Meeting Report

8th GloBal TestNet Forum

10th to 11th January 2017
The Institute of Marine Engineering, Science and Technology
1, Birdcage Walk
London
SW1H 9JJ
United Kingdom

Contents

Figure 1: GloBal TestNet Members and Observers at 8th Annual GloBal TestNet Forum in London.

Table 1: GloBal TestNet Members Present or Participating by WebEx or Phone

Name	Representing	2016 Committee Members
Gitte Petersen	DHI-DK	2016 Steering Committee
Guillaume Drillet	DHI-Singapopre	2016 Chair
Stephan Gollasch	GoConsult	
Rich Muller	GBF	
Allegra Cangelosi	G S I	
David Wright	ERS	
Tim Fileman	Plymouth Marine Laboratory & PML Applications Ltd	2016 Secretariat
Cato Tjabbes	MEA-NL	
Da Young Song	BTP-MBDC	
Youngsoo Kim	KOMERI	
Sooyeon Lim	KOMERI	
Kyungsoon Shin	KIOST	
Mario Tamburri (via WebEx)	MERC	2016 Steering Committee

Table 2: GloBal TestNet Observers Present or Participating by WebEx or Phone

Name	Representing
Antoine Blonce	IMO GloBallast
Jan Linders (Presentation given on his behalf)	GESAMP-BWWG
Marte Rusten	DNV GL AS
Sahan Abeysekara (via WebEx)	Lloyds Register EMEA

Note: Apologies were sent from Mario Tamburri (Steering Committee), Jan Linders (GESAMP BWWG) and Sahan Abeysekara (Lloyds Register) who could not be present in person but either joined via WebEx or contributed a presentation.

1. Introduction

A total of 17 people representing 12 of the test facilities or individuals that signed the GloBal TestNet MoU in Busan were present or contributed to the meeting via WebEx. Guillaume Drillet (DHI), Chair, opened the meeting with a welcome address to the participants and thanks for their effort in joining the annual meeting. The agenda (Annex 1) was accepted with some slight modifications to adjust for the travelling schedules of the different members and the availability of others on WebEx. As soon as the house keeping rules have been announced, the members present started working.

2. 2016 GloBal TestNet Activities

The members of the GloBal TestNet have been working together for years and have considerably improved their ways of working together. Tim reported that in 2016, the group has met once in Montreal, the Steering Committee met 4 times for long meetings and has had numerous additional communications. The group has voted and agreed on bylaws and is now more than ever ready to increase the amount of work as a team. Guillaume proposed to carry on building on the group's achievements. The 1st communication under the umbrella of GloBal TestNet by one of the member took place in 2016 in Croatia (see Item 4 below) and was well received by other stakeholders. An additional opportunity has been ensured by Tim at the 6th IMarEST conference in London just after this annual meeting and the members agreed to work on the presentation all together (see Annex 2). Similarly, during the discussions about how GloBal TestNet could support other areas other than just ballast water management systems (BWMS) TA testing (see Item 3 below on registration at IMO as NGO), the members could not clearly agree on how the organization should deal with having clear objectives as per its roles in supporting compliance, monitoring and enforcement (CME). There was agreement that the members are well prepared to offer support to administrations in this respect. Finally the group supported the general idea of generating joint communication on matters which the GloBal TestNet can support with experience from its members.

3. GloBal TestNet NGO Status at the IMO

Antoine Blonce (IMO GloBallast) provided an update on the IMO Convention's entry-into-force and the final GloBallast Programme activities before its job is done and it closes. The IMO member states continue to ratify the BWM Convention (New Zealand ratified in early January 2017), and GloBallast is working on closing the project but carrying on the last bits of its objectives in offering training to build capacities in GloBallast member countries (e.g. Jamaica, Croatia). The main objective for GloBallast is to ensure that the efforts made to develop capabilities are not lost. In this respect, there is a strong hope that the GloBal TestNet will carry on working toward its objectives of comparability and reliability of the testing.

GloBal TestNet has voted and agreed on its intention to obtain the status of NGO at the International Maritime Organization to support the work of the IMO and the member states.

Members were introduced to the obligations that GloBal TestNet will have to fulfill to gain this status at IMO (next deadline 31st March 2017). In order to gain NGO status, GloBal TestNet must be officially registered in any country and the HQ address should be permanent. It was proposed that the Secretariat becomes the HQ of the GloBal TestNet if registration of an NGO is simple in the UK. The members agreed that the GloBal TestNet priority is the testing of BWMS and developing into an organization testing other products was premature. Nevertheless, it was proposed that the wording in the registration under the IMO status could allow for future developments of the group into other types of technical support at IMO (e.g. biofouling).

Action: Tim to check for NGO registration in the UK, if found difficult, Guillaume will register an NGO in France or in Singapore. Guillaume and Tim will lead the preparation of the dossier to IMO and circulate it ASAP to the members. (Deadline: 31st March).

4. GloBal TestNet Participation in Meetings

Guillaume shared his experience of presenting on behalf of GloBal TestNet to the First Croatia-GloBallast National Global Industry Alliance (GIA) meeting that will be held in Zagreb, Republic of Croatia, from 14th to 15th November 2016. We have developed a GloBal TestNet presentation which was shared with the meeting (see Annex 2).

Action:

- **Add slide on Observers (not list them) in GloBal TestNet**
- **Add slide on what we committed to in the GloBal TestNet MoU**
- **Add slide on GloBal TestNet activities together (e.g. >50 micron ring test NSBWOP - North Sea Ballast Water Opportunity Project at NIOZ, >10<50 micron work in NSBWOP and at GSI, Meteor Cruise, MPN Group etc.)**
- **Members to send Guillaume details of other joint GloBal TestNet activities**
- **Add slide on who originally requested that GloBal TestNet exists e.g. Class Societies, ICS, GloBallast etc.**
- **Add slide on publication list (also add to website)**
- **Add slide on future tasks for GloBal TestNet**
- **Add slide to describe our continuous process of improvement as scientists (no right or wrong scientific answers)**
- **Add slide on what we are targeting moving forward e.g. new methods, validation – what is sufficient? Etc.**

5. GloBal TestNet Member Publications

It was agreed that the GloBal TestNet and its members represent the best source of knowledge on ballast water management, TA and testing and therefore the members agreed to share the list of their publications for sharing on the GloBal TestNet website. A list of the publications (international peer reviewed journals) can be prepared and do not need to be accessible

directly (copyright issues), additionally reports produced by different members and which can be accessed freely online can also be listed (together with a link to these reports)

It was also discussed whether the GloBal TestNet should be registered under ResearchGate to show its existence as a scientific organization. However it is unknown whether it is possible for individual members to be registered both under the name of their company and under GloBal TestNet.

Action: Guillaume has asked the members to provide a list of publication and Tim will upload this on the website. Tim will check with GloBal TestNet on the possibility for dual registration under two research organizations (Deadline: end of February 2017 for sending updated list of paper + two months for updating the website)

6. Observer Status in GloBal TestNet

During the discussion about the presentation, it was noted that there is a need to clarify the role and the rules applying to the observers. It was agreed to allow observers to be present in the meeting if desired or simply be updated with the activities of the GloBal TestNet. To ensure that the working conditions in meeting are not disturbed, it was proposed that the bylaws should contain some text to ensure that smooth working conditions occur even when observers are present.

Action: Steering committee to propose an amendment to the bylaws and pass this through members for voting.

7. Election of the 2017 Steering Committee and Secretariat

The elections were carried out and a new steering committee was elected. The new steering committee is as follows:

- Guillaume Drillet – Steering Committee Chairman
- Allegra Cangelosi – Steering Committee
- Youngsoo Kim – Steering Committee
- Tim Fileman – Secretariat

8. Technical Discussions:

Revised G8 (see Annex 3)

- The technical discussions were initiated by what was considered the most important topic of the meeting: the revised G8 guidelines. After a summary presentation from Stephan, the group agreed to break down the topics into sub-discussions so we can align on how to understand the guidelines. It was proposed that the GloBal TestNet should be the group setting up the standard and best practices as it is difficult for administrations to know what is globally feasible or not.

  Action: Gitte agreed to prepare a table with the differences between IMO new and old G8 as well as ETV to support the group in capturing this and preparing to adjust testing protocols where necessary. Marte has shared some preliminary documents on this topic. Deadline, end of April 2017

- A question was raised on how to interpret Paragraph 2.4.11 in the proposed revised G8

guidelines (MEPC 70/WP.5 Report of the Intersessional Working Group on the Review of Guidelines (G8); Annex 3). This relates to the environmental acceptability of systems not using active substances but potentially generating changes in water quality and raised a question about UV based systems. Some members explained that there have been studies showing that UV has no serious impact on the water quality and therefore can be ignored but not all UV systems have been tested and therefore there might be some grey areas which need to be clarified.

Action: Cato to find and share documentation on the impacts of UV on water chemical composition and environmental acceptability (deadline February 2017). Marte (DNV-GL Observer) to communicate with GESAMP to get a clarification on the requirements on this matter (February 2017)

- Discussions on the new salinity ranges proposed in the revised G8 guidelines took place. The group doesn't quite understand all the benefits that the changes will bring to improve testing. It was, however, agreed that the "at least 10PSU difference" between adjacent salinity ranges is important and should be kept. It was also agreed that the new freshwater limit of <1SPU is more appropriate than the one in the old G8 (<3PSU). One of the key issues is the impact of salinity on the functioning of systems. For example, electrochlorination systems perform only when salts are present in the water and the new range doesn't necessarily ensure that this is tested. But the group agreed that this could be carried out as part of the System Design Limitation (SDL) which is part of the new G8 guidelines.

- The group discussed the salinity issue in the context of what is believed to be an US ETV issue which expects that the salinity ranges offer a range of contrasting biodiversity and therefore a better testing. Many test facilities are testing in areas where the organisms found in brackish and marine waters are the same. It was agreed that brackish water organisms are expected to be tougher than those from marine water because they are more often challenged by salinity and temperature changes and are often more UV resistant because of their capacity to survive in tidal pools etc. From a biological point of view, the group could not see why the testing at 2 salinities (marine and brackish) was really improving the testing. However, the difference in the DOC levels proposed in the guidelines was something that was considered more important and therefore impacting the challenge to BWMSs. On this basis, the group agreed that testing under the three salinity ranges proposed was acceptable.

  Action: To develop a working group within GloBal TestNet to discuss the impact of salinity on systems and the potential benefit of different communities in testing to generate recommendations. (no deadline agreed upon, Land Based test facilities to get organized).

- On Standard Test Organisms (STOs), Paragraph 2.4.23, the group couldn't understand why STOs should not be considered more robust than naturally occurring organisms. The group did agreed that the more robust the organisms that are to be treated, the better the testing. Gitte mentioned having some data supporting the increased

robustness of *Tetraselmis* as STOs and therefore the group agreed that STOs, when validated for their robustness, may be used to improve testing.

- On land-based testing set-up, test tank internal structures (Paragraph 2.4.13.2), the group expressed serious concerns with the revised G8 and the fact that these will become mandatory. The group believes that for land-based testing, no internal structures should be required in test tanks as they increase the risk of cross-contamination between tests because they make tanks difficult to clean thoroughly. Internal structures in tanks will therefore increase costs because of the need for more thorough cleaning and there is absolutely no evidence that they increase the robustness of testing. On cleaning issues; cleaning tanks with freshwater which are used for freshwater testing is a non-sense unless this is carried out using steam (Allegra has long experience in this). Rich mentioned that if chlorine is used for disinfection of the tanks after testing, then chlorine residual should not be present before carrying out additional testing.
  Action: the group cannot take any action on this particular topic but hope that an IMO member state will raise this question at the IMO.

- On temperature, Paragraph 2.5, the group agreed that testing at all temperatures between 0°C and 40°C cannot be the responsibility of the test facilities because they can only routinely test at local ambient temperatures. It should however, be the responsibility of the BWMS technology developers to ensure that some additional evaluations are carried out with or without the test facilities. It was noted that there was a big difference in testing the effects of temperature on a BWMS and testing the effects of temperature on the treatment efficacy on the biology.

- On holding time and regrowth, there was a general agreement that Paragraph 2.6 can be a bit confusing. The group debated for some time about whether the objective was to evaluate regrowth after discharge but eventually agreed that the discharge standard is the D-2 ballast water performance standard and therefore there are is no regrowth evaluation to perform after discharge. The regrowth should only be considered in tanks. The group agreed that the evaluation of regrowth is possible for bacteria and small organisms and agreed that regrowth is close to impossible to evaluate for some size classes such as zooplankton as there are no clear methods for this. The group also agreed that potentially no testing could ensure that regrowth will never happen in tanks during real ballasting operations.

- The GloBal TestNet group also expressed a concern that Paragraph 2.6 does not explicitly specify what a Flag State is supposed to do if regrowth if reported. Therefore the group agreed that, as mentioned in the first paragraph on regrowth, is it up to the administration to decide.

- The group members who were present during the MEPC Intersessional Working Group on the Review of Guidelines G8 explained the objectives that the correspondence group tried to capture under the paragraphs on regrowth (Paragraphs 2.6.1- 2.6.7). In general

the members present in the group understand and agreed that: 1) systems are to be tested under a minimum holding time that manufacturers are to test for and which will be reported on their Type Approval Certificate; 2) for systems that use only treatment at intake, some water should be stored in conditions similar to test tanks to evaluate regrowth potential over at least 5 days post treatment; 3) for systems that use treatment on intake and discharge and for systems using neutralization on discharge, the holding time of the test water should be at least 5 days in conditions similar to the test tanks. This is in line with the holding time required by GESAMP.

