INTERNATIONAL MARITIME ORGANIZATION

E

MARINE ENVIRONMENT PROTECTION COMMITTEE
82nd session
Agenda item 14

MEPC 82/14/1
28 June 2024
Original: ENGLISH
Pre-session public release: ☒

WORK PROGRAMME OF THE COMMITTEE AND SUBSIDIARY BODIES

Proposal for a new output to amend MARPOL Annex VI and the NO_X Technical Code 2008

Submitted by Belgium, Canada, Denmark, Finland, Germany, Ireland, Netherlands (Kingdom of the), Norway and United States

SUMMARY	
Executive summary:	This document proposes a new output to review and revise MARPOL Annex VI and the NO_X Technical Code 2008 to address concerns about high NO_X emissions from Tier II and Tier III compliant ships relative to the intended purpose of these standards.
Strategic direction, if applicable:	2
Output:	Not applicable
Action to be taken:	Paragraph 22
Related documents:	MEPC 80/5/1, MEPC 80/17; MEPC 81/5/3, MEPC 81/5/6, MEPC 81/INF.7; PPR 11/INF.2/Rev.1 and PPR 11/INF.4

Introduction

1 This document is submitted in accordance with the provisions of the *Organization and method of work of the Maritime Safety Committee and the Marine Environment Protection Committee and their subsidiary bodies* (MSC-MEPC.1/Circ.5/Rev.5) on the submission of proposals for new outputs and proposes a new output to amend the NO_X Technical Code 2008 and related parts in MARPOL Annex VI, including regulation 13.

Background

2 MARPOL Annex VI entered into force on 19 May 2005 and contains requirements for the control of NO_X emissions, where gradually stricter requirements apply to new ships over time. While the Committee has not assessed the overall effectiveness of these requirements in reducing NO_X emissions from shipping, several delegations submitted documents at MEPC 81 expressing concern over the effectiveness of regulation 13 of MARPOL Annex VI in reducing NO_X emissions from shipping. Specifically, document MEPC 81/5/3 (Belgium et al.) presented growing concerns that the NO_X emission control programme under regulation 13 of MARPOL Annex VI and the NO_X ECA requirements are not achieving the anticipated reductions in air pollution from marine diesel engines; document MEPC 81/5/6 (Finland) also

NAVIGATING THE FUTURE: SAFETY FIRST!

noted concerns about the effectiveness of MARPOL Annex VI with regard to uniform implementation and a proposed way forward; and document MEPC 81/INF.7 (Canada) provided information on the slower than expected incidence of Tier III ship calls to Canada to date and the results of a modelling analysis of air quality and health impacts of NO_X Tier III standards in Canadian waters. Earlier documents submitted to MEPC 80 and PPR 11 also noted that the emission reductions promised in the 2008 amendments to MARPOL Annex VI were not being achieved (MEPC 80/5/1, PPR 11/INF.2/Rev.1 and PPR 11/INF.4).

3 The discussion of these documents identified several specific issues with respect to regulation 13 of MARPOL Annex VI, NO_X engine emission control programme, including the following:

.1 keel laying dates can be used to circumvent compliance with the NO_X limits, suggesting weaknesses with the applicability provisions;

.2 the disconnect between actual ship operating profiles and engine certification test cycles may result in much higher NO_X emissions than originally expected, suggesting weaknesses in the engine certification provisions; and

.3 the NO_X compliance and enforcement provisions in MARPOL Annex VI make it difficult to detect and enforce against ships that exceed the NO_X limits. This is evidenced by the difficulty in following up on possible exceedances, identified in remote measurement campaigns, with an effective response.

4 Following consideration at MEPC 81, the Committee invited interested Member States and international organizations to continue conducting research on the matter and to consider submitting proposals for a new output on the review of the effectiveness of regulation 13 of MARPOL Annex VI, including the NO_X Tier III standard contained therein, to a future session of the Committee.

5 The remainder of this document describes such a new output for the Committee to consider and approve, to address concerns about the effectiveness of the MARPOL Annex VI regulation 13 NO_X emission control programme, including stringency of the standards, certification and other implementation aspects, and compliance provisions.

