INTERNATIONAL MARITIME ORGANIZATION

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MARITIME SAFETY COMMITTEE
110th session
Agenda item 6

MSC 110/6/7
11 April 2025
Original: ENGLISH
Pre-session public release: ☒

DEVELOPMENT OF A SAFETY REGULATORY FRAMEWORK TO SUPPORT THE REDUCTION OF GHG EMISSIONS FROM SHIPS USING NEW TECHNOLOGIES AND ALTERNATIVE FUELS

Proposed revision of Interim guidelines for the safety of ships using methyl/ethyl alcohol as fuel (MSC.1/Circ.1621) to appropriately reflect the properties of ethanol as a marine fuel

Submitted by Brazil and IBIA

SUMMARY

Executive summary:	This document seeks to highlight the need for an amendment of the *Interim guidelines for the safety of ships using methyl/ethyl alcohol as fuel* to appropriately address differences in properties between methanol and ethanol and as such ensure the safe use of ethanol as a marine fuel.
Strategic direction, if applicable:	2
Output:	2.3
Action to be taken:	Paragraph 7
Related documents:	MSC.1/Circ.1621; MEPC 83/WP.1, MEPC 83/WP.6 and MEPC 83/7/17

Introduction

1 Document MEPC 83/7/17 (Brazil and IBIA) highlighted the use of ethanol as a marine fuel, but that there were several regulatory issues needing to be considered. MEPC 83 noted the recommendation by ISWG-GHG 18 (MEPC 83/WP.6, paragraph 181) and agreed to invite ISO to consider the development of an ISO standard for ethanol as marine fuel (MEPC 83/WP.1, paragraph 7.20). Furthermore, the co-sponsors requested the MEPC to note the need for the IGF Code to properly differentiate between methanol and ethanol as a marine fuel and to that effect planned to bring the matter to the attention of the Maritime Safety Committee.

2 The *Interim guidelines for the safety of ships using methyl/ethyl alcohol as fuel* (MSC.1/Circ.1621) groups methanol (methyl alcohol) and ethanol (ethyl alcohol) as "methyl/ethyl alcohols", implying they have identical safety, storage, and handling requirements.

3 The co-sponsors recognize that ethanol and methanol have similar properties, however, there are some notable differences (see also table 1 in the annex to this document) that can affect safety as follows:

.1 energy density: Ethanol has higher energy density (~26.8 MJ/kg) than methanol (~19.9 MJ/kg), meaning ethanol provides more energy per unit of fuel;

.2 flammability and safety: Methanol has a lower flash point (11°C) compared to ethanol (14°C), creating a small, but distinct difference in safety considerations for storage and handling. The two alcohols have some noticeable differences in spill plume behaviour;

.3 corrosiveness and water tolerance: Both fuels are hygroscopic (absorb water); however, with some distinct differences regarding material compatibility with existing fuel systems; and

.4 toxicity and ecotoxicity: Differences in odour thresholds and human toxicity thresholds. Differences in dispersion behaviour upon accidental release into water and different levels of ecotoxicity.

Discussion

4 The co-sponsors consider that MSC.1/Circ.1621, in its current form, does not sufficiently address the distinct differences between methanol and ethanol, failing to recognize the different chemical and physical properties that could influence the safety of: storage, handling, fire safety, crew protection measures, etc. Amending the Interim Guidelines (MSC.1/Circ.1621) to provide further clarity on these safety differences, could motivate investment to develop more optimized onboard safety solutions and enable a wider uptake of either of these fuels. Examples of which paragraphs of the Interim Guidelines might be amended are set out in the annex to this document.

5 A more thorough safety distinction between the two fuels could also enable an improved understanding of the differences between methanol and ethanol fuels by onboard crew, creating improved safety awareness and confidence in the use of these alternative fuels.

6 The co-sponsors support the safe and inclusive uptake of fuels and emphasize the need for improved clarity on matters related to the safe zero/near zero (ZNZ) use of methyl/ethyl alcohol fuels, including, but not limited to, addressing the safety impact due to differences in e.g. flammability, corrosivity and toxicity, and therefore addressing different needs for the safety of e.g. the design of safety systems, storage requirements, fire suppression means, emergency response, ventilation requirements, leak detection settings, gas detection calibration, odour thresholds and requirements for personal protective equipment.

Action requested of the Committee

7 The Committee is requested consider the above information and forward the document to CCC 11 under agenda item 3 on "Amendments to the IGF Code and development of guidelines for alternative fuels and related technologies" (2.3) to review, with a view to preparing draft amendments to MSC.1/Circ.1621 to appropriately reflect the different properties of ethanol as a marine fuel that can affect safety.

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ANNEX

EXAMPLES OF POSSIBLE AMENDMENTS TO MSC.1/CIRC. 1621 INTERIM GUIDELINES FOR THE SAFETY OF SHIPS USING METHYL/ETHYL ALCOHOL AS FUEL TO APPROPRIATELY REFLECT THE PROPERTIES OF ETHANOL AS A MARINE FUEL

A clear differentiation between ethanol and methanol handling procedures is crucial due to their varying physical and chemical properties as follows:

Table 1: Differences in properties between ethanol and methanol

PROPERTIES	ETHANOL	METHANOL
Odour threshold (ppm)	10	100
Viscosity (mPa.s @ 25°C)	1.040	0.544
Density	0.789	0.791
Vapour density	1.6	1.1
Vapour pressure (mmHg)	44.5	88.7
Boiling point (°C)	78	64.6
Flashpoint (°C)	14	11
LEL (%HC)	3	6
UEL (%HC)	19	36
Auto-Ignition temp (°C)	365	464

Paragraphs in the Interim Guidelines where possible amendments could be made are set out as follows:

11.6.6 Suitable detectors should be selected based on the fire characteristics of the fuel. Smoke detectors should be used in combination with detectors which can more effectively detect methyl/ethyl alcohol fires.

