INTERNATIONAL MARITIME ORGANIZATION

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POLLUTION PREVENTION AND RESPONSE

Proposed amendments to the draft Guidance on System Design Limitations of ballast water management systems and their monitoring

Submitted by IMarEST

SUMMARY

Executive summary:	This document provides proposed amendments to the draft guidance contained in document PPR 5/24, annex 19
Strategic direction, if applicable:	1
Output:	Not applicable
Action to be taken:	Paragraph 8
Related documents:	MEPC 73/11; MEPC 72/17 and PPR 5/24

Introduction

1 The Sub-Committee on Pollution Prevention and Response, at its fifth session (PPR 5), invited the Marine Environment Protection Committee, at its seventy-third session (MEPC 73), to approve for dissemination as a BWM.2 circular on draft guidance on System Design Limitations of ballast water management systems and their monitoring. The document, presented as PPR 5/24, annex 19, offers guidance on the inclusion of System Design Limitations (SDL) on Type Approval Certificates of ballast water management systems (BWMS). The document recommends potential SDL for various BWMS technology and self-monitoring parameters that may be associated with those SDL.

2 The draft guidance notes that SDL "…should be developed using measures and units that are as accessible as possible to the end-user, that are relevant to the operation of ships, and that may be displayed, monitored, recorded, and alarmed by the BWMS self-monitoring system." The draft guidance further notes that the potential SDL presented within document PPR 5/24, annex 19 are examples to guide BWMS manufacturers and Administrations, and that SDL should be specific to each BWMS.

3 These aspects of the draft guidance were kept in mind during development of the proposed changes presented within this document and with a goal of aiding effective use and implementation of the guidance.

4 IMarEST led a technical review of the table within document PPR 5/24, annex 19. The review included experts in the various technologies that are considered in the table. These experts had differing views on the extent and detail of how the table might be revised. As one example, the draft guidance includes salinity and temperature as water quality parameters that are potential SDL for nearly all technologies. IMarEST received varying views on the relevance of these parameters for each of the different technologies. Given these differing views, this document limits recommended changes to items where there was general agreement. In the areas where there was not general agreement, this document does not recommend changes and leaves the table as-is.

5 This document identifies proposed amendments to the table within document PPR 5/24, annex 19, which would more closely align the guidance with the technical limitations of the various technologies and the most critical self-monitoring parameters. Proposed additions are shown in the annex below as underlined text and proposed deletions are shown as strikethrough text (<u>additions</u>/~~deletions~~).

6 This document proposes amendments to the legend of the table within document PPR 5/24, annex 19 to coordinate with the edits proposed above:

.1 delete: "ORP = Oxidant Reduction Potential";

.2 delete: "TRO = Total Residual Oxidant"; and

.3 add: "All parameters are in reference to the ballast water unless explicitly noted, e.g. feedwater, neutralizing agent, etc.".

7 It is also proposed that the draft guidance be revised throughout to reference the BWMS Code, rather than the 2016 Guidelines (G8).

Action requested of the Committee

8 The Committee is invited to consider incorporation of the proposed amendments that are provided in the annex of this document as part of the approval of the draft guidance on System Design Limitations of ballast water management systems and their monitoring (PPR 5/24, annex 19) as a BWM.2 circular.

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ANNEX

TABLE: LIST OF POTENTIAL SYSTEM DESIGN LIMITATIONS AND RELATED SELF-MONITORING PARAMETERS

Technology	Principles	Potential SDL		Potential Control and monitoring parameters seen in BWMS	Potential Design elements / related information
		Environmental / water quality parameters	Technical / operational parameters		
Filtration	Removal of particles and organisms greater than the filter mesh size (disk, basket, candle, etc.) Automatic cleaning	Suspended solids (size, ~~flexibility,~~ quality, quantity) Salinity and temperature	Flow rate, maximum Backwash pressure, minimum	Flow rate Inlet/outlet pressure or differential pressure (dP) Backwash pressure, minimum	Mesh size or retention threshold (nominal or absolute) Filtration capacity (flow rate) Cleaning capacity (backflush) Number or frequency of backwashes or cleaning cycles
Hydrocyclone	Gravitational separation of particles by centrifugal force (removal of organisms)	Suspended solids (specific gravity, quantity) Salinity and temperature	~~Pressure~~ Flow rate, minimum and maximum	Flow rate Inlet/outlet pressure~~s~~	Capacity ~~Separate~~ Separation percentage
Ultraviolet (UV) irradiation	UV irradiation (low pressure / medium pressure) damages the cells and inactivates or kills microorganisms	UVT Particle size and quantity Salinity and temperature	~~UVI~~ UV dose Flow rate, minimum and maximum Holding time, minimum	UVI, UVT, and/or UV dose Power, or current and voltage Flow rate, minimum and maximum	UV dose Minimum flow rate to avoid reactor overheating CFD analysis of reactor design

