



# 中国船舶大气污染物排放 标准法规最新进展

## **Latest progress on shipping emission standard in China**

环境保护部环境标准研究所  
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# 中国船舶大气污染物排放现状

## Status of Shipping Emission in China

### ■ 中国内河航道状况 Basic information of inland waterways in China

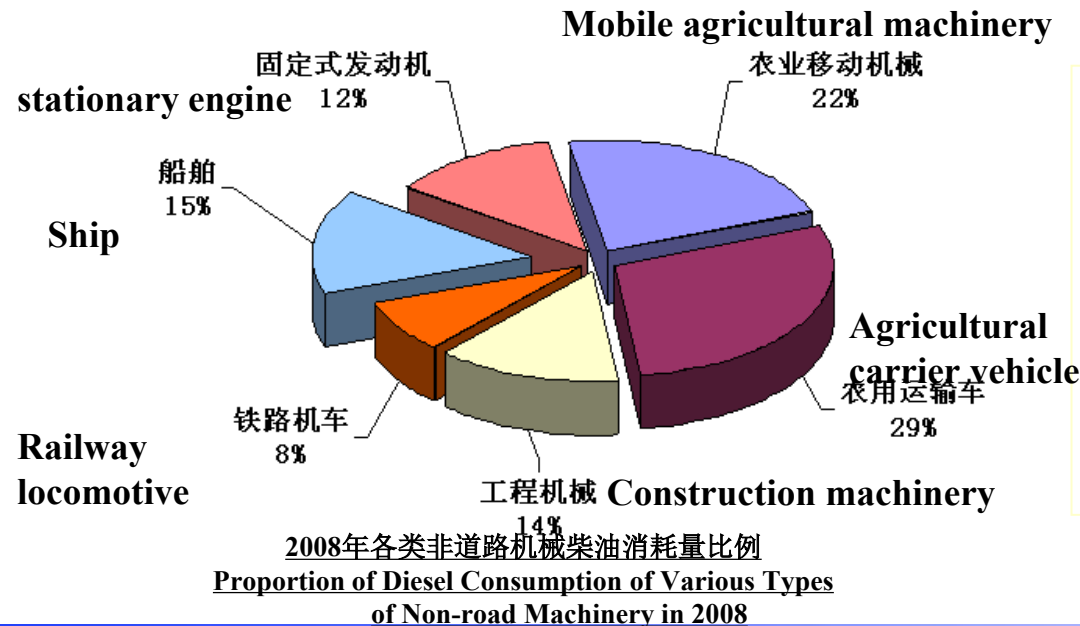
- 中国是一个造船大国，同时也是一个内河航运资源比较丰富的国家；
- 内河航运是一种重要的运输方式，在各种运输方式中占有不可替代的位置
  - 其优势是：能耗低，运能大；
- 内河航运资源比较丰富
  - 拥有大、小天然河流5800多条，河流总长43万公里；
  - 其中流域面积在1000平方公里以上的有80多条；
  - 天然湖泊900多个。
- China is a big country in shipbuilding and a country with abundant resources of inland waterway transport;
- Inland waterway transport is an important means of transportation, which is irreplaceable in various modes of transportation.
  - Its advantages: low energy consumption, and transport; high transport capacity;
- Abundant inland water resources
  - Over 5,800 large and small natural rivers total length of all the rivers: 430,000km;
  - The drainage area of over 80 rivers is at least 1,000 square kilometers ;
  - Over 900 natural lakes.

# 中国船舶大气污染物排放现状

## Status of Shipping Emission in China

### ■ 船舶大气污染物排放现状 Current situation of air pollutant emissions from ships

- 远洋船舶遵守国际公约，大气污染物排放已有所控制；
- 内河船舶尚无专门排放标准，污染物排放状况相对机动车、非道路机械等落后；
- 船舶的柴油消耗量约占非道路用途柴油的15%；
- Ocean-going vessels comply with international conventions; air pollutant emissions have been controlled to a certain extent;
- No special standards for the emissions of inland waterway ships have been formulated. The management on pollutant emissions is outdated as compared with motor vehicles, non-road machinery, etc.;
- The diesel consumption of ships accounts for around 15% of that of non-road machinery;



