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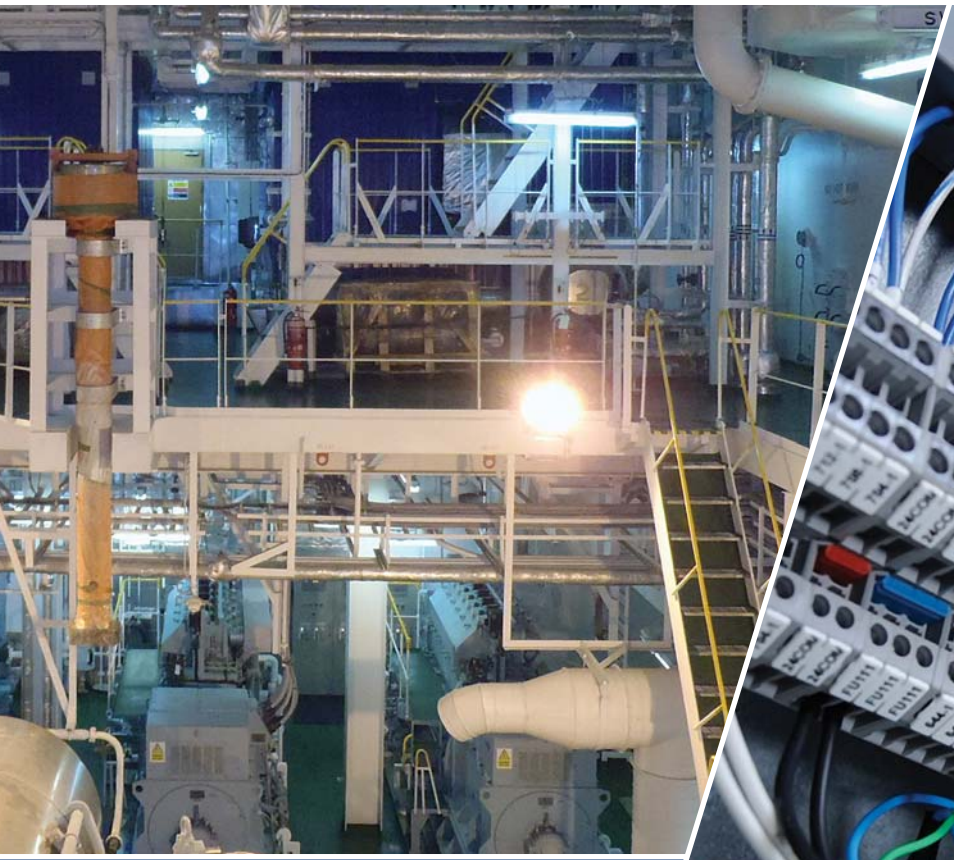
Ballast Water Treatment Advisory 2014



Our Mission

The mission of ABS is to serve the public interest as well as the needs of our clients by promoting the security of life and property and preserving the natural environment.

Health, Safety, Quality & Environmental Policy

We will respond to the needs of our clients and the public by delivering quality service in support of our mission that provides for the safety of life and property and the preservation of the marine environment.

We are committed to continually improving the effectiveness of our health, safety, quality and environmental (HSQE) performance and management system with the goal of preventing injury, ill health and pollution.

We will comply with all applicable legal requirements as well as any additional requirements ABS subscribes to which relate to HSQE aspects, objectives and targets.

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Introduction

The control of nonindigenous species continues to be an important concern and topic in the marine industry. Studies of the impact of the spread of nonindigenous species are frequently published. The world of ballast water treatment and compliance continues to expand with new systems being developed and approved, and countries continuing to refine their requirements and enforcement regimes.

ABS published two previous *Ballast Water Treatment Advisories* that provided useful information on ballast water regulations and treatment technologies to the marine industry. Since last publication of the ABS *Ballast Water Treatment Advisory* in 2011, many regulatory changes have occurred and additional ballast water management options have become available. This *Ballast Water Treatment Advisory 2014* has been expanded to cover updated regulatory requirements, developments in technology, and important information for compliance.

ABS is an accepted subcontractor to the Independent Laboratory (IL) lead by NSF International for evaluating and testing of ballast water management systems (BWMS) for US Coast Guard (USCG) Type Approval. Importantly, USCG Type Approval of BWMS is required for vessels entering and discharging treated ballast water in US waters to prevent the spread of non-native aquatic species in lakes, rivers and coastal waters. ABS performs design, construction and documentation reviews as part of the Type Approval process.

Section 1 | International Ballast Water Management Requirements

In the 1980s, Australia and Canada experienced problems caused by invasive species and brought their concerns to the International Maritime Organization's (IMO's) Marine Environment Protection Committee (MEPC). These actions eventually resulted in the development of the 2004 International Convention for the Control and Management of Ships' Ballast Water and Sediments (i.e., the Ballast Water Management (BWM) Convention).

Continued concerns regarding the spread of nonindigenous species have resulted in various regional regulations worldwide. These actions resulted in shipowners and ship operators being required to meet a myriad of ballast water requirements based upon their current and possible future operations.

International Maritime Organization

The BWM Convention established requirements and standards for ballast water management on vessels of any type operating in the aquatic environment, including submersibles, floating craft, floating platforms, floating storage units (FSUs) and floating production, storage and offloading units (FPSOs). As of July 2014, 40 countries with an aggregated world merchant shipping tonnage of 30.25 percent have ratified the BWM Convention. Although the BWM Convention has the minimum number of states for ratification, it will not enter into force until 12 months after the percentage of tonnage has increased by at least 4.75 percent. The status of the BWM Convention and Parties to the Convention are listed in Table 1.

Table 1. Status of Ratification of the IMO BWM Convention

States	% Tonnage	Parties to the Convention
Needed: 30	Needed: 35%	Albania, Antigua and Barbuda, Barbados, Brazil, Canada, Congo, Cook Islands, Croatia, Denmark, Egypt, France, Germany, Iran, Kenya, Kiribati, Lebanon, Liberia, Malaysia, Maldives, Marshall Islands, Mexico, Mongolia, Montenegro, Netherlands, Nigeria, Niue, Norway, Palau, Republic of Korea, Russian Federation, Saint Kitts and Nevis, Sierra Leone, South Africa, Spain, Sweden, Switzerland, Syrian Arab Republic, Tonga, Trinidad and Tobago, and Tuvalu.
Currently: 40	Currently: 30.25%	

Applicability of the IMO BWM Convention

The BWM Convention applies to all vessel types operating in the aquatic environment which are designed to carry ballast water and are entitled to fly the flag of a Party to the Convention. This includes submersibles, floating craft and platforms including FSUs and FPSOs, although the applicable requirements vary.

IMO BWM Convention – BWM Standards

The BWM Convention includes two regulations for ballast water management standards to reduce the risk of aquatic organism and pathogen invasions: Regulation D-1 addresses the ballast water exchange (BWE) standard; and Regulation D-2 provides the ballast water performance standard for the discharge of organism from ships.

Some ships are required to initially comply with BWE standards. BWE is founded on the principle that organisms and pathogens contained in ballast water taken on board from coastal waters will not survive when discharged into deep oceans or open seas, as these waters have different temperatures, salinities and chemical compositions. Similarly, the deep ocean waters or open seas contain fewer organisms and pathogens and are less likely to adapt to the new coastal or fresh water environment. Therefore, BWE significantly reduces the probability of organism and pathogen transfer through ballast water.

Ships performing BWE are required to do so with an efficiency of at least 95 percent volumetric exchange. Acceptable methods for ballast water exchange are the sequential method, the flow-through method and the dilution method. The flow-through method and the dilution method are often referred to as "pump-through" methods. Table 2 provides a description of the acceptable BWE methods.

Table 2. Acceptable Methods for BWE

Type of BWE	Description
Sequential Method	A process by which a ballast tank is first emptied and then refilled with replacement ballast water.
Flow-through Method	A process by which replacement ballast water is pumped into a ballast tank, allowing water to flow through overflow or other arrangements. At least three times the tank volume is to be pumped through the tank.
Dilution Method	A process by which replacement ballast water is filled through the top of the ballast tank with simultaneous discharge from the bottom at the same flow rate and maintaining a constant level in the tank throughout the ballast exchange operation. At least three times the tank volume is to be pumped through the tank.

BWE is not a completely effective solution to reduce the spread of unwanted aquatic organisms and pathogens. It is a temporary measure to reduce the spread of nonindigenous species through ship's ballast. The convention ultimately requires all ships to be installed with a ballast water management system that can meet the ballast water performance standard (i.e., Regulation D-2) as shown in Table 3. The ballast water performance standard identifies numbers of organisms for various sizes and concentrations of indicator microbes in ballast water that BWMS are required to achieve prior to discharge.

All BWMS must undergo land-based and shipboard testing and be type approved by an Administration under a structured protocol that demonstrates the capability of the BWMS to achieve the discharge standard under full scale operations. In any port or offshore terminal, an officer authorized by a Party to the Convention may board a vessel, to which the convention applies, inspect the documentation on board and take samples for compliance. Detailed inspection through sampling of the ballast water discharge is expected to be performed if documentation is found not to be in good order.

Table 3. BWM Convention Performance Standards

Constituent	Discharge Limitation
Organisms ≥ 50 µm	< 10 viable organisms per m^3 of ballast water
50 µm > Organisms ≥ 10 µm	< 10 viable organisms per ml of ballast water
Indicator Microbes	
Toxicogenic Vibrio cholera (serotypes O1 and O139)	< 1 colony-forming unit (cfu) per 100 ml
Escherichia coli	< 250 cfu per 100 ml
Intestinal Enterococci	< 100 cfu per 100 ml

In addition to the ballast water management performance standards, all ships are required to implement a Ballast Water and Sediments Management Plan, carry a Ballast Water Record Book, and follow specific ballast water management practices.

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IMO Guidelines Available

Developed and adopted by the BWM Convention, 15 guidelines clarify the requirements and ensure uniform implementation of the regulations. The guidelines supporting the convention are listed in Table 4. Copies of the guidelines also are available from IMO.

Table 4. BWM Convention Guidelines

Guideline	Title
G1	Guidelines for Sediment Reception Facilities (MEPC.152(55))
G2	Guidelines for Ballast Water Sampling (MEPC.173(58))
G3	Guidelines for BWM Equivalent Compliance (MEPC.123(53))
G4	Guidelines for BWM and the Development of BWM Plans (MEPC.127(53))
G5	Guidelines for BW Reception Facilities (MEPC.153(55))
G6	Guidelines for BWE (MEPC.124(53))
G7	Guidelines for Risk Assessment under Regulation A-4 of the BWM Convention (MEPC.162(56))
G8	Guidelines for Approval of BWM Systems (MEPC.125(53); Revision MEPC.174(58))
G9	Procedure for Approval of BWM Systems that make use of Active Substances (MEPC.126(53); Revision MEPC.169(57))
G10	Guidelines for Approval and Oversight of Prototype BW Treatment Technology Programs (MEPC.140(54))
G11	Guidelines for BWE Design and Construction Standards (MEPC.149(55))
G12	Guidelines for Design and Construction to Facilitate Sediment Control on Ships (MEPC.209(63))
G13	Guidelines for Additional Measures Regarding BWM Including Emergency Situations (MEPC161(56))
G14	Guidelines on Designation of Areas for BWE (MEPC.151(55))
–	Guidelines for BWE in the Antarctic Treaty Area (MEPC.163(56))

Ballast Water Sampling for Compliance

Understanding the requirements and procedures for ballast water sampling is important for shipowners and operators, as well as shipbuilders to ensure that systems are properly configured and crews are properly trained. The G2 guideline addresses general sampling procedures for all parties, including Port State Control officers, to determine if a ship is in compliance with the BWM Convention. It is important to note that the G2 guideline does not address specific legal requirements as the legislative procedures and requirements for enforcement action vary from country to country. The G2 guideline was adopted in 2008.

Testing for compliance is proposed to be performed in two steps: indicative analysis (i.e., quick assessment of compliance potential); and detailed analysis (i.e., thorough analysis for compliance). In May 2013, the MEPC approved Circular BWM.2/Circ 42 ("Guidance on ballast water sampling and analysis for trial use in accordance with the BWM Convention and Guidelines (G2)") to provide general recommendations on methodologies and approaches to sampling and analysis for compliance testing for the D-1 and D-2 standards.

The guidance includes the information on the sampling and analysis approaches and methods for compliance testing. The methods and approaches are dependent of the type of analysis (i.e., indicative or detailed analyses). A comparison of the differences between indicative and detailed analysis is provided in Table 5.

Table 5. Comparison of Indicative and Detailed Analyses

	Indicative Analysis	**Detailed Analysis**
Purpose	To provide a quick, rough estimate of the number of viable organisms	To provide a robust, direct measurement of the number of viable organism
Sampling		
Volume	Small or large depending on specific analysis	Small or large depending on specific analysis
Representative Sampling	Yes, representative of volume of interest	Yes, representative of volume of interest
Analysis Method		
Analysis Parameters	Operational (chemical, physical) and/or performance indicators (biological)	Direct Counts (i.e. Biological Organisms)
Time-Consuming	Lower	Higher
Required Skill	Lower	Higher
Accuracy of Numeric Organism Counts	Poorer	Better
Confidence with respect to D-2	Lower	Higher

Source: BWM.2/Circ.42

BWM.2/Circ.42 contains specific information on analysis methods and approaches for sampling that should be reviewed. MEPC recommends that BWM.2/Circ.42 should be read along with the BWM Convention, Port State Control guidelines, G2 guidelines, and other guidance documents for assessment of compliance with the discharge standards.

BWM Convention Compliance Timeframe

In December 2013, the 28th IMO Assembly recommended each party enforce ballast water discharge standards per the schedule illustrated in Table 6. For vessels with a keel laying date prior entry into force of the BWM Convention, the implementation schedule for compliance with the D-2 standard has been aligned with the first International Oil Pollution Prevention (IOPP) renewal survey. Vessels with a keel laying date after entry into force are to be in compliance with the D-2 standard at delivery.

Table 6. IMO BWM Convention Implementation Schedule

<table>
<tr><th rowspan="2">Ballast Water Capacity (m3)</th><th rowspan="2">Keel Laying Date</th><th colspan="4">Year and Applicable Standard</th></tr>
<tr><th>2014</th><th>2015</th><th>2016</th><th>2017</th></tr>
<tr><td>< 1,500 or > 5,000</td><td>< 2009
(B-3.1.2)</td><td colspan="2">D-1 or D-2</td><td colspan="2">D-2*</td></tr>
<tr><td>1,500 ≤ or ≤ 5,000</td><td>< 2009
(B-3.1.1)</td><td colspan="4">D-2 compliance required at first IOPP renewal survey after EIF</td></tr>
<tr><td rowspan="2">< 5,000</td><td>> EIF</td><td colspan="4">D-2 compliance at delivery</td></tr>
<tr><td>2009 ≤ K < EIF
(B-3.3)</td><td colspan="4">D-2 compliance required at first IOPP renewal survey after EIF</td></tr>
<tr><td rowspan="3">≥ 5,000</td><td>2009 ≤ K < 2012
(B-3.4)</td><td colspan="2">D-1 or D-2</td><td colspan="2">D-2*</td></tr>
<tr><td>2012 ≤ K < EIF
(B-3.5)</td><td colspan="4">D-2 compliance required at first IOPP renewal survey after EIF</td></tr>
<tr><td>≥ EIF</td><td colspan="4">D-2 compliance at delivery</td></tr>
</table>

Key:

D-1 = Ballast Water Exchange Standard

D-2 = Ballast Water Performance Standards

EIF = Entry into Force

IOPP= International Oil Pollution Prevention

*D-2 compliance is required at the first IOPP Renewal Survey following the Anniversary Date of Ship Delivery or, if EIF is after 31 December 2016, D-2 compliance is required at the first IOPP Renewal Survey following the date of EIF.

For some vessels, the specific date of compliance to the D-2 standard depends on the date of entry into force for the BWM Convention. If the BWM Convention enters into force before the end of 2016, some vessels with a keel laying date before entry into force will be required to comply with the D-2 standard at the first IOPP renewal survey following the anniversary date of ship delivery; while some will be required to comply with the D-2 standard at the first IOPP renewal survey after entry into force. If the BWM Convention enters into force after 2016, all vessels with keel laying dates before the entry into force will be required to comply with the D-2 standard at the first IOPP renewal survey after entry into force.

Owners and operators are encouraged to consult with representatives from the local ABS technical offices for additional clarification once the entry into force criteria have been satisfied.

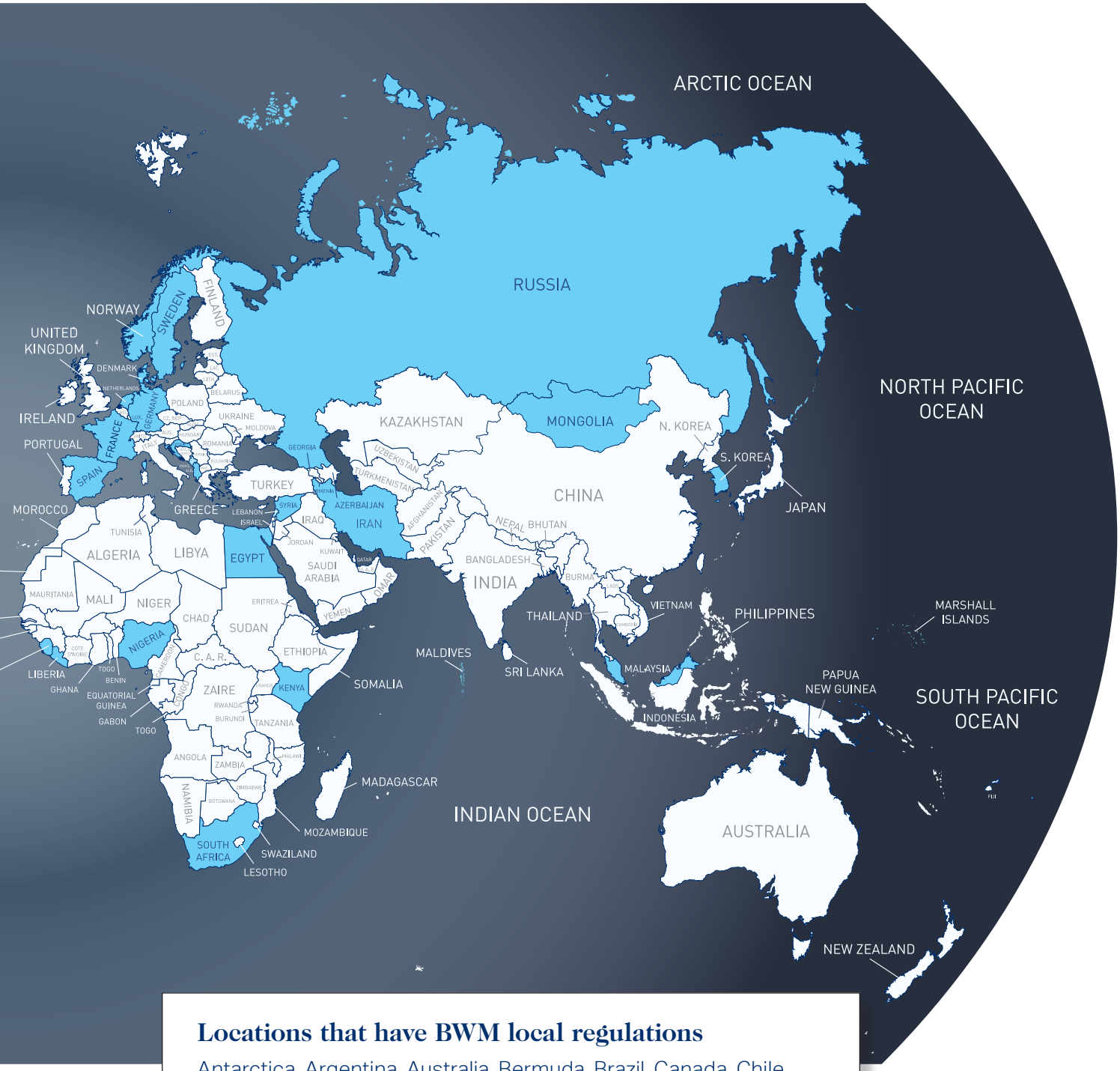
Overview of Some Regional, National and Local Regulations

As previously stated, 40 countries have ratified the BWM Convention. Various foreign countries have established ballast water management requirements as part of the vehicle for incorporation of the convention or for standalone requirements. Figure 1 identifies information on the countries and their requirements.

