



## Nonroad Engines, Equipment, and Vehicles Ocean Vessels and Large Ships

Large ships such as container ships, tankers, bulk carriers, cruise ships, and Lakers are significant contributors to air pollution in many of our nation's cities and ports. There are two types of diesel engines used on large ships: main propulsion and auxiliary engines. The main propulsion engines on most large ships are "Category 3" marine diesel engines, which can stand over three stories tall and run the length of two school buses. Auxiliary engines on large ships typically range in size from small portable generators to locomotive-size engines.

This page provides general and technical information on EPA's coordinated strategy to address emissions from large ships, including ocean vessels and Lakers, flagged in the United States and in other countries. EPA's coordinated strategy includes:

- EPA domestic actions under the Clean Air Act; and
- U.S. Government action through the International Maritime Organization, including:
  - Designation of [Emission Control Areas](#) for U.S. coastal waters; and
  - Adoption of [new international standards](#) for all ships in global waters.

Combined, these actions make a comprehensive program that is expected to significantly improve U.S. air quality and public health.

For more information on EPA's requirements for marine diesel engines smaller than Category 3 installed on U.S. vessels, see [Diesel Boats and Ships](#). For information on EPA's requirements for gasoline-powered marine engines, see [Gasoline Boats and Personal Watercraft](#).

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### EPA Actions

#### Engine and Fuel Standards

In a rule published on April 30, 2010, EPA adopted standards that apply to Category 3 (C3) engines installed on U.S. vessels and to marine diesel fuels produced and distributed in the United States. That rule added two new tiers of engine standards for C3 engines: Tier 2 standards that begin in 2011 and Tier 3 standards that begin in 2016. It also includes a regulatory program to implement Annex VI to the International Convention for the Prevention of Pollution from Ships (a treaty called "MARPOL") in the United States, including engine and fuel sulfur limits, and extends the [Emission Control Area \(ECA\)](#) engine and fuel requirements to U.S. internal waters. The rule also revised our domestic CAA diesel fuel program to allow for the production and sale of diesel fuel with up to 1,000 ppm sulfur for use in C3 marine vessels, phasing in by 2015.

On January 18, 2012, EPA published a [Direct Final Rule](#) that adds a provision to our large marine engine program to provide an incentive to repower Great Lakes steamships with new, more efficient, diesel engines. This consists of an automatic, time-limited fuel waiver that allows the use of residual fuel in the replacement diesel engines that exceeds the global and ECA sulfur limits that otherwise apply to the fuel used in ships operating on the U. S. portions of the Great Lakes. This automatic Great Lakes steamship repower fuel waiver is valid through December 31, 2025; after that date, repowered steamships will be required to comply with the Great Lakes ECA fuel sulfur limits for diesel engines. This automatic fuel waiver is available only to steamships that operate exclusively on the Great Lakes, that were in service on October 30, 2009 and that are repowered with a Tier 2 or better diesel engine.

See the electronic [Code of Federal Regulations \(e-CFR\)](#) for the full text of current CAA regulations at [40 CFR part 94](#) or [40 CFR part 1042](#) that apply to marine compression-ignition engines. See [40 CFR Part 80 Subpart I](#) of the e-CFR for the full text of current regulations that apply to marine diesel fuels. See [40 CFR part 1043](#) for the full text of APPS regulations implementing MARPOL Annex VI and the [North American ECA](#).

- **Direct Final Rule:** Great Lakes Repower Incentive Program (published January 18, 2012)
  - Fact Sheet: [Great Lakes Steamship Repower Incentive Program \(PDF\)](#) (2 pp, 129K, EPA-420-F-12-003, January 2012)
  - [Direct Final Rule \(PDF\)](#) (7 pp, 181K, published January 18, 2012)
- **Final Rule: Control of Emissions from New Marine Compression-Ignition Engines at or Above 30 Liters per Cylinder** (published April 30, 2010)
  - Fact Sheet: [EPA Finalizes More Stringent Standards for Control of Emissions from New Marine Compression-Ignition Engines at or Above 30 Liters per Cylinder: Regulatory Announcement \(PDF\)](#) (6 pp, 144K, EPA-420-F-09-068, December 2009)
  - Fact Sheet: [Frequently Asked Questions about the Great Lakes Residual Fuel Availability Waiver \(PDF\)](#) (5 pp, 546K, EPA-420-F-12-008, February 2012)
  - [Facts and Figures \(PDF\)](#) (1 pp, 126K, EPA-420-F-09-075, December 2009)
  - [Final Rule \(PDF\)](#) (171 pp, 3.59M, April 2010)
  - [Summary and Analysis of Comments \(PDF\)](#) (205 pp, 1.2M, EPA-420-R-09-015, December 2009)
  - [Final Regulatory Impact Analysis \(PDF\)](#) (527 pp, 9.7B, EPA-420-R-09-019, December 2009)
  - See [Proposed Emission Standards](#) for the proposed rule, fact sheet and regulatory support documents, and for the separate rule establishing the deadline for the