来源：“十一五”国家科技支撑计划项目《环境污染物排放关键技术标准研制》

Source: Project of the National Science and Technology Support Program in the “11th Five-Year” Period Development of Key Technology Standards for Environmental Pollutant Emissions



# 中国船舶大气污染物排放现状

## Status of Shipping Emission in China

### ■ 船舶大气污染物排放现状

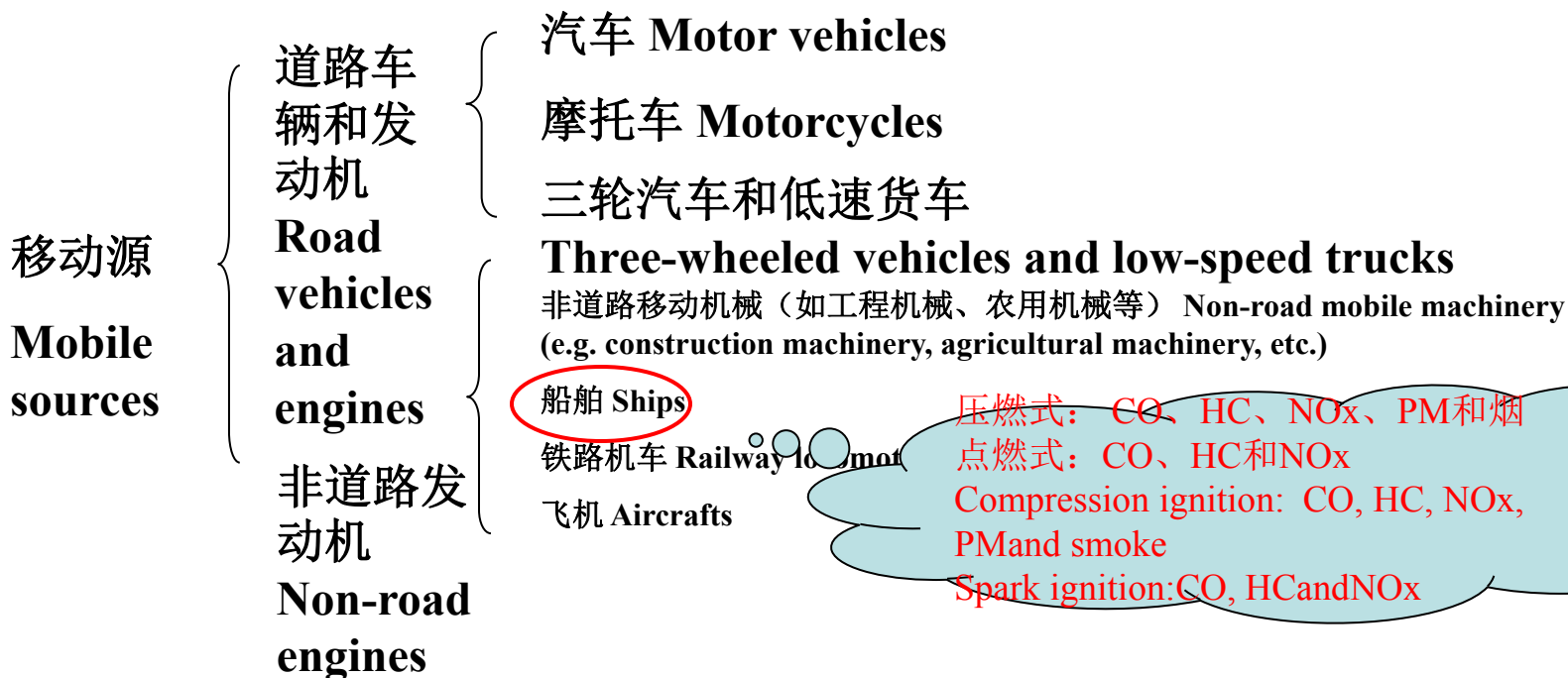
#### Current situation of air pollutant emissions from ships

- 内河船型旧、吨位小，多使用技术落后的中小型船舶柴油机发动机；
- 为降低成本，一些船舶使用劣质的燃料油，使污染情况更加复杂和严重；
- 粗略估算，内河船舶排入大气的污染物（仅估算柴油机船舶部分）：
  - NO<sub>x</sub>: 60~70万吨/年；
  - PM: 5~6万吨/年；
  - SO<sub>x</sub>: 10万吨/年。
- Inland waterway ships feature old models and low tonnage. Most of them are equipped with backward small and medium-sized diesel engines;
- To reduce costs, inferior fuel oil is used in some ships, resulting in more complicated and serious pollution;
- Rough estimation, air pollutants from inland waterway ships (only for diesel-engined ships):
  - NO<sub>x</sub>: 600,000~700,000 tons/year;
  - PM: 50,000~60,000 tons/year;
  - SO<sub>x</sub>: 100,000 tons/year.