Need for review and revision of the MARPOL NO_x emission control programme

6 The NO_X emission standards of regulation 13 of MARPOL Annex VI, originally adopted in 1997, were revised in 2008 to help Member States address the high contribution of ship emissions to global NO_X and ozone pollution throughout the world. A geographic-based approach was adopted, in which more stringent Tier III NO_X limits would apply to engines above 130 kW while operated in designated NO_X Emission Control Areas (NO_X ECAs); outside of those areas, less stringent Tier II standards would apply beginning in 2011. The currently-designated NO_X ECAs include the North American and the U.S. Caribbean Sea NO_x ECAs, applicable to engines on ships with a keel laying date of 1 January 2016 or later; the Baltic Sea and North Sea NO_X ECAs, applicable to ships with a keel laying date of 1 January 2021 or later. Two additional ECAs are to be considered for adoption at MEPC 82: the Canadian Arctic ECA, applicable to engines ships with a keel laying date of 1 January 2025, and the Norwegian Sea ECA, applicable to engines on ships based on a three-date criteria.[1]

[1] Building contract on or after 1 March 2026; or in the absence of a building contract, a keel lay date of 1 September 2026; or a delivery date on or after 1 March 2030.

7 The Tier III NO_X limits, which range from 2.0 to 3.4 g/kWh, depending on engine speed, are typically met through the use of selective catalytic reduction (SCR) or, less commonly, exhaust gas recirculation (EGR). Tier III technologies, especially for SCR, are on/off technologies, which can be disengaged outside of NO_X ECAs. In addition, MARPOL Annex VI and the NO_X Technical Code allow for the engine and/or its ancillary equipment (including the SCR system) to be protected against operating conditions that could result in damage or failure, through the use of an approved auxiliary control device (ACD). ACDs are often set to disengage the SCR unit when the exhaust temperatures are too low to allow its operation and to mitigate potential clogging of catalyst blocks. This typically occurs for operation below 25% of the engine's maximum continuous rating (MCR), which is a common operating profile in-port entries, ports and even in coastal areas. Even when engine temperatures may be high enough to extend the operation of the SCR system[2] below 25% load, some engine manufacturers may choose that limit because the certification test cycles for propulsion engines[3] do not test engine emissions below 25% load. In these cases, NO_X reductions would not occur below this load point.

8 SCR systems, while effective at reducing NO_X emissions, are highly dependent on operating conditions and maintenance practices, and are also susceptible to several factors that can diminish their performance. Fuel quality and contaminants, in the form of sulphur and heavy metals, can reduce the effectiveness of the catalyst; in addition, there is a natural degradation of the system, and the catalyst blocks need to be exchanged. This is acknowledged in the SCR Guidelines (resolution MEPC.291(71); and resolution MEPC.198(62), as amended by resolution MEPC.260(68)), and a strategy to monitor the catalyst condition needs to be implemented. However, the different alternative strategies that can be used for such monitoring might not be sufficiently robust to readily identify an SCR system that is not performing as expected and certified.

9 As described in the documents referenced above, various studies have been conducted indicating that the Tier III emission reductions are not being sufficiently achieved especially in coastal areas and ports. Furthermore, the introduction of ships using Tier III engines has been slower than anticipated, in part due to the effective date being based solely on keel lay date. In addition, there is also a concern that the intended emissions reductions for Tier II and Tier III limits are not being achieved at low load operation, as engines are primarily calibrated for lower emissions at high power modes, which are the heaviest-weighted power modes in the engine certification test cycles.

10 Coupled with the above issues is growing concern about the weakness of the enforcement provisions for regulation 13 of MARPOL Annex VI. While port State control duly enforces regulation 13 based on documentation checks, the enforcement tools specified in MARPOL Annex VI (e.g. review of engine certificates, record book of engine parameters; verifying consistency between engine settings and the engine technical file) might not be sufficient to identify a non-compliant engine, especially if the engine is fitted with an SCR system. Also, these tools are not sufficient to investigate emission levels if a ship is flagged for potentially high emissions in a remote measurement campaign.

---

2 Typical "light-off" temperature for marine application SCR-systems using 1000 ppm sulphur fuel is about 280°C.

3 The test cycles for auxiliary engines include lower load mode points that are not included in the test cycles for propulsion engines (10% for D2 and 10% and idle for C1), however the modal limit, for Tier III engines, of 1.5 times the NO_X emission limit does not apply at these modes. As a result, SCR may be disengaged at loads lower than 25% through the use of an approved ACD.

