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HARMFUL AQUATIC ORGANISMS IN BALLAST WATER

Report of the Correspondence Group on the Review of the Guidelines (G8)

Submitted by the United Kingdom

SUMMARY

Executive summary:	This document contains the report of the Correspondence Group on the Review of the *Guidelines for approval of ballast water management systems* (G8), established by MEPC 69
Strategic direction:	2
High-level action:	2.0.1
Output:	2.0.1.2
Action to be taken:	Paragraph 75
Related documents:	MEPC 69/WP.8, MEPC 69/4/6, MEPC 69/4/10; BWM.2/Circ.43, BWM.2/Circ.33; resolutions MEPC.173(58) and MEPC.174(58)

Introduction

1 The Marine Environment Protection Committee (MEPC), at its sixty-ninth session, agreed to re-establish the Correspondence Group on the Review of the *Guidelines for approval of ballast water management systems* (G8) in order to complete the work outlined in the action plan endorsed by the Committee at its sixty-seventh session. Mindful of the urgency for the completion of the review of Guidelines (G8) at MEPC 70, the correspondence group was instructed to:

.1 continue the review of the Guidelines (G8) focusing on work items identified within the report of the Ballast Water Review Group at MEPC 69 (MEPC 69/WP.8);

.2 forward any items that are not finalized to the intersessional meeting of the Working Group on the Review of the Guidelines (G8) for completion; and

.3 submit a report to MEPC 70.

2 The correspondence group was made up of delegations from the following Member Governments:

ARGENTINA
AUSTRALIA
BAHAMAS
BELGIUM
BRAZIL
CANADA
CHINA
CYPRUS
DENMARK
FINLAND
FRANCE
GERMANY
GREECE
INDIA
IRAN (ISLAMIC REPUBLIC OF)
IRELAND
ITALY
JAMAICA
JAPAN
LATVIA
LIBERIA
MALAYSIA
MALTA
MARSHALL ISLANDS
NEW ZEALAND
NETHERLANDS
NIGERIA
NORWAY
PERU
POLAND
REPUBLIC OF KOREA
RUSSIAN FEDERATION
SINGAPORE
SOUTH AFRICA
SWEDEN
UNITED KINGDOM
UNITED STATES

the following intergovernmental organization:

EUROPEAN COMMISSION (EC)

the following non-governmental organizations in consultative status:

INTERNATIONAL CHAMBER OF SHIPPING (ICS)
BIMCO
INTERNATIONAL ASSOCIATION OF CLASSIFICATION SOCIETIES (IACS)
EUROPEAN CHEMICAL INDUSTRY COUNCIL (CEFIC)
COMMUNITY OF EUROPEAN SHIPYARDS' ASSOCIATIONS (CESA)
INTERNATIONAL ASSOCIATION OF INDEPENDENT TANKER OWNERS (INTERTANKO)
INTERNATIONAL UNION FOR CONSERVATION OF NATURE (IUCN)
CRUISE LINES INTERNATIONAL ASSOCIATION (CLIA)
INTERNATIONAL ASSOCIATION OF DRY CARGO SHIPOWNERS (INTERCARGO)
THE INSTITUTE OF MARINE ENGINEERING, SCIENCE AND TECHNOLOGY (IMAREST)
INTERNATIONAL SHIP MANAGERS' ASSOCIATION (InterManager)
INTERNATIONAL TRANSPORT WORKERS' FEDERATION (ITF)
WORLD SHIPPING COUNCIL (WSC)
NACE INTERNATIONAL

and representatives from:

WORLD MARITIME UNIVERSITY (WMU)
GESAMP-BALLAST WATER WORKING GROUP (GESAMP-BWWG).

Background

3 The correspondence group (the group) communicated via email over an 11-week period from 1 May to 15 July 2016.

4 The work of the group has built on that of the previous correspondence groups and the work of the Ballast Water Review Group (BWRG) during MEPC 69, and has been conducted under the instruction and terms of reference as provided by MEPC 69. The items discussed by the group, as determined by the terms of reference, were as follows:

Item	*Topic*
1	Agree text to reflect the principles of the use of standard test organism (STO), as outlined within MEPC 69/WP.8, for inclusion within the revised Guidelines (G8).
2	Continue discussions concerning testing at temperatures ranging from 0°C to 40°C.
3	Finalize the definition of viable organisms.
4	With regard to challenge levels of suspended and dissolved matter in test water, as agreed by the BWRG (document MEPC 69/WP.8, paragraph 29):
	.1 determine the challenging constituents of the suspended and dissolved matter in ballast water;
	.2 clarify the role of these constituents in posing a challenge to the operation of a BWMS; and
	.3 determine the appropriate level of relevant constituents in challenge water with respect to conditions normally encountered in worldwide operation.
5	Continue the discussions under section 5.1 of annex 6 of document MEPC 69/4/6 (finalize "test" definitions).
6	Continue the review of annex 3 of document MEPC 69/4/6 with a view to finalizing text.
7	Collate submissions from group members regarding type approval protocols with a view to providing documentation to the intersessional meeting of the Working Group on the Review of the Guidelines (G8) (the intersessional meeting).
8	Further develop the concept of system design limitations (SDL) and integrate the concept into Guidelines (G8).
9	Based upon the text provided by the United States to the BWRG at MEPC 69, develop text for inclusion within Guidelines (G8) regarding test facility validation.
10	Control water – Develop text as directed under item 9 of annex 6 of document MEPC 69/4/6.
11	Determine where in Guidelines (G8) sections 5 and 6 of BWM.2/Circ.43 should be inserted.

Item	*Topic*
12	Control and monitoring – Take into consideration the proposal by Denmark in paragraph 9 of document MEPC 69/4/10 when considering control and monitoring.
13	Consider the text proposal from Norway provided to the correspondence group coordinator regarding bypass arrangements.
14	Collate information and documentation regarding scaling as identified with the BWRG report (MEPC 69/WP.8).
15	Establish a sub-group on the effects of temperature on holding times with instructions to work to the terms of reference provided by the United States to the BWRG at MEPC 69.
16	Sampling provisions – align Guidelines (G8) with Guidelines (G2).
17	Consider the text provided to the group by Norway on item 20 (Land-based testing) of annex 6 to document MEPC 69/4/6.
18	Consider the text provided to the group by the Netherlands on item 21 regarding technical and biological tests.
19	Conclude discussions regarding environmental tests.
20	Review of Guidelines (G8) section 7 – Installation requirements.
21	Review of Guidelines (G8) section 8 – Installation survey and commissioning procedures.
22	Compile list of items not completed by the group for finalization by the intersessional meeting.

Comments and discussions

Item 1 – Standard test organisms

5 The coordinator of the correspondence group proposed text to encapsulate the principles agreed at MEPC 69 regarding the use of standard test organisms (STO). The group agreed to replace the existing section 2.3.19 of Part 2 of the annex to Guidelines (G8) with the following text:

"2.3.19 Use of standard test organisms (STO)

.1 the use of cultured or standard test organisms (STO) is permissible if the challenge levels in naturally occurring water are found to be inadequate and require supplementation. The use of STO should not be considered standard practice. Their use should be locally isolated to ensure that the risk to the local environment is minimized; non-indigenous organisms which have the potential to cause harm to the environment should not be used;

.2 procedures, processes and guidance for the use of STO should be based on the most relevant and up-to-date available scientific data. Such procedures, processes and guidance should form a part of the testing facilities' quality assurance regimes; and

.3 the use of STO, including concentrations and species, should be recorded within the test report. The test report should include information pertaining to the evaluation and justification for the use of STO, an assessment of the impact of their use on other test parameters and potential impacts on the test being undertaken. The information contained within the report should reflect both the positive and negative impacts of the use of STO."

6 The group reiterated the need for adequate controls, processes and procedures when using STO and noted the invitation to members by the Committee at MEPC 69 to provide submissions on this topic. Due to the actions agreed at MEPC 69 and the time restraints placed on the correspondence group this item is considered complete for the purposes of the review of Guidelines (G8).

Item 2 – Testing at temperatures ranging from 0°C to 40°C

7 The group agreed that evaluation of the ballast water management system (BWMS) should be undertaken to ensure it operates correctly across the 0 to 40°C temperature range. To reflect this decision the group agreed to the following inclusions and amendments.

8 To be included within section 1.6 of Part 1 of the annex of Guidelines (G8):

".5 sufficient information to allow evaluation of the ability of the BWMS to operate correctly in temperatures ranging from 0°C to 40°C (2°C to 40°C for fresh water), including during short and extended voyages, allowing a tolerance as appropriate to address practical difficulties and variations."

9 For inclusion in Part 2 of the annex to Guidelines (G8) as 2.3.18*ter*:

"2.3.18*ter* The efficacy of the system to work effectively over a temperature range from 0°C to 40°C should be evaluated. Testing to prove efficacy over this temperature range may employ, among others, land-based, shipboard or bench-scale testing."

10 Additional text to be included within the main body of Guidelines (G8):

"4.9*bis* The ballast water management equipment should be effective throughout a ballast water temperature range of 0°C to 40°C (2°C to 40°C for fresh water), in the time available for treatment during short and extended voyages. If temperature is identified as a system design limitation, the Type Approval Certificate should be appropriately annotated."

11 These changes can then be referenced when including the limited operation notation by amending the first sentence of paragraph 6.2*bis* of the main body of Guidelines (G8) to:

"6.2*bis* If the effective operation of a BWMS is restricted in terms of the inlet criteria identified beginning at paragraph 2.3.17 of the annex or if it is restricted in terms of the criteria set out in paragraph 4.9bis then this should be clearly stated on the Type Approval Certificate..."

12 When discussing how to assess efficacy of BWMS across the 0°C to 40°C range, the majority of respondents supported the use of three tests (one each to reflect low, high and mid-range temperatures). There was not clear support for identifying the mid-range temperature at which the test should be undertaken. The group indicated that testing may be undertaken during ship, land or bench-scale testing depending on the test requirements. It was

noted that shipboard testing may not be able to meet the temperature extremes but appropriate variation in season and geography would give an indication across the temperature ranges. Time restraints prevented text from being developed to reflect these decisions; however, it was anticipated that final text would be agreed during the intersessional meeting.

13 Further consideration of the interactions between temperature and other parameters (particularly impact on organisms) was given. To reflect possible interactions during testing and within the test report the following text was agreed for inclusion to section 1 of Guidelines (G8):

> "1.5*quater* In its evaluation, the Administration should take into consideration potential interactions between parameters, notably interactions between temperature and other parameters, including biological parameters, and guidance from the Organization on identifying and validating system design limitations for common BWMS processes."

14 The group did not have sufficient time to consider the form of the guidance referred to in the proposed text shown above or how the proposed guidance will be developed. This outstanding task was assigned to the intersessional meeting.

Item 3 – Definition of viable organisms

15 After an extensive and robust discussion regarding the definition of the term "viable organisms", its inclusion in Guidelines (G8) and how to ensure methods used to determine viability are acceptable to the Organization, the majority of respondents agreed to the following text being included within Guidelines (G8):

> "3.12 *Viable organisms* are organisms that have the ability to successfully generate new individuals in order to reproduce the species."

16 In support of this definition and to provide further clarification, the group considered an amendment to paragraph 4.6 of Part 4 of the annex of Guidelines (G8) was also deemed necessary. The following text was agreed by the group to replace the existing paragraph 4.6:

> "4.6 The viability of organisms should be determined using a method that has been accepted by the Organization as appropriate to the ballast water treatment technology being tested. Acceptable methods should provide assurance that organisms not removed from ballast water have been killed or rendered harmless to the environment, human health, property and resources. Viability may be established by assessing the presence of one or more essential characteristics of life, such as structural integrity, metabolism, reproduction, motility, or response to stimuli."

17 To further support the definition of the term "viable organisms", the group reiterated the need for methodologies for assessing viability to be identified and evaluated. The group noted that document MEPC 69/WP.8, paragraph 28 invited proposals for methodologies to PPR 4 for consideration for inclusion within an appropriate document.

Item 4 – Challenge levels of Total Suspended Solids (TSS)

18 Particle size distribution, particle density, and sediment quality (structure/character) were identified as important constituents when considering TSS. It was noted that inorganic particles (e.g. sand) could impact UV transmittance (UV-T), diffuse light and have an abrasive effect on the surface of components (e.g. lamps) and that the presence of organic particles could result in a reduction of the oxidation potential of Active Substances, cause agglomeration and may also result in shadowing and thereby effect UV-T.

19 The group identified BWMS that may be affected by the presence of TSS, including systems that make use of a filter (clogging/caking/increased backflushing), UV systems (UV-T/shadowing/additional absorbance of UV by organic particles) and systems that use electrolysis (impact on oxidation rates). It was also suggested that the presence of TSS could impact on systems that make use of ultrasonic, cavitation and electromagnetic waves.