# 中国机动车船排放标准体系

## Vehicle and Ship Emission Standard System

- 船舶、非道路移动机械等均属于非道路移动污染源范畴；
- 在机动车污染控制取得显著效果的情况下，国家越来越重视非道路移动污染源的排放控制；
- Marine and non-road mobile machinery belong to the scope of non-road mobile sources of pollution;
- With significant results achieved in the control of motor vehicle pollution , the state pays more attention to the control of non-road mobile source emissions;



# 中国机动车船排放标准体系

## Vehicle and Ship Emission Standard System

### ■ Prevailing standards for ship emissions

#### 船舶相关排放标准现状

- 远洋船舶：按照国际公约（MARPOL 73/78）附则VI《防止船舶造成大气污染规则》的相应要求执行。
- 内河及沿海船舶：
  - 小型船用柴油机按照非道路机械排放标准执行（37kW以下）；
  - 船用柴油机排放标准制订中（37kW以上）；
  - 点燃式船用发动机排放标准尚未制订。
- 《船舶污染物排放标准》（GB 3552-83），防治船舶排放的污染物对水域的污染而制订。
- Ocean-going vessels: In accordance with the international convention (MARPOL 73/78) Annex VI Regulations for the Prevention of Air Pollution from Ships.
- Inland and coastal ships:
  - Small marine diesel engines: In accordance with the standards for emissions from non-road machinery (below 37kW);
  - The standards for emissions from marine diesel engines: in formulation (above 37kW);
  - The standards for emissions from spark ignition marine engines: not yet formulated.
- Effluent Standard for Pollutants from Ship (GB 3552-83), targeting the prevention and treatment of pollution caused by emissions from ships.



# 远洋船舶大气污染物排放控制

## Control of Air Pollutant Emissions from Ocean-going Vessels

### ■ 国际海事组织 (IMO) MARPOL 73/78公约

#### International Maritime Organization (IMO) MARPOL 73/78 Convention

- 附则VI《防止船舶造成大气污染规则》，2005年5月19日生效；
- 适用范围：国际航行的船舶，海船、远洋船等；
  - 第 I 阶段，2000年1月1日或以后建造的船舶，输出功率超过130kW的柴油机（或重大改装的）；
- NO<sub>x</sub>第 I 阶段排放限值：
- AnnexVI Regulations for the Prevention of Air Pollution from Ships, effective as from May 19, 2005;
- Scope of application: international ships, sea-going vessels, ocean-going vessels, etc.;
  - Phase I, Ships built on or after January 1, 2000; diesel engines with the power output higher than 130kW (or with major modification);
- NO<sub>x</sub> emission limits for Phase I:  
Rated engine speed

发动机额定转速n (r/min)	NO <sub>x</sub> (g/kWh)
n < 130	17.0
130 ≤ n < 2000	45 * n <sup>-0.2</sup>
n ≥ 2000	9.8



### ■ 国际海事组织 (IMO) MARPOL 73/78公约 International Maritime Organization (IMO) MARPOL 73/78 Convention

- NO<sub>x</sub>第II阶段和第III阶段限值，分别于2011年和2016年生效：
- NO<sub>x</sub> emission limits for Phase II and Phase III come into effect as from 2011 and 2016 respectively:

发动机额定转速 Rated engine speed n (r/min)	NO <sub>x</sub> (g/kWh)	
	第II阶段 Phase II	第III阶段 Phase III
n < 130	14.4	3.4
130 ≤ n < 2,000	44 * n <sup>-0.23</sup>	9 * n <sup>-0.2</sup>
n ≥ 2,000	7.7	2.0