- The group also discussed the implications of Paragraph 2.6 for technology developers who have a Type Approval under the old G8 with 5 days holding time. The group discussed the possibility of using data from tests carried out for less than 5 days holding time and agree that it is reasonable to support a minimum holding time of <1hour for systems that can demonstrate that immediately after treatment, the D-2 Standard is reached (sampling just after the treatment at intake). However, for systems that cannot demonstrate an efficacy down to the D-2 standard immediately after treatment then the systems should be re-tested with a minimum holding time to be reported on the TA Certificate.

- Finally, the group agreed that port state control compliance testing should be carried out using methods that have been used for type approval (i.e. use of MPN regrowth methods for UV systems).
  Action: No action was agreed upon: DNV/LR as observers to provide a point of view of the administrations?

- The group discussed the mention in the revised G8 guidelines that a shipboard test cycle includes the storage of ballast water on the ship during a voyage. We feel that shipboard testing should also include the transfer of BW from tank to tank in port. The group agreed that the guidelines should include the mention "if possible" in the requirements of paragraph 2.3.1.3 and should be interpreted this way to ensure that testing on ship is possible. Being able to test when a ship is in port is necessary to ensure that ship-board can be carried out in a proper way.

- On ship-board testing, the group also agreed that for the purpose of transparency, an invalid test should be clearly reported with a proper explanation of the failure. An unsuccessful test shall never be reported as an invalid test.

Transparency in Testing

- The group discussed the transparency that is necessary to properly reflect the work the GloBal TestNet is carrying out in terms of ensuring comparability. The group agreed that the GloBal TestNet should be the group of experts defining the test standards and, therefore, supporting the administrations to align on an understanding of the testing guidelines to the extent possible. The group agreed to refresh the "Istanbul Paper" with the methodology all the GloBal TestNet organizations including those that have recently

joined GloBal TestNet. It was noted that this paper will be excellent proof that our members are pursuing very similar approaches to testing. This document should be renamed adequately (e.g. "methodology Comparison Charts of the GloBal TestNet Members) and this should be publically available after a member vote.

Action: Guillaume and Tim prepare the document with the new format and Stephan ensures that all members are updating their methodologies. Deadline: 15th of March

V. cholera 01 and 0138 Detection

- A discussion was held on issues to do with performing shipboard microbiological testing. Through a statement to follow, the GloBal TestNet seeks to inform the IMO and the USCG that, until a validated approach is developed, GloBal TestNet members should cease to report results as valid to port state authorities in support of shipboard certification testing from *V. cholera* tests which have not met protocol requirements, like maximum hold time. Port State authorities should also cease to require V. cholera analysis in support of shipboard certification testing. We support the development of a validated and field-appropriate method for *V. cholera* analysis. Global TestNet members will collaborate to demonstrate and compare alternative methods of *V. cholera* evaluation with the colony blot method at land-based facilities and where possible, in the shipboard context. GloBal TestNet members will report the outcomes of their comparisons to the IMO and USCG within 12 months.

  Action: Allegra to come up with a proposition for shipboard testing improvement for V. cholera (deadline: end of January). Guillaume to contact OIE and ask for a list of other important aquatic pathogens that testing could integrated (no deadline)

Augmentation of Test Water

- The group discussed the importance of validating the use of additives to augment test water during land based testing. The used of DOC is of particular importance because it affects the TRO consumption and UV transmittance (UVT). Gitte showed validation results using lignosulfonate and sodium citrate and compared these with ice tea and showed that ice tea exhibited increased TRO consumption compared with natural DOC. The group agreed that there was a great improvement in the sharing of information concerning augmentation of test water compared to previously when, as presented in the Istanbul paper, only a yes or no answer was given for water quality additions. The group also agreed that testing should be challenging but not necessarily reflect rare conditions.

  Action: methodologies to be reflected into the refresh Istanbul paper (Stephan).

Source Water Database

- Allegra presented a possible development for the group in the preparation of a database offering information on validated water quality around the world. There was some discussion on how GloBal TestNet should leverage on these data (e.g. UVT, TSS etc.) to

support other stakeholders and eventually use this information as a source of potential funding. The database was considered as a great opportunity for the GloBal TestNet to increase the impacts it has on other stakeholders and therefore the group agree to support this action if the IP stays within GloBal TestNet.

Action: Allegra check with the funding agency supporting this program whether GloBal TestNet could enjoy the full proprietary right of the data compiled.

Deadline: January 2017

"The Emperor Has No Clothes" Presentation by Mario Tamburri

- Mario presented his recent presentation from BWMTech Miami and London in 2016. The presentation has made quite some "noise" and the GloBal TestNet members were happy to eventually get the full story. The USCG has been seen as a gold standard by many stakeholders though test facilities know its limitations. The challenge seems to be partly related to the fact that the final rule makes direct reference to the ETV protocols which was not intended originally to be part of the legislation as this means that it is fixed and cannot be changed or developed. There are some concerns about how we should interpret the communications coming from the USCG as it seems that their Q&A is not what prevails in cases of misinterpretation (i.e. Regulation and ETV prevails). The members discussed the fact that different contact points in the USCG administration have given different answers to test facilities for similar questions which is worrying. The members of the GloBal TestNet proposed that we should be working faster toward the setting up of standards of good practice.

  Actions: Mario shares SOP on eggs and resting eggs viability assessment, size measurements of cells (DNV to share their IL position, Marte), and methodology for assessing protozoans >50um. (deadline for sharing of info January 2017; discussion and implementation of a common methodology across facilities, June 2017 or on new test plans, whatever comes first). The methodologies will be reflected on the Istanbul paper (Guillaume).

Annex 1: Meeting Final Agenda

Agenda of the GloBal TestNet Annual Meeting 10-11th January 2017

Venue:
IMarEST
1, Birdcage Walk
London SW1H 9JJ
United Kingdom
+44 (0) 20 7382 2600

The meeting room is limited to 24 people and therefore the seat will be offered in priority to the members of the GloBal TestNet, the speakers and then to the observers.

Agenda Day 1 - 10th of January 2017

09:00 – 10:00	**Registration** at the IMarEST main office (London)
10:00 - 10:15	**Welcome Address** **Acceptance** of the agenda – (Modification if necessary) **Housekeeping rules** reminder (IMarEST)
10:15 - 10:30	**Administrative Discussion 1**: Review of 2016' GloBal TestNet Achievements (Tim Fileman confirmed)
10:30 -11:00	**Coffee Break**
11:00 – 12:00	**Administrative Discussion 2**: On accession to IMO NGO status (Antoine Blonce, IMO, IMO confirmed)
12:00 – 13:30	**Lunch**
13:30 – 14:00	**Administrative Discussion 3**: Participation of GloBal TestNet in 2017 meetings (Guillaume Drillet)
14:00 – 14:30	**Administrative Discussion 4**: Any Other administrative or organizational business to be discussed (website, secretariat, communication etc.) (Tim Fileman, confirmed)
14:30 – 15:00	**Election** of new Steering Committee & secretariat (all); observers are not to participate in this portion of the meeting.
15:00 – 15:30	**Coffee break**
15:30 – 16:00	**Scientific Discussion 1**: Review of the Istanbul's internal report on methodologies used across facilities (Need speaker)
16:00 – 17:00	**Scientific Discussion 2**: Harbor water quality data base (Allegra confirmed)
17:00 - XX	Day 1 adjourned **Diner,** restaurant to be found

Agenda Day 2 - 11th of January 2017

09:00 – 10:30	**Scientific Discussion 3**: Impacts of new G8 guidelines on testing (Stephan Gollasch, Confirmed)
10.30 - 11:00	**Coffee break**
11:00 -12:00	**Scientific Discussion 4:** Splashing story, the Emperor has no Clothes - Resting stages and testing (Mario Tamburri via WebEx)
12:00 -13:00	**Scientific Discussion 5:** Bacteria standards and methodologies (Allegra, confirmed)
13:00 – 14:00	**Lunch**
14.00 – 15.00	**Scientific Discussion 6:** Update from GESAMP (Tim Fileman on behalf of Jan Linders)
15.00 – 16.00	**Scientific Discussion 7:** Augmentation in tanks DOC-TRO (Gitte Petersen , confirmed)
16.00 – 16:30	**coffee**
16:30 – 17:00	**Wrapping up and conclusions of the meeting**
17:00	Day 2 adjourned

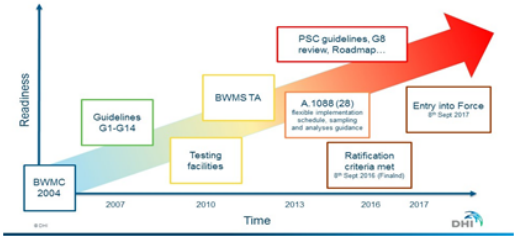
Annex 2: GloBal TestNet presentation given to IMarEST Conference London 12th - 13th January 2017

Developments and Achievements of the GloBal TestNet 2010-2016

London 12-13th January 2017
IMarEST Conference

Guillaume Drillet
Chair of the GloBal TestNet,
www.globaltestnet.org The Global Ballast Water Test Organizations Network

In the light of the BWM Convention…



Adapted from Drillet 2016, IMO-GloBallast R&D Forum, Montreal

Which rules and Guidelines for testing?

- Guidelines for Approval of Ballast Water Management Systems (G8). Res. MEPC.174(58) & MEPC.279(70)
- Procedure for Approval of Ballast Water Management Systems that Make Use of Active Substances (G9). Res. MEPC. 169(57)
- U.S. Coast Guard. Standards for Living Organisms in Ships' Ballast Water Discharged in U.S. Waters. 33 CFR Part 151 and 46 CFR Part 162.
- U.S. Environmental Protection Agency, Environmental Technology Verification Program. Generic Protocol for the Verification of Ballast Water Treatment Technology. EPA/600/R-10/146.

Ensuring that testing is accurate & comparable

- The GloBal TestNet aims to promote comparable and accurate test results on the performance of ballast water management systems for certification, through an open exchange of information, transparency in methodologies and advancing the science of testing
- It initially received a strong support from the GloBallast to ensure that most test facilities around the world sit down at the same table and start sharing experiences

What our members are committed to?

- To participate in annual meetings, build awareness and coordinate with various members cross-training and inter-calibration testing activities
- To discuss methods, analyses, share procedures and protocols used to support certification. To work together toward standardization of test and analytical methods. To share insight and lessons learned from testing
- To assist in vetting or validating new testing methods and analyses
- To encourage diverse input from scientific experts, including those outside the ballast water testing community

Are we late? NO we are not…

- Meeting involving scientists testing BWMS started in 2010 under this umbrella which eventually was shaped into the "GloBal TestNet" through the Busan MoU
- There are 19 Signatories of the Busan MoU (and many observers). All perform some levels of testing of BWTS and they participate in annual meeting to discuss technical challenges

Our Members

- Busan Techno Park
- Cal Maritime Golden Bear Facility
- DavidConsult
- DHI Denmark
- DHI Singapore
- Environmental Research Services
- GoConsult
- Kaiyo Engineering Co. Ltd (FODECO)
- Korea Institute of Ocean Science and Technology (KIOST)
- Korea Marine Equipment Research Institute (KOMERI)
- Laboratory of Aquatic Science Consultant Co.
- Marine Biological Research Institute of Japan, Co., Ltd
- Marine Eco Analytics (MEA-nl)
- Maritime Environmental Resource Center (MERC)
- Norsk institutt for vannforskning (NIVA), Norway
- Northeast-Midwest Institute Great Ships Initiative
- Plymouth Marine Laboratory and PML Applications Ltd
- Royal Netherlands Institute for Sea Research (NIOZ)
- Wageningen Marine Research IMARES

Having a status of observer at the GloBal TestNet

- IMO - GloBallast
- GESAMP-BWWG
- MARAD
- BSH
- NRL
- NSF
- NLP
- Busan Techno Park
- DNV GL AS
- LR
- ICS

Image: Pinterest.com

Cooperation with many stakeholders…

- IMO GloBallast Partnership
- Class Societies
- Shipping representatives
- Administration
- Research funding agencies
- Universities

Working together

- The GloBal TestNet is a voluntary act and signatories of the MoU are financing their meetings alone.
- As for today, there has been 8 international meetings

1st GloBalTestNet meeting 24-25 Jan 2010 in Malmö, Sweden
2nd GloBalTestNet meeting 28-29 Oct 2010 in Singapore
3rd GloBalTestNet meeting 24-25 Oct 2011 in Istanbul, Turkey
4th GloBalTestNet meeting 13 Nov 2012 in Singapore
5th GloBalTestNet meeting 21-22 Oct 2013 in Busan, Republic of Korea
6th GloBalTestNet meeting 9-13 Dec 2014 in Plymouth, UK
7th GloBalTestNet meeting 14-15 Mar 2016 in Montreal, Canada
8th GloBalTestNet meeting 10-11 Jan 2017 in London, UK

Ensuring that testing is comparable



http://www.globaltestnet.org/home

The big challenge is the process which is required to make progresses in terms of harmonization

- It is a time consuming task, it requires building trust
- It is costly
- It is technically challenging because it is global
- There is no right or wrong : it is a group learning process
- It works and progress are made every years !

How do we work together?

