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WORK PROGRAMME

New output proposal to amend SOLAS regulation II-2/4 and relevant recommendations (MSC.1/Circ.1321) to mitigate the risks of fires in the engine-room caused by leakages from low-pressure fuel pipes and lubrication oil pipes

Submitted by Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands (Kingdom of the), Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, the European Commission, IACS and IUMI

SUMMARY

Executive summary:	This document proposes a new output to amend SOLAS regulation II-2/4 and relevant recommendations (MSC.1/Circ.1321) in respect of arrangements for oil fuel, lubrication oil and other flammable oils to reduce the possibility of engine-room fires originating from leakages in low-pressure fuel pipes and lubrication oil pipes.
Strategic direction, if applicable:	7
Output:	Not applicable
Action to be taken:	Paragraph 27
Related documents:	MSC 79/20/3, MSC 79/INF.9 and MSC 79/23 (paragraph 20.11)

Introduction

1 This document is submitted in accordance with the relevant provisions of the draft revision of *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) (MSC 109/22, paragraph 19.14 and annex 26) on the submission of proposals for new outputs, and proposes a new output to amend SOLAS regulation II-2/4 in respect of arrangements for oil fuel, lubrication oil and other flammable oils' piping and relevant recommendations (MSC.1/Circ.1321), with a view to enhancing the safety of ships concerning low-pressure fuel piping systems and reducing the possibility of engine-room fires originating from low-pressure fuel pipes and lubrication oil pipes' leakages.

Background

2 The Maritime Safety Committee, at its seventy-ninth session, having considered documents MSC 79/20/3 and MSC 79/INF.9 submitted by the Republic of Korea, recognized the need for the development of practical guidelines providing a set of measures to minimize the possibility of fires in engine-rooms and cargo pump-rooms taking into account relevant IMO instruments and present engineering and shipbuilding technology, and agreed to include in the Fire Protection (FP) Sub-Committee's work programme, a high priority item on "Measures to prevent fires in engine-rooms and cargo pump-rooms", with four sessions needed to complete the item (MSC 79/23, paragraph 20.11).

3 The Maritime Safety Committee, at its eighty-sixth session, having considered a proposal by FP 53, approved the *Guidelines for measures to prevent fires in engine-rooms and cargo pump-rooms* (MSC.1/Circ.1321).

4 In 2017, Cefor (the Nordic Association of Marine Insurers) initiated a project within its Technical Forum focusing on the increased number of reported fires in engine-rooms due to leakage from low-pressure fuel and lubrication oil pipes.

5 In May 2017, the Cefor Technical Forum started a dialogue with IACS and IUMI related to such fire risks. This dialogue continued with annual meetings with IACS-IUMI, where the Norwegian Hull Club (a member of the Cefor Technical Forum) presented the results of their case study on behalf of Cefor/IUMI. The subject was discussed in October 2019 at the Tripartite 2019 meeting in Tokyo, Japan, where IACS presented the subject of fire risks due to leakages from low-pressure fuel pipes. These activities have led to the establishment of an IACS-IUMI Correspondence Group to cooperate on identifying and developing practicable measures to reduce the risk of fires in the engine-room caused by the spray of fuel and lubricating oil onto hot surfaces, which has agreed on the need to revise SOLAS regulation II-2/4.

IMO's objectives

6 The co-sponsors consider that this proposal for a new output to amend SOLAS regulation II-2/4 regarding arrangements for oil fuel, lubrication oil and other flammable oils, is in line with the IMO mission statement of promoting safe, secure, environmentally sound, efficient and sustainable shipping. This lies within the IMO strategic direction 7 "Ensure regulatory effectiveness".

