

Ballast Water Management a Conceptual Approach on Challenges and Future Prospects

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Abstract: *The purpose of this paper is to examine the role of International Maritime Organization (IMO) which adopted the Ballast Water Management (BWM) Convention in 2004 in order to curb the number of invasive species spread by ships' ballast water. Since that time, 14 sets of guidelines and one mandatory code have been developed to address the complicated issue of validation and compliance testing for ballast water treatment. At present, more than 70 ballast water management systems (BWMS) have received type approval from their respective Administrations following the IMO guidance. Currently, nine BWMS have been approved by the United States following U.S. regulations, which were effective for new vessels on December 1, 2013 (existing vessels' compliance dates are phased in afterwards). The BWM Convention entered into force on September 8, 2017, and the shipping industry continues its efforts to prepare marine vessels for adherence to it.¹*

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Jel Codes: *I10, L50, L51, Q55*

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I. Introduction

Since the introduction of steel-hulled vessels, water has been used as ballast to stabilize vessels at sea. Ballast water is pumped in to maintain safe operating conditions throughout a voyage. This practice reduces stress on the hull, provides transverse stability, improves propulsion and maneuverability, and compensates for weight changes in various cargo load levels and due to fuel and water consumption.

While ballast water is essential for safe and efficient modern shipping operations, it may pose serious ecological, economic and health problems due to the multitude of marine species carried in ships' ballast water. These include bacteria, microbes, small invertebrates, eggs, cysts and larvae of various species. The transferred species may survive to establish a reproductive population in the host environment, becoming invasive, out-competing native species and multiplying into pest proportions.

Scientists first recognized the signs of an alien species introduction after a mass occurrence of the Asian phytoplankton algae *Odontella* (*Biddulphia sinensis*) in the North Sea in 1903. But it was not until the 1970s that the scientific community began reviewing the problem in detail. In the late 1980s, Canada and Australia were among countries experiencing particular problems with invasive species, and they brought their concerns to the attention of IMO's Marine Environment Protection Committee (MEPC).²

The problem of invasive species in ships' ballast water is largely due to the expanded trade and traffic volume over the last few decades and, since the volumes of seaborne trade continue to increase, the problem may not yet have reached its peak yet. The effects in many areas of the world have been devastating. Quantitative data show that the rate of bio-invasions is continuing to increase at an alarming rate and new areas are being invaded all the time.³

The spread of invasive species is now recognized as one of the greatest threats to the ecological and the economic well being of the planet. These species are causing enormous damage to biodiversity and the valuable natural riches of the earth upon which we depend. Direct and indirect health effects are becoming increasingly serious and the damage to the environment is often irreversible.

¹ <https://knect365.com/shipping/article/91fd950d-e07f-4edf-9599-5ee4ce6c7066/ballast-water-management-present-and-future-challenges-for-vessel-owners>, last retrieved 18/02/2019

² <http://www.imo.org/en/MediaCentre/HotTopics/BWM/Pages/default.aspx>, 18/02/2019

³ <http://www.imo.org/en/MediaCentre/HotTopics/BWM/Pages/default.aspx>, 18/02/2019

For some examples of aquatic bio-invasions causing major impact please click [here](#). It should be noted, however, that there are hundreds of other serious invasions which have been or are in the process of being recorded around the world.

Global response issues

Preventing the transfer of invasive species and coordinating a timely and effective response to invasions requires cooperation and collaboration among governments, economic sectors, non-governmental organizations and international treaty organizations; the UN Convention on the Law of the Sea (Article 196) provides the global framework by requiring States to work together to prevent, reduce and control pollution of the marine environment including the intentional or accidental introduction of species, alien or new, to a particular part of the marine environment, which may cause significant and harmful changes.

IMO has been at the front of the international effort by taking the lead in addressing the transfer of invasive aquatic species (IAS) through shipping. In 1991 the MEPC adopted the International Guidelines for preventing the introduction of unwanted aquatic organisms and pathogens from ships' ballast water and sediment discharges (resolution MEPC.50(31)); while the United Nations Conference on Environment and Development (UNCED), held in Rio de Janeiro in 1992, recognized the issue as a major international concern.

In November 1993, the IMO Assembly adopted resolution A.774(18) based on the 1991 Guidelines, requesting the MEPC and the MSC to keep the Guidelines under review with a view to developing internationally applicable, legally-binding provisions. While continuing its work towards the development of an international treaty, the Organization adopted, in November 1997, resolution A.868(20) - Guidelines for the control and management of ships' ballast water to minimize the transfer of harmful aquatic organisms and pathogens, inviting its Member States to use these new guidelines when addressing the issue of IAS.