20 To further support the decision-making of the group the following references were provided:

.1 Total Suspended Solids and water quality (http://ky.gov/nrepc/water/ramp/rmtss.htm); and

.2 wastewater technology fact sheet – ultraviolet disinfection (US EPA, https://www3.epa.gov/npdes/pubs/uv.pdf), Hejkal et al., 1981.

21 To reflect the conclusions drawn, the group supported the addition of the following text to paragraph 1.6.3 of the annex to Guidelines (G8):

".3 sufficient information to verify operation with the different sediment loads under which the BWMS will operate, including information on potential constituents (chemical and physical) related to TSS (e.g. particle size distribution, density and sediment quality) and resultant effects (e.g. filter clogging, UV transmittance, consumption of the oxidation potential of the Active Substance);"

22 The majority of the group concluded that "normal" operating conditions could not, at this time, be quantified and it is therefore suggested that the text within Guidelines (G8) referring to levels of TSS remain unchanged.

23 Where there is sufficient and scientifically robust information regarding TSS, the group concurred that the system design limitation concept should be used to further evaluate the impact of TSS on the efficacy of BWMS for which this parameter is important.

Item 5 – Test definitions

24 The group agreed that for land-based testing the tests should be completed consecutively. Paragraph 2.3.1 of the annex to Guidelines (G8) is to be replaced by the following:

"2.3.1 The test set-up including the ballast water treatment equipment should operate as described in the provided documentation during at least 5 consecutive valid successful replicate test cycles. Each test cycle should take place over a period of at least 5 days."

25 To further enhance understanding and consistency when approving BWMS, the group developed and agreed to the following definitions for inclusion within section 3 of Guidelines (G8):

"Test cycle – One testing iteration (to include uptake, treatment, holding and discharge as appropriate) under a given set of requirements used to establish the ability of a BWMS to meet the set standards.

Test – The set of required test cycles under a given set of requirements.
Valid Test cycle – A test cycle in which all the required test conditions and arrangements, including challenge conditions, test control, and monitoring arrangements (including piping, mechanical and electrical provisions) and test analytical procedures were achieved by the testing organization.

Successful test cycle – A valid test cycle where the BWMS functions to its specifications and treated water is determined to meet the standard set within regulation D-2.

Failed test cycle – A valid test cycle in which the performance of the BWMS resulted in treated water that is determined to be non-compliant with the standard set within regulation D-2.

Invalid test cycle – A test cycle in which, due to circumstances outside the control of the BWMS, the requirements for a valid test cycle are not met. When a test is invalid, it does not count as one of the required consecutive test cycles in a test and the test can be continued."

26 There was limited support for the inclusion of references to "other requirements or standards"; however, it was concluded that the definitions have been developed for the purpose of supporting the Guidelines (G8) and reference to other standards would therefore be inappropriate.

27 The general consensus of the group was that the term "replicates" would be sufficiently understood amongst those that would be using the Guidelines.

Item 6 – Test reporting and test reports

28 The group agreed that, provided sensitive information was redacted, the type approval report should be made available to both the public and Member States. It was also noted that test results and conditions should not be considered as sensitive information. The following text will therefore be included within Guidelines (G8):

"6.7 An Administration approving a ballast water management system should promptly provide a type approval report to the Organization in accordance with Part 6 of the annex. Upon receipt of a type approval report, the Organization should promptly make it available to the public and Member States by an appropriate means."

29 The group agreed that if the BWMS has an unintended effect on the ship's ballasting system, the impact should be recorded. Impacts on the performance or condition of ballasting system that were identified included changes to planned ballast water flow rates during operation, changes in pressure or impacts on pipework, tanks or valves.

30 The group also conclude that "total operating time" is the sum of all hours the BWMS is run. "Continuous operating time" is the number of hours the system was run continuously during one test/ballasting operation. Longer total and continuous operating times, in conjunction with data on maintenance and failures during testing provide an indication of the reliability of a system. With this understanding, the group expanded the text agreed during MEPC 68 for inclusion within the annex of Guidelines (G8):

"2.4.1*bis* After approval tests have been completed, a report should be submitted to the Administration. This report should include information regarding the test design, methods of analysis, the results of analyses for each test cycle (including failed and invalid test cycles), BWMS maintenance logs and any observed effects of the BWMS on the ballast system of the vessel (e.g. pumps, pipes, tanks, valves). Shipboard test reports should include information on the total and continuous operating time of the BWMS."

31 Following on from the work of the BWRG during MEPC 69 regarding the content and structure of type approval reports and certificates, the group agreed to the inclusion of the following text within Part 6 (Type Approval and Type Approval Report) of the annex to the revised Guidelines (G8):

> "6.6 Documents should not be incorporated by reference into the Type Approval Certificate, which should be carried on board vessels or available at the vessel owner's office on shore. The Administration may incorporate an annex by reference into the type approval report if the reference (e.g. Internet URL) is expected to remain permanently valid. Upon any reference becoming invalid, the Administration should promptly resubmit the type approval report to the Organization and include the referenced document or an updated reference to it; the Organization should promptly make the revised report available to the public and Member States through an appropriate means."

Item 7 – Type approval protocols

32 The correspondence group was tasked with collating information regarding the type approval protocols used by Administrations for consideration during the intersessional meeting. The following information was provided by the correspondence group:

.1 http://www.ecfr.gov/cgi-bin/text-idx?tpl=/ecfrbrowse/Title46/46cfr162_main_02.tpl (US BWMS type approval procedures and requirements as published in 46 CFR 162.060); and

.2 ETV Protocol http://www.uscg.mil/hq/cg5/cg522/cg5224/docs/600r10146.pdf

33 It was felt that the findings of the Study on the implementation of the ballast water standard described in regulation D-2 of the BWM Convention have been adequately reflected and addressed through the work of the correspondence group.

Item 8 – System design limitations

34 The group continued to work on introducing the concept of system design limitations (SDL) into Guidelines (G8), which resulted in the development of the following text for inclusion in the revision of Guidelines (G8):

> "1.17*bis* The limitations of the ballast water management systems determined in addition to the required type approval testing parameters – as submitted by its manufacturer and validated by the Administration – should be documented on the Type Approval Certificate. These system design limitations do not determine if the equipment may be type approved or not, but provide information on the conditions beyond the type approval testing parameters under which proper functioning of the equipment can be expected."

> "3.9*bis* The *system design limitations* of a BWMS set out the water quality and operational parameters, determined in addition to the required type approval testing parameters, that are important to its operation, and, for each such parameter, a low and/or a high value for which the BWMS is designed to achieve the performance standard of regulation D-2. The system design limitations should be specific to the processes being employed by the BWMS and should not be limited to parameters otherwise assessed as part of the type approval process. The system design limitations should be identified by the manufacturer and validated under the supervision of the Administration in accordance with these Guidelines."

1.6.4*bis* System design limitations – The manufacturer should identify all known parameters, determined in addition to the required type approval testing parameters, to which the design of the BWMS is sensitive that are material to its ability to achieve the performance standard of regulation D-2. The basis for this identification should be supplied. The parameters should not be limited to those that are specifically referenced in these Guidelines, and should include both water quality parameters (e.g. salinity, temperature, oxidant demand, ultraviolet transmittance) and operational parameters (e.g. minimum flow rate, time between uptake and discharge). For each parameter the manufacturer should claim a low and/or a high value for which the BWMS is capable of achieving the performance standard of regulation D-2. The proposed method for validating each claimed system design limitation should be set out, together with information on the source, suitability and reliability of the method."

35 To aid the identification of SDL, the group was asked to develop a matrix showing technology types and SDL parameters. Three matrix formats were provided by the group and suggestions for the population of the matrix were received, shown in annex 1. The first matrix lists all parameters, the second separates those parameters that are temperature dependent from those that are not and the third shows the relationship between Guidelines (G8) and Procedure (G9) parameters. Many members of the group expressed the view that the users of the matrix should be aware that it is not an exhaustive list of either parameters or technology types.

36 It was proposed to the group that there may be a need for the SDL matrix to be developed as a separate guidance document that could be developed independently of the Guidelines (G8) review. The intersessional meeting is invited to consider whether the matrix should be developed as a part of the Guidelines (G8) review or as a separate document and to complete work accordingly.

Item 9 – Test facility validation

37 Building on the MEPC 69 discussions and based on the text proposal provided to the coordinator following the work completed by the Ballast Water Review Group, the following text was agreed to replace paragraph 2.1.1 of the annex to Guidelines (G8) in order to clarify how to verify and validate the competence of test facilities.

"2.1.1 The test facility should demonstrate its competency in conducting valid type approval tests in two ways: (1) have implemented a rigorous quality control/quality assurance program, approved, certified and audited by an independent accreditation body, or to the satisfaction of the Administration, and (2) be able to demonstrate its ability to conduct valid test cycles with appropriate sample collection, sample analysis, and method detection limits. It is the responsibility of the Administration, or its authorized delegate, to determine the acceptability of the test facility."

38 This further text was developed to replace the existing paragraph 2.1.2 of part 2 of the annex of Guidelines (G8):

"2.1.2 The test facility's quality control/quality assurance programme should consist of:

.1 A Quality Management Plan (QMP), which addresses the quality control management structure and policies of the testing body (including subcontractors and outside laboratories);

.2 A Quality Assurance Project Plan (QAPP), which defines the methods, procedures, and quality assurance and quality control (QA/QC) protocols used by the test facility for testing BWMS in general. It identifies the test team members, and it includes all relevant standard operating procedures (SOPs), typically as appendices; and

.3 A Test/Quality Assurance Plan (TQAP), that provides specific details for conducting a test of a given BWMS at a given site and time. The TQAP includes detailed plans for commissioning the BWMS, the experimental plan, decommissioning, and reporting the results. The TQAP identifies all organizations involved in the test and includes the BWMS vendor's documentation and performance claims. The TQAP also identifies the data to be recorded, operational and challenge parameters that define a valid test cycle, data analyses to be presented in the verification report, and a schedule for testing."

39 The inclusion of a new paragraph 2.1.2*bis* to the annex of Guidelines (G8) was also agreed.

"2.1.2*bis* The testing facility performing the BWMS tests should be independent. It should not be owned or affiliated with the manufacturer or vendor of any BWMS, by the manufacturer or supplier of the major components of that equipment, or by the owner or operator of ships that would be required to use such equipment."

Item 10 – Use of control water

40 Following discussion on the impracticalities of using control water during shipboard testing, the group agreed that this requirement should be removed from the Guidelines. Paragraph 2.2.2.6.1 of Part 2 to the annex of Guidelines (G8) will be deleted and the reference to control tanks removed from paragraph 2.2.1.3.

41 The use of control water will only be required as a part of land-based testing under the revised Guidelines (G8).

Item 11 – Inclusion of BWM.2/Circ.43

42 The group agreed that this work should be undertaken once a "clean" copy of the revised Guidelines (G8) was available to ensure that all relevant information was included and no text unnecessarily deleted.

Item 12 – Control and monitoring

43 Control and monitoring was identified as an item that would benefit from further face to face discussions during the intersessional meeting. However the group, using document PPR 2/5 as a basis on which to start discussions, agreed a number of broad concepts for inclusion within Guidelines (G8), including the following text to be inserted at a place to be considered during the intersessional meeting:

"Administrations should ensure that type approved ballast water management systems have a suitable self-monitoring system that will monitor and record sufficient data to verify correct operation of the system"

"Ballast water management systems should monitor and store a minimum number of parameters for detailed evaluation."

44 Based upon consideration of document PPR 2/5, it was also agreed that amendments to Guidelines (G8) should reflect the following points:

.1 all system indications and alarms should be stored and available for inspection;

.2 storage should follow common standards;

.3 each manufacturer identify those parameters that are critical to the functioning of the system, and to design and incorporate an appropriate control and monitoring system;

.4 test organizations should verify that the system does in fact adequately control and monitor the parameters identified by the manufacturer adequately, and that no other unmonitored critical parameters exist, based on a general understanding of the treatment process; and

.5 there is a need to protect data, information and software from tampering and relevant information should be password protected at an appropriate level.

45 The group concluded that there was no need for continuous monitoring and that the proposals in document PPR 2/5 were too prescriptive in their current form.

46 The group discussed the possibility of developing a new part to Guidelines (G8) dedicated to control and monitoring and the possibility of including section 1 of the annex of document PPR 2/5 within BWM.2/Circ.43 with the appendix of PPR 2/5 annexed to the end; alternatively, it was suggested that the whole annex of document PPR 2/5 could be included within the circular.

47 To further facilitate the continued discussion of control and monitoring the delegation of Germany provided two text proposals for consideration during the intersessional meeting. The text is provided as annex 2.

48 When considering document MEPC 69/4/10, the group considered it was too early to discuss this as indicative tools are at the early stages of development and use. Further respondents stated biological self-monitoring was not necessary as the other parameters offer sufficient confidence. The decision of MEPC 69 to invite more detailed submissions to MEPC 70 was noted.