Need

7 Cefor statistics show that, from 2008 to Q1 2023, there were 137 incidents and accident reports of engine-room fires. In 109 of these incidents, a gross repair cost of more than $0.51 billion was registered. Most of these cases were identified to have oil fuel, lubricating oil, thermal oil, etc. involved, and about 60% of them started with a fuel or oil leaking and/or spraying onto hot surfaces (please refer to tables 1, 2 and 3 below). From the analysis of these incidents, the co-sponsors have concluded that fires caused by leakage from high-pressure fuel pipes are under control, due to the double wall piping arrangement and fuel leakage detection system arrangement. However, any defect or damage in low-pressure piping systems may cause a safety hazard because oil flow continues for as long as the fuel or lubricating oil pump is running; this acts as a continuous supply of "fuel to the fire" even after the engine (that is supposed to receive the fuel) has stopped running (due to the lack of the fuel). The study of these cases has led to the consideration of the need to develop practicable and feasible measures to reduce the possibility of leakage and/or spraying from low-pressure oil fuel and lubricating oil piping onto hot surfaces, which would help mitigate the risk of fires in the engine-room.

Year:	Number of incidents:
2008-2011	13
2012-2015	35
2016-2019	26
2020-Q1 2023	63

Table 1: Incident period

Medium:	Number of incidents:
MDC/HFO	31
HFO	52
Lubricating oil	19
Thermal oil	8
Unknown	27

Table 2: Medium involved

Root cause:	Number of incidents:
Pipe connection failure – wrong tightening/torque	17
Loose flange/studs to HP pumps including foundation	10
Vibration – insufficient pipe support, resulting fatigue	15
Loose pipe flange – burst sealing	11
Pipe welding crack (flange/connection welding)	12
Modification of pipe system (crew)	11
Flexible hoses including connections	4
Overflow	2
Unknown	55

Table 3: Root causes

8 Other findings have led to the consideration of a measure to isolate different gauges and instrumentations, e.g. sensors to monitor pressure, temperature, flow or other parameters, by fitting an isolating valve at their connection to the oil fuel and lubricating oil systems, so that any leakage or spraying from a damaged or ill-fitted gauge or instrumentation can be promptly and easily stopped by shutting down the isolating valve.

9 In addition to the above measure, the co-sponsors understand that related guidelines in MSC.1/Circ.1321 can be used as a good reference to generate practicable and feasible measures, which could be further developed as amendments to SOLAS regulation II-2/4, introducing additional requirements for low-pressure oil fuel and lubricating oil systems to reduce the possibility of leakage and/or spraying onto hot surfaces and electrical installations.

Analysis of the issue

10 SOLAS regulation II-2/4 provides requirements relating to the design, construction, and arrangement of oil fuel and lubricating oil systems, while MSC.1/Circ.1321 gives guidelines on the piping arrangement and protection.

11 From the studies of the fires reported to Cefor, it is concluded that the requirements in SOLAS regulation II-2/4, as well as the provisions in MSC.1/Circ.1321, are not always fully implemented or followed on board. The deficiencies discovered concern both the actual arrangements on board and the human element, and are presented in paragraphs 12 and 13 below.

12 Deficiencies pertaining to the actual arrangement on board were as follows:

.1 some shielding methods were proven to provide insufficient protection against spray onto hot surfaces due to poor design and quality, deterioration, as well as wear and tear over time;

.2 the fuel oil return line was pulled out and disconnected (by crew or vibration) and the fuel oil leak detection system was not working;

.3 the gasket at the lubricating oil pipe joint was partially fractured and a section of it had been displaced producing a gap where lubricating oil could have escaped;

.4 the fuel oil spray from a duplex filter;

.5 the loose flange connection (with only two bolts in position);

.6 the fuel oil tank which was located above the main engine exhaust ducts with damaged/missing insulation; fuel oil leakage dripping directly onto the exhaust ducts;

.7 poor piping arrangement which was easily subjected to mechanical damage;

.8 the lack of shielding/protection of pipes and hoses;

.9 the lack of pipe supports;

.10 missing or damaged spray insulation tape;

.11 bad interface between the main engine and different oil systems;

.12 poor or no insulation of hot surfaces, for example, exhaust ducts; and

.13 small space for inspection and maintenance.

13 Deficiencies related to the human element were as follows:

.1 poor installation and maintenance; and

.2 crew fatigue after long periods of working.

14 From the above studies and analysis, the co-sponsors believe that the measures listed in paragraphs 15 and 16 concerning arrangements on board and the human element could reduce the possibility of leakage and/or spray from low-pressure oil fuel and lubricating oil systems.