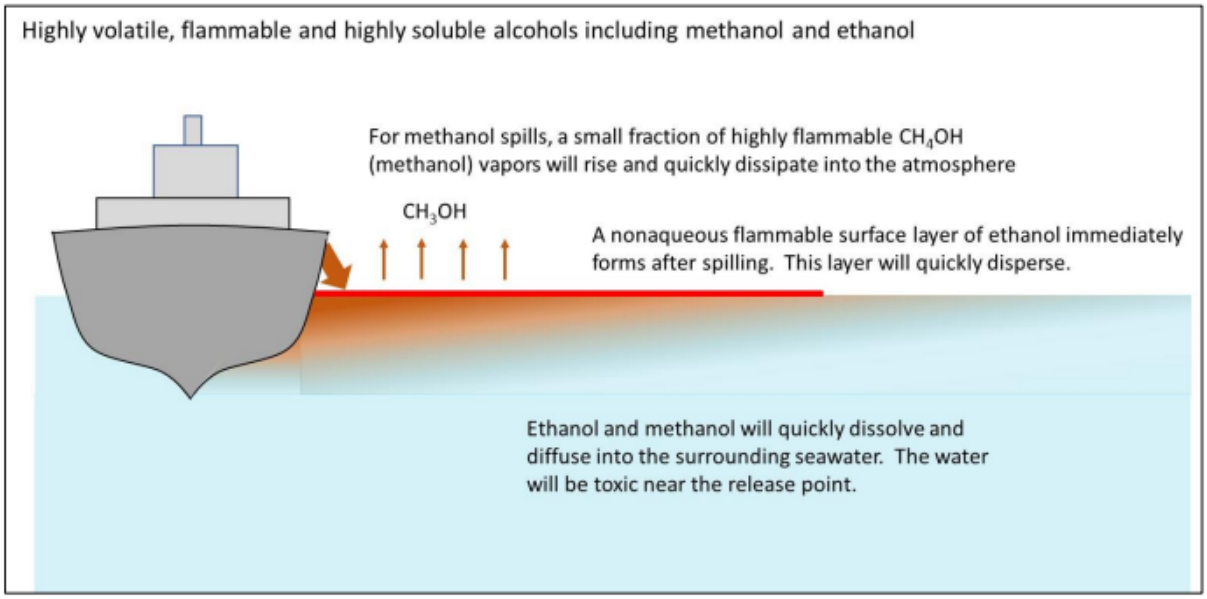
In the case of an ethanol fire, small-scale fires typically produce little smoke which can be hard to detect by a smoke detector. However, larger-scale fires tend to generate more smoke because the central part of the fire pool becomes oxygen-depleted, resulting in incomplete combustion. Therefore, we can conclude that this guideline is more effective for the early detection of fires, before they escalate into larger, more hazardous situations.

15.7.4 An audible and visible alarm should be activated at a fuel vapour concentration of 20% of the lower explosion limit (LEL). The safety system should be activated at 40% of LEL at two detectors. Special consideration should be given to toxicity in the design process of the detection system.

16.3.3 Training, drills, and emergency exercises

Methanol and ethanol have differences in spill behaviour which is impacting fire hazard upon a larger leak. Understanding distinctions in spill behaviour and mitigation options can also improve preparedness and reduce any environmental impact. Training regimes, onboard drills and emergency exercises should reflect these differences in order to create sufficient confidence for crew.

Differences in spill behaviour between methanol and ethanol can be simplified as follows:



17.3.1 Maintenance and repair procedures should include considerations with respect to the fuel containment system and adjacent spaces. Special consideration should be given to the toxicity of fuel.

Update toxicity and personal protective equipment (PPE) requirements to align with methanol's higher health risks.

Methanol exposure presents significantly higher health risks than ethanol due to its neurotoxic and systemic toxicity effects.

PPE requirements should be adjusted accordingly as follows:

TOXICITY	ETHANOL	METHANOL
PEL (ppm)	1000	200
STEL (ppm)	1000	250
IDLH (ppm)	3300	6000

The importance of closed transfer systems to minimize exposure risks should also be emphasized.

17.4.3.1 Prior to conducting bunkering operations, pre-bunkering verification including, but not limited to, the following should be carried out and documented in the bunker safety checklist:

.3 operation of portable gas detection equipment;

Although ethanol is much less toxic than methanol, it is still considered hazardous. The Lower Explosive Limit (LEL) of ethanol is 3.3%, or 33,000 ppm, for vapour concentration in air. According to ACGIH guidelines, the Permissible Exposure Limit (PEL) and Short-Term Exposure Limit (STEL) for ethanol are both set at 1000 ppm. At 20% of the LEL, the vapour concentration is 6,600 ppm, and at 40% of the LEL, it reaches 13,200 ppm, both concentrations exceed the recommended exposure limits for workers.