Item 13 – Bypass arrangements

49 To ensure the issues regarding bypass arrangements are appropriately addressed within Guidelines (G8) the group agreed to the inclusion of a new heading "Bypass arrangements" and three new paragraphs under section 7 of the current Guidelines (G8) (Installation requirements):

"**Bypass arrangements**

7.3 Suitable bypasses or overrides to protect the safety of the ship and personnel should be installed and used in the event of an emergency.

7.4 Any bypass of the BWMS should activate an alarm, and the bypass event should be recorded by the control equipment.

7.5 The requirement in paragraph 7.4 does not apply to internal transfer of ballast water within the ship (e.g. anti-heeling operations). However, for BWMS where the effect of internal transfer will affect the D-2 standard of the discharged ballast water (i.e. circulation or in-tank treatment, the recording in paragraph 7.4 shall identify such internal transfer operations."

Item 14 – Scaling

50 The issue of scaling of BWMS was identified as one of the most important issues yet to be addressed through the review of Guidelines (G8). It was therefore felt that this issue would be better dealt with during the intersessional meeting. When undertaking this work the intersessional meeting will be invited to consider the points outlined below:

.1 during the correspondence group some members of the group felt that this issue would be better addressed through a review of BWM.2/Circ.33 and as such could be completed "outside" of the Guidelines (G8) review to allow this technical discussion to be given due consideration, possibly through PPR;

.2 how to ensure relevant drawings and specifications, with respect to scaling of BWMS, are submitted to the authorizing Administration;

.3 whether it is the responsibility of the authorizing Administration or the manufacturer to verify scaling through the use of computer modelling; and

.4 how to ensure that scaling of BWMS is assessed across the spectrum of sizes claimed by the manufacturer.

51 Correspondence group members provided a range of documents, position papers and information to further inform the scaling discussions. These documents have not been included within this report in order to keep size of this document to a manageable level. The intersessional meeting is therefore requested to take into consideration all documents submitted to the correspondence group on this issue.

Item 15 – Holding time

52 In recognition of the complicated nature of the issues surrounding holding times, as directed by the terms of reference, the correspondence group agreed to allow a sub-group to be created in order for relevant experts and interested parties to discuss this issue outside of the ongoing work of the correspondence group.

53 It was recognized by the correspondence group that this issue needed to be overseen by a member of the group that fully understood the technical nature of the discussion. A member of the delegation of Singapore offered to fulfil the role of coordinator of this sub-group and operate under the terms of reference agreed by the correspondence group.

54 The report of this sub-group, including terms of reference and participants list, as submitted to the correspondence group can be found in annex 3.

55 In summary, the sub-group identified the following principles which it was felt should be reflected within Guidelines (G8):

.1 a BWMS should be effective in meeting the D-2 discharge standard on short voyages and long voyages (i.e. short and long intervals between treatment and discharge), regardless of temperature, unless the system is intentionally constructed for use in specific waters;

.2 ballast water discharged following treatment should be safe for the environment on short voyages and long voyages (i.e. short and long intervals between treatment and discharge), regardless of temperature;

.3 the design of the BWMS should account for the fact that, regardless of the BWMS technology employed, viable organisms remaining after treatment may reproduce in the interval between treatment and discharge;

.4 shipowners should ensure that the BWMS is used according to the manual and prevent regrowth by removal of sediments prior to installation of a BWMS, and/or after the ship was exempted from ballast water treatment;

.5 the correct operation of the BWMS (e.g. dosing) should not depend on a prediction of the interval between treatment and discharge, which is not always known accurately in vessel operations; and

.6 the known interval between treatment and discharge established for type approval testing should not be a factor in the design of the BWMS or in its operation during testing.

56 With regard to the use of an appropriate holding time during testing, the sub-group agreed that Guidelines (G8) should be amended to reflect that a "minimum holding time of 24 hours" is required. If deemed appropriate, the Guidelines may be further amended to ensure a proper and thorough evaluation of regrowth during the type approval process, taking into account the effects of temperature. In support of this approach, the sub-group discussed methodologies that could be employed to evaluate regrowth and indicated that such methodologies should be shared with the authorizing Administration, referred to during the type approval process and recorded within the type approval report.

57 The sub-group recommended that BWMS developers should have to state a minimum holding time required to efficiently treat water at all temperatures, which in turn should be used when developing the BWMS test plan. The inclusion of a minimum holding time on the Type Approval Certificate was supported by the sub-group.

58 It was noted by the sub-group that there may be confusion between the terminology used within Guidelines (G8) and that used within Procedure (G9) and that it would be good practice to clearly define this terminology and its use. Members of the GESAMP-BWWG took part in the sub-group and as a part of correspondence shared this view.

59 Time restraints prevented the group from exploring text proposals or reviewing Guidelines (G8) to ensure the stated principles and conclusions drawn are adequately reflected within the Guidelines. It was therefore agreed that the report of the sub-group would be used by the intersessional meeting to make further revisions to Guidelines (G8).

Item 16 – Sampling provisions

60 Based upon text proposals provided to the group, the following text amendments were developed in order to strengthen the ballast water sampling provisions within Guidelines (G8); however, there was insufficient time to completely refine the proposals, which are therefore forwarded to the intersessional working group for finalization:

["3.7*bis* Representative sampling reflects the relative concentrations (chemicals) and numbers and composition of the populations (organisms) in the volume of interest. Samples should be taken in a time-integrated manner and the sampling facility should be installed in accordance with the annex, Part 1 of the Guidelines on ballast water sampling (G2)."

"2.2.2.6 Sampling regime and volumes for analysis

2.2.2.6.1 For the enumeration of organisms greater than or equal to 50 micrometres or more in minimum dimension:

.1 three replicate samples of influent water should be collected over the duration of uptake as time-integrated samples (continuously or by collecting sequential samples at the beginning, middle and end of the operation). Three replicate samples of discharged water should be collected as time-integrated samples over the whole duration of discharge;

2 influent water samples of at least one cubic metre should be collected unless a rationale is provided that smaller samples will ensure representative enumeration of organisms. Discharge water samples of at least one cubic metre should be collected;

.3 if samples are concentrated for enumeration, the samples should be concentrated using a sieve no greater than 50 micrometres mesh in diagonal dimension and with a method documented to have minimal effect on organism survival; and

.4 the full volume of each sample should be analysed unless the total number of organisms in an individual sample is higher than 100, in which case a minimum of 100 organisms should be counted and the average density may be extrapolated based on the analysed fraction of that sample.

2.2.2.6.2 For the enumeration of organisms greater than or equal to 10 micrometres and less than 50 micrometres in minimum dimension:

.1 a sample of influent and treated water should be collected in a time integrated manner over the full duration of uptake/discharge;

.2 a sample of at least 10 litres should be collected, from which a representative subsample of minimum 1 litre may be transferred to a smaller container for analysis;

.3 the sample should not be concentrated for enumeration; and

.4 a minimum of three subsamples each representing 2 millilitres should be analysed in full, unless the total number of organisms in each subsample is higher than 100, in which case a minimum of 100 organisms should be counted per subsample and the average density may be extrapolated based on the analysed fraction of each subsample.

2.2.2.6.3 For the evaluation of bacteria:

.1 one sample each of influent and discharged water collected in a time-integrated manner over the full duration of uptake/discharge;

.2 a sample of at least 10 litres should be collected, from which a representative subsample of minimum 1 litre may be transferred to a sterile container for analysis; and

.3 a minimum of three subsamples should be analysed for colony-forming units of bacteria listed in regulation D-2."]

Item 17 – Land-based sampling

61 The following amendments to Part 2 of the annex to Guidelines (G8) were also developed by the correspondence group. As with item 16, there was insufficient time to completely refine the proposals, which are therefore forwarded to the intersessional working group for finalization:

["2.3.28 Facilities or arrangements for sampling should be provided to ensure representative samples of treated and control water can be taken that introduce as few adverse effects as possible on the organisms."

"2.3.29 Samples described in paragraphs 2.3.26 and 2.3.27 should be collected in triplicate for each occasion for the enumeration of organisms greater than or equal to 50 micrometres or more in minimum dimension and as one sample for each occasion for the enumeration of organisms greater than or equal to 10 micrometres and less than 50 micrometres in minimum dimension and bacteria."

"2.3.31 For enumeration of organisms greater than or equal to 50 micrometres or more in minimum dimension:

.1 at least 20 litres of influent water and 1 cubic metre of treated and control discharge water should be collected;

.2 if samples are concentrated for enumeration, the samples should be concentrated using a sieve no greater than 50 micrometres mesh in the diagonal dimension and with a method documented to have minimal effect on organism survival; and

.3 samples should be analysed in full unless the total number of organisms in each sample is higher than 100, in which case a minimum of 100 organisms should be counted per subsample and the average density may be extrapolated based on the analysed fraction of each subsample.

2.3.32 For the enumeration of organisms greater than or equal to 10 micrometres and less than 50 micrometres in minimum dimension:

.1 at least 10 litres of influent water, 10 litres of treated water and 10 litres of control discharge water should be collected, from which a representative subsample of minimum 1 litre may be transferred to a smaller container for transport and analysis;

.2 the sample should not be concentrated for enumeration; and

.3 at least three subsamples each representing 2 millilitres should be analysed in full, unless the total number of organisms in each subsample is higher than 100, in which case a minimum of 100 organisms should be counted per subsample and the average density may be extrapolated based on the analysed fraction of each subsample".

2.3.33 For the evaluation of bacteria:

.1 at least 10 litres of influent water, 10 litres of treated discharge water and 10 litres of control discharge water should be collected, from which a representative subsample of minimum 1 litre may be transferred to a sterile container for transport and analysis; and

.2 at least three subsamples should be analysed for colony-forming units of the bacteria listed in regulation D-2."]

62 It should be noted that some concerns were raised regarding the practicality of paragraph. 2.3.32.2 as there may be a need to concentrate the treated water sample for enumeration due to the fact that the counted number of organisms should be over 100 in accordance with paragraph 2.3.32.3. The correspondence group did not have time to further discuss this point.

63 The group agreed to delete paragraphs 2.3.35 and 2.3.37 of Part 2 to the annex of Guidelines (G8).

64 When considering Part 2 of the annex of Guidelines (G8) and the section on "Land-based test design – inlet and outlet criteria" the following text was found to accurately express the opinion of the group and was agreed for inclusion under this heading within the revised Guidelines (G8):

"2.3.17*bis* Test water should be natural waters. Any augmentation of test water with dissolved organic carbon (DOC), particulate organic carbon or total suspended solids to achieve the minimum required content must be validated to not adversely affect the ability of the test to evaluate the potential effect of natural waters on BWMS performance and the production of disinfection by-products (DBPs). DOC constituents in natural waters are complex and primarily of aromatic character. The type of added DOC is particularly critical, and non-aromatic simple compounds such as glucose, sucrose, or sodium citrate used alone for augmentation do not have relevant properties as compared to natural DOC."

65 It was noted that it is important to examine what kind of precursor is involved in the process of DBP production and TRO consumption and that it may be pertinent to gather further information on this topic. As this is an issue that impacts on BWMS that make use of Active Substances, it was proposed that this should also be reviewed by the GESAMP-BWWG in order to ensure compatibility between Guidelines (G8) and Procedure (G9).

Item 18 – Technical and biological testing

66 After discussion and clarification to determine what was meant by the terms "technical tests" and "biological test", the group did not consider it would be appropriate to split the tests. Based upon this decision, no further work is required on this subject.

Item 19 – Environmental tests

67 The group agreed to include a reference to IACS UR E10 within Part 3 of the annex to Guidelines (G8). Paragraph 3.3 will therefore be replaced with:

> "3.3 Equipment is to be tested in accordance with IACS UR E10, Rev.6, October 2014 – Test Specification for Type Approval."

68 In addition, paragraphs 3.4 to 3.15 of the annex of Guidelines (G8) will be deleted. It was agreed that paragraph 3.13*bis* should be retained within the revision of Guidelines (G8).

Item 20 – Chapter 7 – Installation requirements

69 The group concluded that this item required further consideration, specifically as to whether the Guidelines (G8) should end with type approval and whether separate guidance was required on installation.

Item 21 – Chapter 8 – Installation survey and commissioning procedures

70 Although a number of respondents concluded that Guidelines (G8) should end once type approval had been addressed, the following proposed replacement for paragraph 8.1 was received for consideration:

> "8.1 Verify that the following documentation is on board in a suitable format:
>
> .1 a copy of the Type Approval Certificate of BWMS;
>
> .2 a statement from the Administration, or from a laboratory authorized by the Administration, to confirm that the electrical and electronic components of the BWMS have been type-tested in accordance with the specifications for environmental testing contained in Part 3 of the annex;
>
> .3 equipment manuals for major components of the BWMS;
>
> .4 an operations and technical manual for the approved by the Administration, referred to in paragraph 5.1.3;
>
> .5 BWM plan specific to the ship and approved by the Administration;
>
> .6 installation specifications;
>
> .7 installation commissioning procedures; and
>
> .8 initial calibration procedures."