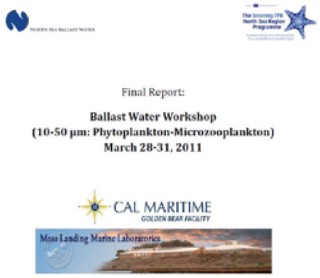
- Self funded annual meetings where members are discussing technical issues. Each member may bring up a topic and propose a "best way" forward, a best methodology. This is discussed and challenged.
- Self funded Ring tests and QA where members benchmark their skills to globally accepted standards (i.e. Bequalm inter-comparision tests (with IOC), ring test from the Marine Institute of Galway (Ireland) for Phytoplankton, the SAHFOS foundation ring test for zooplankton…etc)
- Externally funded arrangements through grants and governmental support

Example of funded workshop

- 3 days workshop at the Minnesota Pollution Control Agency (MPCA), Duluth, USA
- 5 GloBal TestNet members
- and many external participants

Example of funded workshop

- 4 days workshop at the Moss Landing Marine Laboratories, California State University
- 8 GloBal Testnet members
- and many external participants



Example of funded workshop

- 4 days workshop funded by the North Sea Ballast Water Interreg IVB North Sea Region Programme
- 6 GloBal TEstNet members and many external participants

Other examples of workshop and activities

- ETV tech panel meetings
- Independent laboratories testing facility meetings
- Cooperation for validation of methods such as the MPN method…
- Interreg IVB funding for PSC workshop, ecotoxicology

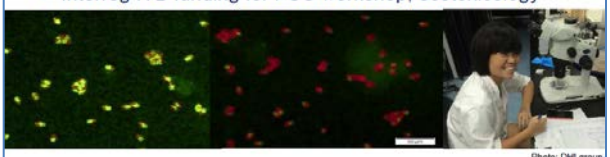


Photo: DHI group

Proposition for additional tests and funding

- Performance evaluation of test facilities, sampling analyses and analyses devices

IMO E

MARINE ENVIRONMENT PROTECTION COMMITTEE 70th session Agenda item 4

MEPC 70/INF.16 9 August 2016 ENGLISH ONLY

HARMFUL AQUATIC ORGANISMS IN BALLAST WATER

Information about a project on building a round-robin facility for performance evaluation of test facilities and sampling and analysis devices

Submitted by Germany

SUMMARY

Executive summary: Representative sampling and validated biological analyses are essential to fulfil the quality criteria needed to provide solid and robust data for type approving ballast water management systems. Germany intends to set up a project named "BAQUA", aiming at creating a round-robin test facility that is independent and can i) verify the ability of test facilities to carry out the tests for type approval to be used for intercalibration exercises, and ii) test the performance of sampling and analysis devices.

Strategic direction: 2

High-level action: 2.0.1

Output: 2.0.1.2

Action to be taken: Paragraph 9

Related documents: BWM.2/Circ.42/Rev.1 and MEPC 69/INF.27

Our members are prolific, they generate scientific information and communicate their findings

- >50 papers out in peer reviewed journals

Environmental Science & technology

Enumerating Sparse Organisms in Ships' Ballast Water: Why Counting to 10 Is Not So Easy

Effects of Temperature on Type Approval Testing of Ballast Water Treatment Systems

A conceptual Port State Control Decision Support System: DHI-PSC.Ballast

81

ScienceDirect

HARMFUL ALGAE

The response of zooplankton and phytoplankton from the North American Great Lakes to filtration

PLOS one

Distribution of an Invasive Aquatic Pathogen (Viral Hemorrhagic Septicemia Virus) in the Great Lakes and Its Relationship to Shipping

Our achievement in 2016 and our tasks in 2017

- Achievements for 2016
  - i. Regular meetings of the steering committee
  - ii. Developments of bylaws
  - iii. Face to face meetings in Montreal (Canada)
  - iv. Improved website
  - v. First ever communication as GloBal TestNet in Croatia (nov 2016)
- Task in the plans for 2017:
  - i. Work on an formalizing further our organization
  - ii. Increasing transparency in processes and sharing of SOPs
  - iii. Generate a comparison between regulations (testing)
  - iv. Generating validation procedures
  - v. Increase information sharing on our website
  - vi. Initiate working plans for water quality data in harbors
  - vii. Communicate on operational implementation of regulations

Our new Steering committee:

- Chair

Guillaume Drillet (DHI Singapore)

- Steering committee members

Allegra Cangelosi (GSI, USA)
Youngsoo Kim (KOMERI, Korea)

- Secretariat

Tim Fileman (PML, UK)

Other benefits and expertise from the GloBal TestNet which others may benefit from:

- We have developed the expertise which is required to test systems according to the best practices available
- We can transfer this expertise into the next phases of ballast water management (CME)
- GloBal TestNet is looking forward to offer more of its expertise as a group of diverse experts from all around the world….

On Behalf of all our members

Thank you

Guillaume Drillet
Chair of the GloBal TestNet
gdr@dhigroup.com

Tim Fileman
GloBal TestNet Secretariat
twf@pml.ac.uk

Annex 3: MEPC 70/WP.5 Report of the Intersessional Working Group on the Review of Guidelines (G8)

INTERNATIONAL MARITIME ORGANIZATION

MARINE ENVIRONMENT PROTECTION COMMITTEE
70th session
Agenda item 4

MEPC 70/WP.5
21 October 2016
Original: ENGLISH

HARMFUL AQUATIC ORGANISMS IN BALLAST WATER

Report of the Intersessional Working Group on the Review of Guidelines (G8)

Introduction

1 The Intersessional Working Group (IWG) on the Review of Guidelines (G8) met from 17 to 21 October 2016, under the chairmanship of Mr. Chris Wiley (Canada).

2 The meeting was attended by delegations from the following Member Governments:

ALGERIA ANGOLA
BAHAMAS BRAZIL
CANADA CHINA
CÔTE D'IVOIRE CYPRUS
DENMARK FINLAND
FRANCE GERMANY
GREECE IRELAND ITALY
JAPAN LIBERIA
MALTA
MARSHALL ISLANDS
NETHERLANDS NORWAY
PALAU PANAMA PERU
PHILIPPINES POLAND
REPUBLIC OF KOREA
SINGAPORE
SOUTH AFRICA SWEDEN
SYRIAN ARAB REPUBLIC THAILAND
TURKEY
UNITED KINGDOM UNITED STATES

by observers from the following non-governmental organizations:

INTERNATIONAL CHAMBER OF SHIPPING (ICS) BIMCO
INTERNATIONAL ASSOCIATION OF CLASSIFICATION SOCIETIES (IACS) EUROPEAN CHEMICAL INDUSTRY COUNCIL (CEFIC)
COMMUNITY OF EUROPEAN SHIPYARDS' ASSOCIATION (CESA)
THE INTERNATIONAL UNION FOR CONSERVATION OF NATURE (IUCN) CRUISE LINES INTERNATIONAL ASSOCIATION (CLIA)
INTERNATIONAL ASSOCIATION OF DRY CARGO SHIPOWNER (INTERCARGO) THE INSTITUTE OF MARINE ENGINEERING, SCIENCE AND TECHNOLOGY (IMarEST)
WORLD SHIPPING COUNCIL (WSC)

and by the Chairman of the GESAMP-BWWG.

Terms of reference

3 The terms of reference for the working group, as agreed by MEPC 69 (MEPC 69/21, paragraph 4.38), were as follows:

.1 continue the review of the *Guidelines for approval of ballast water management systems (G8)*, considering the report of the intersessional correspondence group and any commenting documents submitted to MEPC 70;

.2 consider the application schedule of the revised Guidelines (G8), taking into consideration the Roadmap for the implementation of the BWM Convention; and

.3 submit a report containing the draft revised Guidelines (G8) to MEPC 70, for consideration.

Review of Guidelines (G8)

4 As instructed by the Committee, the IWG continued the review of the *Guidelines for approval of ballast water management systems* (G8) based on the report of the intersessional correspondence group (MEPC 70/4/3, submitted by the United Kingdom) and documents MEPC 70/4/7 and MEPC 70/INF.18 (China) commenting on that report.

5 The IWG commenced its work by considering those items identified in paragraph 72 of the report of the correspondence group that required drafting of new text. As a result, new text to various sections of the Guidelines was drafted and agreed by the IWG.

6 The IWG considered document MEPC 70/4/7 and noted the related document MEPC 70/INF.18. The IWG discussed the proposal in document MEPC 70/4/7 on testing at different temperatures, as an alternative to the range of 0°C to 40°C that had been agreed by the correspondence group. The IWG concluded that the differentials were not significant enough to merit alteration of the already agreed temperature range.

7 The IWG thereafter considered the report of the correspondence group item by item, with a view to resolving any outstanding issues, choosing between provided options, clarifying specific wording and deleting all square brackets.

8 Having considered the issue of scaling of BWMS, and the concerns of some delegations that many models of BWMS had been scaled up from land-based testing, but not verified at full scale during shipboard testing, the IWG revised the section on scaling in the Guidelines (G8) and included a requirement to perform shipboard testing at the upper range of the treatment rated capacity of the BWMS, as appropriate.

9 In this context, the IWG stressed the importance of reviewing the *Guidance on scaling of ballast water management systems* (BWM.2/Circ.33) before entry into force of the BWM Convention and agreed to request the Committee to invite submissions with information on actual experience of tests of scaled up BWMS to MEPC 71, with a view to urgently review the Guidance, if appropriate.

10 Having considered the proposal made in the correspondence group, on the potential need for a matrix on System Design Limitations (SDL), the IWG concluded that it did not have the data, time or expertise to determine the need for such a matrix, let alone finalize and/or choose among the options in annex 1 of the report of the correspondence group.

11 Following discussion, the IWG agreed to request the Committee to instruct PPR 4 to consider annex 1 of the report of the correspondence group (MEPC 70/4/3), to determine if any of the options for an SDL matrix would be useful to be developed into separate guidance, to be used in conjunction with Guidelines (G8).

12 In considering item 12 of the report of the correspondence group, regarding control and monitoring of ballast water, the IWG agreed to option 2 as set out in annex 2 of the report. Consequently, the IWG revised the draft revised Guidelines (G8) in accordance with the text set out in that option.

13 The IWG recognized that certain elements of BWM.2/Circ.43, on *Amendments to the Guidance for Administrations on the type approval process for ballast water management systems in accordance with Guidelines (G8) (BWM.2/Circ.28),* were pertinent in the context of the review of Guidelines (G8). The IWG agreed to include these elements in sections 6 and 7 of Guidelines (G8).

14 When considering item 21 of the report of the correspondence group, regarding section 8 of Guidelines (G8) on installation, survey and commissioning procedures, a proposal was made for a new paragraph 8.2.7 with the intention to verify that:

"the installed BWMS complies with the performance standard described in regulation D-2".

15 In the ensuing discussion, views were expressed that the paragraph, inter alia:

.1 would entail that a compliance test (e.g. indicative or other test as required by the Administration) would be required for each individual BWMS that is installed on board ships;

.2 would provide shipowners with confidence that installed BWMS work as intended and meet the ballast water performance standard described in regulation D-2;

.3 presents several practical difficulties in implementation;

.4 could assist Administrations in verifying compliance with the requirements of the Convention during the survey referred to in regulation E-1.1; and

. 5 highlights that there may be need to review the provisions of survey and certification associated with the BWM Convention.

16 Following extensive discussion, the IWG agreed to request the Committee to advise whether compliance with regulation D-2 of the BWM Convention should be validated in conjunction with commissioning of individual BWMS, and if appropriate, invite submissions on the matter for consideration by MEPC 71.

17 A long discussion was held with regard to the provisions on sampling of ballast water set out in part 2 of the annex of Guidelines (G8). The IWG recognized the concerns of some delegations with regard to how these provisions related to the *Guidelines for port State control under the BWM Convention* (resolution MEPC.252(67)) and the *Guidance on ballast water sampling and analysis for trial use in accordance with the BWM Convention and Guidelines (G2)* (BWM.2/Circ.42/Rev.1).

18 The IWG reiterated and agreed with the view of MEPC 64 that sampling and analysis procedures to be used for enforcement of the BWM Convention should result in no more stringent requirements than what is required for type approval of BWMS.

19 The IWG also noted that more work may be needed on harmonizing related documents, such as BWM.2/Circ.7 on *Interim Survey Guidelines for the purpose of the International Convention for the Control and Management of Ships' Ballast Water and Sediments under the Harmonized System of Survey and Certification* (resolution A.948(23)) with the revised Guidelines (G8). Consequently, the IWG agreed to invite the Committee to review the Interim Survey Guidelines in light of the revised Guidelines (G8).

20 Having completed consideration of the report of the correspondence group, the IWG reviewed a clean copy of the revised Guidelines (G8) line by line, after which it agreed to invite the Committee to adopt the revised Guidelines (G8), as agreed by the IWG and set out in the annex to this document.

21 The IWG recalled that MEPC 68 had supported in principle the view of the correspondence group that the Guidelines (G8) should provide mandatory guidance, but had agreed that the review of the Guidelines (G8) should be finalized before deciding on their possible mandatory status. The IWG reiterated the view that Guidelines (G8) should become a mandatory instrument, and agreed to invite the Committee to decide on the matter.

2 ***Application schedule of the revised Guidelines (G8)***

22 As instructed by the Committee, the Intersessional Working Group considered the application schedule of the revised Guidelines (G8) and unanimously agreed that they should be applied as soon as possible, and that appropriate dates for installations on ships are reflected in the annexed resolution.

23 The application schedule, as agreed by the IWG is described in the draft MEPC resolution for adoption of the revised Guidelines (G8), as set out in the annex. The IWG also agreed to reflect the provisions for non-penalization of early movers in the Roadmap for the implementation of the BWM Convention, agreed by MEPC 68 (MEPC 68/WP.8, annex 2), and MSC.1/Circ.1221 on *Validity of type approval certification for marine products,* in the draft resolution.