15 Measures related to the arrangements on board are as follows:

.1 improved design of the connection between the main engine and different oil systems;

.2 improved shielding, including design and material;

.3 improved design of hot surface insulation (to be covered with metal sheeting) not allowing oil seepage;

.4 improved installation of gauges and instruments with an isolation valve at the connection to oil systems;

.5 improved design to locate filters and strainers at safe places with suitable protection and easy maintenance;

.6 improved installation procedure and tools, ensuring accurate tightening torques and forces to avoid possible damage to bolts or other connections; and

.7 improved design and construction of the joint spray shield.

16 Measures related to the human element are as follows:

.1 highlighting the importance of the ship operator's involvement in the daily operations and maintenance of the ship;

.2 improved maintenance by crew;

.3 improved daily inspection and checking by crew; and

.4 providing improved knowledge and training to crew on proper operation, routine onboard watch, inspection and maintenance.

Analysis of implications

17 The co-sponsors do not foresee major costs to the maritime industry. The proposed way forward on this matter would utilize existing resources and infrastructure, and does not require significant capital investment. This means that the cost of implementing the proposal is minimal, while having a maximum effectiveness as to the arrangement and maintenance of systems on board, resulting in avoidance of fire incidents. The envisaged amendment of SOLAS regulation II-2/4 is designed to be simple and efficient, and might require upgrading the training material for the crew members; typically, expenses for such an upgrade could be covered by overall training costs. The intention is to amend the pertinent requirements and consider recommendations to make them clearer and avoid inconsistency in application.

18 The administrative burden to the Organization and to Member States is anticipated to be minimal. The Checklist for identifying administrative requirements is set out in annex 1.

Benefits

19 By achieving greater effectiveness and consistency of application of the provisions of MSC.1/Circ.1321 and by the introduction of requirements of amended SOLAS regulation II-2/4, the safety of ships will be increased.

Industry standards

20 No particular industry standards relevant to the issues exist.

Output

21 The Committee is invited to consider including a new output on "Revision of SOLAS regulation II-2/4 and relevant recommendations (MSC.1/Circ.1321) to mitigate the risks of fires in the engine-room caused by leakages from low-pressure fuel pipes and lubrication oil pipes" in the Committee's work programme, with the output being placed on the agenda of the SSE Sub-Committee (involvement of HTW Sub-Committee may need to be considered) and with two sessions estimated to complete the item.

22 Parts I and II of the check/monitoring sheet, as given in annex 2 of MSC.1/Circ.1500/Rev.3, have been completed and are provided in annex 2.

Human element

23 The completed checklist for considering human element issues contained in the draft revision of MSC-MEPC.1/Circ.5/Rev.5 (see paragraph 1) is set out in annex 3.

Urgency

24 This proposal is not considered urgent and can be addressed by the Committee in the normal course of its work; it is suggested that two sessions would be needed to complete the work by the SSE Sub-Committee.

Road map

25 As the proposal envisages the work to be performed over two sessions of the SSE Sub-Committee, the initial focus should be on the revision of SOLAS regulation II-2/4 to determine the specifics of the requirements with one session to complete, then followed by the revision of MSC.1/Circ.1321 on the basis of the agreed draft text. At the same session in year 1, a determination regarding the involvement of the HTW Sub-Committee would be required to look into seafarer training requirements, which may influence the final completion date of the output.

Identification of capacity-building implications

26 The completed checklist for the identification of capacity-building implications is set out in annex 4.

Action requested of the Committee

27 The Committee is invited to consider the proposals in paragraphs 21 and 25, and to take action, as appropriate.

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ANNEX 1

CHECKLIST FOR IDENTIFYING ADMINISTRATIVE REQUIREMENTS

(Draft revision of MSC-MEPC.1/Circ.5/Rev.5, annex 6)

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)		

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ANNEX 2

PARTS I AND II OF THE CHECK/MONITORING SHEET FOR THE PROCESS OF AMENDING THE CONVENTION AND RELATED MANDATORY INSTRUMENTS (PROPOSAL/DEVELOPMENT) (MSC.1/CIRC.1500/REV.3)

Part I – Submitter of proposal (refer to section 3.2.1.1)