71 However, there was insufficient time to consider the proposal during the correspondence group and as a result this proposal was forwarded to the intersessional meeting for consideration.

Item 22 – Items to be referred to the intersessional meeting

72 In summary of the information outlined above, the group, as required under the terms of reference (paragraph 1.2), identified the following items for completion during the intersessional meeting:

.1 develop text to reflect the decision made regarding testing across the 0°C to 40°C temperature range (paragraph 12);

.2 decide the format or process for developing guidance on identifying and validating system design limitations for common BWMS processes (paragraph 14);

.3 consider the information regarding the type approval protocols and consider if and how these should be reflected in the revised Guidelines (G8) (paragraph 32);

.4 further consider the appropriateness of an SDL matrix and determine if this work should be completed during the intersessional meeting or outside of the Guidelines (G8) review. If it is considered suitable, develop the matrix based upon one of the three proposals outlined in annex 1 (paragraph 36);

.5 upon reviewing a clean copy of the revised Guidelines (G8), consider if and where it is appropriate to include text from BWM.2/Circ.43 (paragraph 42);

.6 based upon the work of the correspondence group detailed in paragraphs 43 to 48, continue discussions regarding control and monitoring and develop text for inclusion within Guidelines (G8) to reflect the conclusions drawn (paragraphs 43 to 48);

.7 considering the points raised in paragraph 50, continue the discussion on scaling of BWMS and develop text as appropriate (paragraphs 50 and 51);

.8 based upon the conclusion drawn by the sub-group develop text for inclusion in Guidelines (G8) as outlined in paragraphs 55 to 58 (paragraph 59);

.9 finalize the text proposals in items 16 and 17 concerning sampling provisions and land-based sampling, including considering the practicality of the requirement detailed in the proposed Guidelines (G8), paragraph 2.3.32.2 and amend as required (paragraphs 60 and 61);

.10 consider whether the revised Guidelines (G8) needs to include section 7: Installation requirements and if it is not required consider whether separate guidance on this topic is required (paragraph 69);

.11 consider whether the revised Guidelines (G8) need to include Chapter 8: Installation survey and commissioning procedures. If it is considered necessary, review the text proposal provided in paragraph 70; if it is not considered necessary determine if alternate guidance is required (paragraph 71); and

.12 consider the position papers submitted by the GESAMP-BWWG (annex 4), as appropriate, when completing tasks 1 to 11.

Conclusions

73 The group held full and robust discussions on a range of topics and was able to conclude a number of items within the terms of reference and to identify those items that need further consideration or finalization during the intersessional meeting that will be held from 17 to 21 October 2016*, as agreed by MEPC 69 and endorsed by C 116.

74 The intersessional meeting is invited to consider the items identified in paragraph 72.

Action requested of the Committee

75 The Committee is invited to:

.1 agree to the proposed amendments and conclusions of the group for inclusion within Guidelines (G8) taking also into account the outcome of the intersessional meeting of the Working Group on the Review of the Guidelines (G8);

.2 recalling that the submission deadline for non-bulky documents is 11 November 2016, invite submissions to be made to PPR 4 on the methodologies that may be used for the determination of viability of organisms (paragraph 17); and

.3 request the GESAMP-BWWG to review what kind of precursors are involved in the process of DBP production and TRO consumption and considered important during Procedure (G9) assessments in order to ensure compatibility between Guidelines (G8) and Procedure (G9) (paragraph 65).

***

Annex 1: System design limitation matrix

Annex 2: Control and monitoring text proposals

Annex 3: Report of the sub-group on holding time

Annex 4: Position papers submitted by the GESAMP-BWWG on tank holding time and safety aspects

* Refer to Circular Letter No.3665 of 8 July 2016.

ANNEX 1

SYSTEM DESIGN LIMITATION MATRIX

Below are tables showing the potential format of a matrix that could be used to identify the parameters associated with treatment technologies that should be considered as system design limitation factors. The information contained within these tables is not exhaustive and Guidelines (G8) should be amended to reflect the fact that SDL identified by the manufacturer may include, but should not be limited to the parameters identified within the matrix developed for inclusion within Guidelines (G8).

Example 1

Parameter	Treatment type				
	UV	**Chemical**	**Filter**	**Electrolysis**	**Ozonation**
UV transmittance	X				
UV intensity	X				
Dose	X	X	X	X	
Flow rate	X	X	X	X	
Salinity		X		X	
Temperature		X		X	
Oxidant demand		X		X	
Holding time		X		X	
Particle size	X	X	X	X	
Hydrogen generation		X		X	
Chlorine generation		X		X	
MADC		X		X	
Neutralization dose		X		X	
Electric power				X	
Particle composition (individual components should be identified)		X	X	X	

Example 2

Parameter	Treatment type				
	UV	**Chemical**	**Filter**	**Electrolysis**	
Temperature–independent parameters					
UV transmittance	X				
UV intensity	X				
Flow rate	X		X		
Salinity		X			
Temperature		X			
Particle size			X		
(TSS component)	X	X	X	X	
Temperature-dependent parameters					
Dosage		X		X	
Oxidant demand		X		X	
Holding time	X	X		X	
Neutralization dose					
MADC					
Hydrogen generation					
Chlorine generation					

Example 3

	Parameter	Treatment type				
		UV	**Chemical**	**Filter**	**Electrolysis**	**Oxygen deprivation**
Guidelines (G8) Efficacy	UV transmittance	X				
	UV intensity	X				
	Dosage					
	Flow rate	X		X		
	Salinity		X		X	
	Temperature		X		X	
	Oxidant demand		X			X
	Holding time		Z		Z	
	Particle size			X		
	Hydrogen generation		Z		Z	
	Chlorine generation		Z		Z	
Procedure (G9) Environmental Acceptance	Flow rate to ensure MADC		Y		Y	
	Salinity to ensure MADC		Y		Y	
	Temperature to ensure MADC		Y		Y	
	Storage to ensure MADC		Z		Z	
	Hydrogen generation		Z		Z	
	Chlorine generation		Z		Z	
X – SDL which will be verified under Guidelines (G8)						
Y – SDL which will be verified under Procedure (G9)						
Z – SDL which will be verified under Guidelines (G8) and Procedure (G9)						

***

ANNEX 2

CONTROL AND MONITORING TEXT PROPOSALS

Text underlined is taken from document PPR 2/5; text in *italics* has been added.

Option 1 (integrated part of Guidelines (G8) for self-monitoring)

Section from resolution MEPC.174(58): *Guidelines for approval of ballast water management systems* (G8)

[…]

4.12 The monitoring equipment should record the proper functioning or failure of the BWMS and store a minimum number of parameters for detailed evaluation. Administrations should ensure that type approved ballast water management systems have a suitable self-monitoring system that will monitor and record sufficient data to verify correct operation of the system. *The equipment should be able to store a minimum number of self-monitoring parameters following common standards[1]. The equipment should be able to produce (e.g. display, print or export) a report of the applicable self-monitoring parameters for official inspections or maintanance, as required.* In addition, all system indications and alerts should be stored and available for inspection. Storage should follow common standards.

.1 The information and applicable self-monitoring parameters to be recorded for all systems should include, inter alia:

.1 General information for all systems

.2 *BWMS* Operational Parameters: All recorded parameters should be time tagged if applicable.

.3 Method specific information: *The relevant monitoring parameters are* dependent on the basic principle of operation of the BWMS. *Relevant parameters* can be amended if new system categories are developed. More than one *treatment module* may apply to one system. Depending on the system, some parameters may be redundant. In such a case, one measurement can be used for all relevant modules.

.4 System specific additional information: The Administration should require any additional important information to be monitored which due to the particular operation of the system is relevant but not mentioned above. Also, if a system uses a new method of operation, the monitoring information should be determined by the manufacturer and accepted by the Administration under this heading.

.2 System alerts and indications: All systems should have an alert regime. Every alert should be logged and time stamped. To assist the inspections it would be helpful to record an alert summary after each ballast water operation automatically, *if possible.*

.1 General alerts

[1] *Associated guidance for a template on technical details of the monitoring parameters and record intervals to be developed by the Organization.*

.2 Operational alerts: Whenever a *relevant parameter* exceeds the acceptable range approved by the administration, the system should give an alert. In addition, an alert should be logged and time stamped also when a combination of relevant parameters exceeds system specifications, even if each single parameter does not exceed its approved range. If a safety relevant parameter (safety for crew, cargo and/or the ship) related to the BWMS exceeds approved limits, an alert should be mandatory (e.g. hydrogen level at appropriate measurement point(s)).

.3 The Administration may require additional alerts depending on the design of the system and for future developments.

4.13 To facilitate compliance with regulation B-2, the control equipment should also be able to store data for at least 24 months. In the event the control equipment is replaced, means should be provided to ensure the data recorded prior to replacement remains available on board for 24 months.

4.13bis The monitoring equipment should automatically record the proper functioning or failure of a BWMS without user interaction and add a time stamp to every entry. Additionally, the system should have a tool to produce summary files for each ballast water operation on demand to support inspections work.

The system should store the required data in an acceptable format to be able to display, print or to export the data for official inspections. An acceptable format could be:

.1 an internationally standardized readable format (e.g. text format, pdf, MS Excel); or
.2 for automatic evaluation the xml–format.

The equipment should be so designed that, as far as is practical, it will not be possible to manipulate either the data being stored by the system or the data which has already been recorded. Any attempt to interfere with the integrity of the data should be recorded. Permanent deletion of recordings should not be possible. The system should be capable of storing recorded data for at least 24 months to facilitate compliance with regulation B-2. Where navigation equipment is connected to the monitoring system to provide data for recording, the interfaces should comply with applicable parts of IEC 61162.

~~4.14 It is recommended that simple means be provided aboard ship to check on drift by measuring devices that are part of the control equipment, repeatability of the control equipment devices, and the ability to re-zero the control equipment meters.~~

4.14*bis* For BWMS that could emit dangerous gases, a means of gas detection by redundant safety systems is to be fitted in the space of the BWMS, and an audible and visual alarm is to be activated at a local area and at a manned BWMS control station in case of leakage. The gas detection device is to be designed and tested in accordance with IEC 60079-29-1, or other recognized standards acceptable to the Administration. Monitoring measures for dangerous gases with independent shutdown are to be provided on the BWMS.

[…]

Option 2 (self-monitoring outsourced as annex of Guidelines (G8))

Text underlined is taken from document PPR 2/5; text in *italics* has been added.
Section from resolution MEPC.174(58): *Guidelines for approval of ballast water management systems* (G8)

[…]

4 TECHNICAL SPECIFICATIONS

Control and monitoring equipment

4.12 The monitoring equipment should record the proper functioning or failure of the BWMS. Administrations should ensure that type approved ballast water management systems have a suitable self-monitoring system that will monitor and record sufficient data to verify correct operation of the system. *The equipment should be able to produce (e.g. display, print or export) a report of the applicable self-monitoring parameters in accordance with Part 5 of the Annex for official inspections or maintanance, as required.*

4.13 To facilitate compliance with regulation B-2, the control equipment should also be able to store data for at least 24 months. In the event the control equipment is replaced, means should be provided to ensure the data recorded prior to replacement remains available on board for 24 months.

~~4.14 It is recommended that simple means be provided aboard ship to check on drift by measuring devices that are part of the control equipment, repeatability of the control equipment devices, and the ability to re-zero the control equipment meters.~~

4.14bis For BWMS that could emit dangerous gases, a means of gas detection by redundant safety systems is to be fitted in the space of the BWMS, and an audible and visual alarm is to be activated at a local area and at a manned BWMS control station in case of leakage. The gas detection device is to be designed and tested in accordance with IEC 60079-29-1, or other recognized standards acceptable to the Administration. Monitoring measures for dangerous gases with independent shutdown is to be provided on the BWMS.

[…]

Proposed new Part 5 for the annex of Guidelines (G8)

PART 5 – SELF-MONITORING

Introduction

Ballast water management systems should monitor and store a minimum number of parameters for detailed evaluation. In addition, all system indications and alerts should be stored and available for inspection. *Data* storage *and retrieval* should follow common standards. *This Part gives an overview of the minimum required self-monitoring parameters.*

1 MONITORING OF PARAMETERS

The applicable self-monitoring parameters listed below[2] should be recorded for every ballast water management system (BWMS). Any additional parameters that are necessary to ascertain system performance and safety should be determined by the Administration and stored in the system. If a parameter is not applicable due to the particulars of the system, the Administration may waive the requirement to record that parameter. Limiting conditions on the operation of the BWMS should be determined by the manufacturer and approved by the Administration.

1.1 *General* information for all systems

1.1.1 *The information and applicable self-monitoring parameters to be recorded for all systems should include, inter alia:*

- General information: Ship name, IMO number, Ballast water management system manufacturer and type designation, BWMS serial number, Date of BWMS installation on ship, BWMS treatment rated capacity (TRC), Principle of treatment (in-line/in-tank).

