

Economic Impacts of the Category 3 Marine Rule on Great Lakes Shipping

EPA performed an analysis of the economic impacts of the Category 3 Marine Rule on Great Lakes shipping. The study examines three potential effects of increased operating costs associated with the requirement to use reduced sulfur fuel on the Great Lakes: transportation mode shift, source shift, and production shift. Transportation mode shift is not expected: while operating costs, and therefore marine freight rates, will increase as a result of the requirement to use cleaner, lower sulfur fuel, marine transportation is expected to remain less expensive than land-based alternatives for eleven of twelve routes identified as being at risk for transportation mode shift; the results for the remaining scenario are inconclusive. Source shift (switching from stone quarried in Michigan to locally quarried stone) and production shift (relocating steel or electricity production out of the Great Lakes area) are also not expected.

What is EPA's Category 3 Marine Rule and how does it apply to the Great Lakes?

EPA's Category 3 Marine Rule is part of a Coordinated Strategy to reduce emissions from all Category 3 marine engines that operate in the United States, including those that operate on the U.S. portions of the Great Lakes and St. Lawrence Seaway (75 FR 22896, April 30, 2010).¹ The Coordinated Strategy's engine and fuel standards are consistent with the technology-forcing requirements contained in the other parts of our national marine program and will result in significant human health and welfare benefits throughout the United States.

¹ See our website, www.epa.gov/otaq/oceanvessels.htm, for more information about the Coordinated Strategy and our Category 3 marine engine rule.

The Coordinated Strategy consists of three parts:

- (i) national emission standards for new Category 3 engines (engine with per cylinder displacement at or above 30 liters) installed on U.S. vessels and national sulfur limits for fuel produced or sold in the United States (adopted under the Clean Air Act; 40 CFR 1042 and 40 CFR 80);
- (ii) international emission standards for marine diesel engines above 130 kW installed on any vessel and international marine fuel sulfur limits that apply worldwide (adopted in the 2008 amendments to Annex VI to the International Convention for the Prevention of Pollution from Ships, called MARPOL Annex VI; 40 CFR 1043); and
- (iii) additional international engine emission standards and fuel sulfur limits that apply to ships operating in specially designated emission control areas (ECAs), including the recently designated U.S. ECAs (adopted by amendment to MARPOL Annex VI; 40 CFR 1043).

There are two designated U.S. ECAs: the North American ECA and the U.S. Caribbean ECA.² Emission control area designation is an important part of the Coordinated Strategy because the ECA engine and fuel standards are more stringent than the global requirements and apply to all ships operating in an ECA regardless of where the ship is flagged. The interim 10,000 ECA fuel sulfur limit applies from when an ECA goes into effect through 2014; beginning January 1, 2015, that limit is reduced to 1,000 ppm.³ In addition, engines installed on vessels constructed beginning in 2016 will be required to meet more stringent NO_x emission standards while they are operating within an ECA.

Our national regulations implementing MARPOL Annex VI clarify that the Annex VI ECA requirements apply to ships operating in U.S. internal waters shoreward of a designated ECA that can be accessed by ocean-going vessels (called ECA associated areas; 40 CFR 1043.20). This includes U.S. coastal ports, U.S. rivers that are navigable from an ECA (such as the Mississippi River, the Puget Sound, the Chesapeake Bay), and those portions of the Great Lakes and St. Lawrence Seaway that are subject to U.S. authority.

The effective dates of the ECA standards that apply in an ECA associated area are the same as for the designated ECA it adjoins. For the Great Lakes, the interim 10,000 ppm fuel sulfur limit applies from August 1, 2012 through December 31, 2014; beginning January 1, 2015, the 1,000 ppm fuel sulfur limit applies. Similarly, the ECA engine NO_x limits apply to engines onboard ships built on or after January 1, 2016, and to new engines built after that date.

² The North American ECA entered into force on August 1, 2011, and the fuel requirements will begin to apply on August 1, 2012. The U.S. Caribbean Sea ECA will enter into force on January 1, 2013, and the fuel sulfur requirements will begin to apply on January 1, 2014. For more information about these ECAs, see our website www.epa.gov/otaq/oceanvessels.htm.

³ As an alternative to operating on lower sulfur fuel, an alternative method (e.g., exhaust gas cleaning device such as a scrubber) may be used as long as the alternative method is at least as effective in terms of emission reductions.

Why did EPA perform an analysis of the economic impacts of the Category 3 Marine Rule on Great Lakes shipping?

During our rulemaking process, Great Lakes stakeholders commented that using ECA-compliant 1,000 ppm sulfur fuel would increase their operating costs and could lead to a transportation mode shift in the Great Lakes area away from ships and toward less efficient ground transportation which, in turn, could increase emissions overall. Great Lakes commenters also said that increased marine fuel costs could lead to source shift in the regional crushed stone market, leading users to shift their sources of stone away from quarries in the upper Great Lakes to local quarries, and to production shift in the regional steel and electricity markets, leading manufacturers to shift production out of the Great Lakes region.

In response to these comments, we included three Great Lakes provisions in the final Category 3 Marine Rule: a steamship exemption, a 10,000 ppm residual fuel availability waiver, and an economic hardship waiver (see 40 CFR 1043.95). Any ship, including a foreign ship, that operates exclusively in the Great Lakes (defined as all streams, rivers, lakes, and other bodies of water that are within the drainage basin of the St. Lawrence River, west of Anticosti Island; see 40 CFR 1043.20) can take advantage of these provisions. We also provided separate estimates of the rule's compliance costs and inventory benefits for the Great Lakes.⁴ Finally, we indicated that we would perform a separate economic impact analysis of the Category 3 Marine Rule on Great Lakes shipping.⁵

This study also fulfills a request by Congress that EPA perform an analysis of the economic impacts of the Category 3 rule on Great Lakes shipping (see Conference Report 111-316 accompanying HR2996, the Department of Interior, Environment, and Related Agencies Appropriations Act, 2010).