1	*Submitted by (Document Number and submitter)* **MSC 110/18/3 – Austria et al.**
2	*Meeting session* **MSC 110**
3	*Date (date of submission)* **18 March 2025**

Part II – Details of proposed amendment(s) or new mandatory instrument (refer to sections 3.2.1.1 and 3.2.1.2)

1	*Strategic Direction* ***7***
2	*Title of the output* ***Revision of SOLAS regulation II-2/4 and relevant recommendations (MSC.1/Circ.1321) to mitigate the risks of fires in the engine-room caused by leakages from low-pressure fuel pipes and lubrication oil pipes***
3	*Recommended type of amendments* (MSC.1/Circ.1481) (delete as appropriate)
	• **Four-year cycle of entry into force** • ~~exceptional circumstance~~
4	*Instruments intended for amendment (SOLAS, LSA Code, etc.) or developed (new Code, new version of a code, etc.)* **SOLAS**
5	*Intended application (scope, size, type, tonnage/length restriction, service (International/non-international), activity, etc.)* **All ships to which SOLAS chapter II-2 applies**
6	*Application to new/existing ships* **new ships**
7	*Proposed coordinating sub-committee* **SSE Sub-Committee**
8	*Anticipated supporting sub-committees* **possibly HTW Sub-Committee**
9	*Time scale for completion* **2028**
10	*Expected date(s) for entry into force and implementation/application* **1 January 2032**
11	*Any relevant decision taken, or instruction given by the Committee* **None**

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ANNEX 3

CHECKLIST FOR CONSIDERING AND ADDRESSING THE HUMAN ELEMENT

(Draft revision of MSC-MEPC.1/Circ.5/Rev.5, annex 5, appendix)

	1 **Question**	**2** **Yes/ No**	**3** **IMO references**	**4** **Considerations**	**5** **Instructions**
Workload			*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*
1	**Does the "output" affect workload?**	No		Proposed changes are mainly related to design as well as training of crew members and will not affect the onboard workload	
1.1	**On board, especially in the already intensive phases of the voyage and port operations to:**	No	~~*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))~~	See 1 above	
			~~*Guidelines for the investigation of accidents where fatigue may have been an issue* (MSC/Circ.621)~~		

	1 Question	2 Yes/ No	3 IMO references	4 Considerations	5 Instructions
1.1.1	Operations including navigation, cargo and engineering	No		*See 1 above*	
1.1.2	Maintenance of the ship's structure and its equipment	No		See 1 above, maintenance may focus on fuel oil system connections and joints	
1.1.3	Onboard administration in support of the ships' management systems	No		See 1 above, as may affect training course and routeing inspection by crew members.	
1.1.4	Onboard administration related to regulation involving flag States, classification societies, port State and other bodies such as charterers and port authorities	No		See 1 above	
1.1.5	Increased workload or time pressure on personnel if involved in implementation of changes prior to the implementation date	No		See 1 above, no particular workload has been identified while effective training course provided.	
1.2	**Ashore, in a manner that would affect the ships operation to:**			Proposed changes give further clarification to SOLAS CH II-2 Part B, Reg. 4 and will not affect related processes	
1.2.1	Companies' administration	No		See 1.2 above	

	1 Question	2 Yes/ No	3 IMO references	4 Considerations	5 Instructions
1.2.2	Flag State, port State and classification societies administration such that certification and other processes are compromised or delayed	No		See 1.2 above	
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?**			Proposed changes are mainly related to design as well as training of crew members and will not have any impact on decision-making on board.	
2.1	By confusion with existing requirements and regulations	No		See 2 above, no confusion with existing requirements will be made.	
2.2	By changing responsibilities as laid out in the ISM Code	No		See 2 above	
2.3	By creating complexity in its implementation and/or in the safety management systems	No		See 2 above, as may affect training course and routeing inspection by crew members.	

	1 Question	2 Yes/ No	3 IMO references	4 Considerations	5 Instructions
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	No		See 2 above	
2.5	By limiting the time available to establish situational awareness, decide, communicate (possibly across time zones) or check	No		See 2 above	
2.6	By increasing reliance on judgement and administrative controls to manage major risks such as oil spills and collisions	No		See 2 above	
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)	Proposed changes are mainly related to design as well as training of crew members and will not affect the living and working environment on board.	