# 船用发动机排放标准进展

## Progress of Standards for Marine Engine Emissions

- 适用范围：内河船、沿海船、江海直达船和海峡（渡）船
- 小型船用柴油机大气污染物排放标准
- **Scope of application: inland waterway ships, coastal ships, river-sea ships and cross-channel ferries**
- **Standards for Air Pollutant Emissions from Small Marine Diesel Engines**
  - GB 20891-2007 《非道路移动机械用柴油机排气污染物排放限值及测量方法（中国 I、II 阶段）》；
  - 也适用于净功率 $P \leq 37$  kW 用于船舶驱动的柴油机；
  - 2007年10月1日第一阶段，2009年1月1日第二阶段；
  - 第三、四阶段标准即将发布。
  - GB 20891-2007 Limits and measurement methods for exhaust pollutants from diesel engines of non-road mobile machinery (China Phase I, II);
  - Also applicable to diesel engines with the net power  $P \leq 37$  kW and used for driving ships;
  - October 1, 2007 Phase I, January 1, 2009 Phase II;
  - Standards for Phase III and IV will be issued soon.

Rated net power

阶段	额定净功率 ( $P_{max}$ ) (kW)	CO (g/kWh)	HC (g/kWh)	NO <sub>x</sub> (g/kWh)	HC+ NO <sub>x</sub> (g/kWh)	PM (g/kWh)
Phase	$18 \leq P_{max} < 37$	8.4	2.1	10.8	—	1.0
第 I 阶段	$8 \leq P_{max} < 18$	8.4	—	—	12.9	—
Phase I	$0 < P_{max} < 8$	12.3	—	—	18.4	—
第 II 阶段	$18 \leq P_{max} < 37$	5.5	1.5	8.0	—	0.8
	$8 \leq P_{max} < 18$	6.6	—	—	9.5	0.8
	$0 < P_{max} < 8$	8.0	—	—	10.5	1.0



### ■ 船用柴油机大气污染物排放标准

## Standards for Air Pollutant Emissions from Marine Diesel Engines

标准正在制订中，控制思路：

#### ■ 控制范围：

- 内河船、沿海船、江海直达船和海峡（渡）船；
- 功率 $\geq 37\text{kW}$ 的柴油发动机；
- 远洋船舶按照国际公约（MARPOL 73/78）相应阶段执行，不适用于本标准。

#### ■ 污染物控制项目

- 包括：NO<sub>x</sub>、PM、CO、HC、SO<sub>2</sub>等；

#### ■ 常规污染物的控制需要改善燃烧，或加装后处理装置，类似于道路柴油车；

Standards under preparation. Concept on control:

#### ■ Scope of control:

- Inland waterway ships, coastal ships, river-sea ships and cross-channel ferries;
- Diesel engines with the power $\geq 37\text{kW}$ ;
- For ocean-going vessels, standards for the corresponding phases of the international convention (MARPOL 73/78) shall apply. These standards are not applicable.

#### ■ Pollution control projects

- Including: NO<sub>x</sub>, PM, CO, HC, SO<sub>2</sub>, etc.;

#### ■ To control conventional pollutants, efforts need to be made in improving combustion or installing after-treatment devices, similar to diesel-engined vehicles;

### ■ 船用柴油机大气污染物排放标准

## Standards for Air Pollutant Emissions from Marine Diesel Engines

#### ■ 排放限值

- 综合借鉴IMO国际法规、美欧排放法规；
- 控制水平，相当于美国第2阶段（2005年开始）和欧盟第1阶段（2006年开始）。

#### ■ 测试循环

- 等效使用ISO8178-4中规定的C1、D2、E2或E3测试循环；
- 与欧、美等法规一致，有利于船机认证的国际协调和统一。

#### ■ Emission limit values

- Using IMO and US and European laws and regulations on emissions for reference;
- Control level, equivalent to Phase II of the U.S. (as from 2005) and Phase I of the EU (as from 2006).

#### ■ Test cycle

- Equivalently using the test cycles of C1, D2, E2 or E3 provided for in ISO8178-4;
- Aligned with European and US laws regulations; facilitating the international coordination and harmonization of marine engine certification.