Countries that have ratified the BWM Convention

Albania, Antigua and Barbuda, Barbados, Brazil, Canada, Cook Islands, Congo, Croatia, Denmark, Egypt, France, Germany, Iran, Kenya, Kiribati, Lebanon, Liberia, Malaysia, Maldives, Marshall Islands, Mexico, Mongolia, Montenegro, Netherlands, Nigeria, Niue, Norway, Palau, Republic of Korea, Russian Federation, Saint Kitts and Nevis, Sierra Leone, South Africa, Spain, Sweden, Switzerland, Syrian Arab Republic, Tonga, Trinidad and Tobago, and Tuvalu.

Figure 1.



Locations that have BWM local regulations

Antarctica, Argentina, Australia, Bermuda, Brazil, Canada, Chile, China, Colombia, Croatia, Egypt, Georgia, Israel, Lithuania, Namibia, New Caledonia, New Zealand, Norway, Northwest Europe, Panama, Peru, Persian Gulf, Portugal, ROPME Sea Area (RSA), Russian Federation, Turkey, Turks and Caicos Islands, Ukraine, United Kingdom, United States of America, Orkney Islands, and Vanuatu.

Recent IMO Activity Related to the BWM Convention

The most recent MEPC sessions addressed various issues regarding the BWM Convention – from Type Approval applications to testing to requirements for offshore support vessels.

Amendments to the Type Approval process were approved and published in Circular BWM.2/Circ.43 ("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)"). The amendments clarified what information should be provided in the Type Approval application and listed specific testing information that should be provided in the Type Approval certificate.

In line with BWM.2/Circ.43, Resolution MEPC.228(65) was adopted that specifies information to be reported when approving BWMS. The information includes:

- An annex to the Type Approval certificate containing test results of each land-based and shipboard test run and the conditions (i.e., salinity, temperature, flow rates) of the test
- Details on the testing protocol, such as information on the test organisms, BWMS operating parameters, energy consumption and report of failures
- Description of active substances
- Identification of the specific MEPC report granting Final Approval

Circular BWM.2/Circ.44 ("Options for ballast water management for Offshore Support Vessels in accordance with the BWM Convention") addresses methods of compliance for offshore support vessels (OSVs) and clarifies that drill water taken on board for the purpose of protecting low flash point liquid tanks, which is not discharged into the environment, is not subject to the requirements of the BWM Convention.

Circular BWM.2/Circ.46 ("Application of the BWM Convention to Mobile Offshore Units") states that mobile offshore units should comply with the provisions of the BWM Convention and should be surveyed and certified according to the BWM Convention. For mobile offshore units, the committee confirmed that ballast water loaded in preload tanks on self-elevating units and ballast tanks on column-stabilized units is subject to treatment under the convention – unless it is discharged to the same location from which it was taken on board and that no mixing with unmanaged seawater and sediments from other areas has occurred.

BWM.2/Circ. 46 also recognizes that residual water remaining on board, after a field move, could be internally treated and transferred to another tank and mixed with seawater taken on board from that new location. The committee acknowledged that seawater in spudcans or leg footings is handled differently and only agreed that the method of handling such seawater should be indicated in the BWM plan.

The issue of entry and exit of ships from the national policies, strategies or programs for ballast water management was discussed and resulted in developed in Circular BWM.2/Circ.52 ("Guidance on entry or re-entry of ships into exclusive operation within waters under the jurisdiction of a single Party"). This issue may apply in circumstances such as:

- The need to bring a ship, such as a mobile offshore unit, into exclusive operation within the waters of a single Party for an extended period; and
- The need to allow a domestic ship of a Party to visit a foreign drydock and then to return to exclusive operation within the Party's waters.

BWM.2/Circ. 52 provides guidance on entry or re-entry into exclusive operations and when application of the BWM Convention ceases. The circular also provides guidance on the verification required for ceasing application to the convention.

Section 2 | US Ballast Water Regulations

Ballast water management requirements in the United States are a result of USCG regulations, US Environmental Protection Agency (EPA) permits, and individual state regulations. In March 2012, the USCG published the long awaited final ballast water rule. The EPA followed suit with revising ballast water requirements in the Final National Pollutant Discharge Elimination System (NPDES) General Permit for Discharges Incidental to the Normal Operation of a Vessel (a.k.a. 2013 Vessel General Permit) issued in March 2013. In general, US federal requirements align with the BWM Convention, while including additional requirements to enhance the control of introduction and spread of nonindigenous species from ships' ballast water in waters of the United States.

US Coast Guard

The USCG "Standards for Living Organisms in Ships' Ballast Water Discharged in US Waters" final rule established new US requirements for BWM, ballast water reporting, ballast water recordkeeping, and established an approval process for BWMS.

The USCG amended existing BWM requirements to include ballast water discharge standards equivalent to the BWM Convention. The implementation schedule for USCG discharge standards, shown in Table 7, is similar to the BWM Convention but is not dependent upon ratification of the convention. The USCG rule established a firm timeline for ships to be required to treat ballast water if entering US waters.

The USCG ballast water regulation became effective on 21 June 2012 and applies to all vessels, US flag and non-US flag, equipped with ballast tanks operating in waters of the US unless specifically exempt (i.e., crude oil tankers engaged in coastwise service, vessels that operate exclusively within one Captain of the Port (COTP) Zone).

Table 7. USCG Ballast Water Discharge Standards Implementation Schedule

	Ballast Water Capacity	Compliance Date
New Vessels (Constructed on or after 1 December 2013)	All	On Delivery
Existing Vessels (Constructed prior to 1 December 2013)	< 1,500 m^3	1st Scheduled Drydocking after 1 January 2016
	1,500 – 5,000 m^3	1st Scheduled Drydocking after 1 January 2014
	> 5,000 m^3	1st Scheduled Drydocking after 1 January 2016

The USCG defines scheduled drydocking as "hauling out a vessel or placing a vessel in a drydock or slipway for an examination of all accessible parts of the vessel's underwater body and all through-hull fittings and does not include emergency drydocking and emergency hull repairs." The USCG also defines a ballast tank as any tank or hold on a vessel used for carrying ballast water, whether or not the tank or hold was designed for that purpose (33 CFR 151.1504). US navigable waters include the territorial sea as extended to 12 nautical miles from the US shoreline or outer shoreline of barrier islands.

Overview of USCG Ballast Water Management Program

The USCG ballast water management program includes requirements for:

- Ballast Water Management (BWM)
- Ballast Water Reporting
- Ballast Water Recordkeeping

Prior to the dates for implementation of the ballast water discharge standards, all vessels with ballast tanks, unless specifically exempt, as identified below, must be in compliance with all aspects of the regulation – BWM, reporting and recordkeeping.

As previously stated, the USCG exempts crude oil tankers engaged in coastwise trade and vessels that operate exclusively within one COTP Zone from BWM, ballast water reporting, and ballast water recordkeeping requirements of the ballast water regulation.

The USCG also exempts the following vessels from BWM requirements but not the reporting or recordkeeping requirements:

- Seagoing vessels that operate in more than one COTP Zone, do not operate outside of the Exclusive Economic Zone (EEZ), and are less than or equal to 1,600 gross registered tons (i.e., 3,000 gross tons)
- Non-seagoing vessels
- Vessels that take on and discharge ballast water exclusively in one COTP Zone

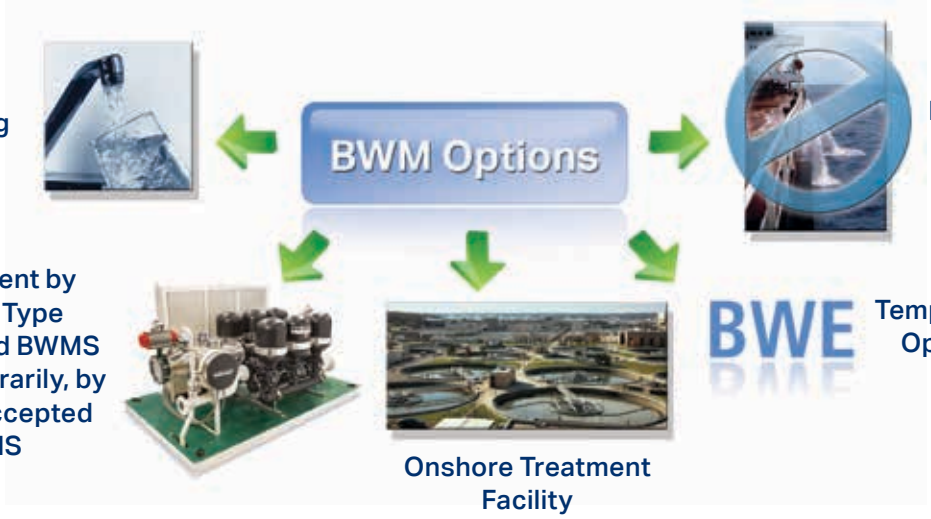
BWM Options

Vessels are required to use one of the following BWM options:

- Install and operate a BWMS that has been type approved by the USCG under 46 CFR Part 162
- Use only water from a US public water system
- Perform complete ballast water exchange (BWE) in an area 200 nm from any shore prior to discharging ballast water unless required to use a BWMS
- Use an alternate management system (AMS), unless required to use a BWMS
- No discharge of ballast water
- Discharge to a facility onshore or another vessel for treatment purposes only

Additional information on the USCG Type Approval process and USCG accepted AMS is provided in Section 4. The USCG also specifies additional requirements related to the operation and maintenance of the vessel, development of a ship-specific BWM plan, and management of sediment. Figure 1 includes detailed information on the requirements of the USCG Ballast Water Program. Many requirements in the USCG ballast water regulation are not included in the BWM Convention or related guidelines. Shipowners and operators need to understand the additional requirements of the USCG ballast water regulation.

The USCG has published further guidance regarding the requirements as well as responses to Frequently Asked Questions on the USCG Ballast Water Management website http://homeport.uscg.mil/ballastwater.



USCG: Additional Requirements

- Minimizing or avoiding uptake of ballast water in areas or under conditions where marine organisms are likely to be abundant
- Cleaning the ballast tanks regularly to remove sediments and ensuring that sediment disposal is in accordance with local, State and Federal regulations
- Discharging only the minimal amount of ballast water essential for vessel operations
- Rinsing anchors and anchor chains when the anchor is retrieved to remove organisms and sediments at their places of origin
- **Removing fouling organisms from the vessel's hull, piping and tanks on a regular basis and disposing of any removed substances in accordance with local, State and Federal regulations**
- **Maintain a BWM Plan developed specifically for the vessel**
- Training the master, operator, person in charge and crew on the application of ballast water and sediment management and treatment procedures; and
- When discharging ballast water to a reception facility in the United States, discharge only to reception facilities that have an NPDES permit to discharge ballast water

USCG BWM Plan Requirements

- Detailed safety procedures
- Actions for implementing the mandatory BWM requirements and practices
- Detailed fouling maintenance and sediment removal procedures
- Fouling maintenance procedures may be documented in a standalone document
- Procedures for coordinating the shipboard BWM strategy with USCG authorities
- Identification of the designated officer(s) in charge of ensuring that the plan is properly implemented
- Detailed reporting requirements and procedures for ports and places in the US where the vessel may visit, and
- A translation of the plan into English, French or Spanish if the vessel's working language is another language

USCG Sediment Management Requirements

- Sediment from ballast water tanks or holds is to be disposed
- Clean ballast tanks regularly to remove sediment
- Dispose of sediment in accordance with applicable regulations
- Document practices, removal and disposal in BWM Plan

Figure 2. USCG Ballast Water Program

Ballast Water Reporting and Recordkeeping

Vessels are to record information on the vessel, voyage, total ballast water, BWM practices (including BWM methods and BWM plans on board), ballast water tanks to be discharged into US waters or at a reception facility, and sediment disposal practices. The BWM activities are to be recorded on the Ballast Water Reporting Form (OMB Control No. 1625 0069) and submitted in accordance with the specified instructions. The form and instructions are available on the National Ballast Information Clearinghouse website (http://invasions.si.edu/nbic/submit.html). The signed reporting form is to be retained on board the vessel for two years. Appendix D contains a copy of the Ballast Water Reporting Form.

In October 2012, the USCG and National Ballast Water Clearinghouse established the Equivalent Reporting Program – an alternative single monthly batch reporting instead of the port-to-port pre-arrival notification.

To participate, vessels must meet the following criteria:

- The applicant vessel must operate exclusively within the US Exclusive Economic Zone (EEZ) or Canadian equivalent
- The applicant vessel must not have ever been listed on a USCG Lookout List for failing to submit a ballast water report or for submitting incomplete or inaccurate reports
- The person submitting the form must have suitable capability for e-mailing the form as an attachment

and either

- The applicant vessel makes ten or more ballast water reports per calendar month, or
- The fleet of applicant vessels, owned by the same company, makes 50 or more ballast water reports per calendar month

Details on the Equivalent Reporting Program are located at http://invasions.si.edu/nbic/equivalentprogram.html.

On 5 June 2013, the USCG proposed to amend its existing BWM reporting and recordkeeping requirements. The USCG proposed to require vessels with ballast tanks operating exclusively on voyages between ports or places within a single COTP Zone to submit an annual report of their BWM practices. The USCG also proposed to update the current ballast water report to include only data that is essential to understanding and analyzing BWM practices. The proposed rule will allow most vessels to submit ballast water reports after arrival to the port or place of destination. ABS will provide additional information when the USCG finalizes the proposed changes to ballast water reporting requirements.

US EPA Vessel General Permit

The 2013 Vessel General Permit (VGP) issued on 28 March 2013 covers discharges incidental to the normal operation of a vessel, including ballast water, into waters of the US. Effluent limits and requirements are established for ballast water that aligns with USCG requirements. The 2013 VGP became effective 19 December 2013 and expires on 18 December 2018. In general, the 2013 VGP works in conjunction with the USCG ballast water regulations in the US and includes additional definitions, exclusions and management requirements for vessels. Table 8 lists some of the additional features in the 2013 VGP. One important difference with the USCG ballast water regulations is lack of an exemption for crude oil tankers in coastwise trade (33 CFR 151.2015(b)(1)).

Table 8. Additional Ballast Water Requirements for 2013 VGP

Exclusions from VGP Requirements and Reporting
Vessels that do not travel more than 10 nm and cross no physical barriers or obstructions (e.g., locks), whether or not they operate within one US Coast Guard COTP zone
Unmanned, unpowered barges,
Vessels with a ballast water capacity of less than 8 m^3
"Lakers" Built Before 1 Jan. 2009
Additional Ballast Water Requirements
When using a BWMS, vessels must also conduct BWE or saltwater flushing (as applicable) in addition to ballast water treatment if: • Vessel operates outside of the EEZ and more than 200 nm from shore and then enters the Great Lakes from the St. Lawrence Seaway System; and • Vessel has taken on ballast water that has a salinity of less than 18 ppt from a coastal, estuarine, or fresh water ecosystem within the previous 30 days
Specific requirements for "Lakers" including annual inspections of sea screens and ballast tanks for sediment accumulation and minimizing the uptake at ballast dockside.
Use of public water as a BWM option was expanded to include water from the Canadian drinking water system
Specific discharge limitations for biocides or residuals from BWMS that use active ingredients,
Specific training requirements for all vessels equipped with ballast water tanks
Extensive monitoring and testing requirements for installed BWMS

EPA VGP Monitoring and Reporting Requirements

The EPA has included detailed monitoring requirements for vessels with installed and operating BWMS. The 2013 VGP requires three areas of monitoring for BWMS:

- Functionality
- Biological Organism Monitoring
- Residual Biocide and Derivative Monitoring

Functionality monitoring is included to verify the BWMS is operating according to the manufacturer's specifications and includes monitoring for specific metrics depending upon the components of the BWMS as well as sensor calibration. EPA has identified metrics for 18 different technology types that are to be recorded monthly. The number of metrics requiring monitoring depends on the treatment technology in the BWMS. For example, a system with filtration, chlorination and neutralization requires that eight specific metrics to be measured and recorded monthly. In addition to the metrics monitoring, sensors and control equipment in a BWMS are to be calibrated as specified by the manufacturer or, at a minimum, annually.

The 2013 VGP also requires biological organism monitoring. EPA stated that, due to current constraints in monitoring live organisms, the 2013 VGP only includes biological organism monitoring for three listed indicator organisms: total heterotrophic bacteria, *E. coli* and enterococci.