Action requested of the Committee

24 The Committee is invited to approve the report in general and in particular to:

.1 adopt the revised *Guidelines for approval of ballast water management systems* (G8) and the associated draft MEPC resolution, set out in the annex (paragraph 20 and annex);

.2 invite submissions to MEPC 71 with information on the experience of Administrations with the scaling of ballast water management systems, with a view to urgently reviewing the *Guidance on scaling of ballast water management systems* (BWM.2/Circ.33), if appropriate (paragraph 9);

.3 instruct PPR 4 to consider annex 1 of the report of the correspondence group (MEPC 70/4/3), to determine if any of the options for a matrix on System Design Limitations would be useful to be developed into separate guidance to be used in conjunction with Guidelines (G8) (paragraphs 10 and 11);

.4 advise whether compliance with regulation D-2 of the BWM Convention should be validated in conjunction with commissioning of individual BWMS, and, if appropriate, invite submissions on the matter for consideration at MEPC 71 (paragraphs 15 and 16);

5 initiate a review of the *Interim Survey Guidelines for the purpose of the International Convention for the Control and Management of Ships' Ballast Water and Sediments under the Harmonized System of Survey and Certification* (resolution A.948(23)) in light of the revised Guidelines (G8) (paragraph 19); and

.6 decide on the possible mandatory status of Guidelines (G8) (paragraph 21).

***

ANNEX RESOLUTION MEPC.[…(…)]

Adopted on […]

GUIDELINES FOR APPROVAL OF BALLAST WATER MANAGEMENT SYSTEMS (G8)

THE MARINE ENVIRONMENT PROTECTION COMMITTEE,

RECALLING Article 38(a) of the Convention on the International Maritime Organization concerning the functions of the Marine Environment Protection Committee conferred upon it by the international conventions for the prevention and control of marine pollution from ships,

RECALLING ALSO that the International Conference on Ballast Water Management for Ships held in February 2004 adopted the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004 (the Ballast Water Management Convention) together with four conference resolutions,

NOTING that regulation D-3 of the annex to the Ballast Water Management Convention provides that ballast water management systems used to comply with this Convention must be approved by the Administration, taking into account the Guidelines developed by the Organization,

NOTING ALSO resolution MEPC.125(53) by which the Committee adopted the *Guidelines for approval of ballast water management systems* (G8), and resolution MEPC.174(58), by which the Committee adopted a revision to the Guidelines (G8),

NOTING FURTHER that, by resolution MEPC.174(58), the Committee resolved to keep Guidelines (G8) under review in the light of experience gained,

RECALLING the provisions for non-penalization of early movers in the *Roadmap for the implementation of the BWM Convention* agreed at its sixty-eighth session (MEPC 68/WP.8, annex 2),

NOTING MSC.1/Circ.1221 on *Validity of type approval certification for marine products*, stating that the Type Approval Certificate itself has no influence on the operational validity of existing ballast water management systems accepted and installed on board a ship and which were manufactured during the period of validity of the relevant Type Approval Certificate, meaning that the system need not be renewed or replaced due to expiration of such Type Approval Certificate,

HAVING CONSIDERED, at its seventieth session, the outcome of the Intersessional Working Group on the Review of Guidelines (G8) (17 to 21 October 2016),

1 ADOPTS the revised *Guidelines for approval of ballast water management systems* (G8), as set out in the annex to this resolution,

2 AGREES to keep the revised Guidelines (G8) under review in the light of experience gained with their application,

3 ENCOURAGES the application of the revised Guidelines (G8) from the date of their adoption,

4 SUGGESTS that Administrations no longer approve BWMS taking into account the previous *Guidelines for approval of ballast water management systems* (G8) (resolution MEPC.174(58)) after 28 October 2018,

5 AGREES that all ballast water management systems to be installed on board ships on or after 28 October 2020 should be approved taking into account the revised Guidelines (G8) set out in the annex to this resolution,

6 AGREES that all ballast water management systems to be installed on board ships prior to 28 October 2020 should be approved taking into account resolution MEPC.174(58), or preferably the revised Guidelines (G8),

7 AGREES that Administrations may permit a ballast water management system to be installed after the expiry date of the associated Type Approval Certificate, provided that the Type Approval Certificate had been issued taking into account resolution MEPC.174(58), and that the system was purchased during the validity period of that Certificate, and that the installation is completed before 28 October 2020,

8 SUPERSEDES the *Guidelines for approval of ballast water management systems* (G8) adopted by resolution MEPC.174(58).

ANNEX

GUIDELINES FOR APPROVAL OF BALLAST WATER MANAGEMENT SYSTEMS (G8)

Contents

GUIDELINES FOR APPROVAL OF BALLAST WATER MANAGEMENT SYSTEMS (G8)

1 INTRODUCTION General

1.1 These Guidelines for approval of ballast water management systems are aimed primarily at Administrations, or their designated bodies, in order to assess whether ballast water management systems meet the standard as set out in regulation D-2 of the "International Convention for the Control and Management of Ships' Ballast Water and Sediments," hereafter referred to as the "Convention". In addition, this document can be used as guidance for manufacturers and shipowners on the evaluation procedure that equipment will undergo and the requirements placed on ballast water management systems. These Guidelines should be applied in an objective, consistent and transparent way and their application should be evaluated periodically by the Organization.

1.2 Articles and regulations referred to in these Guidelines are those contained in the Convention.

1.3 The Guidelines include general requirements concerning design and construction, technical procedures for evaluation, the procedure for issuance of the Type Approval Certificate of the ballast water management system, and reporting to the Organization.

1.4 These Guidelines are intended to fit within an overall framework for evaluating the performance of systems that includes the experimental shipboard evaluation of prototype systems under the provisions of regulation D-4, approval of ballast water management systems and associated systems that comply fully with the requirements of the Convention, and port State control sampling for compliance under the provisions of article 9 of the Convention.

1.5 The requirements of regulation D-3 stipulate that ballast water management systems used to comply with the Convention must be approved by the Administration, taking into account these Guidelines. In addition to such ballast water management system approval, as set forth in regulation A-2 and regulation B-3, the Convention requires that discharges of ballast water from ships must meet the regulation D-2 performance standard on an ongoing basis. Approval of a system is intended to screen-out management systems that would fail to meet the standards prescribed in regulation D-2 of the Convention. Approval of a system, however, does not ensure that a given system will work on all ships or in all situations. To satisfy the Convention, a discharge must comply with the D-2 standard throughout the life of the ship.

1.6 The operation of ballast water management systems should not impair the health and safety of the ship or personnel, nor should it present any unacceptable harm to the environment or to public health.

1.7 Ballast water management systems are required to meet the standards of regulation D-2 and the conditions established in regulation D-3 of the Convention. These Guidelines serve to evaluate the safety, environmental acceptability, practicability and biological effectiveness of the systems designed to meet these standards and conditions. The cost effectiveness of type-approved equipment will be used in determining the need for revisions of these Guidelines.

1.8 These Guidelines contain recommendations regarding the design, installation, performance, testing, environmental acceptability and approval of ballast water management systems.

1.9 To achieve consistency in its application, the approval procedure requires that a uniform manner of testing, analysis of samples, and evaluation of results is developed and applied. These Guidelines should be applied in an objective, consistent, and transparent way; and their suitability should be periodically evaluated and revised as appropriate by the Organization. New versions of these Guidelines should be duly circulated by the Organization. Due consideration should be given to the practicability of the ballast water management systems.

Goal and purpose

1.10 The goal of these Guidelines is to ensure uniform and proper application of the standards contained in the Convention. As such the Guidelines are to be updated as the state of knowledge and technology may require.

1.11 The purposes of these Guidelines are to provide a uniform interpretation and application of the requirements of regulation D-3 and to:

.1 define test and performance requirements for the approval of ballast water management systems;

.2 assist Administrations in determining appropriate design, construction and operational parameters necessary for the approval of ballast water management systems;

.4 provide guidance to Administrations, equipment manufacturers and shipowners in determining the suitability of equipment to meet the requirements of the Convention and of the environmental acceptability of treated water; and

.5 assure that ballast water management systems approved by Administrations are capable of achieving the standard of regulation D-2 in land-based and shipboard evaluations and do not cause unacceptable harm to the vessel, crew, the environment or public health.

Applicability

1.12 These Guidelines apply to the approval of ballast water management systems in accordance with the Convention.

1.13 These Guidelines apply to ballast water management systems intended for installation on board all ships required to comply with regulation D-2.

2 BACKGROUND

2.1 The requirements of the Convention relating to approval of ballast water management systems used by ships are set out in regulation D-3.

2.2 Regulation D-2 stipulates that ships meeting the requirements of the Convention by meeting the ballast water performance standard must discharge:

.1 less than 10 viable organisms per cubic metre greater than or equal to 50 micrometres in minimum dimension;

.2 less than 10 viable organisms per millilitre less than 50 micrometres in minimum dimension and greater than or equal to 10 micrometres in minimum dimension; and

.3 less than the following concentrations of indicator microbes, as a human health standard:

.1 Toxicogenic *Vibrio cholerae* (serotypes O1 and O139) with less than 1 Colony Forming Unit (cfu) per 100 millilitres or less than 1 cfu per 1 gramme (wet weight) of zooplankton samples;

.2 *Escherichia coli* less than 250 cfu per 100 millilitres; and

.3 Intestinal Enterococci less than 100 cfu per 100 millilitres.

3 DEFINITIONS

For the purpose of these Guidelines:

3.1 *Active Substance* means a substance or organism, including a virus or a fungus, that has a general or specific action on or against harmful aquatic organisms and pathogens.

3.2 *Ballast Water Management System (BWMS)* means any system which processes ballast water such that it meets or exceeds the ballast water performance standard in regulation D-2. The BWMS includes ballast water treatment equipment, all associated control equipment, piping arrangements as specified by the manufacturer, control and monitoring equipment and sampling facilities. For the purpose of these Guidelines, BWMS does not include the ship's ballast water fittings, which may include piping, valves, pumps, etc., that would be required if the BWMS was not fitted.

3.3 *Ballast water management plan* means the document referred to in regulation B-1 of the Convention describing the ballast water management process and procedures implemented on board individual ships.

3.4 *Control and monitoring equipment* means the equipment installed for the effective operation and control of the BWMS and the assessment of its effective operation.

3.5 *The Convention* means the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004.

3.6 *Failed test cycle* is 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. A failed test cycle interrupts the required consecutive test cycles and terminates the test.

3.7 *Invalid test cycle* is 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 cycle is invalid, it does not count as one of the required consecutive test cycles in a test and the test can be continued.

3.8 *Land-based testing* means a test of the BWMS carried out in a laboratory, equipment factory or pilot plant including a moored test barge or test ship, according to parts 2 and 3 of the annex to these Guidelines, to confirm that the BWMS meets the standard described in regulation D-2 of the Convention.

3.9 *Major components* means those components that directly affect the ability of the system to meet the ballast water performance standard described in regulation D-2.

3.10 *Representative sampling* means sampling that 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).

3.11 *Sampling facilities* refers to the means provided for sampling treated or untreated ballast water as needed in these Guidelines and in the *Guidelines for ballast water sampling (G2)* developed by the Organization.

3.12 *Shipboard testing* means a full-scale test of a complete BWMS carried out on board a ship according to part 2 of the annex to these Guidelines, to confirm that the system meets the standards set by regulation D-2 of the Convention.

3.13 *Successful test cycle* means a valid test cycle where the BWMS functions to its specifications and treated water is determined to meet the performance standard described in regulation D-2.

3.14 *System Design Limitations* of a BWMS means 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.

*3.*15 *Test cycle* refers to 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.

3.16 *Test* means the set of required test cycles.

3.17 *Treatment Rated Capacity (TRC)* means the maximum continuous capacity expressed in cubic metres per hour for which the BWMS is type approved. It states the amount of ballast water that can be treated per unit time by the BWMS to meet the standard in regulation D-2 of the Convention. The TRC is measured at the inlet of the BWMS.

3.18 *Valid test cycle* means 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.

3.19 *Viable organisms* mean organisms that have the ability to successfully generate new individuals in order to reproduce the species.

4 TECHNICAL SPECIFICATIONS

4.1 This section details the general technical requirements which a BWMS should meet in order to obtain type approval.

General principles for operation

4.2 A BWMS should be effective in meeting the D-2 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.

4.3 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.

4.4 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.

Ballast water management systems

4.5 The BWMS should be designed and constructed:

.1 for robust and suitable operation in the shipboard environment;

.2 for the service for which it is intended;

.3 to mitigate any danger to persons on board when installed. Equipment that could emit dangerous gases/liquids shall have at least two independent means of detection and shutdown of the BWMS (i.e. hazardous gas level reaching lower explosive limits (LEL) or level of toxic concentrations that can result in severe effects on human health); and

.4 with materials compatible for the substances used, purpose which it is intended, the working conditions to which it will be subjected and the environmental conditions on board.

4.6 The BWMS should not contain or use any substance of a dangerous nature, unless adequate risk mitigation measures are incorporated for storage, application, installation, and safe handling, acceptable to the Administration.

4.7 In case of any failure compromising the proper operation of the BWMS, audible and visual alarm signals should be given in all stations from which ballast water operations are controlled.

4.8 All working parts of the BWMS that are liable to wear or to be damaged should be easily accessible for maintenance. The routine maintenance of the BWMS and troubleshooting procedures should be clearly defined by the manufacturer in the operation, maintenance and safety manual. All maintenance and repairs should be recorded.

