

Addressing Environmental Issues with Advanced Technologies

Viewing environmental regulations as a business opportunity and a strategy for differentiation, MOL proactively develops and adopts advanced technologies that reduce the environmental impact of our business and set the stage for real solutions to global environmental issues.

It is not really possible for a single nation to regulate merchant vessels, because they move all over the world, so international initiatives are indispensable. The United Nations Framework Convention on Climate Change (UNFCCC) in the Kyoto Protocol directs the International Maritime Organization (IMO) to study measures to control greenhouse gas (GHG) emissions in international ocean shipping. Currently, IMO studies, adopts, and issues various international conventions and regulations.

MOL continues its company-wide efforts to ensure compliance with a wide variety of environmental regulations. (Please refer to the website for details.)

Preventing global warming

Global Warming Issues

Along with global warming caused by the increased atmospheric emissions of CO₂, forecasts say tropical lows will gain intensity, wind forces will gain power, and rainfall amounts will increase. Unstable weather may cause catastrophic events that make safe ocean transport impossible.

Example of Initiatives Development of New Windshield

MOL has moved ahead in developing new wind shields to reduce wind resistance, especially on a new, larger vessels, and thus improve fuel efficiency and reduce CO₂ emissions. The wind resistance-reducing windshield installed on a 6,700TEU containership sailing the north Pacific route at 17 knots (about 31km/h) is expected to reduce CO₂ emissions by about 2%.



Windshield on the containership MOL Marvel

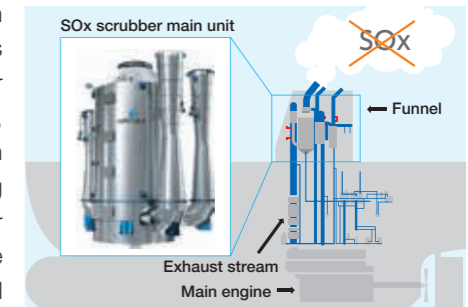
Preventing Air Pollution

Air Pollution Issues

NO_x and SO_x cause acid rain and air pollution. As industrialization has grown, air pollution has become even problematical, affecting the daily lives of people and damaging the natural environment.

Example of Initiatives SO_x Scrubber

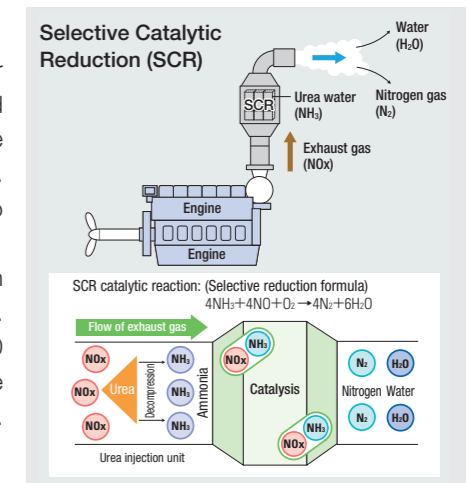
MOL launched a study to equip its in-service fleet with SO_x scrubbers in advance of a revised international treaty that places stronger restrictions on vessel exhaust emissions. It targets car carriers, because their structure makes it more technically challenging to add scrubber systems, compared to other types of vessels. It also focuses on ships already in service, which are more difficult to equip with scrubbers than newbuilding vessels. We will promptly develop detailed specifications for the scrubber system and use the latest technologies such as 3D scanning to promote operational efficiency in installation process, aiming for results that will streamline the development of ship class rules and guidelines.



Example of Initiatives Selective Catalytic Reduction (SCR)

NO_x is generated by bonding nitrogen in fuel oil and the oxygen in the air under high temperature during combustion in the engine. MOL equipped SCR systems, which eliminate NO_x emissions from vessels, to three power generators on its-owned/operated large-scale iron ore carrier. We confirmed that its denitration performance for diesel oil conforms to IMO's NO_x Tier 3 regulations, which will be valid in 2016.

MOL, in cooperation with ClassNK and Yanmar Co., Ltd., has been operating the system since the vessel was delivered in December 2013. Its verification using marine diesel oil (MDO) as fuel and about 3,100 hours of operation (total operation hours of three SCR systems) have been completed. Verification using heavy fuel oil (HFO) is now in progress.



Regulations to Prevent Global Warming

	2014	2015	2016	2017	2018	2019	2020	2025
EEDI	Phase 0	Phase 1			Phase 2		Phase 3	
SEEMP	Mandatory							
MRV, MBM (under consideration)								

In 2013, conventions related to energy efficiency (EEDI and SEEMP) were adopted as measures to reduce GHG emissions from international ocean shipping.