- Operational parameters: All recorded parameters should be time tagged if applicable: BWMS operational modes and any transition modes, including bypass operations (e.g. uptake, discharge, warming-up, cleaning and start-up), Ballast water pump in operation (yes/no – if information is available from ship), Flow-rate at system outlet, Indication of the ballast water tank that is involved in the ballast water operation when practicable.

- It is recommended that positional information on ballast water operations and on the holding time should be recorded automatically. Otherwise it should be entered manually in the ballast water record book as appropriate. Administrations are encouraged to apply automatic position information recording to ships which install BWMS during ship's building to the greatest extent possible.

- System alerts and indications. All systems should have an alert regime. Every alert should be logged and time stamped. To assist the inspections it would be helpful to record an alert summary after each ballast water operation automatically, *if possible*.

- General alerts *include:* Shutdown of system while in operation, when maintenance is required, BWMS bypass valve status if installed and if an internal part of the BWMS, status of BWMS valves representing system operational mode as appropriate

[2] *Associated guidance for a template on technical details of the monitoring parameters and record intervals to be developed by the Organization.*

- Operational alerts: Whenever a *relevant* parameter exceeds the acceptable range approved by the Administration, the system should give an alert. In addition, an alert should be logged and time stamped also when a combination of relevant parameters exceeds system specifications, even if each single parameter does not exceed its approved range. If a safety relevant parameter (safety for crew, cargo and/or the ship) related to the BWMS exceeds approved limits, an alert/alarm should be mandatory (e.g. hydrogen level at appropriate measurement point(s)).

- The Administration may require additional alerts depending on the design of the system and for future developments.

2 *DATA* STORAGE AND RETRIEVAL

Storage of data should follow the requirements taking into account paragraphs 4.10 to 4.14 of these Guidelines. The equipment should be able to store a minimum number of self-monitoring parameters following common standards *determined by the Organization.*

2.1 The monitoring equipment should automatically record the proper functioning or failure of a BWMS without user interaction and add a time stamp to every entry. Additionally, the system should have a tool to produce summary files for each ballast water operation on demand to support inspections work.

2.2 The system should store the required data in an acceptable format to be able to display, print or export the data for official inspections. An acceptable format could be:

.1 an internationally standardized readable format (e.g. text format, pdf, MS Excel); or

.2 automatic evaluation the xml–format.

2.3 The equipment should be so designed that, as far as is practical, it will not be possible to manipulate either the data being stored by the system or the data which has already been recorded. Any attempt to interfere with the integrity of the data should be recorded.

2.4 Permanent deletion of recordings should not be possible. The system should be capable of storing recorded data for at least 24 months to facilitate compliance with regulation B-2 of the BWM Convention. Where navigation equipment is connected to the monitoring system to provide data for recording, the interfaces should comply with applicable parts of International Standard IEC 61162.

***

ANNEX 3

REPORT OF THE SUB-GROUP ON HOLDING TIME

1 Leanne Page, Chair of the Correspondence Group on the review of the Guidelines (G8) has initiated a sub-group to discuss holding time on 6 May 2016 and invited participants to join the sub-group by sending an email to the voluntary Chair of the sub-group (Dr. Drillet, DHI Singapore). The terms of reference of the group have been defined as follows:

.1 collate relevant data on the use of holding times as a means of evaluating BWMS performance;

.2 identify test approaches that may be appropriate for evaluating holding time on various aspects of BWMS performance;

.3 determine the appropriate minimum holding times required in order for test facilities to evaluate the impact of the following potential issues:

.1 the regrowth of organisms;

.2 the BWMS's efficacy in meeting the D-2 standard over a range of operational hold times;

.3 the production of disinfection by-products; and

.4 the time required to neutralize active substance (if used);

.4 identify any other issues that may require minimum holding times and determine appropriate holding times; and

.5 provide a report to the correspondence group by 17 June 2016.

2 There were 66 participants asking to be part of the sub-group discussion. The names and contacts of the participants are:

Guillaume Drillet	gdr@dhigroup.com
Jonathan Spremulli	jonathan.spremulli@ics-shipping.org
Ville-Veikko Intovuori	Ville-Veikko.Intovuori@trafi.fi
Praveen Kumar Mishra	pk.mishra@irclass.org
Sabine Reuland	sabine.reuland@bsh.de
Tadayuki Uemura	uemura-t259@mlit.go.jp
Takahiro Kijima	kijima-t24p@mlit.go.jp
Kenji Okimoto	okimoto-k25c@mlit.go.jp
Yuta Nakagami	nakagami-y24j@mlit.go.jp
Hiroki Osawa	oosawa-h53fs@mlit.go.jp
Kazuya Nakao	nakao-k24d@mlit.go.jp
Ranabir Chakravarty	Ranabir_CHAKRAVARTY@mpa.gov.sg
Leanne Page	Leanne.Page@mcga.gov.uk
Geir Høvik Hansen	ghh@sdir.no
Ingrid Sigvaldsen	Ingrid.Sigvaldsen@dnvgl.com
Line Emilie Tvedt Sverdrup	Line.Sverdrup@dnvgl.com
Jad Mouawad	jad.mouawad@bwm.no

Baiqi Zhang	baiqizhang@hotmail.com
Brett Herbert	Brett.Herbert@agriculture.gov.au
Wang Huifang	hfwang@ccs.org.cn
Allison Miller	amiller@trojanmarinex.com
Bailey, Sarah	Sarah.Bailey@dfo-mpo.gc.ca
Daniel Côté	daniel.cote@desgagnes.com
Debbie Murray	dmurray@acpa-ports.net
Derek Walford	Derek.Walford@teekay.com
Donna Spalding	dspalding@clia-nwc.com
Gilles Morel	GillesMorel@canadianfuels.ca
Kirk Jones	Kirk.jones@shipowners.ca
Lanna Hodgson	isac@isacoffice.com
Lilia Khodjet El Khil	Lilia.KhodjetElKhil@cslships.com
Marc Gagnon	MGagnon@fednav.com
Mark Kustermans	mkustermans@trojanuv.com
Mira Hube	mira.hube@algonet.com
Mudroch, Paul	Paul.Mudroch@tc.gc.ca
Nick Leak	KAJJN@shipowners.ca
Robert Lewis-Manning	robert@cosbc.ca
Sergiy Yakovenko	Sergiy.yakovenko@teekay.com
Silvie Dagenais	dagenais@shipowners.ca
Sonia Simard	ssimard@shipfed.ca
Topping, Paul	paul.topping@tc.gc.ca
Wiley, Chris	Chris.Wiley@tc.gc.ca
Henein, Colin	Colin.Henein@tc.gc.ca
Allegra Cangelosi	acangelo@nemw.org
Stephanie Delacroix	stephanie.delacroix@niva.no
Richard A. Everett	Richard.A.Everett@uscg.mil
Peter Sahlen	peter.sahlen@alfawall.com
Charlene Ceresola	cceresola@bio-uv.com
Shinichi Hanayama	jae00127@nifty.com
Sahan Abeysekara	sahan.abeysekara@lr.org
Cato Tjabbes	cato@catomarine.eu
Frank Fuhr	f.fuhr@mea-nl.com
Tjitse Lupgens	tjitse.lupgens@ilent.nl
Marcel Veldhuis	m.veldhuis@mea-nl.com
Yeong-Jong Hwang	yjhwang@krs.co.kr
Gwang Tak Hwang	gthwang2@krs.co.kr
Choi KeunHyung	keunhchoi@cnu.ac.kr
Youngsoo Kim	catenatum@komeri.re.kr
Kyoungsoon Shin	ksshin@kiost.ac.kr
Kitae Rhie	rhiekt@khu.ac.kr
Jihyun Lee	ljh@ktr.or.kr
Jan Linders	jbhj.linders@gmail.com
Annette Dock	info@adalia.se
Cedric D'Souza	Cedric.DSouza@liscr.com
David Pascoe	DPascoe@liscr.com
Kevin J Reynolds	KJREYNOLDS@GLOSTEN.COM
Ingrid deWilde	ingrid.dewilde@evonik.com

3 An excel sheet was prepared as follows and shared among the group members for comments in order to ease the discussion. The participants were also able to use emails as a preferred format. The discussion was opened until 7 June 2016 and a draft final report submitted to the group on 10 June for comments before final submission to the correspondence group on 17 June 2016.

4 Members and delegations expressed their opinions by sharing information and points of view. Globally, the propositions received are consistent. A summary of the positions and discussions is prepared here below.

General comments

5 The sub-group recalled that the terms of reference proposed are intended to find a practicable solution for the improvement of the robustness of the testing Guidelines (G8). The participants have recapped that the Guidelines (G8) testing guidelines have to be taken into the context of the Convention as a whole.

6 The following general principles were identified:

.1 a BWMS should be effective in meeting the D-2 discharge standard on short voyages and long voyages (i.e. short and long intervals between treatment and discharge), regardless of temperature;

.2 ballast water discharged following treatment should be safe for the environment on short voyages and long voyages (i.e. short and long intervals between treatment and discharge), regardless of temperature;

.3 the design of the BWMS should account for the fact that, regardless of the BWMS technology employed, viable organisms remaining after treatment may reproduce in the interval between treatment and discharge;

.4 the correct operation of the BWMS (e.g. dosing) should not depend on a prediction of the interval between treatment and discharge, which is not always known accurately in vessel operations; and

.5 the known interval between treatment and discharge established for type approval testing should not be a factor in the design of the BWMS or in its operation during testing.

7 Guidelines (G8) could include principles along the lines of the above, and request that the Administration provide an explanation of how they have been met through the type approval report.

Holding time proposition

8 An appropriate holding time during testing is crucial to ensure that the organisms in the control tank survive. The survival of organisms in the control tanks is essential to guarantee that the mortality observed in the treated tanks is due to the efficacy of the BWMS and not to natural mortality of organisms in the tanks during the holding time (see references in MEPC 68/2/19, Drillet 2013, MEPC 63/2/16). Three of the active participants of the sub-group proposed that the revised Guidelines (G8) should change from the actual "5 days minimum holding time" to a "minimum holding time of 24 hours". One of the participants doubted that the "5 days minimum holding time" would be changed but did not take any position for or against other propositions. Considering that no other propositions were made to either

change or propose alternative holding times, it can be considered that the group has reached an agreement and that a "minimum holding time of 24 hours" should be included in the revised Guidelines (G8). However, the group agreed that this change should be combined with a proper evaluation of regrowth during the type approval process, taking into account the interaction with temperature.

Regrowth

9 Two of the members of the sub-group explained how regrowth could affect discharge compliance to the D-2 standard and the results from ship-board testing. During real life operations, or ship-board testing, regrowth of organisms may lead to a non-compliance or test failure if the sediments have not been removed prior to the installation of the BWMS, if accumulation of sediments in the ballast water tanks have been taking place over time, if the BWMS is not used at each ballasting event, and if untreated water enters the tanks because of leaky valves, bypasses, etc. It was noted that regrowth can sometimes occur even if the ballast water treatment at intake has worked properly. However, even without contamination, regrowth can occur when viable organisms remain after treatment (as permitted by the D-2 standard) and this regrowth may be temperature-dependent.

10 While answering the points of the terms of reference given by the correspondence group, the members of the sub-group have identified that the evaluation of the regrowth of organisms is not practicable for all groups/species during land-based and ship-board testing. Experiences from years of testing across different environments, and in different countries have revealed for example that bacteria regrowth may be occasionally important while phytoplankton regrowth in the tanks is inexistent because of the lack of light; larger organisms and zooplankton regrowth in the tanks is often driven by one main order of copepods (Harpacticoids) and may take long periods before possible detection. Temperature being an important factor affecting the growth/development of organisms, it is expected that there is not a single method and experimental time to evaluate regrowth.

11 Therefore, the design of the BWMS should account for the fact that, regardless of the BWMS technology employed, viable organisms remaining after treatment may reproduce in the interval between treatment and discharge. Methodologies to ensure that regrowth is taken into account as part of a ballast water management plan may include (but are not limited to) the treatment at discharge, the continuous release of chemical agents in the ballast water tanks, etc. The group considers that Guidelines (G8) should not refer to specific technologies and re-treatment methodologies as it would become prescriptive. The technology developers have the responsibility for that their systems ensure that the D-2 standard is met at discharge.

12 The participants of the sub-group also proposed different approaches and methodologies which may be used to evaluate regrowth. For small organisms such as bacteria and phytoplankton cells, regrowth may be evaluated using standard methods such as MPN, plate counts, etc., and/or modelling approaches for organisms for which regrowth evaluation using experimental work may be difficult or impossible. The sub-group agreed that the methodology used to evaluate regrowth should be adequate and adapted to the biological requirements of the species tested. The methodology should also be taking temperature into account. The group supported that the methodology used by the test facilities should be shared with the Administration and referred to in the type approval report.

