MARPOL Annex VI and the North American Emission Control Area

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Currently 68 nations representing ~91% of ship tonnage a part of MARPOL VI

MARPOL
International Convention for the Prevention of Pollution from Ships

Annex VI Prevention of Air Pollution from Ships (19 May 2005)

Sets limits on sulphur oxide and nitrogen oxide emissions from ship exhausts and prohibits deliberate emissions of ozone-depleting substances; designated emission control areas set more stringent standards for SOx, NOx and particulate matter.

In 2011, after extensive work and debate, IMO adopted ground-breaking mandatory technical and operational energy efficiency measures which will significantly reduce the amount of greenhouse gas emissions from ships; these measures were included in Annex VI and are expected to enter into force on 1 January 2013.

Source: International Maritime Organization http://www.imo.org
Benefits of U.S. Ratifying MARPOL Annex VI

- Growing ship emissions reducing air quality (most from non-U.S. ships)
- Consistent standards across all U.S. ports and internationally
- Benefits significantly outweigh costs
- Requires reduced fuel sulfur/PM levels and ship emissions controls
- Established North American ECA
North American ECA

Began on August 1, 2012
Caribbean ECA

Begins on January 1, 2014
North American ECA
2020 Potential PM$_{2.5}$ Reductions
North American ECA
2020 Potential Ozone Reductions

Ozone (Smog) reductions from the proposed ECA reach well into the U.S. interior.
North American ECA
2020 Potential Sulfur Deposition Reductions

Improvements in deposition for marine and terrestrial ecosystems
Cost-Benefit of the NA ECA

- Health Benefits (U.S. and Canada) by 2020
  - Annually 14,000 lives saved; respiratory relief for 5,000,000
  - U.S. monetized annual benefits $47-110 billion

- Cost per tonne of emission reduction compare favorably with land-based emission control programs

- Total costs in 2020 estimated to be $3.2 billion
MARPOL Annex VI – SOx and PM

- Global fuel sulfur standards
- ECA standards (27x less than global fuel sulfur average by 2015)
- Or other technological methods that achieve equivalent reductions
  - No commercially available methods identified to date
  - IMO guidelines for evaluating exhaust gas cleaning systems
MARPOL Annex VI

Fuel Sulfur Standards

Sulfur Content

Global

- 4.5% until 1 Jan 2010
- 3.5% from 1 Jan 2010 to 1 Jan 2015
- 0.5% from 1 Jan 2015

ECA

- 1.5% until 1 Jan 2010
- 1.0% from 1 Jan 2010 to 1 Jan 2015
- 0.1% from 1 Jan 2015 to 1 Jan 2020

Subject to a study
MARPOL Annex VI -- NOx

- Reduction requirements are defined by the IMO NOx Technical Code
  - Applies to diesel engines of 130kW
- NOx standards for ships built after 2000
  - Tier I, II, III (ECA)
  - Tier III met with selective catalytic reduction (SCR)
- Certificates required for Ships – EIAPP
  - Certification of the engine on manufacture and checked on installation for settings
### MARPOL Annex VI Nox Requirements

<table>
<thead>
<tr>
<th>Tier</th>
<th>Ship build date</th>
<th>Emission limit (g/kWh) N=rpm</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>N &lt; 130</td>
<td>N = 130 – 1999</td>
</tr>
<tr>
<td>I</td>
<td>Jan 1, 2000</td>
<td>17</td>
<td>45.n^{-0.2} e.g. 720 rpm – 21.1</td>
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<tr>
<td>II</td>
<td>Jan 1, 2011</td>
<td>14.4</td>
<td>44.n^{-0.23} e.g. 720 rpm – 9.7</td>
</tr>
<tr>
<td>III</td>
<td>Jan 1, 2016</td>
<td>3.4</td>
<td>9.n^{-0.2} e.g. 720 rpm – 2.4</td>
</tr>
<tr>
<td></td>
<td>(in ECA only)</td>
<td></td>
<td></td>
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</tbody>
</table>
EPA and U.S. Coast Guard implement
Compliant fuel made available in U.S.
Guidance available:
  - IMO: NOx technical code
  - Coast Guard
    www.homeport.uscg.mil
  - EPA
    www.epa.gov/oms/oceanvessels
  - EIAPP

Fuel availability guidance
Summary

- Many countries have ratified MARPOL Annex VI
- Increased awareness of ship emission control technologies and best practices
- MARPOL (e.g., NA ECA) delivers
  - Substantial health benefits
  - Extremely favorable cost-benefit ratio
- Requirements driving technology development