress. In addition, ships are a large and growing source of greenhouse gas emissions; how and whether to regulate these emissions are the subject of IMO discussions and are a small part of the larger debate over legislation to address climate change.

Congress has begun efforts to address these problems, by enacting legislation to implement MARPOL Annex VI in July 2008. But this is likely to be just the start of Congressional attention to air pollution from ships. Action at the state level, in the courts, and at U.S. EPA will continue to bring the issue to Congress's attention, with numerous opportunities for oversight and legislation.

Author Contact Information

(name redacted)
Specialist in Environmental Policy
[redacted]@crs.loc.gov, 7-....

EveryCRSReport.com

The Congressional Research Service (CRS) is a federal legislative branch agency, housed inside the Library of Congress, charged with providing the United States Congress non-partisan advice on issues that may come before Congress.

EveryCRSReport.com republishes CRS reports that are available to all Congressional staff. The reports are not classified, and Members of Congress routinely make individual reports available to the public.

Prior to our republication, we redacted names, phone numbers and email addresses of analysts who produced the reports. We also added this page to the report. We have not intentionally made any other changes to any report published on EveryCRSReport.com.

CRS reports, as a work of the United States government, are not subject to copyright protection in the United States. Any CRS report may be reproduced and distributed in its entirety without permission from CRS. However, as a CRS report may include copyrighted images or material from a third party, you may need to obtain permission of the copyright holder if you wish to copy or otherwise use copyrighted material.

Information in a CRS report should not be relied upon for purposes other than public understanding of information that has been provided by CRS to members of Congress in connection with CRS' institutional role.

EveryCRSReport.com is not a government website and is not affiliated with CRS. We do not claim copyright on any CRS report we have republished.