EEDI: Energy Efficiency Design Index. Requires that CO₂ emissions in theory conform to the regulations at the design stage of a newbuilding vessel. Target of reduction rate in each phase: Phase 0 = 0; Phase 1 = 10%; Phase 2 = 20%; and Phase 3 = 30%.

SEEMP: Ship Energy Efficiency Management Plan. Requires the selection of an operational method for each vessel to improve energy efficiency, documentation of the action plan, and adoption of method aboard the vessel. It targets newbuilding vessels and existing vessels.

In addition, MRV and MBM have been studied for adoption as measures to further reduce emissions.

MRV: Monitoring-Reporting-Verification system. Preceding the Market-Based Method (MBM), MRV is a system to monitor, report, and verify operational data concerning actual fuel consumption.

Regulations to Prevent Air Pollution

		2014	2015	2016	2017	2018	2019	2020
SO _x (sulfur oxides)	General sea area	Sulfur content 3.5%						Sulfur content 0.5%
	ECA	Sulfur content 1.0%	Sulfur content 0.1%					
NO _x (nitrogen oxides)	General sea area	Tier 2 regulation						
	ECA	Tier 2 regulation			Tier 3 regulation			

SO_x emissions regulations: Regulate the sulfur content in fuel oil to control SO_x volume in exhaust emissions. From 2015, the ratio level in the Emission Control Areas (ECAs) was reduced to 0.1%. Another regulation soon to be introduced will limit fuel sulfur content in general sea areas to 0.5% or less. The year of adoption, either 2020 or 2025, will be decided by 2018 after a survey of demand and supply for relevant fuel oil.

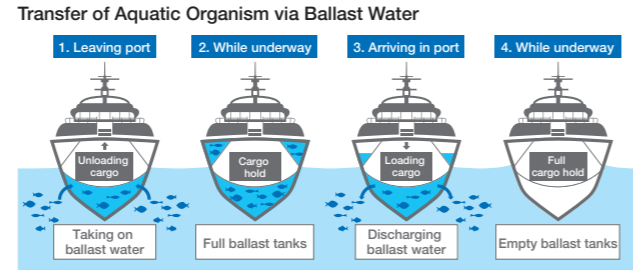
NO_x emissions regulations: Regulate NO_x in exhaust gas from engines in a step-by-step manner. Tier I regulates emission levels by rated engine rpm, targeting the vessels built between 2000 and 2010. Tier II requires the vessels built in 2011 or later to reduce a further 15.5-21.8% from the Tier I level. Tier III applies to vessels built in 2016 or later, in specific Emission Control Areas (ECAs), requiring a reduction of 80% from Tier I.

* ECA-designated sea areas: (1) North America Coast – within 200 nautical miles (NO_x/SO_x), (2) United States Caribbean Sea (NO_x/SO_x), (3) Baltic Sea and North Sea (SO_x)

Contributing to Conservation of Biodiversity

Ballast Water Issues

Ballast water, which is discharged while loading cargo, carries marine organisms around the world and can have a negative impact on marine ecosystems and biodiversity. Accordingly, IMO adopted the Ballast Water Management Convention in February 2004, and its ratification is under way.

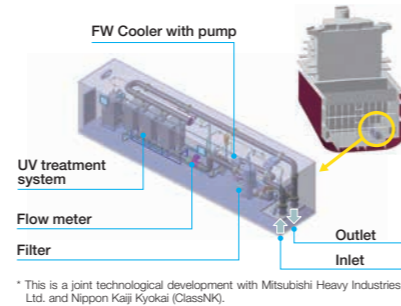


Example of Initiatives Installation of Ballast Water Treatment System before Convention Took Effect

MOL developed a ballast water treatment system in cooperation with manufacturers. And in FY2014, we set a company-wide policy to install the system on our vessels before the convention took effect, and began the process of selecting target vessels and preparing them for system installation. As of May 31, we have installed the system on a total of 57 ships—25 newbuildings and 32 in-service vessels.

Ballast Water Treatment System

MOL has developed the technology to install a packaged ballast water treatment system that takes up the same space as a standard container and can fit in the cargo hold of a containership, and acquired approval in concept from Nippon Kaiji Kyokai (ClassNK) for the first time in Japan. The system makes the most of limited space availability and is designed for easy accessibility and maintenance. Further, installation time is reduced by about seven days compared to installing a system in the engine room. MOL has installed the system on some of its containerships and is now conducting demonstration tests.



* This is a joint technological development with Mitsubishi Heavy Industries, Ltd. and Nippon Kaiji Kyokai (ClassNK).