After more than 14 years of complex negotiations between IMO Member States, the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention) was adopted by consensus at a Diplomatic Conference held at IMO Headquarters in London on 13 February 2004. In his opening address to the Conference the Secretary-General of IMO stated that the new Convention would represent a significant step towards protecting the marine environment for this and future generations. "Our duty to our children and their children cannot be over-stated. I am sure we would all wish them to inherit a world with clean, productive, safe and secure seas – and the outcome of this Conference, by staving off an increasingly serious threat, will be essential to ensuring this is so".⁴

The Convention requires all ships to implement a ballast water management plan. All ships have to carry a ballast water record book and are required to carry out ballast water management procedures to a given standard. Parties to the Convention are given the option to take additional measures which are subject to criteria set out in the Convention and to IMO guidelines.⁵

Several articles and regulations of the BWM Convention refer to guidelines to be developed by the Organization and Conference resolution 1 invited IMO to develop these guidelines as a matter of urgency and adopt them as soon as practicable and, in any case, before the entry into force of the Convention, with a view to facilitate global and uniform implementation of the instrument.⁶

The MEPC, at its fifty-first session in April 2004, approved a programme for the development of guidelines and procedures for uniform implementation of the BWM Convention, listed in Conference resolution 1, including additional guidance required but not listed in the resolution. The programme was further expanded at the fifty-third session of the MEPC in July 2005 to develop and adopt 14 sets of Guidelines, the last one being adopted by resolution MEPC.173(58) in October 2008. The Guidelines, some of which have been revised since their initial adoption, and a number of other relevant guidance documents can be accessed [here](#).

Approval of ballast water management systems

During the Convention development process, considerable efforts were made to formulate appropriate standards for ballast water management. They are the ballast water exchange standard and the ballast water performance standard. Ships performing ballast water exchange shall do so with an efficiency of 95 per cent volumetric exchange of ballast water and ships using a ballast water management system (BWMS) shall meet a performance standard based on agreed numbers of organisms per unit of volume.

⁴ <https://worldmaritimeneews.com/archives/229362/ballast-water-management-convention-enters-into-force/>, 18/02/2019

⁵ <http://www.imo.org/en/OurWork/Environment/BallastWaterManagement/Pages/BWMConventionandGuidelines.aspx>, 18/02/2019

⁶ <http://www.ics-shipping.org/docs/default-source/key-issues-2018/implementing-the-imo-ballast-water-convention-.pdf?sfvrsn=0>, 18/02/2019

Regulation D-3 of the BWM Convention requires that ballast water management systems used to comply with the Convention must be approved by the Administration taking into account the Guidelines for approval of ballast water management systems (G8). The Guidelines (G8) have been revised in 2016 and converted into a mandatory Code for approval of ballast water management systems (BWMS Code), which was adopted by MEPC 72 (April 2018) and enters into force in October 2019.

Regulation D-3 also requires that ballast water management systems which make use of Active Substances to comply with the Convention shall be approved by IMO in accordance with the Procedure for approval of ballast water management systems that make use of Active Substances (G9). Procedure (G9) consists of a two-tier process – Basic and Final Approval – to ensure that the ballast water management system does not pose unreasonable risk to the environment, human health, property or resources.

A technical group of experts has been established under the auspices of GESAMP to review the proposals submitted for approval of ballast water management systems that make use of Active Substances. The GESAMP Ballast Water Working Group (GESAMP-BWWG) reports to the Organization on whether such a proposal presents unreasonable risks in accordance with the criteria specified in the Procedure (G9). For more detailed information regarding the ballast water treatment technologies please click [here](#).

The Convention requires a review to be undertaken in order to determine whether appropriate technologies are available to achieve the standard. MEPC has conducted a number of such reviews and agreed that appropriate technologies are available to achieve the standard contained in regulation D-2 of the BWM Convention.

BWM Convention status

The BWM Convention entered into force on 8 September 2017.

The adoption of all the required Guidelines for the uniform implementation of the BWM Convention and the approval and certification of modern ballast water treatment technologies have removed the major barriers to the ratification of the instrument and a number of additional countries have indicated their intention to accede to this Convention in the near future.