11 During the applicable surveys under regulation 5 of MARPOL Annex VI, the parameter check method[4] in the NO_X Technical Code 2008 is used to demonstrate compliance with the NO_X emission limits on board by checking that an engine is correctly adjusted in accordance with the manufacturer's specifications and remains in a condition of adjustment consistent with the initial certification. This method might be relevant for mechanical controlled engines but might not be sufficient for electronically controlled engines and engines using abatement technology.

Action requested

12 The existing NO_X emission control programme should be carefully reviewed to determine whether and how it should be revised to better achieve the originally intended and expected emission reduction targets for engines on both new ships and ships already in-service. Several items may be taken into consideration to identify regulatory gaps in MARPOL Annex VI as well as the NO_X Technical Code 2008 including: stringency of the standards; certification requirements (gaps in the test cycles at lower loads and off-cycle emissions); and effective dates of the standards, including relying on delivery dates to facilitate timely introduction of lower NO_X emitting ships.

13 The MARPOL Annex VI NO_X compliance programme should also be reviewed for more effective onboard inspections and surveys. This could include various ways to detect non-compliance including, for example, continuous NO_X measurements on board the ship.

Analysis required

14 Review of the MARPOL Annex VI engine NO_X control programme should be based on technical and other analyses performed by Member States and other stakeholders with respect to the stringency of the standards, the effectiveness and implementation of the existing certification requirements, technologies that can improve the existing compliance programme, and such other information that can provide insight into how to revise the programme to obtain the expected NO_X emission reductions.

15 Modifications to the certification and compliance programmes should be considered, including those that may require modifications of engine or aftertreatment systems for more effective NO_X emission reductions. For example, Tier II emissions can be improved through adjustments to fuel injection timing to reduce peak cylinder combustion temperature and combustion pressure increase per crank angle, which will reduce NO_X formation; or by using exhaust gas recirculation (EGR) and SCR to further reduce emissions. Tier III emissions that are controlled by the use of SCR are mainly adversely affected by low exhaust gas temperature. There are many technologies available which increase exhaust gas temperature and extend the operating range of NO_X emission reduction technologies; these will be explored as part of the review. These technologies can be applied to achieve more stringent NO_X limits for new and existing engines.

Analysis of implications

16 The maritime industry is expected to incur some costs if, for example, a more robust certification scheme, more stringent standards and a more robust enforcement regime are implemented. However, the cost will depend on the outcome of the proposed review. The analysis of any proposed amendments should examine costs of hardware and operation, include fuel consumption, as well as the human health and welfare benefits. The administrative

[4] Other methods to demonstrate compliance with the NO_X emission limits on board are also available, but the cosponsors understand that more or less all ships use the parameter check method.

burden to the Organization and to the Member States is anticipated to be minimal. The complete checklist for identifying administrative requirements and burdens is set out in annex 1 to this document.

Benefits

17 NO_X is a precursor to ozone and secondary particulate matter formation.[5] Dangerous ozone and particulate matter levels already exist today that put affected populations at extreme risk of adverse health impacts,[6] such as asthma, heart attack, and premature death. Further, atmospheric deposition of NO_X emissions contributes to the eutrophication and acidification of land and ocean ecosystems. To reduce these impacts, it is absolutely necessary to review the MARPOL Annex VI NO_X emission programme to strengthen its implementation by ensuring that engines are operated in ways that achieve the regulation 13.4 and 13.5 NO_X standards and that shipowners increase the turnover to Tier III-compliant ships for operation in NO_X ECAs.

Industry standards

18 No other industry standards address the specific concerns.

Human element

19 The completed checklist for considering human element issues as contained in annex 5 to MSC-MEPC.1/Circ.5/Rev.5 is set out in annex 2 to this document. As the proposal is to clarify and improve existing requirements, no impacts on the human element are anticipated.

Output

20 A new output is proposed to review and amend as appropriate MARPOL Annex VI and the NO_X Technical Code 2008 to address concerns about high NO_X emissions from Tier II and Tier III and to ensure that the standards achieve the intended emission reductions.

Urgency

21 It is proposed to include the output in the Committee's current biennial agenda with two sessions needed to complete the item, assigning the PPR Sub-Committee as the associated organ. The urgency to address this issue is imperative to the health and lives of the affected population, and their marine environment, that are not seeing emission reductions from NO_X ECA limits.