4.9 To avoid interference with the BWMS, the following items should be included:

.1 every access of the BWMS beyond the essential requirements of paragraph 4.8, should require the breaking of a seal;

.2 if applicable, the BWMS should be so constructed that a visual indication is always activated whenever the BWMS is in operation for purposes of cleaning, calibration, or repair, and these events should be recorded by the control and monitoring equipment; and

.3 the BWMS should be provided with the necessary connections to ensure that any bypass of the BWMS will activate an alarm, and that the bypass event is recorded by the control and monitoring equipment.

4.10 Facilities should be provided for checking, at the renewal surveys and according to the manufacturer's instructions, the performance of the BWMS components that take measurements. A calibration certificate certifying the date of the last calibration check, should be retained on board for inspection purposes. Only the manufacturer or persons authorized by the manufacturer should perform the accuracy checks.

4.11 The BWMS should be provided with simple and effective means for its operation and control. It should be provided with a control system that should be such that the services needed for the proper operation of the BWMS are ensured through the necessary arrangements.

4.12 The BWMS should, if intended to be fitted in hazardous area locations, comply with the relevant safety regulations for such spaces. Any electrical equipment that is part of the BWMS should be based in a non-hazardous area, or should be certified by the Administration as safe for use in a hazardous area. Any moving parts, which are fitted in hazardous areas, should be arranged so as to avoid the formation of static electricity.

4.13 The BWMS should not endanger the health and safety of the crew, interact negatively with the ship's systems and cargo or produce any adverse environmental effects. The BWMS should not create long-term impacts on the safety of the ship and crew through corrosive effects in the ballast system and other spaces.

4.14 It should be demonstrated by using mathematical modelling and/or calculations, that any up or down scaling of the BWMS will not affect the functioning and effectiveness on board a ship of the type and size for which the equipment will be certified. In doing so, the manufacturer of the equipment should take into account the relevant guidance developed by the Organization.

4.15 Scaling information should allow the Administration to verify that any scaled model is at least as robust as the land-based-tested model. It is the responsibility of the Administration to verify that the scaling used is appropriate for the operational design of the BWMS.

4.16 At a minimum, the shipboard test unit should be of a capacity that allows for further validation of the mathematical modelling and/or calculations for scaling, and preferably selected at the upper limit of the rated capacity of the BWMS, unless otherwise approved by the Administration.

Control and monitoring equipment

4.17 Administrations should ensure that type approved BWMS have a suitable control and monitoring system that will automatically monitor and record sufficient data to verify correct operation of the system. The control and monitoring equipment should record the proper functioning or failure of the BWMS. Where practical, system design limitation parameters should be monitored and recorded by the BWMS to ensure proper operation.

4.18 The BWMS should incorporate control equipment that automatically monitors and adjusts necessary treatment dosages or intensities or other aspects of the BWMS of the vessel, which while not directly affecting treatment, are nonetheless required for proper administration of the necessary treatment.

4.19 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 maintenance, as required.

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

4.21 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.

4.22 All software changes introduced to the system after the pre-test evaluation shall be done according to a change handling procedure ensuring traceability.

5 TYPE APPROVAL PROCESS

5.1 The type approval requirements for ballast water management systems are as follows.

5.2 The manufacturer of the equipment should submit information regarding the design, construction, operation and functioning of the ballast water management system in accordance with part 1 of the annex including information regarding the water quality and operational parameters that are important to the operation of the system. This information should be the basis for a first evaluation of suitability by the Administration.

5.3 Following the Administration's pre-test evaluation, the ballast water management system should undergo land-based, shipboard, and other tests in accordance with the procedures described in parts 2 and 3 of the annex. The BWMS tested for type approval should be a final and complete product that meets the requirements of section 4 and it should be constructed using the same materials and procedures that will be used to construct production units.

5.4 Successful fulfilment of the requirements and procedures outlined in parts 2 and 3 of the annex, as well as all other requirements of these guidelines, should lead to the issuance of a Type Approval Certificate by the Administration in accordance with section 6.

5.5 The limitations of the ballast water management system, in addition to the required type approval testing parameters identified in section 2.4.20 and 2.5.1 of the annex, as submitted by its manufacturer and validated by the Administration, should be documented on the Type Approval Certificate. These 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.

5.6 When a Type Approved ballast water management system is installed on board, an installation survey according to section 8 should be carried out.

5.7 The documentation submitted for approval should include at least the following:

.1 a description and diagrammatic drawings of the BWMS;

.2 operation, maintenance and safety manual;

.4 hazard identification;

.5 environmental and public health impacts; and

.6 System Design Limitations.

6 APPROVAL AND CERTIFICATION PROCEDURES

6.1 A BWMS which in every respect fulfils the requirements of these Guidelines may be approved by the Administration for fitting on board ships. The approval should take the form of a Type Approval Certificate of BWMS, specifying the main particulars of the BWMS and validated System Design Limitations. Such certificate should be issued in accordance with part 7 of the annex in the format shown in appendix 1.

6.2 A BWMS that in every respect fulfils the requirements of these Guidelines, except that it has not been tested at all the temperatures and salinities set out in part 2 of the annex, should only be approved by the Administration if corresponding limiting operating conditions are clearly stated on the issued Type Approval Certificate with the description "Limiting Operational Conditions". For the limiting values, the System Design Limitations should be consulted.

6.3 A Type Approval Certificate of BWMS should be issued for the specific application for which the BWMS is approved, e.g. for specific ballast water capacities, flow rates, salinity or temperature regimes, or other limiting operating conditions or circumstances as appropriate.

6.4 A Type Approval Certificate of BWMS should be issued by the Administration based on satisfactory compliance with all the requirements described in parts 1, 2, 3 and 4 of the annex.

6.5 The System Design Limitations should be specified on the Type Approval Certificate in a table that identifies each water quality and operational parameter together with the validated low and/or high parameter values for which the BWMS is designed to achieve the ballast water performance standard described in regulation D-2.

6.6 An Administration may issue a Type Approval Certificate of BWMS based on testing already carried out under supervision by another Administration.

6.7 A Type Approval Certificate should only be issued to a BWMS that has been determined by the Administration to make use of an Active Substance after it has been approved by the Organization in accordance with regulation D-3.2. In addition, the Administration should ensure that any recommendations that accompanied the Organization's approval have been taken into account before issuing the Type Approval Certificate.

6.8 The Type Approval Certificate should be issued taking into account Circular MSC.1/Circ.1221 on *Validity of type approval certification for marine products*.

6.9 An approved BWMS may be type approved by other Administrations for use on their ships. Should a BWMS approved by one country fail type approval in another country, then the two countries concerned should consult one another with a view to reaching a mutually acceptable agreement.

6.10 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.

6.11 In the case of a type approval based entirely on testing already carried out under supervision by another Administration, the type approval report should be prepared and kept on file and the Organization should be informed of the approval.

6.12 In the case of a BWMS that was previously type-approved by an Administration taking into account resolution MEPC.174(58), the manufacturer, in seeking a new type approval under these Guidelines, should only be requested to submit to the Administration the additional test reports and documentation set out in these Guidelines.

7 INSTALLATION REQUIREMENTS, FOLLOWING TYPE APPROVAL

7.1 The BWMS should be accompanied by sampling facilities as described in Guidelines (G2), so arranged in order to collect representative samples of the ship's ballast water discharge.

7.2 Suitable bypasses or overrides to protect the safety of the ship and personnel should be installed and used in the event of an emergency and these should be connected to the BWMS so that any bypass of the BWMS should activate an alarm. The bypass event should be recorded by the control and monitoring equipment and within the ballast water record book.

7.3 The requirement in paragraph 7.2 does not apply to internal transfer of ballast water within the ship (e.g. anti-heeling operations). For BWMS that transfer water internally which may affect compliance by the ship with the standard described in regulation D-2 (i.e. circulation or in-tank treatment) the recording in paragraph 7.2 shall identify such internal transfer operations.

8 INSTALLATION SURVEY AND COMMISSIONING PROCEDURES, FOLLOWING TYPE APPROVAL

8.1 The additional information outlined in the paragraphs below is intended to facilitate ship operations and inspections and assist ships and Administrations in preparing for the procedures set out in the *Survey Guidelines Under the 2004 International Convention for the Control and Management of Ships' Ballast Water and Sediments*, developed by the Organization, which describe the examination of plans and designs and the various surveys required under regulation E-1 of the Convention.

8.2 The Administration issuing the International Ballast Water Management Certificate should verify that the following documentation is on board in a suitable format:

.1 for the purpose of information, a copy of the Type Approval Certificate of BWMS;

.2 the operation, maintenance and safety manual of the BWMS;

.3 the ballast water management plan of the ship;

.4 installation specifications, e.g. installation drawing, P&ID diagrams, etc.; and

.5 installation commissioning procedures.

8.3 Prior to issuance of the International Ballast Water Management Certificate, following the installation of a BWMS, the Administration should verify that:

.1 the BWMS installation has been carried out in accordance with the technical installation specification referred to in paragraph 8.2.4;

.2 the BWMS is in conformity with the relevant Type Approval Certificate of BWMS;

.3 the installation of the complete BWMS has been carried out in accordance with the manufacturer's equipment specification;

.4 any operational inlets and outlets are located in the positions indicated on the drawing of the pumping and piping arrangements;

.5 the workmanship of the installation is satisfactory and, in particular, that any bulkhead penetrations or penetrations of the ballast system piping are to the relevant approved standards; and

.6 that the installation commissioning procedures have been completed.

Annex

This annex provides detailed test and performance specifications for a BWMS and contains:

PART 1 – Specifications for Pre-test Evaluation of System Documentation

PART 2 – Test and Performance Specifications for Approval of Ballast Water Management Systems

PART 3 – Specification for Environmental Testing for Approval of Ballast Water Management Systems

PART 4 – Sample Analysis Methods for the Determination of Biological Constituents in Ballast Water

PART 5 – Self monitoring

PART 6 – Validation of System Design Limitations

PART 7 – Type Approval Certificate and Type Approval Report

Appendix –TYPE APPROVAL CERTIFICATE OF BALLAST WATER MANAGEMENT SYSTEM

PART 1 – SPECIFICATIONS FOR PRE-TEST EVALUATION OF SYSTEM DOCUMENTATION

1.1 Adequate documentation should be prepared and submitted to the Administration and be shared with the testing organization as part of the approval process well in advance of the intended approval testing of a BWMS. Approval of the submitted documentation should be a pre-requisite for carrying out independent approval tests.

1.2 Documentation should be provided by the manufacturer/developer for two primary purposes: evaluating the readiness of the BWMS for undergoing approval testing, and evaluating the manufacturer's proposed System Design Limitations and validation procedures.

Documentation

1.3 The documentation to be submitted as a part of the readiness evaluation should include at least the following:

.1 A BWMS Technical Specification, including at least:

.1 a description of the BWMS and treatment processes it employs and details of any required permits;

.2 adequate information including descriptions and diagrammatic drawings of the pumping and piping arrangements, electrical/electronic wiring, monitoring system, waste streams and sampling points. Such information should enable fault finding;

.3 details of major components and materials used (including certificates where appropriate);

.4 an equipment list showing all components subject to testing including specifications, materials and serial numbers;

.5 an Installation specification in accordance with manufacturers installation criteria requirements for the location and mounting of components, arrangements for maintaining the integrity of the boundary between safe and hazardous spaces and the arrangement of the sample piping;

.6 information regarding the characteristics and arrangements in which the system is to be installed, including scope of the ships (sizes, types and operation) for which the system is intended. This information may form the link between the system and the ship's ballast water management plan; and

.7 a description of BWMS side streams (e.g. filtered material, centrifugal concentrate, waste or residual chemicals) including a description of the actions planned to properly manage and dispose of such wastes.

.2 Operation, maintenance and safety manuals – These should at least include:

.1 instructions for the correct operation of the BWMS, including procedures for the discharge of untreated water in the event of malfunction of the ballast water treatment equipment;

.2 instructions for the correct arrangement of the BWMS;

.3 maintenance and safety instructions and the need to keep records;

.4 trouble-shooting procedures;

.5 emergency procedures necessary for securing the ship;

.6 any supplementary information considered necessary for the safe and efficient operation of the BWMS, e.g. documentation provided for approval under Procedure (G9); and

.7 calibration procedures.

.3 Information on any hazard identification conducted to identify potential hazards and define appropriate control measures, if the BWMS or the storage tanks for processing chemicals could emit dangerous gases or liquids.

.4 Information regarding environmental and public health impacts including:

.1 identification of potential hazards to the environment based on environmental studies performed to the extent necessary to assure that no harmful effects are to be expected;

.2 in the case of ballast water management systems that make use of Active Substances or Preparations containing one or more Active Substances, the dosage of any Active Substances used and the maximum allowable discharge concentrations;

.3 in the case of ballast water management systems that do not make use of Active Substances or Preparations, but which could reasonably be expected to result in changes to the chemical composition of the treated water such that adverse impacts to receiving waters might occur upon discharge, the documentation should include results of toxicity tests of treated water as described in paragraph 2.4.11 of these Guidelines; and

.4 sufficient information to enable the test organization to identify any potential health or environmental safety problems, unusual operating requirements (labour or materials), and any issues related to the disposal of treatment by products or waste streams.

.5 Information regarding System Design Limitations including:

.1 the identification of all known parameters to which the design of the BWMS is sensitive;

.2 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; and

.3 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.

.6 Software change handling and revision control document including:

.1 all software changes introduced to the system after the pre-test evaluation shall be done according to a change handling procedure ensuring traceability. Therefore, the manufacturer shall present a procedure describing how changes are to be handled and how revision control is maintained. As a minimum for a modification request, the following types of information should be produced and logged:

– reason for modification
– specification of the proposed change
– authorization of modification
– test record

.7 Functional description including:

.1 a textual description with necessary supporting drawings, diagrams and figures to cover:

– system configuration and arrangement
– scope of supply
– system functionality covering control, monitoring, alarm and safety functions
– self-diagnostics and alarming functionalities
– safe states for each function implemented.