	1 Question	2 Yes/ No	3 IMO references	4 Considerations	5 Instructions
3.1	By interfering with existing arrangements for abandonment, fire-fighting and other emergency plans or procedures	No		See 3 above	
3.2	By introducing new materials that could create an explosion, fire, environmental or occupational health risk	No		See 3 above	
3.3	By introducing new high energy sources such as high-voltage, high pressure fluids	No		See 3 above	
3.4	By affecting access or egress and causing lack of ventilation in working spaces	No		See 3 above	
3.5	By affecting the habitability of accommodation spaces due to noise, vibration, temperatures, dust and other contaminants	No		See 3 above	

	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 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*
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)~~	The proposed changes will not add new equipment and will not affect the operation and expecting improving the maintenance of (fuel oil) system.	

	1 Question	2 Yes/ No	3 IMO references	4 Considerations	5 Instructions
			~~*Guidelines for the standardization of user interface design for navigation equipment* (MSC.1/Circ.1609)~~		
4.1	By introducing equipment that the user may find difficult to operate or maintain or may be unreliable	No		See 4 above	
4.2	By introducing new and/or novel technology, or technology that changes the role of the person	No		See 4 above	
4.3	By introducing requirements for new competencies and roles	No		See 4 above	
4.4	By overloading existing infrastructure such as power generation and ventilation systems	No		See 4 above	
4.5	By poor integration with existing systems and controls	No		See 4 above	
4.6	By introducing new and unfamiliar operations/procedures	No		See 4 above	
4.7	By introducing new and unfamiliar operating interfaces?	No		See 4 above	

	1 Question	2 Yes/ No	3 IMO references	4 Considerations	5 Instructions
4.8	By introducing risks to the ship during any modifications required prior to the implementation date of the output	No		See 4 above	
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)~~	Proposed changes mainly pertain to design and updating the relevant training of crew members. They will not affect crew skills, operation and maintenance manuals, additional occupational safety requirements regarding PPE, or shore support.	
5.1	Training	No		See 5 above, no particular skill other than existing crew member's skill on board	
5.2	Practical skill development and competences	No		See 5 above	
5.3	Operating, management and/or maintenance procedures	No		See 5 above	

	1 Question	2 Yes/ No	3 IMO references	4 Considerations	5 Instructions
5.4	Information/manuals for operation and maintenance	No		See 5 above	
5.5	Spares outfit	No		See 5 above, basic & usual spare pieces such gasket and fuel oil pipe's connections.	
5.6	Occupational safety requirements including guarding and PPE	No		See 5 above	
5.7	Shore support	No		See 5 above	

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ANNEX 4

CHECKLIST FOR THE IDENTIFICATION OF CAPACITY-BUILDING IMPLICATIONS

(Appendix 1 of Annex 2 of draft revision of MSC-MEPC.1/Circ.5/Rev.5)

1 For Administrations

- □ Is new legislation required? It will require an amendment.
- □ Is there a requirement for new equipment and/or systems? No
  - o Does equipment manufacturing capacity exist internationally? Yes
  - o Do equipment repair/servicing facilities exist internationally? Yes
  - o Is there capacity to develop new systems? N/A
- □ Will the implementation require additional financial resources? No
- □ Is there a need for additional human resources or new skills? No
- □ Will there be a need to upgrade current infrastructure? No
- □ Is there enough lead time towards implementation? Yes
- □ Will a rapid implementation procedure be adopted? Yes
- □ Is there a substantial modification of existing standards? No
- □ Will a guide to implementation be needed? No

2 For the industry

- □ Would the industry require new and/or enhancement of existing systems? No
  - o Does capacity exist internationally to develop new systems? Yes
- □ Is there a need for additional training of seafarers?
  - o Do related and validated training courses exist? Yes
  - o Are sufficient simulation training courses available internationally? Yes
- □ Will there be a requirement for new equipment? No
  - o Does manufacturing capacity exist internationally? Yes
- □ Is there repair/servicing and/or retrofitting and does maintenance capacity exist internationally? N/A