Residual biocide and derivative monitoring is related to the active ingredients that may be used in the BWMS. EPA provided a list of common biocides and residuals (i.e., chlorine dioxide, chlorine, ozone, peracetic acid, and hydrogen peroxide) to be monitored and referenced the *EPA 2009 National Recommended Water Quality Criteria* (http://water.epa.gov/scitech/swguidance/standards/criteria/current/upload/nrwqc-2009.pdf) for identification of other biocides.

The frequency of monitoring biological organisms and residual biocides and derivatives is related to the specific BWMS installed. BWMS that were approved with high quality data require less frequent monitoring because EPA believes systems with high quality data may be more reliable. BWMS with high quality data are defined as systems that obtained USCG Type Approval or were accepted by the USCG as an AMS.

Table 9. 2013 VGP Functionality Monitoring Metrics

Technology Type	Required Metrics to be Reported
Alkylamines	Alkylamines sample concentration Alkylamines dosage and usage pH readings
Biological agents	Treatment chemical sample concentration Treatment chemical dosage and usage
Cavitation	Pressure readings
Chlorination: (e.g., sodium chlorite and sodium hypochlorite)	Chlorine readings from both on-line sensor and sample analysis Chlorine dosage on treatment (if chlorine addition) Oxidation reduction potential (ORP) readings Total Residual Oxidizers (TRO) readings Conductivity/salinity and temperature readings
Chlorine Dioxide	Chlorine dioxide readings from both on-line sensor and sample analysis Chlorine dioxide dosage and usage (if chlorine addition)
Coagulation (flocculent)	Treatment flocculent concentration Treatment chemical dosage and usage Coagulant effluent turbidities
Deoxygenation	Deoxygenation gas dosage and usage pH readings Dissolved oxygen concentrations
Electric Pulse	Electric pulse module power consumption, voltage and current readings
Filtration	Flow readings Filter pressures (before and after) Filter backwash frequencies
Heat	Temperature readings
Hydrocyclone	Hydrocyclone back flush frequencies Hydrocyclone power consumption, voltage and current
Menadione/Vitamin K	Menadione/Vitamin K concentration at injection Menadione/Vitamin K dosage and usage
Ozone	TRO readings Ozone readings from both on-line sensor (if used) and sample analysis Bromate measurements Conductivity/salinity and temperature readings
Peracetic acid	Hydrogen peroxide readings from both on-line sensor and sample analysis Hydrogen peroxide dosage and usage Peracetic acid readings from both on-line sensor and sample analysis Peracetic acid dosage and usage pH readings
Plasma pulse	Plasma pulse module power consumption, voltage and current readings Temperature readings
Shear	Pressure readings
Ultrasound	Ultrasound module power consumption, voltage and current readings
Ultraviolet (UV) and UV plus TiO2	UV module power consumption, voltage and current readings UV dosage, intensity and transmittance Flow readings

Table 10. 2013 VGP Monitoring Frequency

Type of Monitoring	BWMS with High Quality Data	BWMS without High Quality Data
Biological Organism Monitoring	2 times per year for the first year If sampling results are below effluent limits, monitoring can be reduced to 1 time per year Monitoring will remain at 2 times per year, if samples exceed effluent limits	4 times per year
Residual Biocide and Derivative Monitoring		
Initial Monitoring	3 times in the first 10 discharge events (not to exceed a 180 day period)	5 times in the first 10 discharge events (not to exceed a 180-day period)
Maintenance monitoring	2 times per year	4 times per year

Detailed self-inspection and reporting requirements are specified in the VGP. Appendix H provides the form for the Annual Report and the Supplemental Addendum (Supplemental Ballast Water DMR) for monitoring. EPA is also developing the electronic reporting form. More information regarding the 2013 VGP is available at http://cfpub.epa.gov/npdes/vessels/vgpermit.cfm.

Individual State Requirements

To date, 16 states in the US have specific BWM requirements. States have imposed these requirements either through specific state regulations or Clean Water Act (CWA) Section 401 Certifications for the 2013 VGP. California is considered to have the most stringent requirements. Figure 2 identifies states with ballast water requirements in addition to the federal requirements. Information on California and New York requirements are presented below, and a summary of state requirements is provided in Appendix A.

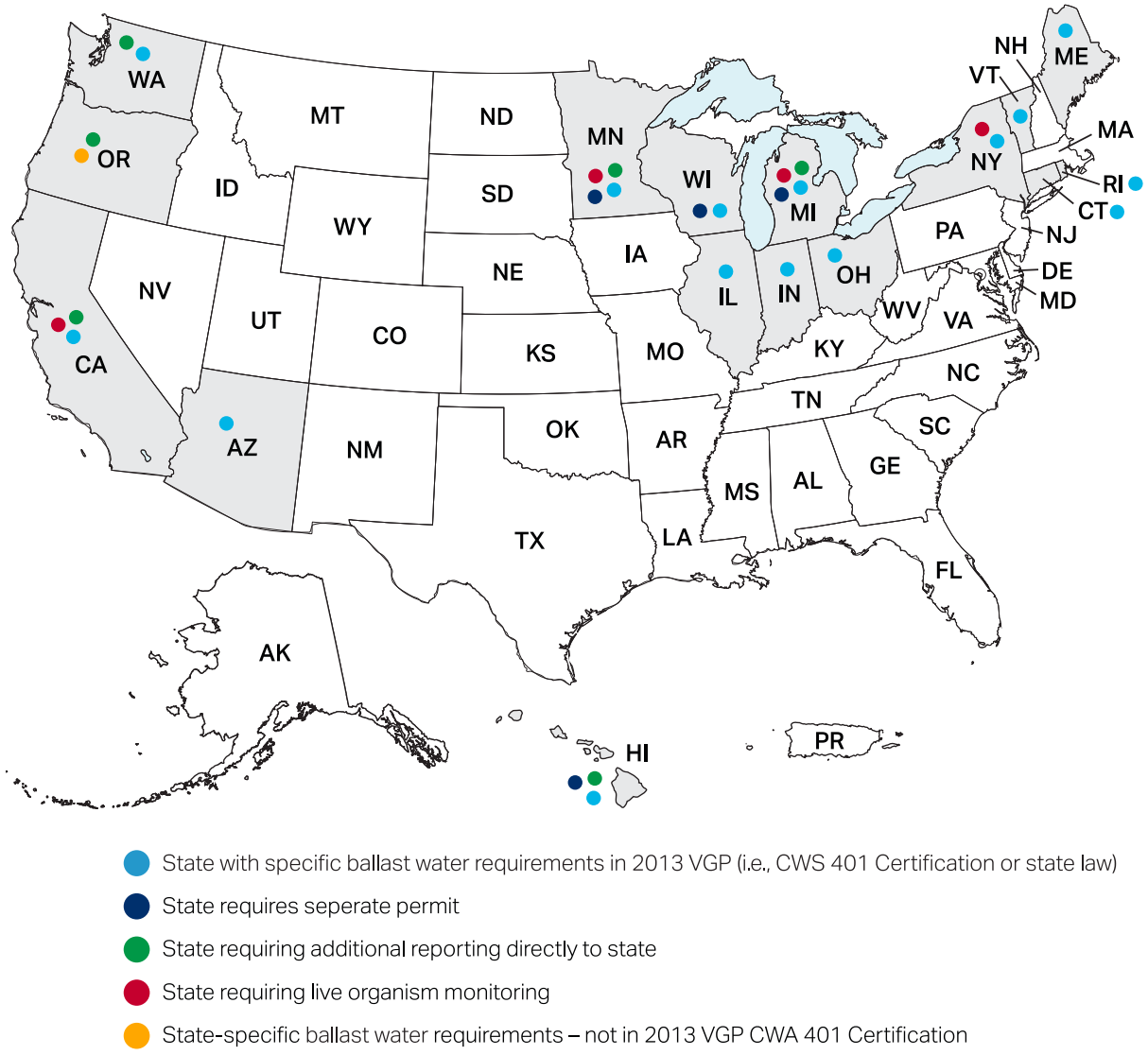


Figure 3. US States with Specific Ballast Water Management Requirements

California

The most stringent ballast water requirements have been established in California. The California State Lands Commission Marine Invasive Species Program has developed a two prong approach to preventing and minimizing the introduction of nonindigenous species in California waters through requirements for ballast water management and hull fouling on ships of 300 gross registered tons or more.

At present, vessels discharging ballast water in California waters are required to conduct ballast water exchange. The ballast water exchange requirements depend on the vessel's port of origin. California developed interim and final performance standards that treatment systems are to achieve. Table 11 contains the California interim performance standards.

Table 11. California Interim Ballast Water Treatment Performance Standards.

Organism Size Class	Discharge Limitation
Larger than 50 µm (micrometer or one millionth of a meter) in minimum dimension	No detectable living organisms
10 – 50 µm in minimum dimension	Less than (<) 0.01 living organisms per ml (milliliter)
Less than 10 µm in minimum dimension	Less than 10^3 (1,000) bacteria per 100 ml Less than 10^4 living viruses per 100 ml
Escherichia coli	Less than 126 cfu (colony forming units) per 100 ml
Intestinal enterococci	Less than 33 cfu per 100 ml
Toxicogenic Vibrio cholera (Human cholera)	Less than 1 cfu per 100 ml or Less than 1 cfu per gram of wet weight biological material

In June 2013, the California State Lands Commission approved a report to the California Legislature recommending a delay in the implementation of California's interim performance standards. In response to the recommendations, the California Legislature passed Senate Bill (SB) 814, which was signed by the California Governor and became effective on 1 January 2014 (Public Resources Code (PRC) Section 71205.3). The revised implementation schedule for the interim standards is presented in Table 12.

Table 12. California Interim Standard Implementation Schedule

Ballast Water Capacity of Vessel	Implementation for New Vessels Constructed on or After	Implementation for Existing Vessels
Less than 1,500 MT (metric tons)	1 January 2016	1 January 2018
1,500 – 5,000 MT	1 January 2016	1 January 2016
More than 5,000 MT	1 January 2016	1 January 2018

The final discharge standards are zero detectable living organisms for all organism size classes listed in Table 11 and are to be effective 1 January 2020. The implementation schedule for final discharge standards was not revised. The California State Lands Commission will conduct another review of available BWMS by 1 July 2014 to further evaluate the implementation schedules.

For hull fouling, vessels are required to remove fouling regularly and submit the Hull Husbandry Reporting Form once each calendar year. Regular removal is defined by one of the following:

- No longer than by the expiration date (or extension) of the vessel's full-term Safety Construction certificate
- No longer than by the expiration date (or extension) of the vessel's USCG certificate of Inspection
- No longer than 60 months (five years) since the vessel's most recent out-of-water drydocking

California has proposed modifications to both the ballast water management regulations and hull husbandry requirements. The existing ballast water management regulations are being modified to establish requirements for sampling ports and collection, analysis, and handling of ballast water samples so as to ensure compliance with the performance standards.

The hull husbandry regulations are being modified to establish biofouling management practices, performance standards, recordkeeping and reporting requirements. The proposed modifications have not been adopted. The California State Lands Commission plans to reintroduce a revised draft of the proposed regulations for comment. ABS will provide further information guidance when the California proposed modifications are final.

Recordkeeping and Reporting Form Submission Requirements

California requires the USCG Ballast Water Reporting Form to be submitted upon departure from each port of call to the state as well as the USCG. The *Ballast Water Recordkeeping and Reporting Form Submission* contains detailed information regarding submission requirements. The *Hull Husbandry Reporting Form* includes instructions for completion and must be submitted annually upon receiving a request from the Commission. The proposed modifications for biofouling management include requirements for a biofouling management plan in addition to the existing Hull Husbandry Reporting Form.

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New York

New York initially established discharge standards similar to California but revised their requirements to align with USCG and EPA 2013 VGP requirements. New York has deferred more stringent water quality based effluent limitations until the next VGP. However, New York continues to require ballast water exchange regardless of whether the vessel is equipped with a BWMS.

New York also includes additional management practices for ballast water taken aboard in Viral Hemorrhagic Septicemia (VHS) affected waters that include: annual inspection (and documentation) and replacement, as necessary, of ballast sea chest screens; lightening the ship as much as practical to elevate water intakes before ballasting to minimize sediment uptake and increase water flow; and a requirement for ballast water to be taken aboard or discharged via the pumps and prohibiting "gravity fed or drained" ballast.

In addition to the 2013 VGP biological indicator compliance monitoring, all vessels covered under the VGP and operating in New York waters, after a BWMS is installed, must sample and analyze the ballast water discharge for live organisms (i.e., organisms >50 µm and organisms from 10-50 µm) at least once a year using acceptable sampling and testing protocol. The monitoring results are to be submitted to the EPA and the New York State Department of Environment Conversation on an annual basis. At the time of this publication, no compliance sampling and testing protocol is available.

Section 3 | Ballast Water Management Options

Various ballast water management options have been developed for compliance with regulations. While the installation of a BWMS may be the most predominant solution, other options have been identified. In the US, shipowners may also be in compliance with requirements through the following methods:

- Transfer to onshore treatment facility or another vessel for purposes of treatment
- Use of public water
- Retention of ballast water
- No discharge of ballast water in US waters

Several regulations permit the onshore treatment of ballast water or discharge to another vessel for purposes of treatment. Onshore treatment facilities and vessels used for treatment must have the appropriate discharge permits. Piping and connections to onshore treatment facilities or other vessels must prevent the discharge of untreated ballast water. The State of California has also included the same provision but noted that no treatment facilities or treatment vessels have been identified.

The USCG regulation was the first to permit the use of public water as ballast water. According to the USCG regulation, ships intending to use public water as ballast may use only water from a US public water system (PWS), as defined in 40 CFR 141.2, and meeting the requirements of 40 CFR Parts 141 and 143, as ballast water. The US EPA incorporated the same requirements but expanded the definition of public water to include water from a Canadian water system, as defined in Health Canada's "Guidelines on Canadian Drinking Water Quality."

Vessels using PWS water as ballast must have either: (i) previously cleaned the ballast tanks (including removing all residual sediments) and not subsequently introduced ambient water or (ii) never introduced ambient water to those tanks and supply lines. MEPC 65 included a discussion on the use of drinking water as ballast water and encouraged Administrations to provide additional information to the Bulk Liquid and Gases Sub-Committee (BLG) regarding the option.

An important part of compliance with all regulations is determining if ballast water can be retained on board or if no ballast water will be discharged in US waters. Shipowners and operators need to initially evaluate their ballasting operations to determine if retention or use of one of the previously mentioned alternatives is an option, prior to installing a ballast water treatment technology.

Ballast Water Treatment Technologies

In general, ballast water treatment technologies fall into two groups: separation technologies or disinfection technologies. Separation technologies remove organisms from ballast water upon intake or prior to discharge. Disinfection technologies kill or render organisms incapable of reproducing. BWMS have been developed using various combinations of the technologies.

Separation Technologies

Equipment is available that separates organisms from ballast water through natural physical differences in organisms (i.e., size of organism) or is induced through the introduction of chemicals to coagulate and flocculate organisms such that separation more easily occurs. The most predominant type of separation technology in BWMS is filtration systems.

Filtration is the passage of a fluid through a porous medium to remove suspended matter, such as sediment, organisms, and silt. BWMS vendors use many different types of filters – disk, drum, mesh, screen, stacked disk and stacked. Each of the filter types identified have different arrangements, technical specifications and means for backflushing. BWMS filters are reported to remove organisms from 10 µm to 200 µm in diameter.

Various other types of separation technologies are being used. A hydrocyclone uses centrifugal force to separate items of different densities for removal of organisms. One BWMS removes organisms by using flocculating agents and then separates the larger "flocs" by magnetic separation technology.

Disinfection Technologies

The destruction of organisms is an important part of ballast water management. Disinfection can kill organisms or alter organisms such that they cannot reproduce or are no longer viable. According to the Guidelines for Approval of Ballast Water Management System (G8), "viable organisms" are defined as "organisms and any life stages thereof that are living." Several disinfection technologies are used in BWMS, including chlorination, ozone treatment, deoxygenation, and ultraviolet (UV) treatment. The ability for technologies to be effective disinfectants is impacted by the salinity and turbidity of the seawater.

Chlorination is a traditional technique for waste water disinfection and can be accomplished through conversion of naturally occurring chlorine in seawater or direct injection of chlorine-containing compounds. In electrolytic chlorination (i.e., electrolysis), an electrical current is applied directly to seawater generating free chlorine, sodium hypochlorite and hydroxyl radicals. Electrolytic chlorination requires a certain salinity level in ballast water or additional salt will need to be added. In seawater, the hydroxyl radicals generated quickly form disinfection byproducts – like hypobromous acid, a highly effective biocide or germicide.

Electrolytic chlorination may be either in-line where the entire ballast water flow is treated or side-stream where 1 to 2 percent of the ballast water flow is treated and then re-injected to the ballast water flow. The use of chlorine dioxide (ClO_2) for disinfection requires generation and inject of ClO_2. Chlorine dioxide is an effective oxidant but does not result in the same disinfection byproducts as traditional chlorination. One BWMS using chlorine dioxide also does not involve or create free available chlorine or disinfection byproducts due to the process for generating the chlorine dioxide.

Ozone treatment is an effective disinfectant in fresh water and seawater. In fresh water, ozone quickly decomposes and forms free radicals that are strong oxidants for destruction of organisms. In seawater, ozone treatment initiates chemical reactions similar to chlorination that result in the formation of the highly effective biocide/germicide of hypobromous acid.

UV treatment is used to break down cell membranes killing organisms outright or destroying its ability to reproduce. The effectiveness depends on the turbidity of the ballast water (i.e. the concentration of sediments) as this could limit the transmission of the UV treatment. UV lights are required to be maintained and power consumption needs to be considered. BWMS systems use a variety of UV lamps.

In BWMS with de-oxygenation, dissolved oxygen in the ballast water is removed and replaced with inactive gases, such as nitrogen or other inert gases. Removing the oxygen not only kills the aerobic organisms in ballast water but can also have positive side effect for corrosion prevention - provided that the oxygen content is maintained at the correct levels. De-oxygenation technologies may require ballast water to be held for a significant amount of time (i.e., 96 hours) for organism counts to meet the discharge levels in IMO D-2 and USCG standards.

BWMS that use active substances or preparations, like chlorination and ozone treatment, to comply with the BWM Convention are required to undergo Basic and Final Approval by IMO.

Section 4 | Approval of BWMS

When choosing a BWMS, shipowners and operators need to ensure the system has achieved the appropriate Type Approval(s). IMO has developed a regime for BWMS Type Approval and requirements are contained in IMO guidelines G8 and G9. In 2012, the USCG developed an independent BWMS Type Approval regime that BWMS installed on vessels flagged or trade in the US waters have to undergo.