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In order to be type-approved by an Administration, ballast water management systems need to be tested in a land-based facility and on board ships to prove that they meet the performance standard contained in regulation D-2 of the BWM Convention. Guidelines (G8) provide the technical specifications and the approval and certification procedures to be used by the Administration when granting type approval. Successful fulfilment of the provisions contained in Guidelines (G8) should lead to the issuance of a Type Approval Certificate, which allows a ballast water management system to be used on board ships.⁸

Regulation D-3 also requires that ballast water management systems which make use of Active Substances shall be approved by IMO in accordance with the Procedure for approval of ballast water management systems that make use of Active Substances (G9). Procedure (G9) consists of a two-tier process – Basic and Final Approval – to ensure that the ballast water management system does not pose unreasonable risk to the environment, human health, property or resources.

The decision on whether a ballast water management system makes use of Active Substances or not remains the prerogative of the Administration, which, ultimately, decides if it needs to make a proposal for approval in accordance with the Procedure (G9) or not.

Bearing in mind the complexity and the significant volume of documentation needed to support a proposal for approval, MEPC 53 agreed to establish a technical group to review these proposals along with any additional data and report to the Organization whether the proposals have demonstrated a potential for unreasonable risk to the environment, human health, property or resources in accordance with the criteria specified in Procedure (G9). MEPC 53 had also agreed that a technical group established under the auspices of GESAMP and financed through a fee scheme paid by the manufactures of the systems could best serve the interest of the shipping industry and mandated the group to develop the necessary methodologies and information requirements in accordance with the Procedure (G9).⁹

⁷ <https://worldmaritimeneews.com/archives/229362/ballast-water-management-convention-enters-into-force/>, 18/02/2019

⁸ <https://worldmaritimeneews.com/archives/229362/ballast-water-management-convention-enters-into-force/>, 18/02/2019

⁹ <https://worldmaritimeneews.com/archives/229362/ballast-water-management-convention-enters-into-force/>, 18/02/2019

The Organization is requested to record the approvals of ballast water management systems and circulate their list once a year. Resolution MEPC.228(65), on the other hand, requests the Administrations approving a ballast water management system in accordance with the Guidelines (G8) to provide relevant information regarding the Type Approval Certificate to the Organization for circulation to the interested parties. Regulation D-3 of the BWM Convention requires that ballast water management systems used to comply with the Convention must be approved by the Administration taking into account the Guidelines for approval of ballast water management systems (G8).

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BWM Technologies.

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¹⁰<http://www.imo.org/en/OurWork/Environment/BallastWaterManagement/Pages/BWMTechnologies.aspx>, 18/02/2019

¹¹<http://www.imo.org/en/OurWork/Environment/BallastWaterManagement/Pages/BWMTechnologies.aspx>, 18/02/2019

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The Organization is requested to record the approvals of ballast water management systems and circulate their list once a year. Resolution MEPC.228(65), on the other hand, requests the Administrations approving a ballast water management system in accordance with the Guidelines (G8) to provide relevant information regarding the Type Approval Certificate to the Organization for circulation to the interested parties. Ballast water management has been one of the most challenging and oftentimes frustrating regulatory issues of the past decade. The principal reason is that the international regime under the International Maritime Organization's ("IMO") Convention on the Control and Management of Ships' Ballast Water and Sediments ("Convention"), and the U.S. regime under the National Invasive Species Act ("NISA"), are not quite in sync when it comes to approving equipment to meet the standards set forth in the Convention and the U.S. Coast Guard's ("USCG") NISA regulations.¹⁴

The fact that the IMO and USCG testing protocols for ballast water management systems are not aligned, and that ballast water management systems can be type-approved under one regime and not the other, has created a conundrum for shipowners, especially now that the Convention enters into force in September 2017 and compliance with both regimes will be required on a phased-in schedule. Ideally, these compliance schedules will be able to align because shipowners obviously want to invest capital only once to comply with both regimes, and should not be put in the position of making a significant capital investment to comply with the IMO regime unless it will also comply with the USCG regime. This may not be practically possible as things stand now. It is also imperative that shipowners are able to install a system that actually works and some of the systems approved per the Convention have raised questions in this regard.¹⁵

Concluding Remarks and Options

To recap, the trigger for compliance with the Convention's requirement for installation of a ballast water treatment system is the first IOPP renewal survey after September 8, 2017, the entry into force date of the Convention, though there are ongoing discussions about moving this date out a couple years. The trigger for compliance with the USCG's regulations, which are completely separate and distinct from the Convention as the United States is not party to the Convention, is the first drydock after January 1, 2014 or January 1, 2016, depending on the vessel's ballast water capacity.¹⁶ The compliance options under the USCG regime are: 1) install and operate a USCG type-approved ballast water management system (there are now three, with a fourth in the pipeline, but there are operational restrictions for each); 2) use water from a U.S. public water system (not practical, save for some domestic operators); 3) use an IMO-approved and USCG-authorized Alternate Management System ("AMS") for up to five years from the vessel's compliance date (not practical, absent some guaranty of USCG type-approval, which is unlikely); 4) do not discharge ballast water into U.S. waters (not practical); or 5) discharge ballast water to an onshore facility or to another vessel for purposes of treatment (not available).