#### Related Topics

- [Diesel Boats and Ships](#)
- [Gasoline Boats & Personal Watercraft](#)

NOTE: You will need Adobe Acrobat Reader, available as a free download, to view some of the files on this page. See [EPA's PDF page](#) to learn more about PDF, and for a link to the free Acrobat Reader.

final rule.

- **Final Emission Standards: Tier 1 Marine Diesel Engines** (published February 28, 2003)
  - [Fact Sheet \(PDF\)](#) (7 pp, 427K, EPA420-F-03-001, January 2003)
  - [Final Tier 1 Rule \(PDF\)](#) (44 pp, 373K, published February 28, 2003)
  - Summary and Analysis of Comments: [Control of Emissions from New Marine Compression-Ignition Engines at or Above 30 Liters per Cylinder \(PDF\)](#) (121 pp, 337K, EPA420-R-03-003, January 2003)
  - Final Regulatory Support Document: [Control of Emissions from New Marine Compression-Ignition Engines at or Above 30 Liters per Cylinder](#) (EPA420-R-03-004, January 2003)
  - [Final Index for Docket A-2001-11 \(PDF\)](#) (35 pp, 231K)
  - See [Proposed Emission Standards](#) for the proposed rule, fact sheet and regulatory support documents.

## Emission Control Area Designation

MARPOL Annex VI contains a program that applies stringent engine emission standards and fuel sulfur limits to ships that operate in specially designated Emission Control Areas. The quality of fuel that complies with the ECA standard changes over time.

The United States has obtained designation for the [North American ECA](#) and the [US Caribbean ECA](#). The effective dates of the standards for an area depend on the area's designation date. See [Annex VI Amendments](#) for more information about this international program.

### U.S. Caribbean Emission Control Area

On July 15, 2011, the IMO officially designated waters around Puerto Rico and the U.S. Virgin Islands as an area in which stringent international emission standards will apply to ships. For this area, the effective date of the first-phase fuel sulfur standard is 2014, and the second phase begins in 2015. Stringent NOx engine standards begin in 2016.

The documents that describe and support the U.S. Caribbean ECA are available below.

- Fact Sheet: [Designation of Emission Control Area to Reduce Emissions from Ships in the U.S. Caribbean \(PDF\)](#) (5 pp, 192K, EPA-420-F-11-024, July 2011)
- **ECA Amendments to MARPOL Annex VI:** These [treaty amendments \(PDF\)](#) (7 pp, 98K, July 2011) were adopted in 2011 to define the boundaries of the new control area. [The emission and fuel standards](#) are the same in all ECAs.
- **Proposal to the IMO:** The proposal includes an Executive Summary plus two annexes: Description of the Area and Proposed Regulatory Amendments. Also submitted to the IMO is an Information Document that provides a complete analysis of how the proposal addresses the IMO's approval criteria. In addition, a comprehensive Technical Support Document (TSD) is available where the reader seeks additional detail.
  - [Proposal to Designate an Emission Control Area for the Commonwealth of Puerto Rico and the U.S. Virgin Islands for Nitrogen Oxides, Sulphur Oxides and Particulate Matter \(PDF\)](#) (12 pp, 125K, MEPC 61/7/3, June 2010)
  - [Propuesta de designación de una zona de control de las emisiones de óxidos de nitrógeno, óxidos de azufre y materia particulada para el Estado Libre Asociado de Puerto Rico y las Islas Vírgenes de los Estados Unidos \(PDF\)](#) (12 pp, 136K, MEPC 61/7/3, junio 2010)
  - Information Document: [Designation of an Emission Control Area for Nitrogen Oxides, Sulphur Oxides and Particulate Matter \(PDF\)](#) (59 pp, 1.81MB, MEPC 61/INF.9, June 2010)
  - Technical Support Document: [Proposal to Designate an Emission Control Area for Nitrogen Oxides, Sulfur Oxides and Particulate Matter \(PDF\)](#) (175 pp, 2.3M, EPA-420-R-10-013, August 2010)