Action requested of the Committee

22 The Committee is invited to consider the proposals in paragraphs 20 and 21, and to take action as appropriate.

***

[5] Karl et al., 2019 Atmospheric Chemistry and Physics, "Effects of ship emissions on air quality in the Baltic Sea region simulated with three different chemistry transport models" https://doi.org/10.5194/acp-19-7019-2019

[6] WHO global air quality guidelines: particulate matter (PM2.5 and PM10), ozone, nitrogen dioxide, sulphur dioxide and carbon monoxide.

ANNEX 1

CHECKLIST FOR IDENTIFYING ADMINISTRATIVE REQUIREMENTS

This checklist should be used when preparing the analysis of implications required in submissions of proposals for inclusion of outputs. For the purpose of this analysis, the term "administrative requirement" is defined in accordance with resolution A.1043(27), as an obligation arising from a mandatory IMO instrument to provide or retain information or data.

Instructions:

(A) If the answer to any of the questions below is **YES**, the Member State proposing an output should provide supporting details on whether the requirements are likely to involve start-up and/or ongoing costs. The Member State should also give a brief description of the requirement and, if possible, provide recommendations for further work, e.g. would it be possible to combine the activity with an existing requirement?

(B) If the proposal for the output does not contain such an activity, answer **NR** (Not required).

(C) For any administrative requirement, full consideration should be given to electronic means of fulfilling the requirement in order to alleviate administrative burdens.

1. Notification and reporting? Reporting certain events before or after the event has taken place, e.g. notification of voyage, statistical reporting for IMO Members	**NR**	Yes □ Start-up □ Ongoing
Description of administrative requirement(s) and method of fulfilling it: (if the answer is yes)		
2. Record keeping? Keeping statutory documents up to date, e.g. records of accidents, records of cargo, records of inspections, records of education	**NR**	Yes □ Start-up □ Ongoing
Description of administrative requirement(s) and method of fulfilling it: (if the answer is yes)		
3. Publication and documentation? Producing documents for third parties, e.g. warning signs, registration displays, publication of results of testing	**NR**	Yes □ Start-up □ Ongoing
Description of administrative requirement(s) and method of fulfilling it: (if the answer is yes)		
4. Permits or applications? Applying for and maintaining permission to operate, e.g. certificates, classification society costs	**NR**	Yes □ Start-up □ Ongoing
Description of administrative requirement(s) and method of fulfilling it: (if the answer is yes)		
5. Other identified requirements?	**NR**	Yes □ Start-up □ Ongoing
Description of administrative requirement(s) and method of fulfilling it: (if the answer is yes)		

***

ANNEX 2

CHECKLIST FOR CONSIDERING HUMAN ELEMENT ISSUES BY IMO BODIES

	1	2	3	4	5
	Question	**Yes/No**	**IMO references**	**Considerations**	**Instructions**
Workload			*Other relevant references may be added* *Strike out references that are not relevant*	*If answer to the question is "yes" identify considerations. If answer is "no" make proper justification*	*Identify how human element considerations should be addressed in the output*
1	**Does the "output" affect workload?**	**No**			
.1	**On board, especially in the already intensive phases of the voyage and port operations to:**		*Revised guidelines for the operational implementation of the International Safety Management (ISM) Code by Companies* (MSC-MEPC.7/Circ.8) *Guidelines on fatigue* (MSC.1/Circ.1598) *Principles of minimum safe manning* (resolution A.1047(27)) *Guidelines for the investigation of accidents where fatigue may have been an issue* (MSC/Circ.621)		

	1	2	3	4	5
	Question	**Yes/No**	**IMO references**	**Considerations**	**Instructions**
1.1.1	Operations including navigation, cargo and engineering				
1.1.2	Maintenance of the ships structure and its equipment				
1.1.3	Onboard administration in support of the ships' management systems				
1.1.4	Onboard administration related to regulation involving flag States, classification societies, port state and other bodies such as charterers and port authorities				
1.1.5	Increased workload or time pressure on personnel if involved in implementation of changes prior to the implementation date				
1.2	**Ashore, in a manner that would affect the ships operation to:**				
1.2.1	Companies' Administration				
1.2.2	Flag State, port State and classification societies administration such that certification and other processes are Compromised or delayed				