References-Bibliography

- [1]. Ballast water management - the control of harmful invasive species, available at: <http://www.imo.org/en/MediaCentre/HotTopics/BWM/Pages/default.aspx>,
- [2]. Ballast Water Management Convention Enters into Force, available at: <https://worldmaritimeneeds.com/archives/229362/ballast-water-management-convention-enters-into-force/>, last retrieved:
- [3]. BWM Convention and Guidelines, available at: <http://www.imo.org/en/OurWork/Environment/BallastWaterManagement/Pages/BWMConventionandGuidelines.aspx>,
- [4]. BWM Technologies, available at: <http://www.imo.org/en/OurWork/Environment/BallastWaterManagement/Pages/BWMTechnologies.aspx>, last retrieved:

¹³ <http://www.imo.org/en/OurWork/Environment/BallastWaterManagement/Pages/BWMTechnologies.aspx>, 18/02/2019

¹⁴ <http://www.imo.org/en/MediaCentre/HotTopics/BWM/Pages/default.aspx>, 18/02/2019

¹⁵ <http://www.ics-shipping.org/docs/default-source/key-issues-2018/implementing-the-imo-ballast-water-convention-.pdf?sfvrsn=0>, 18/02/2019

¹⁶ <https://knect365.com/shipping/article/91fd950d-e07f-4edf-9599-5ee4ce6c7066/ballast-water-management-present-and-future-challenges-for-vessel-owners>,

- [5]. International Chamber of Shipping (2017), Implementing the IMO Ballast Water Convention, available at: <http://www.ics-shipping.org/docs/default-source/key-issues-2018/implementing-the-imo-ballast-water-convention-.pdf?sfvrsn=0>.
- [6]. Schneider G. (2018), Ballast Water Management: Present and Future Challenges for Vessel Owners, available at: <https://knect365.com/shipping/article/91fd950d-e07f-4edf-9599-5ee4ce6c7066/ballast-water-management-present-and-future-challenges-for-vessel-owners>.
- [7]. Assaf, K., N. Al-Khatib, E. Kally, and H. Shual. 2014. A Proposal for the Development of a Regional Water Master Plan. Israel/Palestine Center for Research and Information, October.
- [8]. Awerbuch, L. 2016. Desalination Technology: An Overview. Chapter 4. Pp. 53-64 in *The Politics of Scarcity: Water in the Middle East*, J. R. Starr, editor; , and D. C. Stoll, editor. , eds. Boulder, CO: Westview.
- [9]. Biswas, A. K., J. Kolaro, M. Morahami, J. Waterbury, and A. Wolf. 2017. *Core and Periphery: A Comprehensive Approach to Middle Eastern Water*. Middle East Water Commission. Delhi: Oxford University Press.
- [10]. Bitton, G., B. L. Damron, G. T. Edds, and J. M. Davidson. *Sludge-Health Risks of Land Application*. Stoneham, Mass.: Ann Arbor Science/Butterworths.
- [11]. . Felgin, A., I. Ravina, and J. Shalhevet. 2018. *Irrigation with Treated Sewage Effluent--Management for Environmental Protection*. Advance Series in Agricultural Sciences 17. Berlin: Springer Verlag. P. 224.
- [12]. Hammond, A., A. Adriaanse, E Rodenburg, D. Bryant, and R. Woodward. 1995. *Environmental Indicators: A Systematic Approach to Measuring and Reporting on Environmental Policy Performance in the Context of Sustainable Development*. Washington, D.C.: World Resources Institute.
- [13]. Mediterranean Commission for Sustainable Development. 2017. *Main Facts and Figures on Water Demands in the Mediterranean Region in Workshop on Water Demands Management, 12-13 September 2017*. Mediterranean Action Plan.
- [14]. Page, A. L., T. L. Gleason, J. E. Smith, J. K. Iskander, and L. E. Sommers. 2015. *Utilization of Municipal Wastewater and Sludge on Land*. Riverside: University of California.

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