Time for efficacy, DBPs production and neutralization

13 The sub-group agreed that BWMS developers should have a claim on the minimum holding time required to treat efficiently the water at all temperatures. One of the participants proposed that the time necessary to ensure an efficient treatment should be referred as the

"retention time" and proposed that specifications on how to evaluate "retention time" during scaling should be described. The "retention time" should take into account the interaction with temperature. This was supported by a few members of the sub-group. The claim on the minimum holding time required to treat efficiently the water at all temperatures ("the retention time") should be used for the design of the testing plan. This also supports that the holding time should be 24 hours or more. The sub-group agreed that this should be reported on the Type Approval Certificate. It was also noted that the terminology used in Guidelines (G8) and Procedure (G9) has been inconsistent over time; for instance, the "holding time" as referred to in some existing Basic and Final Approval from the GESAMP-BWWG is now referred to as the storage time by GESAMP-BWWG. It may be a good idea to clearly define these terminologies (past and present) in the report from the correspondence group.

14 Recalling that the participants of the sub-group agreed on that BWMS should ensure that the D-2 standards are met at discharge, the time for efficacy should be considered as part of the testing plans for a BWMS (minimum holding time) and neutralization should ensure that the ballast water discharged following treatment is safe for the environment.

15 The GESAMP-BWWG indicated its concern on the case, in which the minimum tank holding time to ensure D-2 standard is shorter than the storage time to ensure Maximum Allowable Discharge Concentration, evaluated by the Procedure (G9). The sub-group recommended that treated ballast water should not be discharged until the minimum "storage period". In this case, the longer "storage period" should be shown on the top page of the Type Approval Certificate, rather than the minimum tank holding time identified during Guidelines (G8) testing.

16 Agreeing on that the decay of substances depends on the presence of a combination of Active Substances, DOC concentrations and type/reactivity, and other water quality parameters such as temperature, the sub-group agreed that repeatable test covering realistic worst-case scenarios may very challenging for test facilities. The sub-group supported that the evaluation of DBPs and their associated risks were to be covered by Procedure (G9) and the GESAMP-BWWG protocols such as described in their position paper attached as well as in future communication from the GESAMP-BWWG.

References

a. Drillet et al. (2013), Effects of temperature on type approval testing of ballast water treatment systems. Integrated Environmental Assessment and Management 9:192-195.

b. MEPC 63/2/16, Proposed amendment to the *Guidelines for approval of ballast water management systems* (G8).

c. MEPC 68/2/19, Comments on document MEPC 68/2/8 with regard to five-day holding time.

d. MEPC 69/4/3, Seventh Stocktaking Workshop on the activity of the GESAMP-Ballast Water Working Group.

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ANNEX 4

POSITION PAPERS SUBMITTED BY THE GESAMP BWWG ON TANK HOLDING TIME AND SAFETY ASPECTS

Position paper 1 from the GESAMP-BWWG on tank holding time to the correspondence group

1 INTRODUCTION

1.1 Establishing the worst-case concentrations of Relevant Chemicals in discharged ballast water is a fundamental process for the appropriate evaluation according to Procedure (G9). In general, the concentrations of Relevant Chemicals (RCs) will increase during the voyage time, in which treated ballast water will be held in a ballast water tank (hereafter tank holding time or THT).

1.2 However, there are no quantitative requirements on the minimum tank holding time either in Procedure (G9) or the Methodology for information gathering and conduct of work of the GESAMP-BWWG (the Methodology). The Group has accepted five days' tank holding time, which is required in paragraph 2.3.2.2 of the annex of Guidelines (G8), since all applicants do measure the concentrations in the treated or discharged ballast water that has been prepared in accordance with the Guidelines (G8) both for Basic Approval and Final Approval.

1.3 During the discussion on the review of Guidelines (G8), MEPC 69 and the Correspondence Group on the review of Guidelines (G8) (the CG) discussed whether the five days' tank holding time required in Guidelines (G8) could be variable. On the other hand, MEPC 69 also decided to recommend maintaining the five-day period for the purpose of Procedure (G9), even if five days' tank holding is shortened. To avoid confusion, in this document the term "tank holding time" is referring to Guidelines (G8), whilst the term "storage period[1]" is referring to Procedure (G9).

1.4 As it is not practical to request applicants to prepare another set of test waters only for the purpose of testing in accordance with Procedure (G9), one part of the treated ballast water that has been prepared for the revised Guidelines (G8) will have to be kept separately in a different tank. For reasons of consistency in relation to any future applications that will have to comply with the revised Guidelines (G8), the Group will have to provide new recommendations on how the applicant should implement the five-day storage period.

1.5 The GESAMP-BWWG submitted to MEPC 69 the report of its seventh Stocktaking Workshop (STW 7) (document MEPC 69/4/3), together with the future testing arrangement for Basic and Final Approval with five days' storage time, (attached as appendix 1 of this position paper). MEPC 69 endorsed the recommendations by the Group regarding testing arrangements, in conjunction with the anticipated amendments to tank holding time requirements under Guidelines (G8), in general.

1.6 However, there were several concerns raised among the members, such as follows:

.1 using five days' storage period would not lead to the worst-case concentration of RCs, such that in some cases, more time will be needed to achieve the worst-case (maximum) concentrations;

[1] If the CG agrees, the term "storage period" may be changed to "retention time", which is proposed to the sub-group for THT.

.2 moreover, other parameters will affect the production of RCs, particularly the specifications of DOC will change the production rate of RCs significantly;

.3 for Basic Approval, only one sample at day five may be sufficient for establishing the indicative worst-case concentration of RCs, if the Group indicates unified additives for DOCs;

.4 one additional sampling time will require an additional amount of 18 tests that will cost one million euros. Therefore, it costs too much;

.5 an appropriate simulation model may be used instead of the actual monitoring; and

.6 several requests to correct the schematic flow in the appendix.

1.7 Several of these points have been already discussed during STW 7, but were not reported back to MEPC. Therefore, in this position paper, the Group would like to respond to the concerns raised, and to clarify the current position of the Group on THT and "storage time" from a technical viewpoint.

[1.8 Before starting the discussion on "storage time", the GESAMP-BWWG would like to express its position of THT under Guidelines (G8). It is not our task to recommend a THT from the viewpoint of biological efficacy. It is true that initial efficacy on the aquatic organisms will be determined by the Active Substance dose. And remained Active Substance may prevent regrowth; however, the efficacy would also be accelerated by physical damage during filtering and/or by the turbulence occurred by pumps used in the BWMS.]

1.9 However, the GESAMP-BWWG would like to stress that when it recommends a minimum "storage period" according to Procedure (G9), which is longer than the minimum THT required for Guidelines (G8) efficacy, the GESAMP-BWWG strongly recommends that the ballast water should not be discharged until the minimum "storage period" under Procedure (G9) has passed. For example, some applicants try to accelerate the degradation rate of Active Substances using enzymes. In such a case the GESAMP-BWWG may establish a minimum "storage period" according to Procedure (G9), taking into account a safety margin under extreme low temperatures. Consequently, it is quite probable that a longer "storage period" according to Procedure (G9) will be required as compared to the THT required under Guidelines (G8). In this case, to ensure the environmental acceptability, longer "storage period" should be shown on the top page of Type Approval Certificate, rather than the minimum THT identified during Guidelines (G8) testing.

2 THE CURRENT MANNER OF ESTABLISHING THE WORST-CASE CONCENTRATION OF RELEVANT CHEMICALS

2.1 Requirements in Procedure (G9) and the Methodology of establishing the worst-case concentration of RCs

2.1.1 Procedure (G9) does not state any required conditions on test water or tank holding conditions to establish the worst-case concentration of RCs. Procedure (G9) only requests to perform quantitative assessment both on "Ship and personnel safety" in 6.3.3 and "Environmental protection" in 6.4.2.

2.1.2 Revision 2 of the Methodology requests the performance of an RCR Assessment for human exposure and also requests the performance of a PEC/PNEC ratio assessment for environmental acceptability. Both assessments should be performed on all the Relevant Chemicals identified by the Group.

2.1.3 Particularly for the PEC of RCs, paragraph 6.3.1.1 states that "Based on measured data of Relevant Chemicals, the worst-case concentration at discharge should be established".

2.1.4 In accordance with these recommendations, almost all applicants have performed chemical analyses at multiple timings, including five days, together with Guidelines (G8) efficacy tests.

2.2 The current sampling conditions and timings

2.2.1 To establish the worst-case concentration of RCs, almost all applicants perform sampling and chemical analysis under multiple timings and conditions as shown in Table 2-1 below. In total 12 cases of chemical analyses are required. Some applicants have omitted some cases. However, in general, the GESAMP-BWWG has accepted such omissions without explanation.

Table 2-1: The test waters needed for RCs' identification in conjunction with the current Guidelines (G8)

Parameter name	Requirements in Guidelines (G8) and Procedure (G9)'s methodology
Test water type(3)	seawater, brackish and fresh water
Sample timing (2)	24 and/or 48 hours, 120 hours
Treatment (2)	Prior to and after neutralization process
Temperature (1)	Not specified

The number in the brackets shows minimum cases in each parameter.

2.2.2 For the three water types among the test water types, not only salinity but also requirements on POC, DOC and TSS can be significantly different among the three water types. Therefore, the GESAMP-BWWG considered that it is necessary to perform the RCs identification on all three water types.

Table 2-2: Guidelines (G8) test water conditions for three water types

	Seawater	**Brackish water**	**Fresh water**
Salinity	> 32 PSU	3-32 PSU	< 3 PSU
Dissolved Organic Carbon (DOC)	> 1 mg/L	> 5 mg/L	> 5 mg/L
Particulate Organic Carbon (POC)	> 1 mg/L	> 5 mg/L	> 5 mg/L
Total Suspended Solids (TSS)	> 1 mg/L	> 50 mg/L	> 50 mg/L

Guidelines (G8) require testing in two water types (more than 10 PSU apart). However, MEPC encourages to perform Guidelines (G8) testing in all three water types.

2.2.3 With respect to multiple sample timing, the group considered that the total amount of RCs produced after sufficient tank holding time is not time duration-dependent, but is mainly linked to the Active Substance dose and specification of DOC. Therefore, if the tank holding time is limited to five days, RC concentration, which is not yet saturated, could be affected by temperature. However, no such scientific background with kinetics to give a clear answer for quantitative analysis was provided in past applications. In other words, five days is purely coming from the practicability of the tests performed for biological efficacy. The last timing for the sampling at five days may refer to Guidelines (G8) requirements[2] and the sampling timing at one day or two days may refer to the timing for acute ecotoxicity testing recommended in paragraph 6.2.3.2 of the Methodology.

2.2.4 After the discussion at STW 6, the group concluded that the concentrations of most RCs are still increasing in treated ballast water after five days tank holding time (refer to MEPC 68/2/8). On the other hand, some chemicals such as bromate and bromochloroacetic acid reach the worst-case concentrations earlier than after five days. Therefore, the GESAMP-BWWG considered that multiple sampling timings, including five days, will be needed. A summary is shown in Table 2-3.

Table 2-3: Relative changes (%) in concentrations of main Relevant Chemicals in treated ballast waters with time. Mean values are obtained from 10 chemical data sets provided by applicants in non-confidential applications. The number of values is given by n (refer to MEPC 68/2/8).

Substance	Day 0 (%)	Day 1	N	Day 2	N	Day 5	N
Bromate ion	100%	254%	7	119%	4	131%	9
Bromoacetonitrile	100%	333%	4	114%	2	336%	6
Bromochloroacetic acid	100%	349%	6	163%	5	180%	8
Bromochloroacetonitrile	100%	219%	3		0	148%	3
Bromodichloroacetic acid	100%	66%	1		0	11%	1
Bromodichloroacetonitrile	100%	283%	1		0	1%	1
Chlorate	100%	102%	3	98%	3	100%	3
Chlorodibromoacetic acid	100%	141%	1		0	148%	1
Dibromoacetic acid	100%	305%	7	291%	4	332%	9
Dibromoacetonitrile	100%	90%	5	124%	2	91%	7
Dibromochloroacetic acid	100%	156%	5	127%	4	108%	7
Dibromochloromethane	100%	197%	8	701%	5	408%	10
Dichloroacetic acid	100%	158%	3	180%	2	201%	4
Dichloroacetonitrile	100%	2%	2		0	2%	2
Dichlorobromoacetic acid	100%	93%	3	183%	4	258%	5
Dichlorobromomethane	100%	130%	6	1567%	4	470%	8
Tribromoacetic acid	100%	289%	6	285%	4	373%	8
Tribromoacetonitrile	100%	173%	2		0	269%	2
Tribromomethane (bromoform)	100%	268%	8	250%	5	388%	10
Trichloro(nitro)methane	100%		0	839%	1	462%	1
Trichloroacetic acid	100%	115%	5	166%	3	138%	7
Trichloromethane (chloroform)	100%	69%	3	827%	3	439%	4

Yellow colored column shows the maximum rate among 1, 2 and 5 days tank holding time.
Red coloured substances are listed in the GESAMP-BWWG Database of chemicals most commonly associated with treated ballast water.