Shipowners and operators should ensure that any system which is being considered for installation on board a ship should have a valid Type Approval certificate. This certificate should:

- Identify the type and model of the system, related equipment assembly drawings and model specification numbers
- Include a reference to the full performance test protocol on which the approval is based and be accompanied by a copy of the original test results
- State the specific application for which the treatment system is approved, e.g. for specific ballast water capacities, flow rates, salinity or temperature regimes, or other limiting conditions or circumstances as appropriate

Type Approval of a ballast water treatment system should not be considered as an indication that a given system will work on all vessels in all situations. Even after installing a type approved system, the owner or operator is still responsible for compliance of the discharge on an ongoing basis.

Shipowners should perform due diligence in selecting BWMS suitable for their ships and trades. When selecting a BWMS, shipowners are cautioned to take note of the limiting conditions of the BWMS and the tests and test results that the BWMS have undergone and achieved.

Appendix B contains a list of BWMS that have obtained Type Approval by an Administration and USCG AMS acceptance.

Approval Regime

IMO has prepared several guidelines to achieve consistency in the approval process:

- G8 – Guidelines for Approval of Ballast Water Management Systems (Resolution MEPC.174(58))
- G9 – Procedure for Approval of Ballast Water Management Systems that Make Use of Active Substances (Resolution MEPC.169(57))
- G10 – Guidelines for Approval and Oversight of Prototype Ballast Water Treatment Technology Programs (Resolution MEPC.140(54))

The BWM guidelines above outline the approval framework and a uniform manner of testing, analysis of samples and evaluation of results. G8 addresses the suitability and efficacy of the system. G9 is provided as a safeguard for the sustainable use of active substances and preparations and addresses the acceptability of any active substances and preparations for use in BWMS concerning ship safety, human health and the aquatic environment.

For BWMS that do not make use of active substances, the G8 guideline is applicable. For BWMS that makes use of active substances, G8 and G9 guidelines both are applicable.

The G8 approval process includes the following:

- Documentation review and approval of the design and construction of the system and an assessment to determine if any fundamental problems exist that might constrain the ability of the system to manage ballast water or operate safely.
- Successful compliance with environmental testing by an approved laboratory of all system components, including specified limits of vibration, temperature, humidity, fluctuations in power supply, inclination and, if applicable, protection from green water impact.
- Land-based testing to confirm that the system can meet the D-2 standard for a range of water conditions (i.e., fresh, brackish and sea). Any limitations imposed by the treatment system on the testing procedure should be noted and evaluated by the Administration in its consideration for Type Approval. In some situations, the land-based testing can be done on scaled-down equipment.
- Shipboard testing of a complete, full scale system throughout a full ballast cycle (uptake, storage, treatment, and discharge). At least three consecutive successful test cycles that comply with Regulation D-2 are required over a period not less than six months.

During MEPC 66, the need to revise the G8 guideline was discussed. Further developments are expected during MEPC 67.

The G9 guideline, applicable to BWMS that make use of active substances, consists of a two-tier process (i.e., Basic Approval and Final Approval) – to ensure that the BWMS does not pose unreasonable risk to the environment, human health, property or resources. The Administration approving a BWMS makes the decision on whether a BWMS makes use of active substances or not and whether the BWMS needs to make a proposal for approval to IMO in accordance with the G9 guideline.

Testing for Basic Approval is conducted in a laboratory under conditions simulating ballast water discharge. Basic Approval confirms that no unacceptable adverse effects, or a potential for unreasonable risk to the environment, human health, property or resources exists and screens for persistency, bioaccumulation and toxicity. Final Approval confirms the previous risk evaluation and addresses concerns identified during the Basic Approval process. In addition, a risk evaluation is performed to qualitatively account for the cumulative effects that may occur due to the nature of shipping and port operations.

Both steps involve Administration review and a review by the Group of Experts on the Scientific Aspects of Marine Environmental Protection – Ballast Water Working Group (GESAMP-BWWG). The GESAMP-BWWG makes a recommendation to the IMO MEPC on the approval of the BWMS.

Once the technical review and testing are completed to the satisfaction of the Administration who now holds sufficient evidence that the quality assurance program employed by the manufacturer indicates the equipment can be produced consistently to the required specification, a Type Approval certificate may be issued. When a type approved BWMS is installed on board a vessel, an installation survey is conducted to confirm that the system has been installed as designed, is ready for operation, and conforms to the Type Approval certificate. Upon successful completion of the installation survey, a BWM certificate may be issued as required by the convention. Figure 3 provides a flow chart of the overall approval process.

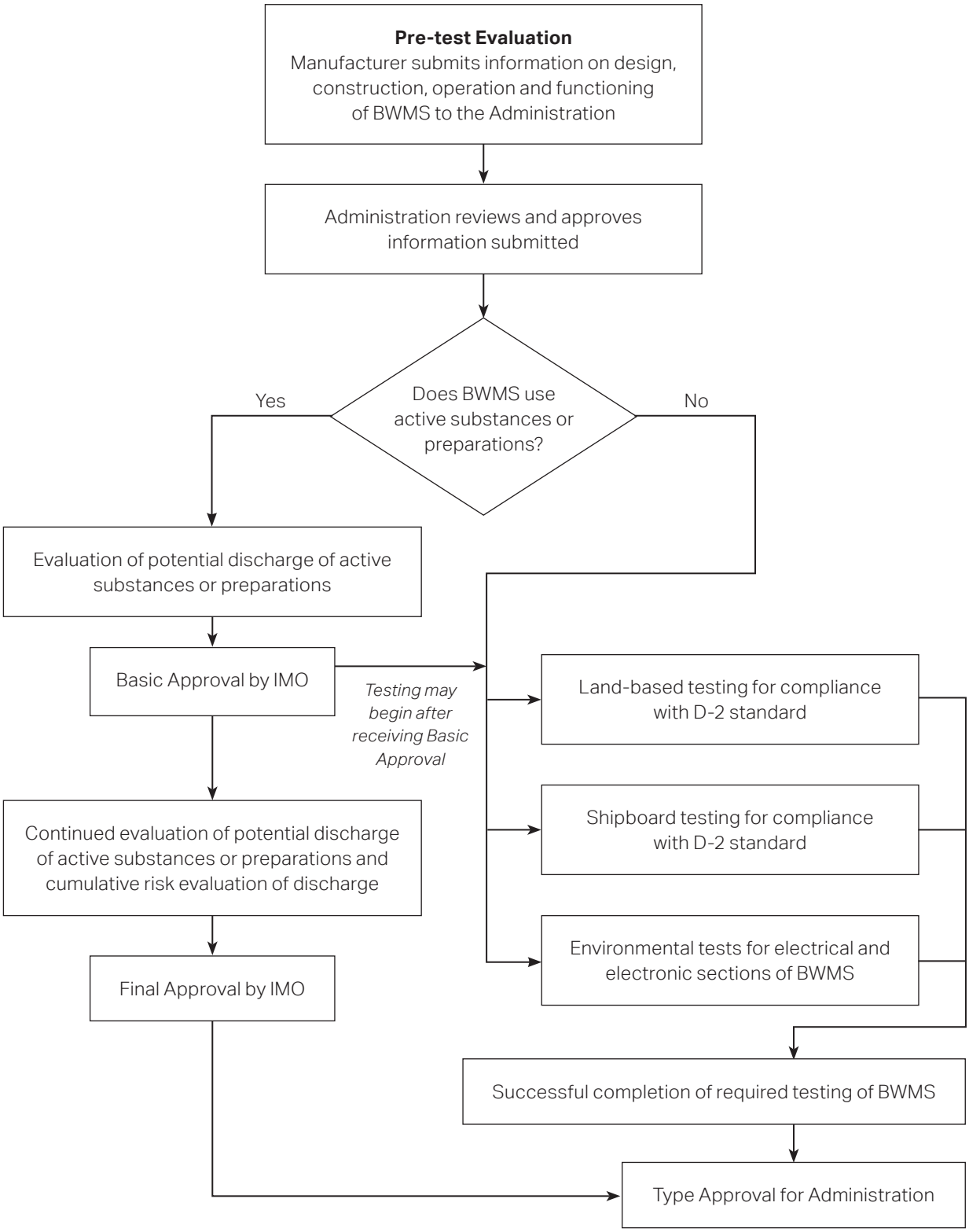


Figure 3. Flow Chart of BWMS Type Approval Process

To encourage the development of new ballast water treatment technologies, the convention also includes an allowance for short term approval of a treatment system that undergoes prototype testing according to the G10 guideline. For any ship that participates in a prototype testing program, the requirements of Regulation D-2 shall not apply until five years after the date the equipment was installed or five years after the date on which the ship would otherwise be required to comply with D-2, whichever is later.

USCG Approval Procedures

The USCG regulations for engineering equipment in 46 CFR Part 162 establish specific procedures and requirements for approval of BWMS to be installed on board vessels for the purpose of complying with the USCG discharge standards in 33 CFR Part151, subparts C and D. In addition to achieving the discharge standards, BWMS are to comply with specific design and construction requirements and have appropriate control and monitoring equipment, adequate arrangements for hazardous materials, active substances, preparations and/or pesticides.

BWMS has two paths to obtain USCG Type Approval: existing test data from Type Approval testing for a foreign Administration or test data from an independent laboratory (IL) accepted by the USCG. Manufacturers can seek USCG Type Approval of a BWMS on the basis of existing data and information generated for Type Approval by another Administration in accordance with the IMO BWM Convention. In this case, the manufacturer will contact an IL to evaluate and explain to what degree the existing data and information satisfy USCG requirements. The USCG has stated that many foreign-approved BWMS will require additional testing and analysis, but the process to secure USCG approval should be shorter than if the manufacturer were required to repeat all testing.

For new testing, applications for Type Approvals must be submitted under the auspices of a USCG accepted IL. USCG accepted ILs are to evaluate, inspect, and test BWMS. All test plans and land-based testing must meet the requirements of the *Final Generic Protocol for the Verification of Ballast Water Treatment Technology* (ETV Protocol). In general, the ETV Protocol is consistent with the BWM Convention but includes more detailed requirements and evaluates many more aspects (i.e., biological treatment performance, cost, predictability) of a treatment system than the G8 guideline.

At the time of this publication, the USCG has not type approved any BWMS. The USCG Maritime Information exchange approved equipment website (http://cgmix.uscg.mil/Equipment/EquipmentSearch.aspx) will list USCG type approved systems.

Alternate Management Systems (AMS)

A BWMS accepted as an AMS is not a USCG type approved system. The AMS acceptance program was incorporated into the USCG rule to ensure BWMS are available for vessel installation and use without having to delay the USCG implementation schedule and also to provide an incentive for the early installation and use of BWMS instead of relying exclusively on BWE.

AMS are intended as a bridging strategy to allow foreign type approved BWMS to be installed and operated on vessels. An AMS must be installed prior to the vessel's compliance date and may be used up to five years after the date when the vessel is required to be in compliance with USCG ballast water discharge standards. The USCG stated that this interim measure will allow BWMS vendors or manufacturers sufficient time to obtain USCG Type Approval without penalizing vessel owners for having been early installers.

BWMS vendors, not shipowners or operators, are to submit an application for AMS determination that includes the foreign Administration's Type Approval report, the testing protocols and the testing results. The USCG will examine the AMS application and determine if the BWMS is accepted as an AMS. When accepted as an AMS, the USCG will provide BWMS vendors with letters of acceptance that include conditions for use of the BWMS. For example, AMS acceptance letters include limitations on the salinity for which the BWMS may be used in US waters.

The USCG announced the acceptance of the first AMS in April 2013. USCG AMS acceptance letters contain details on the acceptance and limitations of systems and are available from BWMS vendors. The USCG Ballast Water Management website (http://homeport.uscg.mil/ballastwater) contains a link to the list of accepted AMS.

Once a USCG type approved BWMS becomes available for a given class, type of vessel or specific vessel, vessels in that class or type will no longer be able to install an AMS in lieu of USCG type approved systems. Various shipowners and operators have requested clarification from the USCG on this statement. As of August 2014, further guidance has not been received. ABS will publish any information that is made available regarding the use of an AMS.

Section 5 | Choosing the "Best" BWM System for Vessel Operations

After shipowners or operators have determined that a BWMS is needed for their vessels to be in compliance with ballast water regulations, identifying the "best" BWMS to install on a vessel is an important decision. The shipowner or operator must evaluate various factors and determine which system best meets the demands of the ship by balancing costs and the impact to the ship operations.

A shipowner or operator needs to evaluate the following factors:

- Ports of call and operational areas
- Necessary approvals
- Vessel-specific information
- Materials, equipment protection (IP rating) and hazardous spaces
- Technology preferences
- Installation considerations
- Life cycle costs
- Vendor qualifications and reputation

Ports of Call and Operational Areas

A vessel owner needs to assess where the vessel will need to operate and ballast to identify potential BWMS candidates for two reasons:

- Some ports have specific requirements for BWMS
- Characteristics of the water determine possible BWMS options

The vessel service or trade route is critical for treatment system selection. Various ports have established specific requirements. For example, ships discharging ballast water in waters of the US will be required to have a USCG type approved BWMS as well as be cognizant of local requirements. A ship discharging ballast water in California waters is required to have a USCG type approved BWMS that achieves the California performance standards.

Section 1 and Section 2 provide information on areas where specific requirements may need to be achieved for a vessel. In addition to regulatory requirements, the water quality varies by port. Turbidity, salinity and silt content impacts the operation and performance of BWMS. Shipowners or operators need to verify the conditions under which a BWMS was tested. If regular port calls occur or are planned in areas with low salinity (i.e., fresh or brackish water), the treatment technology needs to have been tested in such conditions.

The list of ports should encompass all possible areas for ship operation. If treatment options for local requirements are too expensive, ship operators may opt to change their ballast management practices to avoid discharge in certain ports, if possible.

Necessary Approvals (Official Approvals)

First and foremost, a vessel must ensure any BWMS considered has received Type Approval from the appropriate authorities (i.e., flag Administration). In general, most Type Approval certificates will state the BWMS was found to comply with IMO Resolution MEPC.174(58). Ships with type approved BWMS may be issued an International BWM certificate upon a successful onboard functional test. Some flag Administrations may develop their own Type Approval procedures and resulting Type Approval certificates. For example, ships discharging ballast water in US waters will be required to have a USCG type approved BWMS.

A certificate of Type Approval from a flag Administration indicates that, under test conditions, the system has achieved the discharge standards. Only prototype systems or systems being tested for Type Approval would not have Type Approval certificates. When evaluating BWMS, shipowners and shipbuilders need to request a copy of the BWMS Type Approval certificate and data from testing of the system.

The Type Approval certificate should clearly identify:

- Name of BWMS supplier
- BWMS model designation
- Manufacturer of BWMS
- List of drawings
- Manufacturer of additional equipment
- Limiting conditions
- Test results of each land-based and shipboard test run

Shipowners should review the limiting conditions listed to determine if the limiting conditions would impact the ship's use of the BWMS. The BWMS is only in compliance when limiting conditions are not exceeded.

A copy of the original test results should also be included with the Type Approval certificate. The shipowner and shipyard should review the data for the test conditions (i.e., salinity, water temperature) to ensure the BWMS was tested at conditions important to the ship operation. For example, ships that update and discharge fresh water as ballast water should ensure the BWMS was tested in fresh water and that treatment of fresh water is allowed by the limiting conditions in the Type Approval certificate.

Vessel-specific Information

In order to identify the "best" system to install on a specific ship, a variety of factors should be considered. Shipowners and operators should evaluate the type of ship, ballast water capacity, space and many other characteristics.

Ship Type and Capacity

The ship ballasting characteristics are an important factor in selecting a suitable treatment system. Some ships are high ballast dependent, such as tankers and bulkers, and some are low ballast dependent ships, such as containerships, general cargo ships and cruise ships. The determination of whether a ship has a high or low ballast dependency is based upon the ballast demands, such as the maximum amount of discharge at any one port, pump capacities, and maximum ballast flow rates. Table 13 lists the representative ballast water capacity and ballast pump rates for a variety of vessel types.

Table 13. Ballast Water Capacity & Ballast Pump Rates by Vessel Type

Vessel Category	Vessel Type	Representative Ballast Capacity (m^3)	Representative Pump Rate (m^3/hr)
High Ballast Dependent Vessels	**Bulk Carriers**		
	Handy	18,000	1,300
	Panamax	35,000	1,800
	Capesize	65,000	3,000
	Tankers		
	Handy	6,500	1,100
	Handymax-Aframax	31,000	2,500
	Suezmax	54,000	3,125
	VLCC	90,000	5,000
	ULCC	95,000	5,800
Low Ballast Dependent Vessels	**Containerships**		
	Feeder	3,000	250
	Feedermax	3,500	400
	Handy	8,000	400
	Subpanamax	14,000	500
	Panamax	17,000	500
	Postpanamax	20,000	750
	Other Vessels		
	Chemical Carriers	11,000	600
	Passenger Ships	3,000	250
	General Cargo	4,500	400
	Ro/Ro	8,000	400
	Combination Vessels	7,000	400

As illustrated in Table 13, a wide range of ballast capacities and pumping rates exist for commercial vessels. High ballast dependent vessels need to ballast in a fixed period of time to facilitate rapid port turnaround times – typically 12, 18 or 24 hours for ballast operations. The low ballast dependent vessels generally have smaller ballast capacities, and their pumps do not typically have to handle the full ballast capacity on a regular basis. Movement of ballast is often to shift ballast from one tank to another to adjust trim or heel – rather than a full ballasting operation when offloading vessel cargo.

Ballast Water Handling Practices

The proper sizing of a treatment system depends on the amount of ballast that has to be treated at any given port, more so than the total ballast capacity or maximum flow rate. If, through active ballast management, discharge can be reduced or eliminated, then treatment demands decrease. For example, most containerships rarely need to discharge a full ballast load at any one time.

Another ballast practice issue that impacts treatment selection is how accumulated mud and silt in the ballast tanks is addressed. Sediment, mud and silt can contain invasive species even when the tank is empty of water (i.e., NOBOB – no ballast on board condition). Even if ballast is loaded locally, it can become contaminated by the residue in the tank. This may necessitate the treatment of ballast water on discharge as well as loading. If little mud accumulates and the tanks are cleaned regularly, this may be less of a concern and the treatment system can be selected accordingly. For those ships constructed in or after 2009, compliance with G12 guideline is to be applied.

Turbidity, salinity and silt content can impact the efficacy, maintenance or reliability of some technologies. If regular calls in a port are planned where the water has high mud/silt content or has a low salt content (fresh or brackish), these should be considered in the treatment technology selection.