1.4 The documentation may include specific information relevant to the test set-up to be used for land-based testing according to these Guidelines. Such information should include the sampling needed to ensure proper functioning and any other relevant information needed to ensure proper evaluation of the efficacy and effects of the equipment. The information provided should also address general compliance with applicable environment, health and safety standards during the type approval procedure.

Readiness evaluation

1.5 During the readiness evaluation, the Administration should ensure that each technical specification set out in section 4 of the body of these Guidelines has been met, other than those that will be assessed during later testing.

1.6 The readiness evaluation should examine the design and construction of the BWMS to determine whether there are any fundamental problems that might constrain the ability of the BWMS to manage ballast water as proposed by the manufacturer, or to operate safely, on board ships.

1.7 Administrations should ensure adequate risk assessments including the implementation of preventative actions, have been undertaken relating to the safe operation of BWMS.

1.8 As a first step the manufacturer should provide information regarding the requirements and procedures for installing, calibrating, and operating (including maintenance requirements) the BWMS during a test. This evaluation should help the test organization to identify any potential health or environmental safety problems, unusual operating requirements (labour or materials), and any issues related to the disposal of treatment by-products or waste streams.

1.9 The evaluation should identify the most vulnerable models in the BWMS range to be submitted for approval, and propose which model(s) should be evaluated through land-based and/or shipboard testing in order to verify that correct treatment and operation are maintained over the whole range. In any case, the system efficacy at maximum rated capacity of a BWMS should be verified as suitable during shipboard testing.

1.10 The test facility should have a procedure to deal with deviations that occur prior to testing and an evaluation process which includes an assessment and validation process to address any unforeseen deviations that may occur during testing. Deviations from the testing procedure should be fully reported.

1.11 During the readiness evaluation the major components of the BWMS should be identified. Major components are considered to be those components that directly affect the ability of the system to meet the BWM Convention D-2 discharge standard. Upgrades or changes to major components should not take place during type approval testing. A change to a major component should require a new submission of the test proposal and should involve a new evaluation and repeating of the land-based and shipboard tests.

1.12 The Administration may allow replacements of non-major components of equivalent specification (independently approved to a recognized and equal operational standard) during type approval. Replacements of non-major components during testing should be reported.

1.13 Upgrades of the BWMS that relate to the safe operation of that system may be allowed during and after type approval and should be reported. If such safety upgrades directly affect the ability of the system to meet the standard described in regulation D-2, it should be treated as a change of a major component, as per paragraph 1.11 above.

1.14 The evaluation should identify consumable components in the BWMS. The Administration may allow replacement of like for like consumable components, during type approval testing and all replacements should be reported.

System Design Limitation evaluation

1.15 The System Design Limitation evaluation should be undertaken by the Administration. It should assess the basis for the manufacturer's claim that the System Design Limitations include all known water quality and operational parameters to which the design of the BWMS is sensitive that are important to its ability to achieve the performance standard described in regulation D-2.

1.16 The Administration should also evaluate the suitability and reliability of the methods proposed for validating the claimed low and/or high values for each System Design Limitation. These methods may include tests to be undertaken during land-based, shipboard or bench-scale testing and/or the use of appropriate existing data and/or models.

PART 2 – TEST AND PERFORMANCE SPECIFICATIONS FOR APPROVAL OF BALLAST WATER MANAGEMENT SYSTEMS

The Administration decides the sequence of land-based and shipboard testing. The BWMS used for testing must be verified by the Administration to be the same as the BWMS described under part 1 of the annex with major components as described in paragraphs 1.3.1.3 and 1.3.1.4.

2.1 Quality Assurance and Quality Control Procedures

2.1.1 The testing 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 challenge water, 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.

2.1.2 The test facility's quality control/quality assurance program 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. Appropriate statistical distributions should be considered and used to analyse data.

2.1.3 The testing facility performing the BWMS tests should be independent. It should not be owned or affiliated with the manufacturer or vendor of any ballast water management system, by the manufacturer or supplier of the major components of that equipment.

2.2 Avoiding sampling bias

The sampling protocol must ensure organism mortality is minimized, e.g. by using appropriate valves and flow rates for flow control in the sampling facility, submerging nets during sampling collection, using appropriate sampling duration and handling times, and appropriate concentrating methodology. All methods should be validated to the satisfaction of the Administration.

2.3 Shipboard tests

2.3.1 A shipboard test cycle includes:

.1 the uptake of ballast water of the ship;

.2 treatment of the ballast water in accordance with paragraph 2.3.3.4 by the BWMS;

.3 the storage of ballast water on the ship during a voyage; and

.4 the discharge of ballast water from the ship.

2.3.2 Shipboard testing of BWMS should be conducted by the test facility, independent of the BWMS manufacturer, with the system being operated and maintained by the ships' crew as per the operational manual.

Success criteria for shipboard testing

2.3.3 In evaluating the performance of BWMS installation(s) on a ship or ships, the following information and results should be supplied to the satisfaction of the Administration:

.1 Test plan to be provided prior to testing.

.2 Documentation that an inline BWMS is of a capacity to reflect the flow rate of the ballast water pump for the full rated capacity range of the BWMS.

.3 Documentation that an in-tank BWMS is of a capacity to reflect the ballast water volume that it is intended to treat within a specified period of time.

.4 The amount of ballast water tested in the test cycle on board should be consistent with the normal ballast operations of the ship and the BWMS should be operated at the treatment rated capacity for which it is intended to be approved.

.5 Documentation showing that the discharge of each valid test cycle was in compliance with regulation D-2.

.6 For a test to be valid, the uptake water for the ballast water to be treated should contain a density of viable organisms exceeding 10 times the maximum permitted values in regulation D-2.1.

.7 Sampling regime and volumes for analysis:

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

.1 influent water should be collected over the duration of uptake as one, time-integrated sample. The sample should be collected as a single, continuous sample or a composite of sequential samples, e.g. collected at intervals during the beginning, middle and end of the operation. The total sample volume should be at least one cubic metre. If smaller volume is validated to ensure representative sampling of organisms, it may be used;

.2 treated discharged water should be collected as one time-integrated sample over the duration of discharge from the tank(s). The sample may be collected as a single, continuous sample or a composite of sequential samples, e.g. collected throughout the beginning, middle and end of the operation. The total sample volume should be at least three cubic metres;

.3 if samples are concentrated for enumeration, the organisms should be concentrated using a mesh with holes no greater than 50 micrometres in the diagonal dimension. Only organisms greater than 50 micrometres in minimum dimension should be enumerated; and

.4 the full volume of the sample should be analysed unless the total number of organisms is high, e.g. 100. In this case, the average density may be extrapolated based on a well-mixed subsample using a validated method.

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

.1 influent water should be collected over the duration of uptake as one, time-integrated sample. The sample should be collected as a single, continuous sample or a composite of sequential samples, e.g. collected at intervals during the beginning, middle and end of the operation. A sample of at

least 10 litres should be collected, and a fraction may be subsampled for transport to the laboratory, provided it is representative of the sample and is a minimum of 1 litre. A minimum of three, 1-milliliter sub-samples should be analysed in full to enumerate organisms.

.2 treated discharged water should be collected as one time-integrated sample over the duration of discharge from the tank(s). The sample may be collected as a single, continuous sample or a composite of sequential samples, e.g. collected throughout the beginning, middle and end of the operation. A sample of at least 10 litres should be collected, and a fraction may be subsampled for transport to the laboratory, provided it is representative of the sample and is a minimum of 1 litre. A minimum of six, 1-milliliter sub-samples should be analysed in full to enumerate organisms.

.3 the sample may not be concentrated for analysis unless the procedure is validated. Only organisms greater than 10 micrometres and less than 50 micrometres in minimum dimension should be enumerated;

.4 the full volume of the sample should be analysed unless the total number of organisms is high, e.g. 100. In this case, the average density may be extrapolated based on a well-mixed subsample using a validated method.

.3 For the evaluation of bacteria:

.1 for the influent and discharge samples, the minimum 10-litre sample referred to in paragraph 2.3.3.7.2.2, or another sample at least 10 litres in volume and collected in a similar manner, a sub-sample of minimum 1 litre may be transferred to a sterile container for analysis; and

.2 a minimum of three subsamples of appropriate volume taken from the 1 litre subsample described above should be analysed for colony forming units of bacteria listed in regulation D-2.

.3 the toxicogenic test requirements should be conducted in an appropriately approved laboratory. If no approved laboratory is available, the analysis method may be validated to the satisfaction of the Administration.

.8 The test cycles including invalid test cycles are to span a period of not less than six months.

.9 The applicant is requested to perform three consecutive test cycles in compliance with regulation D-2. Any invalid test cycle does not affect the consecutive sequence.

.10 The six-month shipboard test period starts and ends with the completion of a successful test cycle or invalid test cycle that meets the D-2 standard. The three consecutive and valid test cycles that are required in paragraph 2.3.3.9 must be suitably separated across the six-month period.

.11 The source water for test cycles shall be characterized by measurement of salinity, temperature, particulate organic carbon, total suspended solids and dissolved organic carbon.

.12 For system operation throughout the test period, the following information should also be provided:

.1 documentation of all ballast water operations including volumes and locations of uptake and discharge, and if heavy weather was encountered and where;

.2 documentation that the BWMS was operated continuously throughout the test period for all ballasting and deballasting of the ship;

.3 documentation detailing water quality parameters identified by the testing organization should be measured as appropriate and practicable;

.4 the possible reasons for an unsuccessful test cycle, or a test cycle discharge failing the D-2 standard should be investigated and reported to the Administration;

.5 documentation of scheduled maintenance performed on the system during the test period;

.6 documentation of unscheduled maintenance and repair performed on the system during the test period;

.7 documentation of engineering parameters monitored as appropriate to the specific system; and

.8 a report detailing the functioning of the control and monitoring equipment.

2.4 Land-based testing

2.4.1 The land-based testing provides data to determine the biological efficacy and environmental acceptability of the BWMS under consideration for type approval. The approval testing aims to ensure replicability and comparability to other treatment equipment.

2.4.2 Any limitations imposed by the ballast water management system on the testing procedure described here should be duly noted and evaluated by the Administration.

2.4.3 The test set-up including the ballast water management system should operate as described in the provided operation, maintenance and safety manual during at least 5 consecutive successful test cycles in each salinity.

2.4.4 A land-based test cycle should include the uptake of ballast water by pumping, the storage of ballast water, treatment of ballast water within the BWMS (except in control tanks), and the discharge of ballast water by pumping. The order will be dependent on the BWMS.

2.4.5 At least two test cycles in each salinity should be conducted in order to evaluate compliance with the D-2 standard at the minimum holding time specified by the BWMS manufacturer.

2.4.6 In accordance with the *Procedure for approval of ballast water management systems that make use of Active Substances* (G9), test facilities carrying out identification of Relevant Chemicals and toxicity testing of the treated ballast water from test cycles with a storage time which is shorter or longer than five days, should ensure that sufficient volumes of treated water are collected after five days or are reserved after the efficacy testing to permit the requirements of Procedure (G9) to be assessed for at least one test cycle per salinity.

2.4.7 Land-based testing of BWMS should be independent of the system manufacturer.

2.4.8 Testing should occur using different water conditions sequentially as provided for in paragraphs 2.4.20 and 2.4.22.

2.4.9 The BWMS should be tested at its rated capacity or as given in paragraphs 2.4.16 to 2.4.19 for each test cycle. The equipment should function to specifications during this test.

2.4.10 The analysis of treated water discharge from each test cycle should determine if the treated discharge meets regulation D-2 of the Convention.

2.4.11 The analysis of treated water discharge from the relevant test cycle(s) should also be used to evaluate the formation of Relevant Chemicals as well as the toxicity of the discharged water for BWMS that make use of Active Substances. The same evaluation should be conducted for those BWMS that do not make use of Active Substances or Preparations but which could reasonably be expected to result in changes to the chemical composition of the treated water such that adverse impacts to receiving waters might occur upon discharge. Toxicity tests of the treated water discharge should be conducted in accordance with paragraphs 5.2.3 to 5.2.7 of the *Procedure for approval of ballast water management systems that make use of Active Substances* (G9), as revised.

Land-based testing set-up

2.4.12 The test set-up for approval tests should be representative of the characteristics and arrangements of the types of ships in which the equipment is intended to be installed. The test set-up should therefore include at least the following:

.1 the complete BWMS to be tested;

.2 piping and pumping arrangements; and

.3 the storage tank that simulates a ballast tank, constructed such that the water in the tank should be completely shielded from light.

2.4.13 The control and treated simulated ballast tanks should each include:

.1 a minimum capacity of 200 m^3;

.2 normal internal structures, including lightening and drainage holes;

.3 standard industry practices for design and construction for ships; surface coatings should be in accordance with Performance Standard for Protective Coatings (PSPC); and

.4 the minimum modifications required for structural integrity on land.

2.4.14 The test set-up should be pressure-washed with tap water, dried and swept to remove loose debris, organisms and other matter before starting testing procedures, and between test cycles.

2.4.15 The test set-up will include facilities to allow sampling as described in paragraphs 2.4.31 and 2.4.32 and provisions to supply influents to the system, as specified in paragraph 2.4.20, 2.4.21, 2.4.24 and 2.4.25. The installation arrangements should conform in each case with those specified and approved under the procedure outlined in section 7 of the main body to these Guidelines.