What methodology does this economic impact analysis use?

The Great Lakes study examines the economic impacts of applying the 1,000 ppm ECA fuel sulfur limit to Category 3 ships that operate on a limited number of shipping routes (called "scenarios"). To ensure that the study is responsive to public comments, we chose 16 shipping routes that were identified by Great Lakes stakeholders as being at risk for transportation mode shift, source shift, and/or production shift. If the results of the analysis for these at-risk routes, where the competition between marine transportation and the all-rail alternative is close enough to be of concern to stakeholders, shows no expected change, then adverse impacts on other routes without such market pressures would not be likely.

In addition to the at-risk shipping routes, stakeholders provided essential input with respect to the modeling methodology and data inputs such as vessel characteristics and operating conditions (e.g., vessel speed, length of voyage, and port and waterway draft restrictions). The analysis considers only ships with Category 3 engines, which would be required to switch from residual fuel to distillate diesel fuel to meet the ECA fuel sulfur requirements.

⁴ See Control of Emissions from New Marine Compression-Ignition Engines at or above 30 Liters per Cylinder – Information in Support of Applying Emission Control Area (ECA) Requirements to the Great Lakes Region. EPA-HQ-OAR-2007-0586. December 15, 2009.

⁵ This study also responds to the recommendation contained in Conference Report 111-316 accompanying HR2996, the Department of Interior, Environment, and Related Agencies Appropriations Act, 2010.

The study relies on estimates of the increase in marine freight rates that would occur as a result of an increase in ship operating costs due to the use of ECA-compliant 1,000 ppm sulfur marine diesel fuel. The ECA-adjusted marine freight rates are used to examine the likelihood of transportation mode shift (freight rate comparison analysis), source shift (competitive radius analysis), and production shift (retail revenue analysis). It should be noted that volatility in fuel prices would not be expected to affect the overall findings of the study: marine, rail and truck fuel prices rise or fall in tandem with the global price of oil, and impacts of changing oil prices would be integrated into the base freight rates of each transportation mode.

The transportation shift, source shift, and production shift analyses were peer reviewed pursuant to EPA's Science Policy Council Peer Review Handbook, 3rd edition.

What are the results of the analysis?

Transportation mode shift is evaluated for twelve shipping routes (four routes each for the shipment of coal, iron ore, and grain) by comparing the adjusted marine freight rate for each route to the least-expensive land alternative, rail. This analysis shows that compliance with the 1,000 ppm ECA fuel sulfur limit is not likely to lead to transportation mode shift on these at-risk routes. For ten of the twelve scenarios examined, ECA-adjusted marine freight rates are expected to remain well below the All-Rail Alternative. For one of the two remaining scenarios, an All-Rail Alternative route could not be identified, although the results for a similar case suggest that no transportation mode shift would be indicated. For the other scenario, the results of the analysis are inconclusive.

Source shift is evaluated for four shipping routes by estimating whether an increase in marine operating costs is likely to change the competitive dynamics of the crushed stone market for particular using facilities. This analysis shows no significant change is expected in the number of local quarries that could deliver stone to the using facilities, and therefore no source shift is expected.

Production shift is evaluated for electricity and steel markets using a retail revenue approach. This analysis shows that the estimated increase in marine fuel costs for transporting coal and iron ore is not expected to shift electrical and steel production out of the Great Lakes region both because these cost increases are small in comparison to sector revenues and because the magnitude of the cost increases is well within the bounds of historic electricity and steel price fluctuations. This result is also supported by a more detail analysis for steel destined for use in the Detroit, Michigan area.

Finally, for each of the transportation mode shift scenarios, EPA compared the estimated emissions from the marine-based routes with those of the land-based alternative. The results of this analysis are mixed and depended on the pollutant, the nature of the route and the size of the shipment. This analysis shows that the use of 1,000 ppm sulfur ECA fuel on ships is better for the environment than the all-rail alternative in nine of the scenarios for fine PM and CO₂ emissions, and in eight of the scenarios for NO_x emissions.

How is the report organized?

EPA's full study, Economic Impacts of the Category 3 Marine Rule on Great Lakes Shipping (EPA-420-R-12-005, March 2012) can be found on our website, www.epa.gov/otaq/oceanvessels.htm. The Great Lakes Study is organized as follows:

Chapter 1	The Great Lakes and EPA's Emission Control Program
Chapter 2	Transportation Shift Analysis
Chapter 3	Potential for Other Shifts in Transport of Goods, and Emissions Impacts
Chapter 4	Emission Inventory for the U.S. Great Lakes
Chapter 5	Air Quality, Health and Environmental Impacts and Quantified Benefits of Reduced Emissions from Great Lakes Ships
Chapter 6	Costs of Controlling Emissions from Vessels on the Great Lakes
Chapter 7	Industry Characterization
Chapter 8	Peer Review Process and Response to Comments

For More Information

You can find information about the applicable standards, the final peer-reviewed report and related documents on EPA's Office of Transportation and Air Quality web site at:

www.epa.gov/otaq/oceanvessels.htm

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

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For more information on related topics, please contact EPA OTAQ Public Inquiries:

www.epa.gov/otaq/oms-cmt.htm