Ballast System Configuration

A number of other vessel features related to ship type, excluding ballast capacity, have an impact on BWMS selection. These include the number of separate ballast systems (e.g., oil tankers often have two, one in way of the cargo area and one aft of the cargo), use of eductors to supplement ballast discharge, or gravity draining of ballast tanks. BWMS need to be evaluated to determine if all aspects of the vessel's ballast system configuration can be accommodated. The shipowner or operator may need to contact the flag State regarding complex operational scenarios.

Power

Electrical power consumption by BWMS may be a significant hurdle for some ships. Large power consumers, such as UV lamps, can require 150 to over 300 kW for a 2,000 m^3 per hour capacity system. If these systems must operate when other large shipboard consumers are operating, existing total ship service electrical generating capacity may be insufficient and additional generators may be required.

The large electrical loads are also the primary operating cost for these systems. In contrast, treatment systems that rely on chemical biocides and preparations that are to be dosed into the ballast flow may have an insignificant electrical load impact but require storage space, handling and dispensing equipment.

Space

Treatment systems are available in different configurations to fit the space available. The footprint requirements can vary from 1 to 25 m^2 for a 200 m^3 per hour capacity system to over 50 m^2 for a 4,000 m^3 per hour capacity system. Most BWMS models increase in size as ballast capacity increases. In general, for a specific flow rate, BWMS with UV disinfection are larger than other systems.

Another very important space consideration is the ballast piping. If the treatment system requires new branch lines to be installed, this can sometimes have an even greater impact on the space requirements than the treatment equipment. In most engine rooms, the ballast piping consists of the largest pipes used. On small containerships with medium capacity pumps, pipes can be over 250 mm in diameter. In the high ballast capacity ships, pipes can easily be over 500 mm in diameter. It can be a challenge to find room for tie-in points to the manifold area around the ballast pumps as well as space in the engine room to run lengths of pipe to remote locations if the engine room had insufficient space for installation. Systems that do not require redirecting main ballast flow have an advantage in this case.

In addition to the total or overall size of the treatment equipment, the system's modularity also impacts the ease with which it can be installed in an existing engine room. Skid-mounted systems may not fit into an existing space for a retrofit installation. Lifting and fitting of individual system components separately will usually reduce installation costs and time. Thus, the ability of a system to be easily broken down into modules of convenient size and located in various areas gives the installer more options for completing the work.

In addition to the BWMS components, the space for installation needs to account for maintenance of equipment and any ancillary equipment (i.e., ladders, lighting, storage space for consumables) needed for the BWMS. When necessary, space requirements for storage and handling of chemicals used in treatment systems also needs to be considered. Storage of chemicals may need to occur outside the engine room and may require additional safeguards, such as a specific firefighting system or an enhanced ventilation system.

Materials, Equipment Protection (IP Rating) and Hazardous Spaces

A BWMS must meet all the normal requirements for shipboard materials, equipment protection and hazardous space safety. The materials used in the system components and the level of equipment protection (IP rating) provided should be reviewed at the Type Approval stage and certified as to be in compliance with the class requirements for similar equipment installed in similar locations on board. One important aspect of this approval is a review of the materials for fire rating where the reviewing authority deems the treatment system an 'essential' system. In that case, some plastic pipe materials may not be allowed.

Additionally, specific valve materials and remote operation/shut downs may be required. These issues are not normally a concern for shipowners, unless they wish to specify higher grade materials for longer design service life and lower maintenance costs. The above mentioned issues are normally a concern for shipowners as the grade of compliance is being considered during the selection/assessment of systems.

Critical to selecting a system, is an understanding of the rules and regulations pertaining to the equipment location, specifically the placement of electrical equipment in a hazardous space. Electrical equipment installed in an engine room does not have to meet the requirements to be considered intrinsically-safe (EX ia or EX ib rated). However, the installation of electrical equipment in a hazardous space (such as a cargo pump room on a tanker) would mandate that specific class and statutory requirements aimed at lowering risks associated with combining electrical equipment and a potentially explosive atmosphere must be addressed.

These traditional class and statutory requirements limit the electrical equipment that can be installed in a cargo pump room to intrinsically-safe equipment, including certified lighting fixtures, a fire extinguishing system alarm, general alarm and communication equipment and a through-run of cables in extra heavy pipe. The placement of BWMS in a pump room, on board a tanker constructed in accordance with these rules and regulations, that requires electrical power such as UV lamp banks or a current of more than 20 milliamps, would not appear to be in compliance.

The application of the International Standard IEC 60092-502 entitled "Electrical Installations in Ships – Part 502: Tankers – Special Features" as referenced by SOLAS Regulation II-1/45.11 for ships constructed on or after 1 January 2007, is in general less restrictive on the certification of electrical equipment than traditional class Rules.

The installation of a BMWS in a pump room may be possible on tankers constructed on or after 1 January 2007 provided the tanker is operated and maintained in accordance with the IEC standard. Such an installation would be contingent on compliance with the requirements contained in IEC 60092-502; the submission of a detailed risk assessment addressing those aspects not covered in the IEC standard; and the approval of the designated approving authority.

Tanker owners and operators are also reminded that ballast water from tanks adjacent to cargo oil tanks cannot pass through or be treated by a ballast water system located in the engine room.

Technology Preferences

Shipowners and operators may also have preferences relating to the treatment technology or the treatment sequence. Many may prefer not to use specific technologies that include the use of filters or chemicals, due to impacts on ship operation. Some shipowners and operators may also want to evaluate the treatment sequence. Most BWMS require treatment upon intake and discharge of ballast water, but some BWMS only require treatment upon intake. A variety of BWMS are available, and they need to assess if their treatment technology preference may assist in identifying the best system for their ship.

Installation Considerations

The ship's service life may also be a determining factor for selecting and installing a BWMS. Shipowners may have more options when installing a BWMS during construction of a vessel because the system requirements can be incorporated into the design. Installation of a BWMS for a retrofit may have to occur during drydocking periods or short pierside stays.

Life Cycle Costs

The bottom line concern for owners is the total life cycle cost of the BWMS. Acquisition costs are easy to identify because they are directly quoted by vendors. Installation costs vary from system to system and are more difficult to quantify. Installation costs include changes to existing piping, equipment and structure, as well as the direct equipment installation, connection, startup, testing and survey by the approval authority. Most installations of BWMS will require some out-of-service time for the ship to complete the installation.

Operating and maintenance costs are the most difficult to estimate as both vary based on the type and size of ship, the BWMS selected, and level of detail obtained from vendors. When estimating operating and maintenance costs for a BWMS, the following should be evaluated:

- Energy required to operate the system including electric power and fuel for generating treatment materials (ozone, inert gas and other biocides)
- Consumables such as chemicals, lamps, filter elements and other spare parts
- Crew labor required for training, operation, and maintenance of the BWMS

Vendor Qualifications and Reputation

As with any piece of equipment, the ability of the vendor or manufacturer to deliver the product on time and in the quantities requested is very important. However, the production capacity of BWMS is unchallenged. Some manufacturers may require long lead times on orders, especially if demand increases rapidly. Even though production facilities are subject to quality control review by the Type Approval authority, manufacturing quality and reliability can be unknown until a track record is established. Those systems relying on existing technologies or marine components will have an advantage in this regard.

Another issue with regard to vendor qualification is the service network for a BWMS. If parts or repairs are needed, a ship will need to be able to easily acquire parts and undergo repairs because ballasting cannot occur if the BWMS is inoperable. Shipowners and operators should request information on available service network locations when evaluating BWMS vendors.

Section 6 | Retrofitting Ships for BWMS

Installation of BWMS on existing ships will be a difficult process that requires detailed planning and integration into the ships existing ballast system. Ship owners and operators will need to discuss many issues with their classification society to ensure a successful installation and commissioning of systems.

Planning

Effective planning for installation requires a survey of the ship space, the current ballasting system, and "neighboring" systems that will be impacted by the installation. Many companies are using three-dimensional (3-D) laser scanning to efficiently map an area and convert into 3-D drawings for the system design. While 3-D scanning may represent a high initial cost, engineering firms have noted that the 3-D scanning will reduce the overall cost of design. The scanning will not miss or result in inaccurate measurement of spaces and may reduce costs if a series of installations on "sister" ships is to occur. If 3-D laser scanning is to be performed, a vendor experienced with marine installations is recommended.

BWMS Integration

Proper integration of a BWMS system is required to ensure the safety of the vessel and crew. The ship's classification society is to be consulted with regard to specific requirements.

Location

A BWMS may be installed in various locations throughout a vessel. The acceptability of the location and arrangements depend on the type of treatment system under consideration, the installation specifications and the type of vessel involved. Each installation must be carefully evaluated to verify that potential safety concerns and pollution hazard issues are adequately addressed.

BWMS that do not serve ballast tanks considered to be hazardous may be installed in the following locations, unless specifically prohibited due to the treatment method involved:

- Machinery space or engine room
- Void spaces with or without direct access or adjacent to the machinery room
- Dedicated enclosure

BWMS that serve ballast tanks considered to be hazardous are to be installed in a void space, weather deck enclosure, or enclosed compartment on the cargo deck, complying with the following compartment criteria:

- Determined to be suitable for the service intended
- Treated as "other machinery spaces" with respect to the fire protection
- Positioned outside of any combustible, corrosive, toxic, or hazardous areas unless specifically approved
- Arranged with no direct access to accommodation spaces, service space, machinery space, control stations or other spaces containing sources of ignition, unless specifically approved
- Maintained watertight integrity of all bulkhead openings and penetrations
- Maintained watertight integrity of all deck openings and penetrations
- Minimized the extent of bulkhead and deck openings and penetrations

Retrofitting of BWMS requires a review of the current ballast system layout and operation. Many existing vessels use ballast tanks that drain by gravity. Most BWMS require treatment prior to discharge of the ballast water. Treatment from a gravity drain tank is not easily accomplished and options need to be reviewed. One additional issue with gravity drain tanks is the sampling point included in the G2 guideline. While the BWM Convention does not address sampling, the G2 guideline states that "samples should be taken from the discharge line, as near to the point of discharge as practicable." This is an issue for tanks that discharge by way of gravity drain.

Another issue in retrofitting is for ships that are designed to use eductors to "strip" the ballast tank. While the source water for stripping is local water, the water is mixed with the remaining ballast water and sediment in the ballast tank, which in most cases have not completed all treatment or undergone testing for compliance. This mixing of the source water may be prohibited by the BWM Convention. This issue is being reviewed by MEPC.

Additional restrictions and requirements may apply to installations of BWMS serving ballast tanks of oil and chemical carriers. The ship's classification society should be contacted regarding these requirements.

Ventilation

The ship's classification society needs to be consulted regarding the ventilation requirements. Specific requirements are developed for "hazardous areas and concerns" and other areas. In general, BWMS are to be installed in well ventilated areas. If the BWMS is to be installed in a non-hazardous space, other than the machinery space, and is not to serve any ballast tanks considered to be hazardous, the space should be fitted with an independent mechanical extraction ventilation system providing at least six air changes per hour or the amount specified by the BWMS manufacturer, whichever is greater.

BWMS installed in a separate compartment that is considered to be a hazardous area require verification that the ventilation system for the space meets the design and code. Additional ventilation may be required depending on the specific BWMS. For example, a BWMS using chemicals may require additional ventilation.

Structural

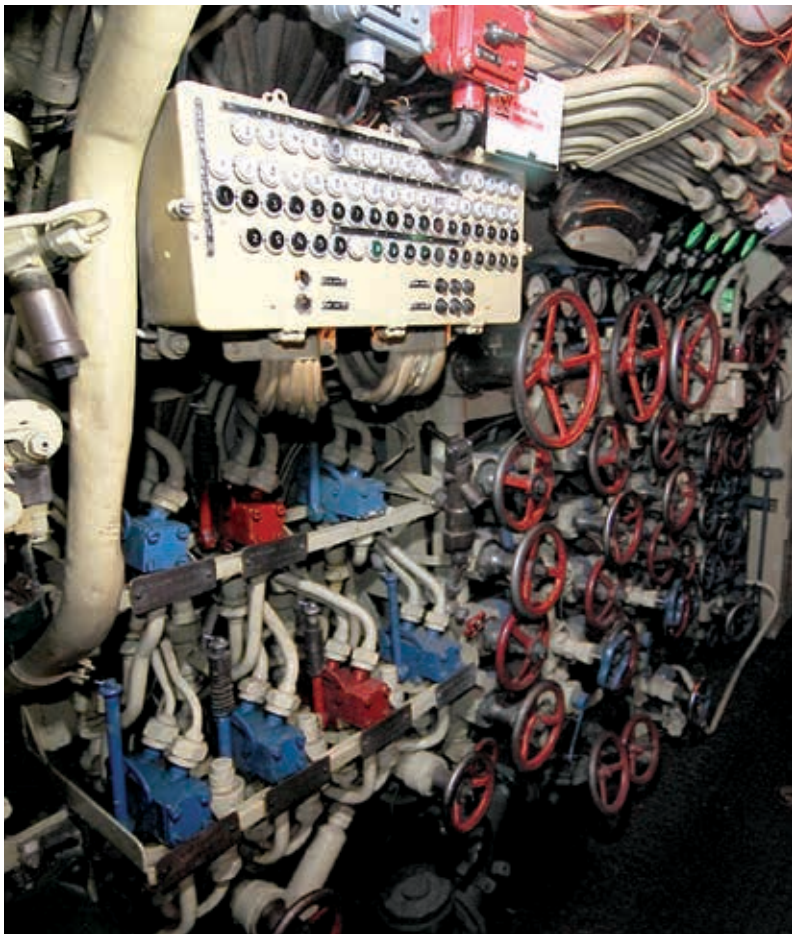
The BWMS equipment must be efficiently supported and the adjacent structures are to be adequately stiffened as required. Structural considerations are subject to all relevant classification society requirements. The installation of a BWMS on a new or existing vessel shall not compromise the integrity of the vessel hull, framing, decks, bulkheads, tank structures, existing equipment foundations or additional structural member. Additionally, the application of a BWMS is not to adversely affect the ballast loading conditions, loading instrumentation, intact stability, damage stability and fire safety.

Electrical Systems

The electrical components of a BWMS are to be integrated with the existing electrical system. The retrofit design needs to ensure that sufficient power is available on the ship for operation of the BWMS. Ships being retrofitted may require additional power for operation of the BWMS.

Instrumentation

The BWMS should be able to connect to existing instrumentation and controls. The shipowner should request information on the BWMS control system prior to purchasing the system to ensure viable installation and integration.



Approvals

Prior to any installation, ship general plans, various drawings, and operational manuals are to be reviewed and approved by the ship's classification society. The specific list of plans, drawings, and manuals may vary by classification society. The classification society is also required to conduct an engineering review and approval of the installation design. The engineering review includes review of hull plans showing the foundation and attachments to vessel's structure for each component of the BWMS. These plans are to clearly indicate the scantlings and details of welding.

Machinery plans are to be reviewed showing the installation design of the BWMS on the vessel including location, piping and electrical details/drawings, general arrangement and layout, and installation and equipment plans. Plans are to include applicable arrangements for hazardous areas.

Shipowners and operators need to allocate sufficient time for review and approval of the required items. Installation is not to occur until approval has been obtained.

Installation

After approval of all applicable plans, drawings, and operational manuals, installation may begin. Retrofit installations have been reported to require from seven to 80 days. Installations have occurred during a drydocking period, short pierside stay or even when underway for smaller, less complicated vessels. During any installation, coordination with other shipboard work must occur. Technicians must identify other ship systems that will be impacted and equipment necessary to perform the installation.

During the installation, ABS recommends all ballast tanks and associated piping to be cleaned. Start-up of a BWMS with no residual organisms in the ballast water system is essential to the performance of the BWMS.

BWMS Start-up and Pre-Commissioning

An initial survey of the BWMS is to be conducted by the classification society to verify that the installation of the BWMS including any associated structure, fitting, arrangements and material are in compliance with applicable requirements, as indicated in the approved drawings and/or plans. The purpose of the survey is to ensure proper documentation is on board and that the BWMS is installed per drawings of the BWMS and that workmanship is acceptable.

After installation of the BWMS, a shipboard function test is to be carried out to the attending Surveyor's satisfaction at the sea or quay trial, as appropriate. The function test is to demonstrate mainly the ability of the BWMS installation to operate consistently with the ship's normal ballast operations at the treatment rated capacity in a shipboard test cycle and reflecting the manufacturer's specific installation criteria. The function test will not evaluate the ability of the BWMS to achieve ballast water discharge standards. A shipboard function test plan is to be prepared and submitted for approval prior to the testing.

Lessons Learned

Various lessons learned have been described by engineering firms designing and performing retrofit installations. As with any design, proper planning is essential. Sufficient time for purchasing, receipt of equipment and installation needs to be allotted.

One engineering firm stated that the design needs to specify the design criteria of piping to be fabricated for the installation to ensure the piping is manufactured as accounted for in the design. When working with a new shipyard, piping was received that did not meet the design criteria and resulted in delays due to the need to fabricate new piping.

The ballast tanks of the ship should be clean during installation of a BWMS. One ship had issues with the start-up of the system due to the need to treat ballast water from ballast tanks that contained sediment build-up with many active organisms.

The installation of the BWMS needs to account for all ballast tanks and ballasting operations. Special attention is required for ballast tanks that drain by gravity. Stripping operations for ballast tanks also need to be carefully evaluated. These particular operations pose a significant issue for compliance with the BWM Convention.

The majority of ships to comply with the BWM Convention are be retrofitted with a BWMS. Retrofitting a BWMS requires that a shipowner or operator undergo a rigorous process to ensure the installation can occur with minimal cost and impact to the operation of the ship.

Section 7 | Evaluation Checklists

ABS has created a set of checklists to assist shipowners and operators in their assessment of BWMS. Some information is to be supplied by the shipowner and some by BWMS vendors.