[2] Paragraph 2.3.2.2 of Guidelines (G8) state that "A land-based test cycle should include the storage of ballast water for at least 5 days."

2.2.5 With respect to applying a neutralization process, there are two reasons to recommend to analyse the RC concentrations both prior to and after the neutralization. Firstly it should be quantitatively verified whether each individual RC can be neutralized or not. It should be noted that the concentration of some vapourable RCs can decrease in the mixing process with air bubbles, even if the neutralizer hardly reacts with them. Additionally, the GESAMP-BWWG has already observed that several RCs in the µg/l order may partially react with the neutralizer, which had been overdosed significantly against stoichiometric demands of Active Substance in mg/L order. Secondly, the RC concentrations prior to and after the neutralization should be identified in ballast water tanks and in discharged water.

2.2.6 With respect to temperature, there are no requirements either in Guidelines (G8) or Procedure (G9). As the volume of the tank for Guidelines (G8) testing at Final Approval should be more than 200 m^3, the temperature control on test water at Final Approval is impractical. Therefore, the group has accepted the raw concentrations of RCs without any adjustment with regard to temperature, which can vary from 4°C to 30°C. Several applicants have submitted data on the concentrations of RCs under varied conditions both concerning tank holding time and temperature. The data indicates that the variation of concentrations for RCs due to temperature is not clear.

2.3 The selection of worst-case concentration of RCs in ballast water tank and at discharge

2.3.1 Currently, the GESAMP-BWWG selects the highest concentration for each RC among all samples water.

4 CONCLUSIONS

4.1 Definitions

4.1.1 These new terms should be defined in the Methodology:

.1 "Tank holding time," means the total time duration, in which treated ballast water will be held in a simulated ballast water tank, with a purpose to verify biological efficacy under Guidelines (G8).

.2 "[Storage period, retention time]" means the total time duration, in which treated ballast water will be held in a simulated ballast water tank, with the purpose to identify the worst-case concentrations of RCs in treated and discharged ballast water.

4.1.2 To avoid any confusion, the terms are also defined in the revised Guidelines (G8).

4.3 Time duration for the period

4.3.1 The maximum Storage period should be totally five days, including the tank holding time for Guidelines (G8).

4.3.2 For Basic Approval, the applicant should prepare additional treated ballast water in a second tank, together with "the preliminary test" for Guidelines (G8). If the treatment process will be separately performed, then an identical test water and BWMS as "the preliminary test" should be applied.

4.3.3 For Final Approval, theoretically, the same concept of using two different tanks may be applied. However, as the volume of the tank for Procedure (G9) purpose should be smaller than that of the first tank for Guidelines (G8) purpose, it is difficult to perform the post treatment (i.e. neutralization process) using the full-scale BWMS. The GESAMP-BWWG considered that a manual neutralization process may introduce a potential artifact on the concentrations of RCs and residual toxicity. In conclusion, from a pragmatic viewpoint, STW 7 could accept a single sample timing, same as the THT for Guidelines (G8), if the CG and the MEPC decided that the THT for Guidelines (G8) may be flexible.

4.3.4 However, as mentioned above, since the concept of the flexible THT for Guidelines (G8) still has some uncertain points to clarify, the GESAMP-BWWG may change the recommended frameworks for Final Approval at a future stage.

4.3.5 In addition, STW 7 agreed to accept the use of the second tank to keep the treated ballast water with tank holding time of five days. In this case same as Basic Approval application, the treated water should be split to the tank for Guidelines (G8) efficacy test and the second tank to guarantee original treated water is also kept in the second tank. In other words, transferring from the main tank for THT to the second tank for the Procedure (G9) storage period is not recommended.

4.4 Tank construction for the period

4.4.1 The volume of the second ballast water tank should be > 5 m^3. Using an air tight and dark tank is recommended. The proposal for the criterion on surface-area-to-volume ratio of the storage tank was not supported by STW 7.

4.5 Multiple sample timing during the total period

4.5.1 In addition to the sampling and analysis at day five, the applicant should take another test water sample at different timings, such as 24 or 48 hours, to identify the worst-case concentrations of RCs during the period. If the transfer timing is different from 24 and 48 hours, the sampling at the timing just prior to the transfer is recommended, which means totally three samples during the five days period. There is no need for any chemical analysis at 0 hours because there are less possibilities to indicate worst-case concentrations at 0 hours.

4.6 Temperature during the period to maintain

4.6.1 STW 7 discussed whether the recommendation shown below can be applied only for Basic Approval in the future. This option may solve the concerns raised in paragraph 1.6 above.

Option 1

For Basic Approval, the GESAMP-BWWG recommended that the temperature during the period should be maintained > 30°C (but maintain the "storage time").

Option 2

For Basic Approval, the GESAMP-BWWG recommended an additional test with total period of 20 days at > 30°C.

***Note**: For Basic Approval, the applicant can raise the temperature during the total period since treated water has been prepared in the second tank from day 0 (refer to paragraph 4.3.2). For Final Approval it is not practical to control the temperature in the first tank with a full volume of > 200 m^3 required by Guidelines (G8). If the applicant raises the temperature only in the second tank, this may cause a temperature shock.*

4.6.2 However, STW 7 concluded that it is premature to provide a unified recommendation on this aspect in the Methodology and agreed to continue the work on this aspect at a future STW. Therefore, the group would like to ask the CG or the intersessional meeting to note the progress and instruct the GESAMP-BWWG with clear instruction, if needed.

4.7 How the post-treatment should be applied?

4.7.1 If any post-treatment, such as neutralization, will be applied at discharge, then the sample and analysis should be performed both at prior to and after the treatment.

4.7.2 For Basic Approval, any post-treatment prior to discharge should be performed by a small scale BWMS used for the treatment.

4.7.3 For Final Approval, as STW 7 could accept a single sample timing, same as the THT for Guidelines (G8) (refer to paragraph 4.3.3), any post-treatment prior to discharge should be performed by the full-scale BWMS used for Guidelines (G8) biological efficacy test.

4.7.4 When using the second tank to conduct storage for five days, STW 7 identified the impracticability in applying the neutralization process by using full scale BWMS. In this case, STW 7 concluded to accept the RC identification on the sample water without neutralization, since almost all RCs will not react with the neutralizer used in the BWMS, therefore the concentrations in the non-neutralized water may be identified as worst-case (refer to paragraph 2.2.4).

4.8 Total cases for RCs identification

4.8.1 Total cases of test water required for RCs identification during Basic Approval is shown in Table 4-1; there are no fundamental changes from the current situation shown in Table 2-1. The only change required for the applicant is to prepare the small volume of the second tank at Basic Approval. For Basic Approval, the GESAMP-BWWG considers the new process will not conflict with the new procedure under the revised Guidelines (G8).

Table 4-1: Test waters needed for RCs identification in conjunction with revised Guidelines (G8) (variable tank holding time) for Basic Approval

Parameter name	Requirement in the Methodology
Test water type(3)	seawater, brackish water and fresh water
Sample timing (2)	24 and/or 48 hours, 120 hours*
Treatment (2)	prior and after neutralization process
Temperature (1)	Not specified

The number in the brackets shows minimum cases in each parameter.

* Sample at 120 hours may be taken from the second tank.

4.8.1 Total cases of test water required for RCs identification during Final Approval is shown in Table 4-2. STW 7 temporarily concluded that the workshop could accept a single sample timing, same as the THT for Guidelines (G8), if the CG and MEPC decided that the THT for Guidelines (G8) may be flexible. However, there are still uncertainties on the manner for flexible THT for Guidelines (G8), such as reproduction of test organisms during THT, the GESAMP-BWWG may change the drafting in the future conjunction with the finalized Guidelines (G8) texts on this aspect.

Table 4-2: Test waters needed for RCs identification in conjunction with revised Guidelines (G8) (variable tank holding time) for Final Approval

Parameter name	Requirement in the Methodology
Test water type (3)	seawater, brackish water and fresh water
Sample timing (1)	[THT designated by the Administration]
Treatment (2)	before and after neutralization process
Temperature	No specific recommendation

The number in the brackets shows minimum sample situations in each parameter.

4.8.2 It should be noted that paragraph 6.3.1.2 in Procedure (G9) states that "Environmental concentrations after discharge of treated ballast water under controlled conditions during development and type approval tests should be estimated and provided in the application dossier for Basic Approval." This paragraph implies that there is no need for a full PEC/PNEC assessment at Final Approval. Also it should be noted that paragraph 8.2.1 in Procedure (G9) it is stated that the results should be conveyed to the Organization for confirmation that the residual toxicity of the discharge conforms to the evaluation undertaken for Basic Approval. Furthermore, the GESAMP-BWWG has already decided its hierarchy in which the results of whole effluent testing (WET) should overrule the PEC/PNEC assessment at Final Approval.

4.8.3 From the view points above, STW 7 discussed the potential omission of test cases at Final Approval, such as:

.1 one of two "sample timings" in the table can be omitted, in accordance with the results at Final Approval;

.2 one of "test water type" in the table can be omitted, in accordance with the results at Basic Approval;

.3 target RCs could be limited only to the substances identified at Basic Approval; and

.4 all these omissions will not be applicable, if the GESAMP-BWWG find out any uncertainties at Basic Approval evaluation.

4.8.4 The GESAMP-BWWG identified the possible omissions in the future; however, it is premature to establish quantitative extrapolation to assume the concentrations at Final Approval from Basic Approval results using small scale BWMS. Therefore, STW 7 decided not to implement such omissions at this timing.

4.8.5 For the total costs for chemical analysis, the list of substances may be limited to 41 substances in appendix 6 of the Methodology and several chemicals may be measured together in only one prepared sample by GC-MS, therefore, the group does not concur with the view raised during the Ballast Water Review Group that it would cost an additional one million euros for each additional sample timing.

4.8.6 Also, in the future, the GESAMP-BWWG may accept the adjusted concentration of RCs only from single sampling times together with the results from a simulation model (as mentioned in paragraph 1.6.5). During STW 6 a potential simulation model was demonstrated to the group (MEPC 68/2/8, paragraphs 19 to 21). Following discussion, STW 6 however concluded at that time that it was too early to start using this simulation model in the same way as MAMPEC is being used, and that more development would be needed to further develop the model.

4.9 The targeting substances list for RCs

4.9.1 At least, the substances listed in appendix 6 in the Methodology should be measured if the BWMS uses electrolysis, ozonation and/or sodium hypochlorite.

4.10 Screening and selection of the worst-case concentration of RCs

4.10.1 A screening process on all the data measured should be performed by the applicant, including assessment on the quality of control water. If the applicant finds any unpredicted results, then the total procedure, including preparation, should be repeated.

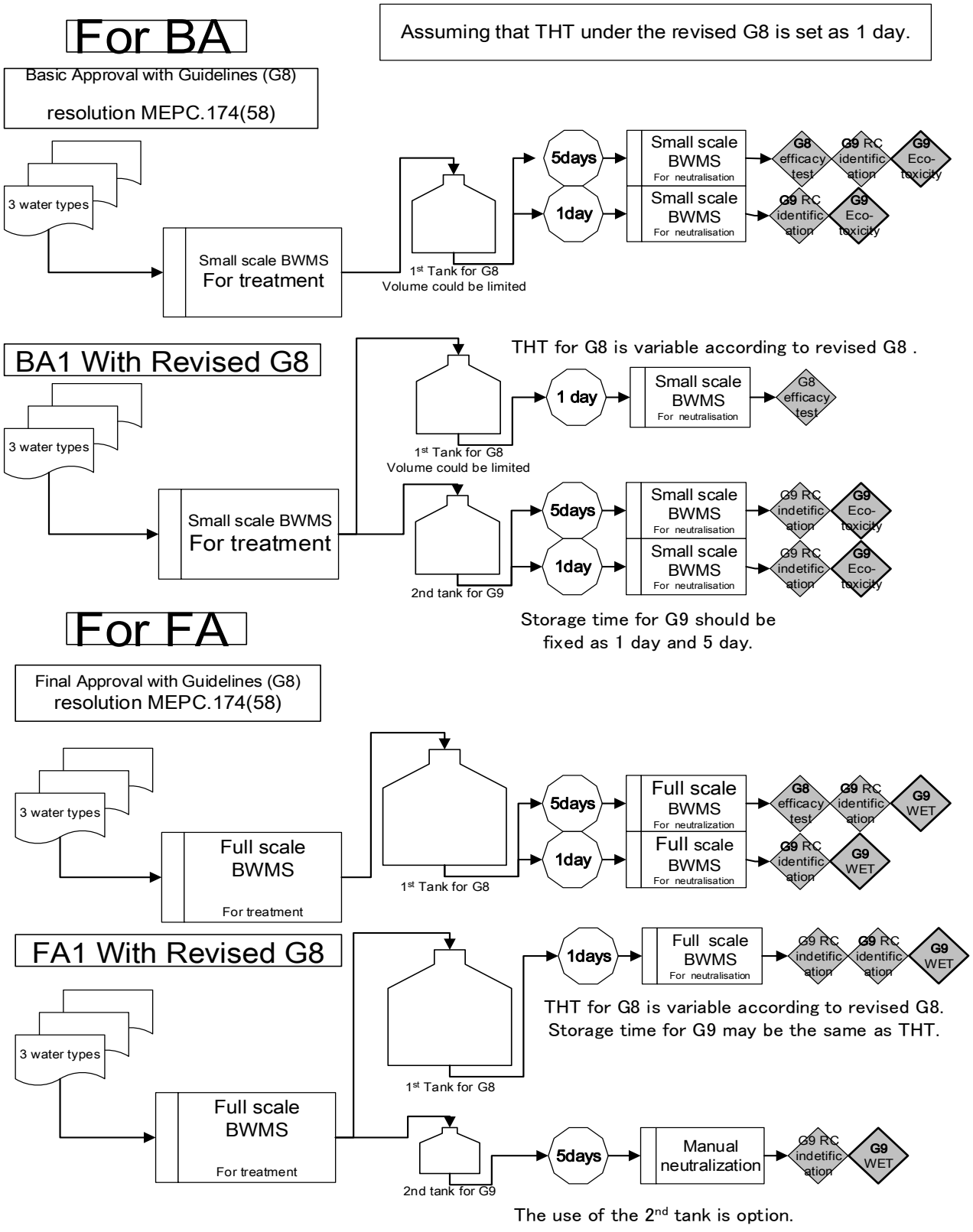
4.10.2 The applicant may propose two worst-case concentrations, one for human health assessment (in a ballast water tank) and the other for environmental risk assessment (in the discharged ballast water), if the applicant can provide scientific background, in which their post treatment procedure, such as aeration, may affect the concentrations in the ballast water tanks.