### North American Emission Control Area

Carnival Corporation is the most recent of several shipping companies, including other cruise lines, to apply for flexibility under the International Maritime Organization requirements to support the development of exhaust gas cleaning technology. Over the next three years, Carnival Corporation intends to develop and deploy a new type of exhaust gas cleaning system for ships—one that provides the potential to exceed the fuel sulfur standard ECA requirements, as well as provide additional benefits in the reduction of particulate matter and black carbon, at a lower cost than using lower sulfur fuel.

- [EPA/Coast Guard Letter to Carnival regarding a trial program for installing SOx scrubbers \(PDF\)](#) (2 pp, 579K, August 2013)

On March 26, 2010, the IMO officially designated waters off North American coasts as an area in which stringent international emission standards will apply to ships. For this area, the effective date of the first-phase fuel sulfur standard is 2012, and the second phase begins in 2015. Beginning in 2016, NOx aftertreatment requirements become applicable.

The documents that describe and support the North American ECA are available below.

- Fact Sheet: [Designation of North American Emission Control Area to Reduce Emissions from Ships \(PDF\)](#) (5 pp, 454K, EPA-420-F-10-015, March 2010)
- **ECA Amendments to MARPOL Annex VI:** These [treaty amendments \(PDF\)](#) (9 pp, 295K, May 13, 2010) were adopted in 2010 to define the boundaries of the new control area. Click to see [the emission and fuel standards](#).
- **Proposal to the IMO:** The proposal includes an Executive Summary with four annexes. Also submitted to the IMO is an Information Document that provides a synopsis of a comprehensive Technical Support Document (TSD).
- [Proposal to Designate an Emission Control Area for Nitrogen Oxides, Sulphur Oxides and Particulate Matter \(PDF\)](#) (74 pp, 1.79M, MEPC 59/6/5, April 2009)
  - Information Document: [Designation of an Emission Control Area for nitrogen oxides, sulphur oxides and particulate matter \(PDF\)](#) (13 pp, 93K, MEPC 59/INF.13, April 2009)
  - Technical Support Document: [Proposal to Designate an Emission Control Area for Nitrogen Oxides, Sulfur Oxides and Particulate Matter \(PDF\)](#) (329 pp, 8.9M, EPA-420-R-09-007, April 2009)
- **For more information about the process for applying to designate the coastal areas of the U.S. as an Emission Control Area under Annex VI, see [Frequently Asked Questions about the Emission Control Area Application Process \(PDF\)](#)** (7 pp, 750K, EPA-420-F-09-001, January 2009)
- [Letter to IMO from EPA and U.S Coast Guard regarding equivalent methods to comply with the ECA fuel sulfur requirements \(PDF\)](#) (2 pp, 501K, March 12, 2012)

EPA has also completed a study to examine the economic impacts on Great Lakes shipping of the requirement to use ECA-compliant fuel. This peer-reviewed study examines

three potential impacts: transportation mode shift, source shift, and production shift. It also provides information about the benefits and costs associated with applying the requirements to the Great Lakes and a description of the Great Lakes shipping sector. Documents related to this economic study are available below.

- Fact Sheet: [Economic Impacts of the Category 3 Marine Rule on Great Lakes Shipping: Program Update \(PDF\)](#) (5 pp, 554K, EPA-420-F-12-016, April 2012)
- Economic Impacts of the Category 3 Marine Rule on Great Lakes Shipping:
  - [Entire Document \(PDF\)](#) (680 pp, 17MB, EPA-420-R-12-005, April 2012)

## International Standards

EPA participates on the U.S. delegation to the International Maritime Organization (IMO). The IMO is the United Nations agency concerned with maritime safety and security and the prevention of marine pollution from ships. The international air pollution standards are found in Annex VI to the International Convention on the Prevention of Pollution from Ships (MARPOL).