### ■ 船用柴油机大气污染物排放标准

#### Standards for Air Pollutant Emissions from Marine Diesel Engines

##### ■ 船舶使用燃料的要求

- 限制内河船上使用低硫轻柴油；
- 不允许使用燃料油；
- 内河船、沿海船、江海直达船和海峡（渡）船上装用的船机，应使用符合标准的柴油；
- **GB 252-2009《普通柴油》**：过渡期至**2013.7.1**，**S含量限值350ppm**。

##### ■ 耐久性要求

- 有效寿命期：**10,000**小时；
- 发动机在有效寿命期内，排放应达标。

##### ■ Requirements for ship fuels

- **Low-sulfur diesel oil for inland waterway ships are limited;**
- **Fuel oil is not allowed;**
- **Inland waterway ships, coastal ships, river-sea ships and cross-channel ferries shall use diesel oil meeting relevant standards;**
- **GB 252-2009 Regular Diesel Fuels: Period of transition to 07.01.2013; content limits 350ppm.**

##### ■ Requirements for durability

- **Useful life period: 10,000hrs;**
- **The emissions of engines within the useful life period shall meet relevant standards.**

### ■ 船用柴油机大气污染物排放标准

### Standards for Air Pollutant Emissions from Marine Diesel Engines

#### ■ SO<sub>2</sub>排放控制

- 高硫燃料造成了船舶的SO<sub>2</sub>高排放;
- 降低SO<sub>2</sub>排放最有效方法就是使用低硫含量的燃油;
- 海水清洗SO<sub>2</sub>除硫效果可达到90%以上, 但仅适用于沿海船舶, 对内河船应用困难, 因在淡水区域航行;
- 本标准未规定专门的SO<sub>2</sub>排放限值;
- 通过降低燃油硫含量来实现SO<sub>2</sub>减排。

#### ■ SO<sub>2</sub>emissions control

- High-sulfur fuels result in higher emissions of SO<sub>2</sub> from ships;
- The most effective method of lowering SO<sub>2</sub> emissions is using low-sulfur fuels;
- By seawater cleaning, more than 90% of SO<sub>2</sub> can be removed. However, this method applies only to coastal ships. It's difficult to be applied for inland waterway ships in freshwater areas;
- There isn't special SO<sub>2</sub> emission limit value in these standards;
- The content of sulfur in fuel oils is lowered to reduce SO<sub>2</sub> emissions.

# 船用发动机排放标准进展

## Progress of Standards for Marine Engine Emissions

### ■ 船用柴油机大气污染物排放标准

#### Standards for Air Pollutant Emissions from Marine Diesel Engines

##### ■ 单台发动机污染物减排幅度

##### ■ Range of pollutant emission reduction of single engine

项 目 Item	NO <sub>x</sub>	PM	SO <sub>2</sub>
未控制状态单台船机排放 Emissions of uncontrolled single marine engine (g/kWh)	10	0.78	1500 (ppm)
Emissions of single marine engine in Phase I 第 I 阶段单台船机排放 (g/kWh)	6.2	0.08	350 (ppm)
Percentage of emission reduction 排放削减率	38%	90%	76%

■ 实施标准后新型达标船舶3年累计排放削减量为：NO<sub>x</sub>，56万吨；PM，10万吨；SO<sub>2</sub>，40万吨。

■ After the implementation of the new standards, the total emission reduction in 3 years are as follows: NO<sub>x</sub>, 560,000 tons; PM, 100,000 tons; SO<sub>2</sub>, 400,000 tons.

### ■ 船用柴油机大气污染物排放标准

## Standards for Air Pollutant Emissions from Marine Diesel Engines

#### ■ 编制工作进展

- 本年度重点推进的排放标准项目；
- 已基本完成征求意见稿；
- 尽快向全社会公开征求意见。

#### ■ Progress of preparation

- Key projects of emissions standards in this year;
- Exposure draft basically completed;
- Soliciting public comments and suggestions as soon as possible.



### ■ 对船用发动机大气污染物排放标准的实施和管理建议

#### **Proposals on the implementation and management of the standards for air pollutant emissions from marine engines**

- 船用发动机按照排放标准进行定型和环保核准;
- 与现有船舶管理体系相结合, 新船舶的准入条件中, 增加环保方面的强制性要求;
- 加强船用燃油的质量监督和管理。
- **Stereotyping and verification and approval regarding environmental protection for marine engines shall be made in accordance with the emission standards;**
- **Based on the existing ship management system, mandatory requirements for environmental protection shall be included in the conditions in access of new ships;**
- **Efforts shall be made in strengthening quality supervision and management of fuel oils for ships.**



**谢谢大家！**  
**Thank you!**