Shipowner Supplied Information

Vessel Ballast System Information

Ballast System Arrangement

Total Ballast Capacity (m^3): _____

Number of Ballast Tanks: _____

Minimum/Maximum Ballast Tank Size (m^3): _____

Number of Separate Ballast Systems (i.e., not served by the same pump):_____

Are ballast tanks contiguous with cargo oil or other hazardous cargo tanks? _____

_____

Does the vessel have a dedicated set of heel control tanks (FW or SW)? _____

Ballast System Equipment

Number of Ballast Pumps and Rating (Flow rate and pressure for each pump): _____

Overall Ballast Rate (m^3/hr): _____

Ballast Pump Location (i.e., engine room, pump room, main deck): _____

Main Ballast Line Configuration (ER, pump room, main deck, etc.): _____

_____

Type of Stripping System, if any: _____

_____

Are all ballast system valves remotely operated? _____

Are ballast pumps piped/shared with other systems (i.e., bilge, fire, cooling water)?_____

_____

Number and Location (i.e., height above bottom) of Sea Chests: _____

_____

Diameter of Main Ballast Line to/from Pumps: _____

Number and Size of Spare Circuit Breakers on Main Switchboard:_____

_____

Estimated Spare Electrical Capacity during Ballasting Operations: _____

_____

Ship Service and Characteristics that Impact BWMS Selection

Ship Type

Type of Ship: _____

Ballast Water Handling Practices

On average, how much ballast is loaded or discharged at any given port?_____

_____

What are the time constraints on ballast intake (i.e., how fast must it happen)?_____

_____

Maximum Required Flow Rate for Intake of Ballast: _____

What are the time constraints on ballast discharge (i.e., how fast must it happen)? _____

_____

Maximum Required Flow Rate for Discharge of Ballast: _____

Sediment Build-up in Tanks (i.e., little, moderate, significant): _____

Minimum Time Ballast Held in a Tank between Port Calls: _____

Ballast Water Characteristics

Does the ship encounter fresh water in ports where discharging ballast is necessary? _____

_____

Minimum salinity of brackish water encountered: _____

Turbidity or silt content of port water (low, moderate, heavy): _____

Vessel Service Characteristics

Any unique service constraints or trading patterns regarding ballast use? _____

_____

Is there trade to special BWT zones: California, Great Lakes, Australia, etc.? _____

_____

Does active ballast management allow zero ballast discharge in some/all ports?_____

_____

Ballast System Characteristics

What are the gravity intake/discharge practices? _____

Can internal ballast transfer to control trim, heel, bending moment be easily accomplished?

_____

Challenges for Installation Engineering

Intake/Discharge Isolation: Cross-Contamination

Can piping installation options provide adequate contamination protection? _____

_____

Can intake and discharge pumps be isolated and dedicated to that service? _____

_____

Sampling and In-service Testing

Does the ship have adequate space and facilities for sampling and testing? _____

_____

Maintaining Ballasting Flexibility

Can the treatment system options selected provide full ballast flexibility? _____

_____

Other

Is adequate space available for all system components and ballast connections? _____

_____

What are the access openings and routes for bringing in new treatment system components?

_____

What are the access needs during system operation and maintenance? _____

_____

Are switchboard modifications required? _____

Are control system modifications required? _____

BWMS Manufacturer/Vendor Supplied Data

Treatment Technology Factors

Treatment Method

Description of Technology Treatment Sequence: _____

_____

For UV System:

Lamp type, required minimum intensity and water clarity: _____

_____

For Chemical or Chlorination Systems:

Required minimum dosage rate and minimum holding time: _____

_____

Neutralizing agents – How stored, dosed? _____

_____

Time required for discharge? _____

Chemicals generated on board or supplied as preparations? _____

_____

For De-Oxygenation:

How much inert gas required? _____

Minimum holding time: _____

Type of gas, fuel type and consumption to generate gas: _____

_____

Treatment System Capacity

Overall BWMS Rate (m^3/hour): _____

Overall Tank Capacity (m^3) required, if applicable: _____

Treatment System Pressure Drops

Expected pressure drops to main ballast flow added by treatment system: _____

_____

Quantity of ballast redirected for cleaning or sludge discharge: _____

Is gravity intake/discharge possible with this system? _____

Equipment Size and Space Requirements

Total space required for treatment equipment: _____

Size of largest single component: _____

Weight of largest single component: _____

Space required for maintenance (element removal, etc.):_____

Materials, Equipment Protection (IP rating) and Hazardous Spaces

IP rating of components: _____

EX rating of components: _____

Any special risk assessments performed to date for hazardous space installations? _____

_____

Power Requirements

Average and maximum power requirements and operating voltage: _____

_____

Duration of maximum power consumption as function of ballast process: _____

_____

Impacts on Ballast Tank and Pipe Corrosion

Is published R&D available regarding the impact on tank and pipe corrosion rates? _____

_____

Health and Safety (Handling, Operation Maintenance)

Quantity of treatment chemicals needed (per ton of ballast water treated):_____

_____

For BWMS using Active Substances, request:

- A copy of the MEPC Final Approval Report with Recommendations
- Material Safety Data Sheets for all Chemicals

General Treatment System Considerations

Proven Efficacy and Official Approvals

Copy of Type Approval certificate issued by or on behalf of, a Government: _____

System limitations or operating guidelines from Type Approval process: _____

Copy of Reports from Land-based and Shipboard Laboratories:_____

Vendor Qualifications and Reputation

Annual production capacity of manufacturer: _____

Which components are custom made or incorporate new/novel technology? _____

_____

How many units have been built at the factory to be used for this installation? _____

Client referrals for previously installed systems: _____

Maintenance Requirements and System Reliability

How many units of similar capacity have been installed?_____

What is average duration of operating experience per unit? _____

What is standard maintenance protocol? _____

- Maintenance required at each operation: _____
- Annual Maintenance:_____
- Other time based maintenance (i.e., 1,000 hour service):_____
- Any condition based maintenance:_____

What is the expected service life? _____

Control and Monitoring

Type of remote control system included: _____

_____

Ease of connection to primary control and monitoring system: _____

_____

Life Cycle Costs

Estimated power consumption for normal ballast operations: _____

_____

Fuel consumption expected for inert gas generation: _____

_____

Cost of consumables (chemicals, lamps, filter elements): _____

_____

Expected frequency of resupply of consumables for planned system size: _____

_____

Availability of consumables (i.e., supplied by one vendor or many): _____

_____

What major components are most likely to need replacement within 10, 15, 20, 25 years? _____

_____

What is their estimated life cycle cost? _____

Section 8 | Sampling and Monitoring Compliance

Many shipowners are concerned with the sampling and monitoring requirements for compliance with the various ballast water discharge standards. As described in Section 1, guidance has been developed to identify the type of analysis that may be required to demonstrate compliance with the BWM Convention and other regional regulations. Information on the collection of samples and means for quick verification of BWMS performance will help shipowners develop a strategy for compliance and ensure BWMS are operating as designed.

Sample Collection

The G2 Guidelines recommend that vessel's install an "isokinetic" sampling facility to ensure that a sample contains the same proportions of the various flowing constituents as the flow stream being sampled. The USCG and Germany have reported developing isokinetic sampling ports that can be incorporated into the ballast system to collect representative samples of ballast water. SGS recently presented information on their new prototype isokinetic sampling port. SGS designed a prototype isokinetic sampling port that can easily be incorporated into ballast systems or carried onto a vessel for collection of samples.

Portable Test Kits

A number of equipment manufacturers and research institutions have developed portable test kits to quickly identify the presence of a variety of organisms, such as phytoplankton, *E. coli*, enterococci. These portable test kits could be used by shipboard personnel to assess proper functioning of the BWMS or by Port State Control for the indicative sampling identified in BWM.2/Circ 42 ("Guidance on ballast water sampling and analysis for trial use in accordance with the BWM Convention and Guidelines (G2)"). Most portable test kits identify if the sample is in gross non-compliance with the D-2 standard. One portable test kit also tests for levels of total residual oxidants (TRO) in the ballast water that may result from using specific BWMS. A summary of portable test kits identified is listed in Table 14.

Some portable test kits use fluorescence for an estimate of the abundance and health of phytoplankton in a sample. Other portable test kits monitor biological indicators, such *E. coli* or enterococci, to assess the efficacy of the BWMS.

Regulatory agencies have suggested purchasing portable test kits to ensure the BWMS is operating correctly after installation and as a means to test operation of the BWMS during the warranty period to ensure the BWMS manufacturer corrects any problems. For ships monitoring BWMS performance, questions have been raised regarding the legal requirement to notify Port State Control of any performance issues with the BWMS.

Table 14. Summary of Available Portable Test Kits

Product	Description
BACTEST Speedy Breedy www.speedybreedy.com	A compact, portable respirometer and detector of microbial activity. Multiple mediums may be purchased for the unit to analyze for various items, including, but not limited to, *E. coli*, coliforms and enterococci.
Chelsea Technologies Group Ltd FastBallast http://www.chelsea.co.uk/applications/marine/ballast-water-monitoring-systems	A compact Fast Repetition Rate fluorometer that is designed for installation into ballast water treatment systems or ballast tanks. The sensor uses proven technology to provide real time monitoring of ballast water to the IMO D-2 standard for the 10 to 50 µm organism category, which is dominated by phytoplankton. The FastBallast system detects the 'variable fluorescence' from a low number of viable phytoplankton cells, on top of a high background signal from non-viable phytoplankton, free chlorophyll and other fluorophores.
Hach® BW700 Ballast Water Validation Kit (includes Hach BW6800 Handheld Fluorometer and Hach Packet Colorimeter) http://www.hach.com/ballast	The BW700 Ballast Water Validation Kit combines three handheld tools for Ship Operators, Port State Control, and Flag State Agents to quickly and easily assess the risk that a ship's ballast water is in gross non-compliance of the IMO ballast water discharge standards. The kit includes a Hach BW680 Handheld Fluorometer which allows a user to quickly and easily determine if a system is in gross non-compliance of the D2 standard, a Hach Pocket Colorimeter II which provides a simple solution to test total residual oxidant (TRO) levels in ballast water systems that use chlorine or ozone to treat ballast water, and a refractometer that satisfies the testing protocol for the IMO D-1 standard.
Photon Systems Instruments Aqua Pen-C http://www.psi.cz/products/pocket-sized-instruments/aquapen-c-ap-c-100	A new cuvette version of the Aqua Pen-P fluorometer. It is a pocket-sized lightweight device that is very convenient for quick, reliable, and easily repeatable measurements in the field or laboratory.
Photon Systems Instruments Aqua Pen-P http://www.psi.cz/products/pocket-sized-instruments/aquapen-p-ap-p-100	A handheld fluorometer that enables rapid and accurate measurement of photosynthetic parameters in suspensions. It is equipped with a LED emitter, optically filtered and precisely focused to deliver light intensities of up to 3,000 µmol (photon)/(m^2s) to measure algal cultures.
Research International Raptor™ http://www.resrchintl.com/RAPTOR_Bioassay_System.html	A portable, rapid, automatic fluorometric assay system that monitors toxins, viruses, bacteria, spores, fungi and other diverse targets.
Turner Designs Ballast-Check™ Handheld Active Fluorometer http://www.turnerdesigns.com/products/field-fluorometer/ballast-check-handheld-fluorometer	The Ballast-Check™ is a small, lightweight, highly durable handheld fluorometer ideal for quick shipboard ballast water compliance checks of the IMO D2 standard for live organisms, 10-50µm. Factory calibrated and set for maximum accuracy at detection level concentrations, the Ballast-Check™ is ready for use right out of the box, no calibration necessary. The Ballast-Check™ has simple one-button measurements that display both estimates of total chlorophyll and yield (Fv/Fm). A risk level of gross exceedance (High, Medium, or Low) is displayed with the measurement.

Section 9 | ABS Solutions

Numerous systems are available on the market to combat the spread of nonindigenous species, each with unique benefits and limitations. ABS helps its clients identify systems that will meet the vessel's operational demands, while providing the required biological efficacy under expected trading conditions.

Ballast water management is an important issue for shipowners and operators. ABS has the experience to provide assistance in understanding the requirements and identifying solutions. ABS is available to:

- Provide guidance on regulatory requirements
- Review ship survey schedules
- Provide assistance in identifying appropriate options for each ship

ABS can also provide additional assistance in many environmental areas, such as assistance in understanding and complying with US EPA VGP requirement. Please contact your ABS representative or email environmentalperformance@eagle.org

Appendix A | Individual US State BWM Requirements

Table 15. Summary of State Requirements

State	Regulation
Arizona	Discharge must not exceed a maximum level of 19 µg/L of total residual chlorine
California	Requirements for ballast water management apply to vessels over 300 gross registered tons, capable of carrying ballast water. Prior to the implementation of performance standards management requirements vary depending on whether the vessel arrives from inside or outside of the Pacific Coast region, and whether ballast water is from inside or outside of the Pacific Coast region. The two regulatory categories are: 1. Vessels arriving to California waters from a port or place outside the Pacific Coast region 2. Vessels arriving to California waters from a port or place within the Pacific Coast region, with ballast water from the Pacific Coast region Information on California discharge standards are in Section 2 of the BWT Advisory.
Connecticut	Vessels entering CT waters must maintain the ability to measure salinity levels in each ballast tank on board the vessel so that salinities between 20 and 25 ppt can be ensured for ballast water exchange (BWE) in marine waters and salinities between 0 and 5 can be ensured for BWE in fresh water.
Hawaii	Vessels that carry ballast water are to follow the state administrative rules for ballast water (HAR 13-76), have a ballast water management plan specifically for that vessel, and file a ballast water reporting form with the Department of Land and Natural Resources (DLNR) no later than 24 hours prior to arrival. HAR 13-76-18 states that any vessel that has not conducted a mid-ocean waters BWE shall not discharge BW into state marine waters. Vessels also shall provide information on ballast water treatment systems (BWTS) and management practices.
Illinois	Vessel using BWTS with chlorine (in any of its forms) shall not exceed the acute WQ standards of 0.019 mg/l or the chronic WQ standard 0.011 mg/l for TRC. To demonstrate the WQS, the discharge of TRC shall not exceed the laboratory quantification level of 0.05 mg/l mg test methods equivalent in accuracy to amperometric titration.
Indiana	Oceangoing vessels that enter the Great Lakes-St. Lawrence Seaway system and are transiting from beyond the 200-nautical-mile Exclusive Economic Zone (EEZ) shall perform open ocean BWE or saltwater flushing before entering the Great Lakes-St. Lawrence Seaway system. For Oceangoing Vessels, constructed prior to 1 December 2013, treatment shall be installed and operational to meet the performance standards for organisms by the vessel's first scheduled drydocking after 1 January 2016. For Oceangoing Vessels, constructed after 1 December 2013, treatment shall be installed and operational to meet the performance standards for organisms prior to commencement of vessel operation in Indiana state waters. Any vessel discharging ballast water via a BWTS using chlorine shall not exceed a maximum total residual chlorine (TRC) limit of 0.02 mg/l and shall not violate applicable water quality standards and discharged in concentrations considered to be toxic or harmful to aquatic life for other biocides used.

Table 15. Summary of State Requirements (continued)

State	Regulation
Maine	Vessels whose voyage originates outside the EEZ and enters Maine waters shall conduct BWE or flushing beyond the EEZ, at least 200 nautical miles from any shore, and in water at least 2,000 meters in depth, resulting in salinity levels of at least 30 ppt. These requirements remain in effect regardless of whether the vessel is equipped with a BWTS. All vessels entering Maine waters must maintain the ability to measure salinity levels in each tank on board the vessel so that salinities of at least 30 ppt can be ensured.
Michigan	Oceangoing vessels are prohibited from discharging ballast water in Michigan's waters unless the vessel has obtained a Certificate of Coverage under the Ballast Water Control General Permit (Permit No. MIG140000) or an Individual Permit from the MDEQ and is in full compliance with the discharge limitations, monitoring requirements, and other conditions set forth in that General Permit or Individual Permit. Vessels whose voyages originate from outside the EEZ and enter Michigan waters with ballast on board, shall conduct BWE at least 200 nautical miles (nm) from any shore and in waters beyond the EEZ. Such vessels that carry only residual amounts of ballast water and/or sediments shall conduct saltwater flushing of their ballast tanks, at least 200 nm from any shore and in waters beyond the EEZ. All vessels entering Michigan waters must maintain the ability to measure salinity levels in each ballast tank on board the vessel so that salinities of at least 30 ppt can be ensured. Any vessel using a BWTS by 31 December 2014, consistent with the technologies identified in Michigan's Ballast Water Control General Permit (Permit No. MIG140000) or an alternative technology approved by the MDEQ, will not be required to meet any future numeric water quality-based effluent limits (WQBEL) for living organisms that may be set forth in a subsequent CWA Section 401 certification until the functional life of that BWTS has expired or the life of the vessel has expired, whichever is earlier. These vessels must continue BWE and saltwater flushing as described in Condition 6.14.2 unless it is demonstrated to the MDEQ that numeric WQBELs adopted after the date of this certification for living organisms are met. Live Organism Monitoring: Any vessel, whose voyages originate from outside the EEZ that discharges ballast water to Michigan waters, shall monitor ballast water discharged from their vessel at least once each year for living organisms greater than 50 µm in minimum dimension, and living organisms equal to or less than 50 µm in minimum dimension and equal to or greater than 10 µm in minimum dimension; and submit a report summarizing the discharge monitoring results collected for the above live organism size categories to the MDEQ no later than 31 December of each year. The ballast water discharge samples shall be collected and analyzed consistent with protocols established by the MDEQ. If the MDEQ fails to establish protocols, then the requirements set forth in this condition will be waived.

Table 15. Summary of State Requirements (continued)

State	Regulation
Minnesota	Vessels must obtain any permits required by the state of Minnesota for vessel discharges and comply with all requirements in the applicable permit at the time of compliance review. Any vessel whose voyage originates outside the EEZ and enters Minnesota waters shall not discharge ballast unless the following conditions are met: the vessel has conducted BWE or flushing beyond the EEZ, at least 200 nautical miles from any shore, and in water at least 2,000 meters in depth, while in oceanic waters, resulting in a salinity level of at least 30 parts per thousand (ppt) prior to the time the vessel enters Minnesota waters. This requirement remains in effect regardless of whether the vessel is equipped with a BWTS. This requirement is in addition to treatment requirements. All vessels entering Minnesota waters must maintain the ability to measure salinity levels in each tank on board the vessel so that salinities of at least 30 ppt can be ensured prior to discharge in Minnesota waters. "High Risk" Ballast Water. If relocation of a high risk ballast discharge is required, proper authorities will identify alternative locations for the discharge of the high risk ballast water. As an alternative to discharging high-risk ballast water, the Minnesota Pollution Control Agency (MPCA) may authorize the use of BWTS identified as promising technology by EPA, USCG, neighboring states or a US ballast water testing research facility (e.g., Golden Bear, Great Ships Initiative and Maritime Environmental Resource Center). Lakers that operate exclusively in the Great Lakes. Specific Best Management Practices (BMPs) are required to be incorporated into the vessel's ballast management plan and implemented prior to discharge of ballast in Minnesota waters. Monitoring: Vessels with a BWTS must sample and analyze the ballast water discharge at least once a year (provided appropriate facilities are available) using the shipboard Environmental Technology Verification (ETV) sampling protocol, a protocol consistent with IMO G8/G9 protocols, or a compliance monitoring protocol developed by the USCG, whichever is most advanced and available. This monitoring shall include sampling, identification and enumeration of live organisms >50 µm and between 10-50 µm in size. The monitoring results shall be submitted to EPA and the MPCA on an annual basis. Live organism monitoring shall include the collection of representative discharge samples and the testing (counting) of live organisms in such samples by qualified personnel in accordance with standard and/or best available sampling and analytical methods. Beginning 24 months after final issuance of the 2013 VGP, all vessels not required to meet numeric ballast treatment limits shall complete the following ballast discharge monitoring: i. sample and analyze, a minimum of once annually, for organism density and composition. Sampling and analysis methods shall be consistent with protocols described above. Samples must be analyzed for total organisms (live or dead) greater than or equal to 10 micrometers in size. The ballast discharge subject to sampling must be taken on the ship in a Great Lakes port for discharge into Minnesota waters. You must report the uptake locations and volumes subject to sampling, as well as the volume you plan to discharge in Minnesota's waters, best management practices employed, and other factors affecting the composition of the sample. ii. Complete a ballast discharge biological study approved by the MPCA.