## Related IMO Activity

The United States regularly submits position papers to IMO committees such as the Marine Environment Protection Committee, in support of advances in measures to reduce air pollution and greenhouse gas emissions from ships. Committees of the IMO meet periodically to consider and adopt revisions to the various annexes of MARPOL and related treaties.

At MEPC 62 in July 2011, the IMO amended MARPOL Annex VI to include energy efficiency standards for new ships through the designation of an Energy Efficiency Design Index.

- Fact Sheet: [Adoption of an Energy Efficiency Design Index for International Shipping \(PDF\)](#) (3 pp, 128K, EPA-420-F-11-025, July 2011)

To learn more about U.S. participation at the IMO in discussions of various MARPOL provisions, you may visit the [U.S. Coast Guard's IMO web page](#), or [contact EPA](#).

## Annex VI to the International Convention for the Prevention of Pollution from Ships (MARPOL) – 2008 Amendments

In October 2008, member states of the IMO adopted new international standards for marine diesel engines and their fuels ([2008 Amendments to MARPOL Annex VI](#)) that apply globally as of July 1, 2010. The amendments also established additional, more stringent emission requirements for ships that operate in designated coastal areas where air quality problems are acute, called [Emission Control Areas \(ECA's\)](#). These new global and geographic standards have the potential to significantly reduce air pollution from ships, and provide important benefits to our national air quality.

Under the new global standards, NOx emissions will be reduced, and the fuel sulfur cap will drop to 5,000 ppm in 2020 (pending a fuel availability review in 2018). Under the new geographic standards, ships operating in designated ECA's will be required to use engines that meet the most advanced technology-forcing standards for NOx emissions beginning in 2016, fuel with a sulfur content not exceeding 10,000 ppm in the first phase of the program, and 1,000 ppm in the second phase of the program. Documents describing the amendments and the amendment process are available below.

- Fact Sheet: [International Maritime Organization Adopts Program to Control Air Emissions from Ocean-going Vessels \(PDF\)](#) (4 pp, 183K, EPA420-F-08-033, October 2008)
- [Amendments to MARPOL Annex VI: Annexes 13 and 14 to the Report of the 58th Session of the Marine Environment Protection Committee](#) (149 pp, 906K, MEPC 58/23/Add.1, October 17, 2008)

### Main U.S. Submittals to Amendment Process:

- U.S. Government Submittal to the 11th Session of the IMO's Subcommittee on Bulk Liquids and Gases: [Development of Standards for NOx, PM, and SOx \(PDF\)](#) (6 pp, 153K, BLG 11/5/15, February 9, 2007)
- U.S. Government Submittal to the 11th Session of the IMO's Subcommittee on Bulk Liquids and Gases: [Air-Quality Concerns from Particulate Matter and Oxides of Sulphur \(PDF\)](#) (4 pp, 151K, BLG 11/5/27, February 23, 2007)
- Statement from the United States to the BLG 11 Meeting: [Introduction of US Paper BLG 11/5/15 - Proposal for new NOx Limits \(PDF\)](#) (3 pp, 15K, BLG 11/5/15, April 16, 2007)
- Statement from the United States to the BLG 11 Meeting: [Introduction of US Paper BLG 11/5/15 - Proposal for new PM and SOx Limits \(PDF\)](#) (3 pp, 17K, BLG 11/5/15, April 16, 2007)
- [Revision of the NOx Technical Code Tiers 2 emission limits for diesel marine engines at or above 130kW \(PDF\)](#) (7pp, 68K, December 1999)

### Other U.S. Submittals to the Amendment Process:

- [Guidelines for Certification of Tier III Engines Utilizing Exhaust Gas After-Treatment \(PDF\)](#) (3 pp, 137K, October 2008)
- [Regulation 13\(7\) Existing Engines \(PDF\)](#) (3 pp, 150K, October 2008)
- [Control of NOx Emissions from Existing Marine Diesel Engines \(PDF\)](#) (5 pp, 142K, October 2008)
- [Compliance and Testing Issues for Tier III Engines \(PDF\)](#) (6 pp, 82K, October 2008)
- [Simplified Certification and Relaxed Technical File Considerations -- A Proposal to Amend the NOx Technical Code \(PDF\)](#) (5 pp, 129K, October 2008)