4.11 The additives for DOC

4.11.1 As reported in document MEPC 69/4/3, although the GESAMP-BWWG identified the effects on the production of RCs by using different specifications of additives for DOC, STW 7 was not able to recommend a standardized DOC additive to be specified in the Methodology, as more research in this area was considered necessary. STW 7 also identified that further assessment will be needed with regard to establishing a suitable level at which to adjust DOC, in comparison with representative natural DOC. Therefore, it was decided to continue this task at a future Stocktaking Workshop in 2017 that will report back to MEPC with a recommended additive for unified applications among test facilities and/or target range of UV absorbance at 254 nm.

APPENDIX 1 TO POSITION PAPER 1

EXAMPLE SCHEMATIC DIAGRAM FOR TANK HOLDING TIMES UNDER GUIDELINES (G8) AND PROCEDURE (G9)



APPENDIX 2 TO POSITION PAPER 1

EXCERPT FROM THE REPORT OF THE SEVENTH STOCKTAKING WORKSHOP ON THE ACTIVITY OF THE GESAMP-BWWG (DOCUMENT MEPC 69/4/3)

Five-day period for Relevant Chemicals determination under Procedure (G9)

14 The Workshop recalled that MEPC 68 had agreed that, for the purpose of Procedure (G9), a five-day storage period for the determination of Relevant Chemicals (RCs) in treated ballast water should be maintained, while the required tank holding time (THT) for the purpose of Guidelines (G8) should be made flexible and this would be further considered in the context of the review of the Guidelines (G8) (MEPC 68/21, paragraph 2.42, and MEPC 68/WP.8, paragraphs 10 and 17). To avoid confusion, in this document the term "tank holding time (THT)" refers to Guidelines (G8), whilst the term "storage period" refers to Procedure (G9). The Workshop considered the scientific background regarding the multiple sampling timings during the storage period, together with recommendations on how applicants could implement this in conjunction with the anticipated revised requirements in Guidelines (G8).

15 In order to establish worst–case concentrations of RCs, most applicants perform sampling and chemical analysis at multiple timings and conditions. In total 12 chemical analyses (combinations of timings and conditions) may be performed, including for example three salinities (seawater, brackish water, fresh water), two sample timings (e.g. 24 and/or 48 hours, 120 hours) and two treatment stages (prior to and after neutralization); the number may increase if more than one temperature is applied, which is however not required.

16 With respect to multiple sample timings, the group has concluded that the concentrations of most RCs are still increasing in treated ballast water even after a 5-day tank holding time or storage period, while some chemicals reach their worst-case concentrations earlier. Therefore, the group is of the position that multiple sampling times, including five days, will be needed. As for neutralization, the group has recommended to analyse the RC concentrations both prior to and after the neutralization process. Furthermore, it should be quantitatively verified whether each individual RC can be neutralized or not. Finally, the group has accepted the raw concentrations of RCs without any adjustment with regard to temperature, which can vary significantly. Data from past applications indicate that the variation of concentrations for RCs in relation to temperature is not clear. For the selection of the worst-case concentrations of RCs, the current practice of the group is to select the highest concentration for each RC amongst all water samples.

17 Following discussion, the Workshop agreed on the following points (see also the explanatory figure in annex 2), noting that new text, which will be developed following the finalization of the review of the Guidelines (G8), should be added to the Methodology for information gathering and conduct of work of the GESAMP-BWWG (hereafter the Methodology) to reflect these points:

.1 the total storage period should be five days, irrespective of any flexible tank holding times used for Guidelines (G8);

.2 for Basic Approval the applicant should prepare additional treated ballast water in a separate tank used for testing under Procedure (G9), together with tests for Guidelines (G8);

.3 for Final Approval the same concept may be applied. However, as the volume of the tank used for testing under Procedure (G9) should be smaller than that for Guidelines (G8) purposes, it may be difficult to perform the

neutralization process using the full scale BWMS. From a pragmatic viewpoint, the group could accept a single sample timing, which would then be the same as the THT under Guidelines (G8). However, since the details of flexible THT for Guidelines (G8) are still under discussion, the group may reconsider this approach for Final Approval at a later stage; and

.4 for both Basic and Final Approval any post-treatment prior to discharge should be verified using the BWMS that is used for the biological efficacy tests under Guidelines (G8).

Five-day period for ecotoxicity and WET tests under Procedure (G9)

20 The ecotoxicity of the discharged ballast water is directly linked to the concentration of RCs in the water. Hence, the storage period for ecotoxicity and whole effluent toxicity (WET) tests is directly related to that required for the chemical analysis of the RCs (paragraphs 14 to 19 above) and some of the main relevant considerations and conclusions of the Workshop are similar and linked to those in paragraphs 16 and 17 above.

21 The Workshop recognized the complex nature of aquatic toxicity, which may be the result of any reaction between AS and various organic matter sources to result in any given RC, and recalled that at Final Approval the group has been giving more weight to the results of WET tests than to the PEC/PNEC assessment, which is based only on the chemical analysis. The Workshop also recognized that, while it is generally expected that higher concentrations of RCs in the discharged water will lead to higher aquatic toxicity, the most adverse ecotoxicological effects may not only result from the highest concentrations but from a combination of different RCs. In comparison with the human risk assessment, where the concentration of RCs before neutralization will also be of interest, for the environmental risk assessment in total six chemical analyses (combinations of timings and conditions) may be performed, as there is no need to test the ballast water prior to neutralization.

22 Based on data from past applications, there is an observed trend of higher aquatic toxicity in discharged ballast water with a storage period of five days, compared for example to day 1 in the algal growth inhibition test. Therefore, the Workshop was of the position that multiple sampling timings, including five days, will also be needed in this context, as was the case with RC identification, see paragraph 16 above. Moreover, the observations on the effects of temperature in that paragraph are also applicable here.

23 After discussion, the Workshop agreed on the following points, noting that new text, which will be developed following the finalization of the review of the Guidelines (G8), should be added to the Methodology to reflect these points:

.1 the numbers and time of sampling for aquatic toxicity tests should be defined based on practicability and test results for the applications for Basic as well as Final Approval;

.2 for Basic Approval, consistent with RC identification, the test water should be sampled at least twice, at day 1 or 2 and at day 5. All the recommendations on sampling for the identification of RCs (paragraph 17) should also be applied to ecotoxicity and WET tests; and

.3 for Final Approval, similarly to RC identification, from a pragmatic point of view, the group may accept that the test water may be sampled only at the end of the THT applied for Guidelines (G8). However, due to potential changes in Guidelines (G8), the group may revisit its position on this issue when the review of Guidelines (G8) is finalized.

Action requested of the Committee

60 The Committee is invited to note the outcome of the Seventh Stocktaking Workshop of the GESAMP-BWWG and in particular to:

.2 endorse the Workshop's recommendations regarding testing arrangements for Basic and Final Approval in conjunction with the anticipated amendments to tank holding time requirements under Guidelines (G8) and note the group's intention to prepare corresponding amendments to the Methodology (BWM.2/Circ.13/Rev.3) for its next revision, which will be carried out following the finalization of the revision of the Guidelines (G8) (paragraphs 17 and 23);

Position paper 2 from the GESAMP-BWWG on risk based or hazard based approach to correspondence group

1 The GESAMP-BWWG noted the last draft of the Guidelines (G8) (reference: Guidelines (G8) – proposed changes in track changes April 2016) (hereafter "New G8") that were presented and discussed at MEPC 69 (and that were sent around to the members of the correspondence group (CG) on Guidelines (G8) on 1 May 2016 by the coordinator Ms. Leanne Page).

2 The GESAMP-BWWG also noted that the hazards mentioned in the current Guidelines (G8) (adopted by resolution MEPC.174(58)) (hereafter "Current G8") are mainly related to electrical equipment (refer to paragraph 4.7 and 4.9 of "Current G8"), and where the environment, ship and public health are concerned, reference is made to the evaluation of BWMS under Procedure (G9) (paragraph 1.6.4 in annex Part 1 of "Current G8").

3 The GESAMP-BWWG also noted that MEPC has adopted the relevant guidance for "hazard identification" as BWM.2/Circ.20 and BWM.2/Circ.43. Particularly, the latter guidance requests the relevant Administration to verify a safety and hazard assessment, which will include at minimum any potential impact on the crew health and safety and references to the classification society safety and hazard rules and recommendation. The GESAMP-BWWG also noted that the classification society issued its rule and recommendation as UR M74.

4 The GESAMP-BWWG further noted that in "New G8" some references are made to hazard analysis in relation to substances, e.g. 4.7 rev and annex paragraph 1.6.4*bis*. Here it is indicated that a hazard identification should be carried out to avoid dangerous situations. The GESAMP-BWWG also considered the section of the correspondence group report on the review of the Guidelines (G8) concerning the unresolved issue of hazard analysis and appropriate control measures.

5 For information, the GESAMP-BWWG currently addresses the potentially hazardous emissions of gases such as hydrogen under its Methodology and carries out detailed appraisals at both Basic and Final Approval stages. The GESAMP-BWWG examines the safety precautions submitted by the applicants in relation to potentially dangerous situations arising from the use of the ballast water treatment system, and will consider the proposed safety measures such as gas detection, and the provision of duplicated alarm mechanisms in the event of LEL's approaching set parameters. In addition to this, the GESAMP-BWWG can also estimate the production rates of such gasses.

6 The GESAMP-BWWG also has experience with the determination of the total residual oxidant (TRO) concentration in relation to the detrimental corrosion of ship structures and fittings. As a result, the GESAMP-BWWG has designated a concentration of TRO < 10 mg/L

as Cl_2 to be the lower limit allowable before full corrosion analysis as per the Methodology is required. The IPPIC and NACE International are involved in corresponding with the GESAMP-BWWG and the setting of corrosion criteria.

7 The GESAMP-BWWG is also experienced in dealing with the production of chlorine (Cl_2) gas, in many cases as the Active Substance, and how it is produced and transported in ballast tanks, where the substance as Cl_2 or as hypochlorite does its disinfection work. In this case, disinfection by-products may be formed and considered as volatile. For all these chemicals, the Methodology of GESAMP-BWWG (Methodology for information gathering and conduct of work of the GESAMP-BWWG, BWM.2/Circ.13/Rev.3) describes in detail how the risk assessment is performed.

8 The Methodology of the GESAMP-BWWG represents a contemporary and detailed risk assessment for the Active Substances and by-products associated with ballast water management systems. This risk assessment applies to the hazardous properties of the chemicals generated by Procedure (G9) systems and is based on a quantitative approach using established scientific criteria.

9 In conclusion, considering the role of the GESAMP-BWWG in the field of hazard and risk assessments, the GESAMP-BWWG would like to have a clarification from the CG on the proposed hazard based approach submitted under the revised Guidelines (G8) and its interrelations with the risk assessments carried out under Procedure (G9). The level of detail required under the proposed Guidelines (G8) amendments should be established so that areas of commonality in the present Procedure (G9) arrangements can be determined. The GESAMP-BWWG is of the opinion that all necessary care should be taken to avoid the establishment of inconsistent or even conflicting approaches with regard to safety of the ship, environment and public health under the revised Guidelines (G8) and Procedure (G9), respectively.