Technology	Principles	Potential SDL		Potential Control and monitoring parameters seen in BWMS	Potential Design elements / related information
		Environmental / water quality parameters	Technical / operational parameters		
Electro-chlorination	Generation of Active Substance through electrolysis of seawater (electric current), in order to kill organisms	Salinity and temperature~~, or conductivity and temperature~~ Feedwater conductivity, or salinity and temperature ~~Oxidant~~ Active Substance demand	~~Decomposition/electric potential~~ Active Substance dose (quantity or concentration) Flow rate, maximum Holding time, minimum	~~Total current or voltage~~ Power, or current and voltage ~~TRO concentration or ORP~~ Active Substance dose or concentration ~~Water conductivity or salinity~~ ~~Water temperature~~ Feedwater conductivity, or salinity and temperature ~~Incoming ballast water flowrate~~ Flow rate Holding time	Active Substance production rate
	Neutralizing agent may be used (as per Procedure (G9) requirements)	Salinity and temperature	Neutralization dose Flow rate, maximum	Neutralizing agent flow rate or quantity Flow rate Active Substance concentration at discharge	Neutralizing agent storage quantity and dosing rate
Chemical injection (e.g. ozone, sodium hypochlorite, ClO_2, etc.)	Storage or generation of Active Substance and injection of the created biocide in ballast water to kill organisms	Salinity and temperature ~~Oxidant~~ Active Substance demand	Active Substance dose (quantity or concentration) Flow rate, maximum Holding time, minimum	~~Total current or voltage~~ Power, or current and voltage Temperature of ozone generator ~~Active Substance dosage (concentration or flow or quantity)~~ ~~TRO/ORP~~ Active Substance dose or concentration Salinity and/or water conductivity Water temperature Flow rate~~ of the ballast water~~ Holding time	Active substance production rate, storage quantity and/or dosing rate

Technology	Principles	Potential SDL		Potential Control and monitoring parameters seen in BWMS	Potential Design elements / related information
		Environmental / water quality parameters	Technical / operational parameters		
	Neutralizing agent may be used (as per Procedure (G9) requirements)	Salinity and temperature	Neutralization dose Flow rate, maximum	Neutralizing agent flow rate or quantity Flow rate Active Substance concentration at discharge	Neutralizing agent storage quantity and dosing rate
Heat	Desiccation of cells	Salinity and temperature	Temperature and holding time, minimum Flow rate, maximum	Temperature and holding time Flow rate	Heating capacity
Cavitation	Shear forces created by gas injection. Cell membrane is damaged by pressure drop.	Salinity and temperature	Differential pressure, minimum Inlet and outlet pressure Flow rate, maximum	Differential pressure Flow rate	Available differential pressure
Ultrasound	Ultrasound waves generate cavitation bubbles in water, resulting in intense shear forces and high stress to cell membranes	Salinity and temperature	Ultrasound power, minimum ~~Flow rate (exposure time)~~ Flow rate, maximum Exposure time, minimum	Power, or current and voltage Flow rate	Frequency, amplitude, and exposure time of ultrasound delivery

Technology	Principles	Potential SDL		Potential Control and monitoring parameters seen in BWMS	Potential Design elements / related information
		Environmental / water quality parameters	Technical / operational parameters		
Deoxygenation	Inert gas injection or creation (CO_2 or N_2) to reduce the available oxygen for organisms in water	Salinity and temperature	Inert gas purity (in %), minimum Injection rate, minimum Holding time, minimum	Dissolved oxygen content ~~N_2 or CO_2~~ Inert gas purity (%) Injection rate Holding time	Inert gas production rate and purity Rate of gas injection and mixing
In tank treatment systems – chemicals	~~Water circulation~~ Injection of Active Substance into ballast water tanks to kill organisms	As appropriate for the chemical in use	Uniformity of tank mixing, minimum Holding time per tank ~~to fulfil treatment or avoid regrowth~~, minimum	Active Substance dose or concentration in tank Holding time	Mixing device placement Circulation flow rate/volume Holding time
	Neutralizing agent may be used (as per Procedure (G9) requirements)	Salinity and temperature	Neutralization dose	Neutralizing agent flow rate or quantity Active Substance concentration in ballast tank	Neutralizer storage quantity and dosing rate
In tank treatment systems – non-chemicals (e.g. inert gas, heat, etc.)	~~Water circulation~~ Application of mechanism into ballast water tanks to kill organisms	As appropriate for the treatment mechanism in use	Fraction of the tank water being circulated Uniformity of mechanism application, minimum Holding time per tank, minimum	Measurement of mechanism to the ballast tank, or in the ballast tank Holding time	Mixing device placement Circulation flow rate/volume Holding time ~~after treatment~~