Ballast water management system scaling

2.4.16 Scaling of the BWMS should be in accordance with the *Guidance on scaling of ballast water management systems* developed by the Organization. The Administration should verify that the scaling used is appropriate for the operational design of the BWMS.

2.4.17 BWMS with at least one model with a TRC equal to or smaller than 200 m^3/h should not be downscaled.

2.4.18 For BWMS with at least one model that has a higher capacity than 200 m^3/h or 1000 m^3/h the following must be observed for land-based testing. In-line treatment equipment may be downsized for land-based testing, but only when the following criteria are taken into account:

.1 BWMS with at least one model with a TRC larger than 200 m^3/h but smaller than 1,000 m^3/h may be downscaled to a maximum of 1:5 scale, but may not be smaller than 200 m^3/h; and

.2 BWMS with at least one model with a TRC equal to, or larger than, 1,000 m^3/h may be downscaled to a maximum of 1:100 scale, but may not be smaller than 200 m^3/h.

2.4.19 In-tank treatment equipment should be tested on a scale that allows verification of full-scale effectiveness. The suitability of the test set-up should be evaluated by the manufacturer and approved by the Administration.

Land-based test design – inlet and outlet criteria

2.4.20 For any given set of test cycles, (five are considered a set) a salinity range should be chosen for each cycle. Given the salinity of the test set up for a test cycle in fresh, brackish and marine water, each should have dissolved and particulate content in one of the following combinations:

	Salinity		
	Marine 28 – 36 PSU	Brackish 10 – 20 PSU	Fresh < 1 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

2.4.21 Test water should be natural water. Any augmentation of test water with dissolved organic carbon (DOC), particulate organic carbon (POC) or total suspended solids (TSS) to achieve the minimum required content should be validated and approved by the Administration. As natural DOC constituents are complex and primarily of aromatic character, the type of added DOC is particularly critical to the evaluation of BWMS performance. The validation should ensure that relevant properties of the augmented water (such as the oxidant demand/TRO decay and UV absorption in the range of 200 to 280 nm, the production of disinfectant by-products and the particle size distribution of suspended solids) are equivalent, on a mg/L basis, to that of natural water that would quantitatively meet the challenge conditions. In addition, the validation should ensure that augmentation does not bias a test for or against any specific treatment process. The test report should include the basis for the selection, use and validation of augmentation.

2.4.22 The BWMS must be tested in conditions for which it will be approved. For a BWMS to achieve an unlimited Type Approval Certificate with respect to salinity, one set of test cycles should be conducted within each of the three salinity ranges with the associated dissolved and particulate content as prescribed in paragraph 2.4.20. Tests under adjacent salinity ranges in the above table should be separated by at least 10 PSU.

2.4.23 Use of standard test organisms (STO)

.1 the use of standard test organisms (STO) is permissible if the challenge levels in naturally occurring water at the test facility require supplementation. The use of STO should not be considered standard practice and the Administration should in every case review that the selection, number and use of supplementary STOs ensures that the challenge posed to the BWMS provides an adequately robust test. The use of STOs should not bias a test for or against any specific treatment process. They 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.

2.4.24 The influent water should include:

.1 test organisms of greater than or equal to 50 micrometres or more in minimum dimension should be present in a total density of preferably 10^6 but not less than 10^5 individuals per cubic metre, and should consist of at least 5 species from at least 3 different phyla/divisions;

.2 test organisms greater than or equal to 10 micrometres and less than 50 micrometres in minimum dimension should be present in a total density of preferably 10^4 but not less than 10^3 individuals per millilitre, and should consist of at least 5 species from at least 3 different phyla/divisions;

.3 heterotrophic bacteria should be present in a density of at least 10^4 living bacteria per millilitre; and

.4 the variety of organisms in the test water should be documented according to the size classes mentioned above regardless if natural organism assemblages or cultured organisms were used to meet the density and organism variety requirements.

2.4.25 The following bacteria do not need to be added to the influent water, but should be measured at the influent and at the time of discharge:

.1 Coliform;

.2 Enterococcus group;

.3 *Vibrio cholerae*; and

.4 Heterotrophic bacteria.

2.4.26 If cultured test organisms are used, then it should be ensured that local applicable quarantine regulations are taken into account during culturing and discharge.

Land-based monitoring and sampling

2.4.27 Change of numbers of test organisms by treatment and during storage in the simulated ballast tank should be measured using methods described in part 4 of the annex, paragraphs 4.5 to 4.7.

2.4.28 It should be verified that the treatment equipment performs within its specified parameters, such as power consumption and flow rate, during the test cycle.

2.4.29 The range of operational flow rates that a BWMS is expected to achieve in service, at the maximum and minimum operational flow rates (where it is appropriate for that technology), should be verified after the filter on the discharge side of the pump. The range of flow rate may be derived from empirical testing or from computational modelling. Where appropriate for the technology, demonstration of system efficacy at low flow rates should reflect the need for flow reduction during the final stages of ballast operations.

2.4.30 Environmental parameters such as pH, temperature, salinity, dissolved oxygen, TSS, DOC, POC and turbidity (NTU)[1] should be measured at the same time that the samples described are taken.

2.4.31 Samples during the test for the purposes of determining biological efficacy should be taken at the following times and locations: immediately before the treatment equipment, immediately after the treatment equipment and upon discharge after the appropriate holding time.

2.4.32 The control and treatment cycles may be run simultaneously or sequentially. Control samples are to be taken in the same manner as the equipment test as prescribed in paragraph 2.4.35 and upon influent and discharge.

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

2.4.34 Samples described in paragraphs 2.4.31 and 2.4.32 should be collected with the following sampling regime and volumes for analysis:

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

.1 influent water should be collected over the duration of uptake as one, time-integrated sample. The sample should be collected as a single, continuous sample or a composite of sequential samples, e.g. collected at intervals during the beginning, middle and end of the operation. The total sample volume should be at least one cubic metre. If smaller volume is validated to ensure representative sampling of organisms, it may be used;

.2 control and treated discharged water should be collected as one time-integrated sample over the duration of discharge from the tank(s). The sample may be collected as a single, continuous sample or a composite of sequential samples, e.g. collected throughout the beginning, middle and end of the operation. The total sample volume should be at least three cubic metres;

.3 if samples are concentrated for enumeration, the organisms should be concentrated using a mesh with holes no greater than 50 micrometres in the diagonal dimension. Only organisms greater than 50 micrometres in minimum dimension should be enumerated; and

.4 the full volume of the sample should be analysed unless the total number of organisms is high, e.g. 100. In this case, the average density may be extrapolated based on a well-mixed subsample using a validated method.

[1] NTU=Nominal Turbidity Unit.

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

.1 influent water should be collected over the duration of uptake as one, time-integrated sample. The sample should be collected as a single, continuous sample or a composite of sequential samples, e.g. collected at intervals during the beginning, middle and end of the operation. A sample of at least 10 litres should be collected, and a fraction may be subsampled for transport to the laboratory, provided it is representative of the sample and is a minimum of 1 litre. A minimum of three, 1-millilitre sub-samples should be analysed in full to enumerate organisms.

.2 control and treated discharged water should be collected as one time-integrated sample over the duration of discharge from the tank(s). The sample may be collected as a single, continuous sample or a composite of sequential samples, e.g. collected throughout the beginning, middle and end of the operation. A sample of at least 10 litres should be collected, and a fraction may be subsampled for transport to the laboratory, provided it is representative of the sample and is a minimum of 1 litre. A minimum of six, 1-milliliter sub-samples should be analysed in full to enumerate organisms.

.3 the sample may not be concentrated for analysis unless the procedure is validated. Only organisms greater than 10 micrometres and less than 50 micrometres in minimum dimension should be enumerated;

.4 the full volume of the sample should be analysed unless the total number of organisms is high, e.g. 100. In this case, the average density may be extrapolated based on a well-mixed subsample using a validated method.

.3 For the evaluation of bacteria:

.1 for the influent and discharge samples, a minimum 10-litre sample referred to in paragraph 2.3.3.7.2.2, or another sample at least 10 litres in volume and collected in a similar manner, a sub-sample of minimum 1 litre may be transferred to a sterile container for analysis; and

.2 a minimum of three, subsamples of appropriate volume taken from the 1 litre subsample described above should be analysed for colony forming units of bacteria listed in regulation D-2.

.3 the toxicogenic test requirements should be conducted in an appropriately approved laboratory. If no approved laboratory is available, the analysis method may be validated to the satisfaction of the Administration.

2.4.35 The samples should be analysed as soon as possible after sampling, and analysed live within 6 hours or treated in such a way so as to ensure that proper analysis can be performed.

2.4.36 If in any test cycle the discharge results from the control water is a concentration less than or equal to 10 times the values in regulation D-2.1, the test cycle is invalid.

2.5 Temperature

2.5.1 The effective performance of BWMS through a ballast water temperature range of 0°C to 40°C (2°C to 40°C for fresh water) and a mid-range temperature of 10°C to 20°C should be the subject of an assessment verified by the Administration.

2.5.2 This assessment may include:

.1 testing during land-based, shipboard, laboratory or bench-scale testing, and/or

.2 the use of existing data and/or models, provided that their source, suitability and reliability is reported;

2.5.3 The report submitted to the Administration should contain all documentation (including procedures, methods, data, models, results, explanations and remarks) associated with the temperature assessment. The report should include at least the information identified in paragraph 2.7.2 of this annex.

2.6 Evaluation of regrowth

2.6.1 The evaluation of the regrowth of organisms should be undertaken to the satisfaction of the Administration in land-based and/or shipboard testing in at least two test cycles in each salinity.

2.6.2 In the case of land-based testing being performed with a holding time of less than five days, a sufficient volume of treated uptake water should be held under conditions similar to conditions in the relevant holding tank. In the case of shipboard testing, water should be retained on board for the evaluation of regrowth during a shipboard test cycle. Additional bench-scale testing may be used to supplement the land-based and/or shipboard testing.

2.6.3 In the case of a BWMS that includes mechanical, physical, chemical, and/or biological processes intended to kill, render harmless, or remove organisms within ballast water at the time of discharge or continuously between the time of uptake and discharge, regrowth should be assessed in accordance with section 2.3 or 2.4 with a holding time of at least five days.

2.6.4 Otherwise, the enumeration of organisms to assess regrowth should be undertaken at least five days after the completion of all of the mechanical, physical, chemical, and/or biological processes intended to kill, render harmless, or remove organisms within ballast water.

2.6.5 Any neutralization of ballast water required by the BWMS should occur at the end of the holding time, and immediately before the enumeration of organisms.

2.6.6 The evaluation of regrowth is not intended to evaluate contamination in ballast tanks or piping, such as may arise from the presence of untreated water or residual sediments.

2.6.7 A report should be submitted to the Administration containing all documentation (including procedures, methods, data, models, results, explanations and remarks) associated with the evaluation of regrowth. The report should include at least the information identified in paragraph 2.7.2 of this annex.

2.7 Reporting of test results

2.7.1 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 and the results of these analyses for each test cycle (including 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.

2.7.2 The reports submitted in accordance with paragraph 2.7.1 should contain at least the following information:

.1 the name and address of the laboratory performing or supervising the inspections, tests or evaluations, and its national accreditation or quality management certification, if appropriate;

.2 the name of the manufacturer;

.3 the trade name, product designation (such as model numbers), and a detailed description of the equipment or material inspected, tested or evaluated;

.4 the time, date, and place of each approval inspection, test or evaluation;

.5 the name and title of each person performing, supervising, and witnessing the tests and evaluations;

.6 executive summary;

.7 introduction and background;

.8 for each test cycle, inspection or evaluation conducted, summary descriptions of:

.1 experimental design;

.2 methods and procedures;

.3 results and discussion, including a description of any invalid test cycle (in the case of a report referred to in part 2 of this annex) and a comparison to the expected performance; and

.4 in the case of land-based testing, test conditions including details on challenge water preparation in line with paragraph 2.4.21;

.9 a description or photographs of the procedures and apparatus used in the inspections, tests or evaluation, or a reference to another document that contains an appropriate description or photographs;

.10 at least one photograph that shows an overall view of the equipment or material tested, inspected or evaluated and other photographs that show:

.1 design details; and

.2 each occurrence of damage or deformation to the equipment or material that occurred during the approval tests or evaluations.

.11 the operational safety requirements of the BWMS and all safety related findings that have been made during the inspections, tests or evaluations

.12 an attestation that the inspections, tests or evaluations were conducted as required and that the report contains no known errors, omissions, or false statements. The attestation must be signed by:

.1 the manufacturer or manufacturer's representative, if the inspection, tests or evaluations are conducted by the manufacturer; or

.2 the chief officer of the laboratory, or the chief officer's representative, if the inspection or tests were conducted by an independent laboratory.

.13 appendices, including:

.1 the complete test plan and the data generated during tests and evaluations reported under subparagraph .8 above, including at least:

.1 for land-based tests, whether ambient, cultured or a mixture of test organisms have been used (including a species-level identification for cultured organisms, and an identification to the lowest possible taxonomic level for ambient organisms);

.2 for shipboard tests, the operating parameters of the system during successful treatment operations (e.g. dosage rates, ultraviolet intensity and the energy consumption of the BWMS under normal or tested Treatment Rated Capacity, if available);

.3 for System Design Limitations, details of all procedures, methods, data, models, results, explanations and remarks, leading to validation; and

.4 invalid test information;

.2 the QMP, the QAPP and Quality Assurance and Quality Control records;

.3 maintenance logs including a record of any consumable components that were replaced; and

.4 relevant records and tests results maintained or created during testing.