### Other Documents Relevant to the Amendment Process:

- [Estimation of Health Benefits of South Coast Air Basin 2007 AQMP/SIP Ocean-going Marine Vessel Control Measures \(PDF\)](#) (7 pp, 224K, October 2007)
- [MARPOL Annex VI: Proposal to Initiate a Revision Process \(PDF\)](#) Submitted by Finland, Germany, Italy, the Netherlands, Norway, Sweden and the United Kingdom (12 pp, 204K, April 2005)
- In June 2007, the World Shipping Council [endorsed the two U.S. proposals](#) to amend MARPOL Annex VI.

## Guidance and Publications

- [EPA Guidance on Use of Distillate Fuel for North American ECA Compliance \(PDF\)](#) (1pp, 31KB, EPA-420-F-12-040, June 2012)

- [Interim Guidance on the Non-Availability of Compliant Fuel Oil for the North American Emission Control Area \(PDF\)](#) (9 pp, 330KB, June 2012)
- [Coast Guard Policy Letter \(CG-543 Policy Letter 09-01\), Guidelines for Ensuring Compliance With Annex VI to the International Convention for the Prevention of Pollution from Ships \(MARPOL\) 73/78; Prevention of Air Pollution from Ships \(PDF\)](#) (43 pp, 1MB, February 2009) and [related Coast Guard information](#)
- [Final Report: Global Trade and Fuels Assessment - Additional ECA Modeling Scenarios \(PDF\)](#) (63 pp, 1.32MB, EPA420-R-09-009, May 2009)
- [Report: Global Trade and Fuels Assessment - Future Trends and Effects of Requiring Clean Fuels in the Marine Sector \(PDF\)](#) (197 pp, 2MB, EPA420-R-08-021, November 2008)
- [AER Report: Modeling Sulfur Oxides Emissions Transport From Ships at Sea \(PDF\)](#) (154 pp, 2.4MB, EPA420-R-07-009, July 2007)
- [Analysis of Commercial Marine Vessels Emissions and Fuel Consumption Data \(PDF\)](#) (158 pp, 2.6MB, EPA420-R-00-002, February 2000)
- **Commercial Marine Activity in the United States Final Reports**
  - [Commercial Marine Activity for Great Lake and Inland River Ports in the United States \(PDF\)](#) (84 pp, 360K, EPA420-R-99-019, September 1999)
  - [Commercial Marine Activity for Deep Sea Ports in the United States \(PDF\)](#) (214 pp, 1MB, EPA420-R-99-020, September 1999)
- [Fact Sheet: Frequently Asked Questions about how to obtain an Engine International Air Pollution Prevention \(EIAPP\) Certificate \(PDF\)](#) (6 pp, 146K, EPA420-F-09-006a, February 2009)
- [Fact Sheet: Emission Standards for New Marine Diesel Engines: Relationship Between EPA's Control Program and MARPOL Annex VI \(PDF\)](#) (6 pp, 216K, EPA420-F-02-004, April 2002)
- [MARPOL 73/78 Annex VI Marine Diesel Engine Requirements - FAQs \(PDF\)](#) (8 pp, 32K, EPA420-F-99-038, October 1999)
- [Guidance for Certifying to MARPOL Annex VI \(PDF\)](#) (4 pp, 17K, January 1999)

## Related Links

- [International Maritime Organization](#) (the United Nations agency that facilitates international shipping regulations through treaties such as MARPOL) [EXIT Disclaimer](#)
- [Nonroad Diesel Equipment](#) (which includes marine diesel engines under 37kW)
- [Diesel Boats and Ships](#)
- [Gasoline Boats and Personal Watercraft](#)
- [Marinas & Boating \(from EPA Office of Water\)](#)
- [National Clean Diesel Campaign](#)
- [Trade, Transportation and Environment](#)
- [Engine Certification Information Center](#)
- [Compliance Fees](#)
- [Importing Vehicles and Engines](#)

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