Safe, Environment-friendly Ship Recycling

Ship Recycling Issues

Aged vessels need to be scrapped from the viewpoints of both safe operation and marine environmental protection. In May 2009, the IMO adopted the Hong Kong International Convention, which sets objectives for solving issues related to vessel scrapping, and is moving toward ratification. This convention prohibits and limits the content of stipulated harmful substances aboard throughout the life of the vessel and requires to create, maintain, and update an inventory list including the amounts of harmful substances and their locations aboard, and to provide that list when handing the vessel over to a recycling yard.

Example of Initiatives Ship Recycling

When a vessel is to be scrapped, we select an environment-friendly recycling yard in conformity with the Hong Kong International Convention. We also check a broad range of items including the yard's ISO certification status, conduct site inspections to confirm that the yard's environmental management standards conform with ISO 14001 or its equivalent, and that its scrapping methods and procedures meet acceptable standards for environmental protection, occupational safety, and human rights.

Currently, the MOL Group was one of the first to start providing these inventory lists to ensure a smoother response to the requirements of the convention. We also provide thorough explanations of the convention's requirements, and share information related to recycling as well as conditions in recycling yards.



Scrapping operations at an MOL-selected safe, environment-friendly recycling yard

Regulations to Protect the Marine Environment

		2015	2016	2017	2018	2019	2020
Ballast Water Management Convention	General sea area	Adopted in 2004: yet to take effect		Expected to be mandatory			
	USCG regulations	Enforced in 2012		Mandatory			
Ship Recycling Convention		Adopted in 2009: yet to take effect, effective year undetermined					
Convention on biofouling on Hulls		Adopted guidelines in 2011					

Ballast Water Management Convention: A convention to prevent cross-border transfer of foreign marine organisms through ballast water of vessels. It was adopted in 2004 and there is an increasing possibility to be effective in 2017. Vessels are mandated to install ballast water treatment systems by the stipulated year, depending on the age of the vessel and ballast water capacity.

USCG Ballast Water Management regulations: United States Coast Guard ballast water regulations took effect in 2012. The regulations for the relevant sea areas cover the same level as the BWM Convention. However, the USCG regulations require a specific type of ballast water treatment system approved by the USCG. As of 2016, all vessels calling at ports in the U.S. are required to use ballast water treatment systems within 12 miles of the coast.

Ship Recycling Convention: A convention to prevent workplace accidents in ship recycling and minimize environmental pollution. It was adopted in 2009, and will be issued 24 months after the requirements for the issues are satisfied. It stipulates rules for ship recycling facilities and recycling procedures, and requires recyclers to create, maintain, and update a list of hazardous substances (inventory list) for existing vessels.

Convention on biofouling on hulls: As marine organisms attached to the bottoms of ships and crossing national borders has emerged as an environmental issue, IMO is holding discussions on formulating guidelines to address this problem. The "Guidelines for the Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species," which was adopted in 2011, was voluntarily implemented during the review period (five years). It may become a convention after a comprehensive review in 2017.

Environmental Initiatives in Business Activities

Environmental Impact of Business Activities	Environmental Initiatives	Ship Construction	Cargo Transport	Scrapping
Global Warming	Measures to reduce CO ₂ emissions	Main engine: Research and development of a system that recovers waste heat from sources of low-temperature heat Improve transport efficiency by adopting larger vessels Introduction of Propeller Boss Cap Fins (PBCF) Introduction of low-friction ship bottom paint Introduction of high-efficiency waste heat recovery system Research of special rotation nozzles Adoption of wind-pressure resistance-reducing design Introduction of hybrid car carriers Research on Power Assist Sail Participation in Wind Challenger Project Study of LNG-fueled Vessels	Expansion of Eco Sailing Use of optimal operation support System Use of optimal trim calculation system	
		Measures to reduce NO _x emission	Selective Catalytic Reduction (SCR)	
Air Pollution	Measures to reduce SO _x emissions	Development of methanol-fueled vessels Study of SO _x scrubber Use of low-sulfur fuels Study to introduce LNG fuel		
		Measures to reduce particulate matter (soot and dust) emissions	Self-cleaning particulate matter (PM) Filter System Use of on-shore electricity in berth	
Marine Environmental Pollution	Initiatives on marine environmental conservation	Double hull structure on tankers Double hull structure on fuel tanks Adoption of NSafe™-Hull with improved collision safety	Proper treatment of waste, waste oil, and bilge	Initiatives on ship recycling
	Initiatives on biodiversity	Installation of ballast water treatment system before convention takes effect Prevention of biofouling		