2.7.3 The results of biological efficacy testing of the BWMS should be accepted if during the land-based and shipboard testing conducted as specified in sections 2.3 and 2.4 of this annex it is shown that the system has met the standard in regulation D-2 and that the uptake water quality requirements were met in all individual test cycles as provided in paragraph 4.7 below.

2.7.4 The test report shall include all test runs during land-based and shipboard tests, including failed and invalid tests with the explanation required in paragraph 2.3.3.12.4 for both shipboard and land-based tests.

2.7.5 The Administration should identify and redact commercially sensitive information (information that is proprietary and not related to the BWMS performance) and make all other information available to interested parties and the Organization. The information should include all of the test reports, including failed tests from both land-based and shipboard testing.

PART 3 –- SPECIFICATION FOR ENVIRONMENTAL TESTING FOR APPROVAL OF BALLAST WATER MANAGEMENT SYSTEMS

3.1 The electrical and electronic sections of the BWMS in the standard production configuration should be subject to the relevant tests specified in paragraph 3.3 below at a laboratory approved for the purpose by the Administration or by the accreditation body of the laboratory, where the scope of the accreditation covers ISO/IEC 17025 and the relevant test standards.

3.2 Evidence of successful compliance with the environmental tests below should be submitted to the Administration by the manufacturer together with the application for type approval.

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

3.4 A report on environmental tests should be submitted to the Administration in accordance with paragraph 2.7.2.

PART 4 – SAMPLE ANALYSIS METHODS FOR THE DETERMINATION OF BIOLOGICAL CONSTITUENTS IN BALLAST WATER

Sample processing and analysis

4.1 Samples taken during testing of BWMS are likely to contain a wide taxonomic diversity of organisms, varying greatly in size and susceptibilities to damage from sampling and analysis.

4.2 When available, widely accepted standard methods for the collection, handling (including concentration), storage, and analysis of samples should be used. These methods should be clearly cited and described in test plans and reports. This includes methods for detecting, enumerating, and determining minimum dimension of and identifying organisms and for determining viability (as defined in these Guidelines).

4.3 When standard methods are not available for particular organisms or taxonomic groups, methods that are developed for use should be described in detail in test plans and reports. The descriptive documentation should include any experiments needed to validate the use of the methods.

4.4 Given the complexity in samples of natural and treated water, the required rarity of organisms in treated samples under regulation D-2, and the expense and time requirements of current standard methods, it is likely that several new approaches will be developed for the analyses of the composition, concentration, and viability of organisms in samples of ballast water. Administrations/Parties are encouraged to share information concerning methods for the analysis of ballast water samples, using existing scientific venues, and papers distributed through the Organization.

Sample analysis for determining efficacy in meeting the discharge standard

4.5 Sample analysis is meant to determine the species composition and the number of viable organisms in the sample. Different samples may be taken for determination of viability and for species composition.

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.

4.7 A treatment test cycle should be deemed successful if:

.1 it is valid in accordance with paragraph 2.3.3.6 (shipboard) or 2.4.20, 2.4.21, 2.4.24 and 2.4.36 (land-based testing) as appropriate;

.2 the density of organisms greater than or equal to 50 micrometres in minimum diameter in the replicate samples is less than 10 viable organisms per cubic metre;

.3 the density of organisms less than 50 micrometres and greater than or equal to 10 micrometres in minimum diameter in the replicate samples is less than 10 viable organisms per millilitre;

.4 the density of *Vibrio cholerae* (serotypes O1 and O139) is less than 1 cfu per 100 millilitres, or less than 1 cfu per 1 gramme (wet weight) zooplankton samples;

.5 the density of *E. coli* in the replicate samples is less than 250 cfu per 100 millilitres; and

.6 the density of intestinal Enterococci in the replicate samples is less than 100 cfu per 100 millilitres.

.7 no averaging of test runs, or the discounting of failed test runs has occurred.

4.8 It is recommended that a non-exhaustive list of standard methods and innovative research techniques be considered[2].

[2] Suggested sources may include but not be limited to:

.1 The Handbook of Standard Methods for the Analysis of Water and Waste Water.
.2 ISO standard methods.
.3 UNESCO standard methods.
.4 World Health Organization.
.5 American Society of Testing and Materials (ASTM) standard methods.
.6 United States EPA standard methods.
.7 Research papers published in peer-reviewed scientific journals.
.8 MEPC documents.

3 ***Sample analysis for determining eco-toxicological acceptability of discharge***

4.9 Toxicity tests of the treated water discharge should be conducted in accordance with paragraphs 5.2.3 to 5.2.7 of the *Procedure for approval of ballast water management systems that make use of Active Substances* (G9) as revised.

PART 5 – SELF MONITORING

Introduction

5.1 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.

Monitoring of parameters

5.2 The applicable self-monitoring parameters listed below should be recorded for every BWMS[3]. 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 operating conditions on the operation of the BWMS should be determined by the manufacturer and approved by the Administration.

4 ***General information for all systems***

5.3 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.

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

– 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, status of BWMS valves representing system operational mode as appropriate.

– 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.

– The System Design Limitation parameters and their corresponding data such as e.g. range, alarm limit, alert delay etc. be password protected on a level above what is required for normal operation and maintenance, i.e. on a system administrator level. Change of any data or parameters which are password protected and interruption of the measurement (wire break, signal out of range) shall be automatically logged and retrievable on a maintenance access level.

5 ***Data storage and retrieval***

5.4 Storage of data should follow the requirements taking into account paragraphs 4.17 to 4.21 of these Guidelines. The equipment should be able to store a minimum number of self-monitoring parameters following common standards determined by the Organization.

5.5 The control and 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 text files for each ballast water operation on demand to support inspections work.

5.6 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 the extensible mark-up language (xml).

5.7 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.

5.8 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.

PART 6 – VALIDATION OF SYSTEM DESIGN LIMITATIONS

6.1 The objective of the System Design Limitations approach is twofold. First, it ensures that the performance of the BWMS has been transparently assessed with respect to the known water quality and operational parameters that are important to its operation, including those that may not be specifically provided for in these Guidelines. Second, it provides transparent oversight of manufacturer BWMS performance claims that may go beyond specific criteria in these Guidelines. Although the validation of System Design Limitations yields transparent information that is reported on the Type Approval Certificate, this information does not affect the eligibility of a BWMS to receive type approval.

6.2 The low and/or high parameter values for each system design limitation should be validated to the satisfaction of the Administration as follows:

.1 the validation should be overseen by the Administration and should consist of a rigorous evidence-based assessment of a specific claim by the BWMS manufacturer that the equipment will operate as intended between pre-stated parameter values;

.2 tests to validate System Design Limitations should be undertaken in accordance with section 2.1 of this annex. Such tests may be combined with land-based and/or shipboard testing if the QAPP establishes that the validation tests will not interfere with the specific procedures in part 2 of this annex. Laboratory or bench-scale testing may also be used in the validation of System Design Limitations;

.3 methods other than testing, such as the use of existing data and/or models, may be used in the validation of System Design Limitations. The source, suitability and reliability of such methods should be reported; and

.4 validation is not intended as a stress-test of the BWMS or as a procedure for identifying equipment failure points. Validation should be undertaken independently of the BWMS manufacturer and should be separate from BWMS research and development activities. Data and models may be supplied by manufacturer when appropriate but should be independently assessed.

6.3 Claims of open-ended performance (expressed as the lack of either a low or a high parameter value for a system design limitation) should also be validated.

6.4 BWMS manufacturers may include a margin of error in claiming System Design Limitations. For this reason, System Design Limitations should not necessarily be interpreted as the exact parameter values beyond which the BWMS is incapable of operation. The Administration should take this into account in considering whether to include any additional restrictions on the Type Approval Certificate in connection with the validation of System Design Limitations.

6.5 System Design Limitations should be established for all known parameters to which the design of the BWMS is sensitive that are important to the operation of the BWMS. In the case of system design limitation parameters that are also subject to specific criteria in part 2 of this annex, the procedure set out in part 2 should be followed. For such parameters, the approach in paragraph 6.2 may be used only to the extent that the performance claim goes beyond the specific criteria in part 2.

6.6 A report should be submitted to the Administration containing all documentation (including procedures, methods, data, models, results, explanations and remarks) associated with the validation of System Design Limitations. The report should include at least the information identified in paragraph 2.8.2 of this annex.

PART 7 – TYPE APPROVAL CERTIFICATE AND TYPE APPROVAL REPORT

Type Approval Certificate

7.1 The Type Approval Certificate of BWMS should:

.1 identify the type and model of the BWMS to which it applies and identify equipment assembly drawings, duly dated;

.2 identify pertinent drawings bearing model specification numbers or equivalent identification details;

.3 include a reference to the full performance test protocol on which it is based;

.4 identify if it was issued by an Administration based on a Type Approval Certificate previously issued by another Administration. Such a certificate should identify the Administration that supervised conduction of the tests on the BWMS and a copy of the original test results should be attached to the Type Approval Certificate of BWMS.

.5 identify all conditions and limitations for the installation of BWMS on board the ship;

.6 include the System Design Limitations, which should be listed under the heading "This equipment has been designed for operation in the following conditions";

.7 include any restrictions imposed by the Administration due to the minimum holding time or in accordance with paragraph 6.4 of this annex; such restrictions should include any applicable environmental conditions (e.g. UV transmittance, etc.) and/or system operational parameters (e.g. min/max pressure, pressure differentials, min/max Total Residual Oxidants (TRO) if applicable, etc.); and

.8 an appendix containing test results of each land-based and shipboard test run. Such test results should include at least the numerical salinity, temperature, flow rates, and where appropriate UV transmittance. In addition, these test results should include all other relevant variables. The Type Approval Certificate should list any identified system design limitation parameters.

Type approval report

7.2 The type approval report should be submitted to the Organization and made available to the public and Member States by an appropriate means. It should contain at least:

.1 information on the type approval of the BWMS, including:

.1 the approval date;

.2 the name of the Administration;

.3 the name of the manufacturer;

.4 the trade name and product designation (such as model numbers) of the BWMS; and

.5 a copy of the Type Approval Certificate including its appendices, annexes or other attachments;

.2 an executive summary;

.3 a description of the BWMS, including, in the case of BWMS using Active Substances, the following information:

.1 the name of the Active Substance(s) or Preparation employed; and

.2 identification of the specific MEPC report and paragraph number granting Final Approval in accordance with the *Procedure for approval of ballast water management systems that make use of Active Substances* (G9), as revised;

.4 an overview of the process undertaken by the Administration to evaluate the BWMS, including the name and role of each test facility, subcontractor, and test organization involved in testing and approving the BWMS, the role of each report in the type approval decision, and a summary of the Administration's approach to overall quality assurance and quality control;

.5 the executive summary of each Test Report prepared in accordance with paragraphs 2.5.3, 2.6.7, 2.7.1, 2.7.2, 3.4 and 6.6 of this annex;

.6 the operational safety requirements of the BWMS and all safety related findings that have been made during the type approval process;

.7 a discussion section explaining the Administration's assessment that the BWMS:

.1 in every respect fulfilled the requirements of these Guidelines, including demonstrating under the procedures and conditions specified for both land-based and shipboard testing that it met the ballast water performance standard of described in regulation D-2;

.2 is designed and manufactured according to requirements and standards;

.3 is in compliance with all applicable requirements;

.4 has been approved taking into account the recommendations provided by the MEPC in the final approval of the BWMS, if any;

.5 operates within the System Design Limitations at the rated capacity, performance, and reliability as specified by the manufacturer;

.6 contains control and monitoring equipment that operates correctly;

.7 was installed in accordance with the technical installation specification of the manufacturer for all tests; and

.8 was used to treat volumes and flow rates of ballast water during the shipboard tests consistent with the normal ballast operations of the vessel;

.8 the following annexes:

.1 appropriate information on quality control and assurance; and

.2 each complete test report prepared in accordance with paragraphs 2.5.3, 2.6.7, 2.7.1, 2.7.2, 3.4 and 6.6 of this annex.

7.3 The Administration should redact proprietary information of the manufacturer from the type approval report before submitting it to the Organization.

7.4 The Type Approval Certificate and the type approval report (including their entire contents and all annexes, appendices or other attachments) should be accompanied by a translation into English, French or Spanish if not written in one of those languages.

7.5 Documents should not be incorporated by reference into the Type Approval Certificate. 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 re-submit 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.

APPENDIX

BADGE OR CIPHER **(Limiting Operating Conditions Apply)**
(delete as appropriate)

NAME OF ADMINISTRATION

TYPE APPROVAL CERTIFICATE OF BALLAST WATER MANAGEMENT SYSTEM

This is to certify that the ballast water management system listed below has been examined and tested in accordance with the requirements of the specifications contained in the Guidelines contained in IMO resolution MEPC...(..). This certificate is valid only for the Ballast Water Management System referred to below.

Name of Ballast Water Management System ……

Ballast Water Management System manufactured by .....

Under type and model designation(s) .....
and incorporating

To equipment/assembly drawing No. ..... date .....

Other equipment manufactured by .....

To equipment/assembly drawing No. ..... date .....

Treatment Rated Capacity (m^3/h):……

A copy of this Type Approval Certificate, should be carried on board a ship fitted with this Ballast Water Management System. A reference to the test protocol and a copy of the test results should be available for inspection on board the ship. If the Type Approval Certificate is issued based on approval by another Administration, reference to that Type Approval Certificate shall be made.

Limiting Operating Conditions imposed are described in this document.

(Temperature / Salinity) Other restrictions imposed include the

following:

This equipment has been designed for operation in the following conditions
(insert System Design Limitations)

Official stamp Signed .....
Administration of .....
Issued this ..... day of ..... 20 .....
Valid until this……day of …….. 20…..

Enc. Copy of the original test results.