	1 Question	2 Yes/ No	3 IMO references	4 Considerations	5 Instructions
Decision-making			*Other relevant references may be added* *Strike out references that are not relevant*	*If answer to question is "yes" identify considerations. If answer is "no" make proper justification*	*Identify how human element considerations should be addressed in the output*
2	**Does the "output" impact decision-making on board the ship?**	**No**			
2.1	By confusion with existing requirements and regulations				
2.2	By changing responsibilities as laid out in the ISM Code				
2.3	By creating complexity in its implementation and/or in the safety management systems				
2.4	By requiring increased mental effort, such as the need to find, transform and analyse data or result in the need to make judgements based on incomplete information				
2.5	By limiting the time available to establish situational awareness, decide, communicate (possibly across time zones) or check				
2.6	By increasing reliance on judgement and administrative controls to manage major risks such as oil spills and collisions				

	1 Question	2 Yes/ No	3 IMO references	4 Considerations	5 Instructions
Living and Working Environment			*Other relevant references may be added* *Strike out references that are not relevant*	*If answer to question is "yes" identify considerations. If answer is "no" make proper justification*	*Identify how human element considerations should be addressed in the output*
3	**Does the "output" affect the living and working environment?**	**No**	*Guidelines on the basic elements of a shipboard occupational health and safety programme* (MSC-MEPC.2/Circ.3) *Guidelines on fatigue* (MSC.1/Circ.1598)		
3.1	By interfering with existing arrangements for abandonment, fire-fighting and other emergency plans or procedures				
3.2	By introducing new materials that could create an explosion, fire, environmental or occupational health risk				
3.3	By introducing new high energy sources such as high-voltage, high pressure fluids				
3.4	By affecting access or egress and causing lack of ventilation in working spaces				
3.5	By affecting the habitability of accommodation spaces due to noise, vibration, temperatures, dust and other contaminants				

	1 Question	2 Yes/ No	3 IMO references	4 Considerations	5 Instructions
Operation and Maintenance			*Other relevant references may be added. Strike out references that are not*	*If answer to question is "yes" identify considerations. If answer is "no" make proper*	*Identify how human element considerations should be addressed in the output*
4.	Does the "output" affect the operation and maintenance of the ship, its structure or systems and equipment?	**No**	*Revised guidelines for the operational implementation of the International Safety Management (ISM) Code by Companies* (MSC-MEPC.7/Circ.8) *Guidelines for bridge equipment and systems, their arrangement and integration (BES)* (SN.1/Circ.288) *Principles of minimum safe manning* (resolution A.1047(27)) *Issues to be considered when introducing new technology on board ships* (MSC/Circ.1091) *Guideline on software quality assurance and human-centred design for e-navigation* (MSC.1/Circ.1512) *Guidelines for the standardization of user interface design for navigation equipment* (MSC.1/Circ.1609)		

	1 Question	2 Yes/ No	3 IMO references	4 Considerations	5 Instructions
4.1	By introducing equipment that the user may find difficult to operate or maintain or may be unreliable				
4.2	By introducing new and/or novel technology, or technology that changes the role of the person				
4.3	By introducing requirements for new competencies and roles				
4.4	By overloading existing infrastructure such as power generation and ventilation systems				
4.5	By poor integration with existing systems and controls				
4.6	By introducing new and unfamiliar operations/procedures				
4.7	By introducing new and unfamiliar operating interfaces?				
4.8	By introducing risks to the ship during any modifications required prior to the implementation date of the output				

	1 Question	2 Yes/ No	3 IMO references	4 Considerations	5 Instructions
Measures to address the human element			*Other relevant references may be added* *Strike out references that are not relevant*	*If answer to question is "yes" identify considerations. If answer is "no" make proper justification*	*Identify how human element considerations should be addressed in the output*
5.	**Does the "output" require changes to:**	**No**	*Shipboard technical operating and maintenance manuals* (MSC.1/Circ.1253) *Revised guidelines for the operational implementation of the International Safety Management (ISM) Code by Companies* (MSC-MEPC.7/Circ.8)		
5.1	Training				
5.2	Practical skill development and competences				
5.3	Operating, management and/or maintenance procedures				
5.4	Information/manuals for operation and maintenance				
5.5	Spares outfit				
5.6	Occupational safety requirements including guarding and PPE				
5.7	Shore support				

_____