Table 15. Summary of State Requirements (continued)

State	Regulation
New York	Vessels whose voyage originates outside the EEZ and enters New York waters shall conduct BWE or flushing beyond the EEZ, at least 200 nautical miles from any shore, and in water at least 2,000 meters in depth, resulting in a salinity level of at least 30 ppt. These requirements remain in effect regardless of whether the vessel is equipped with a BWTS. All vessels entering New York waters must maintain the ability to measure salinity levels in each tank on board the vessel so that salinities of at least 30 ppt can be ensured. The following BMPs are required to be implemented in the Great Lakes: a. Annually inspect (with documentation) and replace, as necessary, ballast sea chest screens, b. Lightening the ship as much as practical to elevate water intakes before ballasting to minimize sediment uptake and increase water flow, c. Ballast water taken aboard in Viral Hemorrhagic Septicemia (VHS) affected waters shall be the minimum needed to ensure the safety of the crew and vessel. d Ballast water shall always be taken aboard or discharged via the pumps and never "gravity fed or drained." Recommended BMPs are also included to reduce the spread of the VHS disease. Live Organism Monitoring. All vessels with a BWTS must sample and analyze the ballast water discharge at least once a year (provided appropriate facilities are available) using the California shipboard sampling protocol, or a compliance monitoring protocol developed by the USCG, whichever is most advanced and available. This monitoring shall include sampling for >50 µm and for 10-50 µm organisms. The monitoring results shall be submitted to EPA and the Department on an annual basis. Such live organism monitoring shall include the collection of representative discharge samples and the testing (counting) of live organisms in such samples by qualified personnel in accordance with standard and/or best available sampling and analytical methods.

Table 15. Summary of State Requirements (continued)

State	Regulation
Ohio	Vessels that operate outside the US EEZ and more than 200 nautical miles from shore, and then enter the Great Lakes via the St. Lawrence Seaway System must conduct salt water flushing of ballast tanks. This condition applies both before and after treatment system deadlines in the VGP. Vessels are prohibited from discharging ballast water sediment in Ohio waters. Ohio EPA believes that IMO treatment standards are not "practical and possible" at this time for existing vessels operating exclusively within the Great Lakes, as defined in the VGP.It is likely that discharges of ballasted sea water will not meet the toxicity narrative water quality standard if discharged in the relatively shallow water of Ohio's Lake Erie ports, due to the dissolved solids levels in sea water. Discharges in the open waters of the Lake minimize the risk of toxicity, and will allow the standard to be met. To prevent toxicity to ambient organisms or rapidly lethal conditions, discharges of ballasted sea water within the breakwalls of Ohio's Lake Erie Ports is prohibited. For BWTS using chlorine, discharges must meet a maximum chlorine limit of 38 µg/l if the discharge lasts for more than 160 minutes/day; the limit is 200 µg/l if the discharge is 160 minutes/day or less. The inside-mixing-zone maximum criterion for short-term exposures to chlorine is 200 µg/l; the otherwise applicable criterion is 38 µg/l. The water quality criteria for bromine are therefore set at1/4 of the chlorine standard. Discharges of other biocides must meet the narrative water quality standard for toxicity noted above. Other biocides used in ballast water treatment must meet Ohio's narrative toxicity water quality standard. To meet the 'no rapidly lethal conditions' narrative, discharges of all biocides must meet inside-mixing-zone water quality standards (Final Acute Values). The discharge of organic quaternary ammonium compounds is prohibited.
Oregon	A vessel may discharge ballast waters into waters of the state if: the vessel conducts an open ocean exchange (at least 200 nautical miles from shore and in waters at least 2,000 meters deep); or the discharged ballast was solely sourced within 'common waters' of the state, identified as the West Coast region of North America between 40° N and 50°N; or a coastal exchange of ballast water takes place (at least 50 nautical miles from shore and in waters at least 200 meters deep) for coastwise voyages with ballast tanks that originated from the Pacific Coastal Region south of 40° N or north of 50°N; or the discharged ballast was treated in a manner authorized by Oregon Administrative Rule 340-143-0050; or conditions are such that conducting an exchange would be unsafe or infeasible due to adverse weather, vessel design limitations or equipment failure. In these instances, the vessel must clearly declare a safety exemption on its ballast water reporting form and may be subject to operational delays and/or alternative management requirements following DEQ review. Oregon requires that vessels submit ballast water management reporting forms to DEQ at least 24 hours before entering state waters. Beginning January 2012, a $70 per arrival fee is assessed on regulated commercial vessels passing through Oregon waters

Table 15. Summary of State Requirements (continued)

State	Regulation
Rhode Island	Vessels whose voyage originates outside the EEZ and enters Rhode Island waters shall conduct BWE or flushing beyond the EEZ, at least 200 nautical miles from any shore, and in water at least 2,000 meters in depth. These requirements remain in effect regardless of whether the vessel is equipped with a BWTS. Vessels are urged to voluntarily install currently available technologies that go beyond the IMO D-2 standard (e.g., systems that have demonstrated the ability to meet and exceed a 10x IMO level of treatment) as a means of gaining useful experience while contributing to the advancement of treatment technology. All vessels covered under the VGP and operating in Rhode Island waters, after a BWTS is installed, must sample and analyze the ballast water discharge at least once a year (provided appropriate facilities are available), using the California shipboard sampling protocol, or a compliance monitoring protocol developed by the USCG, whichever is most advanced and available. The monitoring results shall be submitted to EPA and the department on an annual basis. Such live organism monitoring shall include the collection of representative discharge samples and the testing (counting) of live organisms in such samples by qualified personnel in accordance with standard and/or best available sampling and analytical methods. In addition to EPA submissions, the applicant must submit all sampling results to the Office of Water Resources, RI Department of Environmental Management.
Vermont	The discharge of wastewaters from pressure washing the bottom of vessels and any point source or non-point source pollution from spillage, sanding, sand blasting, or scraping vessels into Vermont waters from any vessel covered under the VGP or sVGP is prohibited.
Washington	Vessel are required to file a ballast water reporting form at least 24 hours prior to arrival into waters of the state and to ensure that the vessel does not discharge ballast water into the waters of the state except as authorized by this law. Discharge of ballast water into waters of the state is authorized only if there has been an open sea exchange, or if the vessel has treated its ballast water, to meet standards set by the department consistent with applicable state and federal laws.

Table 15. Summary of State Requirements (continued)

State	Regulation
Wisconsin	Oceangoing vessels that enter the Great Lakes-St. Lawrence Seaway system and are transiting from beyond the 200-nautical-mile EEZ shall perform open ocean BWE or saltwater flushing before entering the Great Lakes-St. Lawrence Seaway system in order to ensure water quality standards are met that protect the general public interest. Vessels must obtain any permits required by the state of Wisconsin for vessel discharges. Vessels that operate exclusively within the Great Lakes, and which meet the EPA VGP applicability requirements, will be addressed in Wisconsin's next ballast water discharge general permit. Discharges of ballast water from vessels using BWTS using chlorine must meet a daily maximum total residual oxidants limit, measured as total residual chlorine, of 38 µg/L. Discharges of ballast water from vessels containing seawater in other than insignificant residual amounts that remain in tanks and that cannot be pumped out or drained (no ballast on board) is prohibited unless it can be demonstrated that the discharge will comply with Wisconsin chloride limits. High-risk ballast water may not be discharged into waters of the state without Wisconsin Department of Natural Resources (WDNR) review and authorization. Vessel owners or operators with unexchanged or untreated ballast must submit a request, providing sufficient additional information for WDNR to evaluate the request and determine whether an emergency ballast water management alternative is warranted. WDNR, coordinating with the USCG and the states of Illinois, Iowa, Michigan and Minnesota as needed may identify alternative locations for the discharge of unexchanged or untreated ballast water. As an alternative to discharging high-risk ballast water, WDNR may authorize the use of BWTS identified as promising technology by EPA, USCG, neighboring states or a US ballast water testing research facility. US ballast water testing research facilities include, but may not be limited to the Golden Bear, Great Ships Initiative and Maritime Environmental Resource Center. BWTS used in Wisconsin waters must be specifically tested for use in fresh water. Routine visual inspections of the BWTS are to be conducted at least on a monthly basis.

Appendix B | Type Approved BWM Systems

Note: Information presented is current as of 31 July 2014

BWMS	Website	Treatment Method	BWM Convention Flag Administration Approvals	USCG AMS Acceptance Date
Aquarius™-EC **Manufactured by Wärtsila Wäter Systems Limited**	http://www.wartsila.com/en/water-management/ballast-water-hamworthy-trojan/AQUARIUS-EC	Filtration, Electrolytic Disinfection and Sodium Bisulfite Neutralization	The Netherlands December 2013	–
Aquarius™-UV **Manufactured by Wärtsila Wäter Systems Limited**	http://www.wartsila.com/en/water-treatment/ballast-water-management/AQUARIUS-UV	Filtration and Ultraviolet Treatment	The Netherlands December 2012	28 October 2013
AquaStar™ **Manufactured by Aqua Engineering Company, Ltd. – Korea**	www.aquaeng.kr	Filtration, Electrolytic Disinfection and Thiosulfate Neutralization	Korea June 2012	7 January 2014
ARA PLASMA **Manufactured by SAMKUN CENTURY Co., Ltd.**	http://www.samkunok.com/bbs/board.php?bo_table=e_bwts	Filtration, Plasma Arc Disinfection and Ultraviolet Treatment	Korea July 2012	29 October 2013
BalClor™ **Manufactured by SunRui Marine Environment Engineering Company**	http://www.sunrui.net/ProductsBalClorTM BallastWater ManagementSystem/	Filtration, Electrolytic Disinfection and Thiosulfate Neutralization	China January 2011 Norway August 2012	1 May 2013
BallastMaster UltraV **Manufactured by GEA Westfalia Separator Group, Gmbh.**	http://www.westfalia-separator.com/applications/marine/ballast-water-treatment/gea-westfalia-separator-ballastmaster-ultrav.html	Filtration and Ultraviolet Treatment	Germany August 2012	11 November 2013
BALPURE® **Manufactured by Severn Trent DeNora, LLC**	http://www.severntrentdenora.com/Products-and-Services/Ballast-Water-Treatment-Systems/BALPURE/?r=1	Filtration, Electrolytic Disinfection and Sodium Bisulfite Neutralization	Germany July 2011	15 April 2013
BALWAT **Manufactured by** **Shanghai Jiazhou Environmental Mechanical & Electrical Co., Ltd.**	–	Filtration and Ultraviolet Treatment	China February 2013	

USCG AMS Salinity Limitation	ABS Approvals	Explosion Proof Type Approved Models	Maximum Capacity (m^3/h)	Treatment Concentration	Limitation in Type Approval Certificate
–	–	–	3,300	10 mg/L TRO	–
No Salinity Limitation	–		1,000	–	Water Temperature Range: -2°C to 45°C
USCG AMS use limited to treatment of water with PSU > 10	–	✓	5,000	10 mg/L TRO	–
USCG AMS use limited to treatment of water with PSU > 1	–		2,600	–	Installations in exposed areas on open deck require additional testing.
USCG AMS use limited to treatment of water with PSU > 1	ABS Type Approval April 2014		7,000	Type Approval Certificate lists 7.5 mg/L USCG AMS lists 7.4 - 9.5 mg/L TRO	–
USCG AMS use limited to treatment of water with PSU > 1	–		250	–	Water Temperature Range: 5 to 45°C Minimum UV Transmittance at a Wavelength of 254 nm: 45%
USCG AMS use limited to treatment of water with PSU > 10	ABS Type Approval* June 2012 September 2012 *Select models		5,000	15.0 mg/L TRO	Seawater Inlet Temperature = 15 to 35°C
–	–		200	–	Water Temperature Range: ≥ 0°C

Type Approved BWM Systems (continued)

BWMS	Website	Treatment Method	BWM Convention Flag Administration Approvals	USCG AMS Acceptance Date
BIO-SEA® **Manufactured by BIO-UV AS**	http://www.ballast-water-treatment.com/	Filtration and Ultraviolet Treatment	France June 2013	4 March 2014
Blue Ocean Shield **Manufactured by COSCO Shipbuilding Industry**	www.wecosco.com	Filtration and Ultraviolet Treatment	China February 2011	19 November 2013
BSKY™ **Manufactured by Wuxi Brightsky Electronic Co., Ltd.**	www.bsky.cn	Hydrocyclone Separation, Ultrasonic Disinfection, and Ultraviolet Treatment	China March 2011	4 October 2013
Cathelco Ballast Water Treatment System **Manufactured by Cathelco LTD**	http://www.cathelco.com/ballast-water-treatment-overview_81_3.html	Filtration and Ultraviolet Treatment	Germany April 2014	–
CleanBallast® **Manufactured by RWO GmbH – Marine Water Technology, Veolia Water Solutions & Technologies**	http://www.rwo.de/en/technologies_products_and_Solutions/Ballast_Water_Treatment/	Filtration, Electrochemical Oxidation and Sodium Thiosulfate Neutralization	Germany December 2010	15 April 2013
ClearBallast **Manufactured by Hitachi Plant technologies, Ltd.**	http://www.hitachi-pt.com/products/es/ballast/	Flocculation, Magnetic Separation and Filtration	Japan March 2010	–
CrystalBallast® **Manufactured by Auramarine, Ltd. – Finland**	http://www.auramarine.com/products/crystalballast-002/	Filtration and Ultraviolet Treatment	Norway September 2012	7 January 2014
Cyeco **Manufactured by Shanghai Cyeco Environmental Technology Co., Ltd.**	http://www.cyecomarine.com/cyecoBWMS_EV.html	Filtration and Ultraviolet Treatment	China June 2012 and November 2013	3 July 2014
EcoBallast **Manufactured by Hyundai Heavy Industries**	http://english.hhi.co.kr/	Filtration and Ultraviolet Treatment	Korea March 2011	4 March 2014
Ecochlor® **Manufactured by Ecochlor, Inc**	http://www.ecochlor.com/	Filtration and Chlorine Dioxide (ClO_2) Treatment	Germany November and December 2010	15 April 2013

USCG AMS Salinity Limitation	ABS Approvals	Explosion Proof Type Approved Models	Maximum Capacity (m^3/h)	Treatment Concentration	Limitation in Type Approval Certificate
USCG AMS use limited to treatment of water with PSU > 1	–		3,300	–	–
USCG AMS use limited to treatment of water with PSU > 1	–		3,500	–	–
USCG AMS use limited to treatment of water with PSU > 1	–		6,000	–	–
–	–		2,400	–	Uptake Temperature Range: -2°C to 50°C Minimum UV Transmittance at a Wavelength of 254 nm: 45%
USCG AMS use limited to treatment of water with PSU > 1	–		3,750	First Treatment: 2.5 mg/L TRO; Second Treatment: 0.15 mg/L TRO	–
–	–		2,400	30 mg/L Tri-Iron Tetraoxide; 5 mg/L Polyaluminum Chloride (PAC); 1 mg/L Polyacrylamide Acrylate (PASA)	–
USCG AMS use limited to treatment of water with PSU > 1	Product Design Assessment February 2014		3,000	–	UV Intensity Meter Acceptable Range: 10.39 to 150 W/m^2. Intensity below 10.39 W/m^2 implies ballast water is not treated in accordance with TA certificate.
USCG AMS use limited to treatment of water with PSU > 1	–		250	–	–
USCG AMS use limited to treatment of water with PSU > 1	–		2,400	–	Installations in exposed areas on open deck require additional testing.
USCG AMS use limited to treatment of water with PSU > 1	Product Design Assessment May 2012		10,000		Uptake Temperature Range: 0 to 50°C Minimum Holding Time: 48 hours

Type Approved BWM Systems (continued)

BWMS	Website	Treatment Method	BWM Convention Flag Administration Approvals	USCG AMS Acceptance Date
Electro-Cleen™ System **Manufactured by Techcross, Inc.**	http://www.techcross.com/eng_html/main.asp	Electrolytic Disinfection and Thiosulfate Neutralization	Korea December 2008 September 2009 April 2010 March 2011 June 2011 January 2012 September 2012	4 October 2013
ERMA FIRST **Manufactured by ERMA FIRST ESK Engineering Solutions SA**	www.ermafirst.com	Filtration, Electrolytic Disinfection and Sodium Bisulfite Neutralization	Greece May 2012	11 October 2013
FineBallast MF **Manufactured by Mitsui Engineering & Shipbuilding Co. Ltd.**	http://www.mes.co.jp/english/business/ship/	Filtration and Membrane Separation	Japan November 2013	–
FineBallast OZ™ **Manufactured by Mitsui Engineering & Shipbuilding Co., Ltd.**	http://www.mes.co.jp/english/business/ship/	Filtration, Ozone Treatment and Activated Carbon	Japan June 2011	–
GloEn-Patrol™ **Manufactured by PANASIA Co., Ltd.**	http://www.gloen-patrol.com/english.html	Filtration and Ultraviolet Treatment	Korea December 2009	29 April 2013
HiBallast **Manufactured by Hyundai Heavy Industries**	http://english.hhi.co.kr/	Filtration, Electrolytic Disinfection and Sodium Thiosulfate Neutralization	Korea November 2011	24 June 2013
Hyde GUARDIAN™ **Manufactured by Hyde Marine Inc.**	www.hydemarine.com	Filtration and Ultraviolet Treatment	United Kingdom April 2014 Russia April 2009	15 April 2013
HY™-BWMS **Manufactured by Shanghai Hengyuan Marine Equipment Co., Ltd.**		Filtration and Ultraviolet Treatment	China August 2013	–
JFE BallastAce® using NEO-CHLOR MARINE™ **Manufactured by JFE Engineering Corp.**	http://www.jfe-eng.co.jp/en/en_product/environment/environment2271.html	Filtration, Chlorination and Sodium Sulfite Neutralization	Japan June 2013	14 April 2014

USCG AMS Salinity Limitation	ABS Approvals	Explosion Proof Type Approved Models	Maximum Capacity (m^3/h)	Treatment Concentration	Limitation in Type Approval Certificate
USCG AMS use limited to treatment of water with PSU > 1	ABS Type Approval December 2013	✓	8,000	10 mg/L TRO	Installations in exposed areas on open deck require additional testing.
USCG AMS use limited to treatment of water with PSU > 1	–		3,000	10 mg/L TRO	Minimum Water Temperature 5°C Minimum Salinity: 3 PSU
–	–		900	–	–
–	–		300	3.0 mg/L Ozone	–
USCG AMS use limited to treatment of water with PSU > 1	ABS Type Approval January 2013		3,500		–
USCG AMS use limited to treatment of water with PSU > 1	–	✓	8,000	9 mg/L TRO	–
USCG AMS use limited to treatment of water with PSU > 1	ABS Type Approval April 2011		6,000	–	Maximum Water Temperature: 80°C
–	–		200	–	–
USCG AMS use limited to treatment of water with PSU > 1	–		4,500	10.0 mg/L TRO	–

Type Approved BWM Systems (continued)

BWMS	Website	Treatment Method	BWM Convention Flag Administration Approvals	USCG AMS Acceptance Date
JFE BallastAce® Using TG Ballastcleaner **Manufactured by JFE Engineering Corp.**	http://www.jfe-eng.co.jp/en/products/machine/marine/mar01.html	Filtration, Chlorination and Sodium Sulfite Neutralization	Japan May 2010, March 2011 and June 2013	14 April 2014
KBAL **Manufactured by Knutsen OAS Shipping AS**		Pressure Vacuum Reactor and Ultraviolet Treatment	Norway November 2012	3 March 2014
MICROFADE™ **Manufactured by Kuraray Co., Ltd.**	http://www.kuraray.co.jp/en/products/medical/microfade.html	Filtration, Chlorination and Sodium Sulfite Neutralization	Japan May 2012	28 October 2013
MMC BWTS **Manufactured by MMC Green Technology AS**	http://www.mmcgt.no/	Filtration and Ultraviolet Treatment	Norway December 2012	29 August 2013
NiBallast™ **Manufactured by Jiangsu Nanji Machinery Company, Ltd.**		Filtration and Deoxygenation	China October 2013	15 November 2013
NK-O3 BlueBallast® **Manufactured by NK Company, Ltd.**	http://www.nutech-o3.com/; http://nk-eng.nkcf.com/aspx/business/environment_2.aspx	Ozone Treatment (or Ozone Injection) and Sodium Thiosulfate Neutralization	Korea November 2009	15 April 2013
Ocean Protection Service **Manufactured by Mahle Industriefiltration GmbH**	http://www.mahle-industrialfiltration.com/MAHLE_Industry_Filtration/en/Product-segments/Separation-and-water/Ballast-water-treatment-system	Filtration and Ultraviolet Treatment	Germany April 2011, July 2011, and April 2013	12 February 2014
OceanDoctor **Manufactured by Jiujiang Precision Measuring Technology Research Institute**		Filtration and Ultraviolet Treatment and Photocatalytic Oxidation	China	6 June 2014
OceanGuard™ **Manufactured by Headway Marine Technology Co., Ltd.**	http://www.headwaytech.com/en/pxxa.asp?id=10&str=The Global Threat	Filtration, Electrocatalysis enhanced by Ultrasonic Technology and Sodium Thiosulfate Neutralization	Norway November 2011	15 April 2013 23 September 2013

USCG AMS Salinity Limitation	ABS Approvals	Explosion Proof Type Approved Models	Maximum Capacity (m^3/h)	Treatment Concentration	Limitation in Type Approval Certificate
USCG AMS use limited to treatment of water with PSU > 1	–		4,500	20.0 mg/L TRO	
USCG AMS use limited to treatment of water with PSU > 1	–		600	–	UV Intensity Meter Acceptable Range: 43 mJ/cm^2 (KBAL BWTS 200) and 100 mJ/cm^2 (KBAL BWTS 600). Intensity below listed limits imply ballast water is not treated in accordance with TA certificate
USCG AMS use limited to treatment of water with PSU > 1	–		4,000	2.0 mg/L TRO	
USCG AMS use limited to treatment of water with PSU > 1	–		300	–	Water Inlet Temperature Range: 0 to 50°C UV Intensity Meter Acceptable Minimum Limit: 100 mJ/cm^2 for MMC 150 BWMS and MMC 300 BWMS. Intensity below listed limit implies ballast water is not treated in accordance with TA certificate.
No Salinity Limitation	–		1,500	–	
USCG AMS use limited to treatment of water with PSU > 1	ABS Type Approval September 2010		8,000	2.5 mg/L Ozone, 7.5 mg/L TRO	
USCG AMS use limited to treatment of water with PSU > 1	–		1,500	–	A minimum radiation dosage of 83% (250 m^3/h), 85% (50 m^3/h), and 93% (1,500 m^3/h).
USCG AMS use limited to treatment of water with PSU > 1	–		Information Not Available	–	
USCG AMS use limited to treatment of water with PSU > 1	ABS Type Approval April 2014		10,000	2.0 mg/L TRO	

Type Approved BWM Systems (continued)

BWMS	Website	Treatment Method	BWM Convention Flag Administration Approvals	USCG AMS Acceptance Date
OceanSaver MKI **Manufactured by OceanSaver AS**	http://www.oceansaver.com/ballast_water.html	Filtration, Electrolytic Disinfection and Sodium Thiosulfate Neutralization	Norway April 2009	–
OceanSaver MKII **Manufactured by OceanSaver AS**	http://www.oceansaver.com/ballast_water.html	Filtration, Electrolytic Disinfection and Sodium Thiosulfate Neutralization	Norway December 2011	23 September 2013
Optimarin Ballast System **Manufactured by Optimarin AS**	www.optimarin.com	Filtration and Ultraviolet Treatment	Norway November 2009	18 June 2013
OxyClean **Manufactured by DESMI Ocean Guard A/S**	http://www.desmioceanguard.com/home.aspx	Filtration, UV Treatment, and Ozone Treatment	Denmark November 2012	11 October 2013
PureBallast **Manufactured by Alfa Laval Tumba AB**	http://www.alfalaval.com/solution-finder/products/pureballast/Pages/Pureballast.aspx; http://www.alfalaval.com/campaigns/pureballast3/Documents/index.htm	Filtration, Advanced Oxidation Technology (AOT) (Ultraviolet Treatment in combination with TiO_2 catalyst)	Norway June 2008	15 April 2013
PureBallast 2.0 **Manufactured by Alfa Laval Tumba AB**	http://www.alfalaval.com/solution-finder/products/pureballast/Pages/Pureballast.aspx	Filtration, Advanced Oxidation Technology (AOT) (Ultraviolet Treatment in combination with TiO_2 catalyst)	Norway March 2011	15 April 2013
PureBallast 3.0 **Manufactured by Alfa Laval Tumba AB**	http://www.alfalaval.com/solution-finder/products/pureballast/Pages/Pureballast.aspx	Filtration, Advanced Oxidation Technology (AOT) (Ultraviolet Treatment in combination with TiO_2 catalyst)	Norway March 2014	4 June 2014
Purimar **Manufactured by Samsung Heavy Industries Co., Ltd**	http://www.dcsi.gr/purimar.htm	Filtration, Electrolysis and Sodium Thiosulfate Neutralization	Korea October 2011	4 October 2013

USCG AMS Salinity Limitation	ABS Approvals	Explosion Proof Type Approved Models	Maximum Capacity (m^3/h)	Treatment Concentration	Limitation in Type Approval Certificate
–	–			2.5 mg/L TRO	–
USCG AMS use limited to treatment of water with PSU > 1	–		1,000	2.5 mg/L TRO	–
USCG AMS use limited to treatment of water with PSU > 1	ABS Product Design Assessment August 2012		3,000		UV Intensity Meter Acceptable Range: 100 to 2500 W/m^2. Intensity below 100 W/m^2 implies ballast water is not treated in accordance with TA certificate.
No Salinity Limitation	ABS Type Approval January 2013		3,000		For PSU > 3, a treated rate capacity of 100 m^3/h is required per UV unit. For PSU < 3, a treated rate capacity of 75 m^3/h is required per UV unit.
USCG AMS use limited to treatment of water with PSU > 1	–		3,000		–
USCG AMS use limited to treatment of water with PSU > 1	ABS Type Approval October 2012	✓	3,000		–
USCG AMS use limited to treatment of water with PSU > 1	–		6,000		No temperature limitation. UV Intensity Meter Lower Limit: 312 W/m^2 (Model 300 and 600) and 380 W/m^2 (Model 1000). Intensity below listed limits imply ballast water is not treated in accordance with TA certificate
USCG AMS use limited to treatment of water with PSU > 1	ABS Type Approval October 2013	✓	6,500	3.0 mg/L TRO	–

Type Approved BWM Systems (continued)

BWMS	Website	Treatment Method	BWM Convention Flag Administration Approvals	USCG AMS Acceptance Date
Resource Ballast Water Treatment System **Manufactured by Resource Ballast Technologies (Pty) Ltd.**	http://www.resource-technology.com/#	Cavitation, Electrochemical and Ozone Disinfection and Filtration	South Africa April 2011 and January 2013	–
SeaCure™ **Manufactured by Siemens Water Technology**	water.siemens.com/SiCURE	Filtration, Electrolysis and Sodium Sulfite Neutralization	Germany February 2014	–
Seascape® **Manufactured by Elite Marine Ballast Water Treatment System Corp.**	http://www.bwts.cn/En/Default.aspx	Filtration and Ultraviolet (UV) Treatment	China December 2013	–
Smart Ballast **Manufactured by STX Heavy Industries Company, Ltd.**	http://www.stxhi.co.kr/Eng/Biz/smart_ballast.aspx	Electrolytic Disinfection and Sodium Thiosulfate Neutralization	Korea September 2013	7 January 2014
Trojan Marinex™ BWT System **Manufactured by Trojan Technologies**	www.trojanmarinex.com	Filtration and Ultraviolet (UV) Treatment	Norway March 2014	21 July 2014
Venturi Oxygen System (VOS) **Manufactured by NEI Treatment Systems, LLC**	http://www.nei-marine.com/	Deoxygenation	Netherlands July 2011 Republic of Liberia September 2011 Marshall Islands August 2011 Panama February 2010 Malta January 2010	16 December 2013

USCG AMS Salinity Limitation	ABS Approvals	Explosion Proof Type Approved Models	Maximum Capacity (m^3/h)	Treatment Concentration	Limitation in Type Approval Certificate
–	–		4,000	1 PPM	–
–	–		1,500	6 mg/L TRO	–
–	–		6,000	–	UV Dose: 200 to 270 mJ/cm^2
USCG AMS use limited to treatment of water with PSU > 7	–		1,000	11.9 mg/L TRO	–
No Salinity Limitation	–		1,500	–	UV intensity below 2 mw/cm^2, corresponding to an UV transmission of 44%, implies that the ballast water is not treated in accordance with this certificate.
No Salinity Limitation	ABS Product Design Assessment (only for Magnetic Relief Valve) May 2010		6,500	–	Holding Time: 96 hours

Appendix C | BWMS with Only IMO Basic and Final Approvals

The following BWMS have received Basic and Final Approval by MEPC but have not received Type Approval by a flag State.

Final Approval

- EcoGuardian™, Manufactured by Hanla IMS Co., Ltd.
- Evonik BWMS with PERACLEAN® Ocean Manufactured by Evonik Industries AG.
- Greenship Sedinox Ballast Water Management System, Manufactured by Greenship Ltd.
- Neo-Purimar™, Manufactured by Samsung Heavy Industries (SHI) Co., Ltd.
- SKY-SYSTEM® BWMS with PERACLEAN® Ocean, Manufactured by Katayama Chemical, Inc. Shinko Ind. Ltdf., Nippon Yuka Kogyo Co.
- Smart Ballast, Manufactured by STX Metal Co., Ltd.

Basic Approval

- ATPS-BLUEsys, Manufactured by Panasonic Environmental Systems & Engineering Co., Ltd.
- BallastMaster ecoP, Manufactured by GEA Westfalia Separator Systems GmbH
- BlueSeas Ballast Water Management System, Manufactured by Envirotech and Consultancy Pte. Ltd.; National University of Singapore
- BlueWorld, Manufactured by Envirotech and Consultancy Pte. Ltd.
- Blue Zone™ Ballast Water Management System, Manufactured by SUNBO INDUSTRIES Co. Ltd., DSEC Co. Ltd., and the Korean Institute of Machinery and Material (KIMM)
- DMU OH BWMS, Manufactured by Dalian Maritime University (DMU-EEI)
- Ecomarine-EC BWMS, Manufactured by Ecomarine Technology Research Association
- ECOLCELL BTs BWMS En-Ballast, Manufactured by Azienda Chimica Genovese
- GloEn-Saver™, Manufactured by Panasia Co., Ltd.
- HS-BALLAST BWMS, Manufactured by HWASEUNG R&A Co., Ltd.
- KURITA™ BWMS, Manufactured by Kurita Water Industries Ltd.
- KTM-BWMS, Manufactured by Korea Top Marine (KT Marine) Co., Ltd.
- REDOX, Manufactured by REDOX Maritime Technologies (RMT) AS
- Van Oord Ballast Water Management System, Manufactured by Van Oord B.V.

OMB Control Number 1625-0069
Exp. Date 31-May-2015

BALLAST WATER REPORTING FORM

IS THIS AN AMENDED BALLAST REPORTING FORM? YES ☐ NO ☐

1. VESSEL INFORMATION	2. VOYAGE INFORMATION		3. BALLAST WATER USAGE AND CAPACITY
Vessel Name:	Arrival Port:		*Specify Units Below (m^3, MT, LT, ST)*
IMO Number:	Arrival Date (D/M/YYYY)		Total Ballast Water on Board: Volume / Units (m^3) / No. of Tanks in Ballast
Owner:	Agent:		
Type:	Last Port:	Country of Last Port:	
GT:			Total Ballast Water on Board: Volume / Units (m^3) / No. of Tanks in Ballast
Call Sign:	Next Port:	Country of Next Port:	
Flag:			

4. BALLAST WATER MANAGEMENT Total No. Ballast Water Tanks to be discharged: ☐

Of tanks to be discharged, how many: Underwent Exchange: ☐ Underwent Alternative Management: ☐

Please specify alternative method(s) used, if any: ☐

If no ballast treatment conducted, state reason why not: ☐

Ballast management plan on board? YES ☐ NO ☐ Management plan implemented YES ☐ NO ☐

IMO ballast water guidelines on board [res. A.868(20)]? YES ☐ NO ☐

5. BALLAST WATER HISTORY: Record all tanks to be deballasted in port state of arrival; IF NONE, GO TO #6 ***(Use additional sheets as needed)***

Tanks/Holds List multiple sources/tanks separately	BW SOURCE				BW MANAGEMENT PRACTICES						BW DISCHARGE			
	Date D/M/YYYY	PORT or LAT. LONG.	VOLUME (units)	TEMP (units)	Date D/M/YYYY	ENDPOINT LAT. LONG.	VOLUME (units)	% Ech	METHOD (ER/FT/ ALT)	SEA HT. (m)	Date D/M/YYYY	PORT or LAT. LONG.	VOLUME (units)	SALINITY (units)
			m^3	C			m^3		ER				m^3	sg
			m^3	C			m^3		ER				m^3	sg
			m^3	C			m^3		ER				m^3	sg
			m^3	C			m^3		ER				m^3	sg
			m^3	C			m^3		ER				m^3	sg
			m^3	C			m^3		ER				m^3	sg
			m^3	C			m^3		ER				m^3	sg

Ballast Water Tank Codes: Forepeak = FP, Aftpeak = AP, Double Bottom = DB, Wing = WT, Topside = TS, Cargo Hold = CH, Other = O

6. RESPONSIBLE OFFICER'S NAME AND TITLE, PRINTED AND SIGNATURE: ☐

Released 12-Aug-2010 | Send form by email | OR | Send form on-line | OR | Save as text file | Appendix D - NBICReporting

Appendix D | Copy of the Ballast Water Reporting Form *(continued)*

Tanks/Holds List multiple sources/tanks separately	BW SOURCE Date D/M/YYYY	PORT or LAT. LONG.	VOLUME (units)	TEMP (units)	BW MANAGEMENT PRACTICES Date D/M/YYYY	ENDPOINT LAT. LONG.	VOLUME (units)	% Ech	METHOD (ER/FT/ALT)	SEA HT. (m)	BW DISCHARGE Date D/M/YYYY	PORT or LAT. LONG.	VOLUME (units)	SALINITY (units)
			m^3	C			m^3		ER				m^3	sg
			m^3	C			m^3		ER				m^3	sg
			m^3	C			m^3		ER				m^3	sg
			m^3	C			m^3		ER				m^3	sg
			m^3	C			m^3		ER				m^3	sg
			m^3	C			m^3		ER				m^3	sg
			m^3	C			m^3		ER				m^3	sg
			m^3	C			m^3		ER				m^3	sg
			m^3	C			m^3		ER				m^3	sg
			m^3	C			m^3		ER				m^3	sg
			m^3	C			m^3		ER				m^3	sg
			m^3	C			m^3		ER				m^3	sg
			m^3	C			m^3		ER				m^3	sg
			m^3	C			m^3		ER				m^3	sg
			m^3	C			m^3		ER				m^3	sg
			m^3	C			m^3		ER				m^3	sg
			m^3	C			m^3		ER				m^3	sg
			m^3	C			m^3		ER				m^3	sg

Ballast Water Tank Codes: Forepeak = FP, Aftpeak = AP, Double Bottom = DB, Wing = WT, Topside = TS, Cargo Hold = CH, Other = O

Choosing a ballast water management system is a big decision. ABS understands the numerous ballast water regulatory developments and is knowledgeable of the technologies, designs and limitations for BWMS currently available to the market.

For more information, please contact your local ABS representative or email environmentalperformance@eagle.org.

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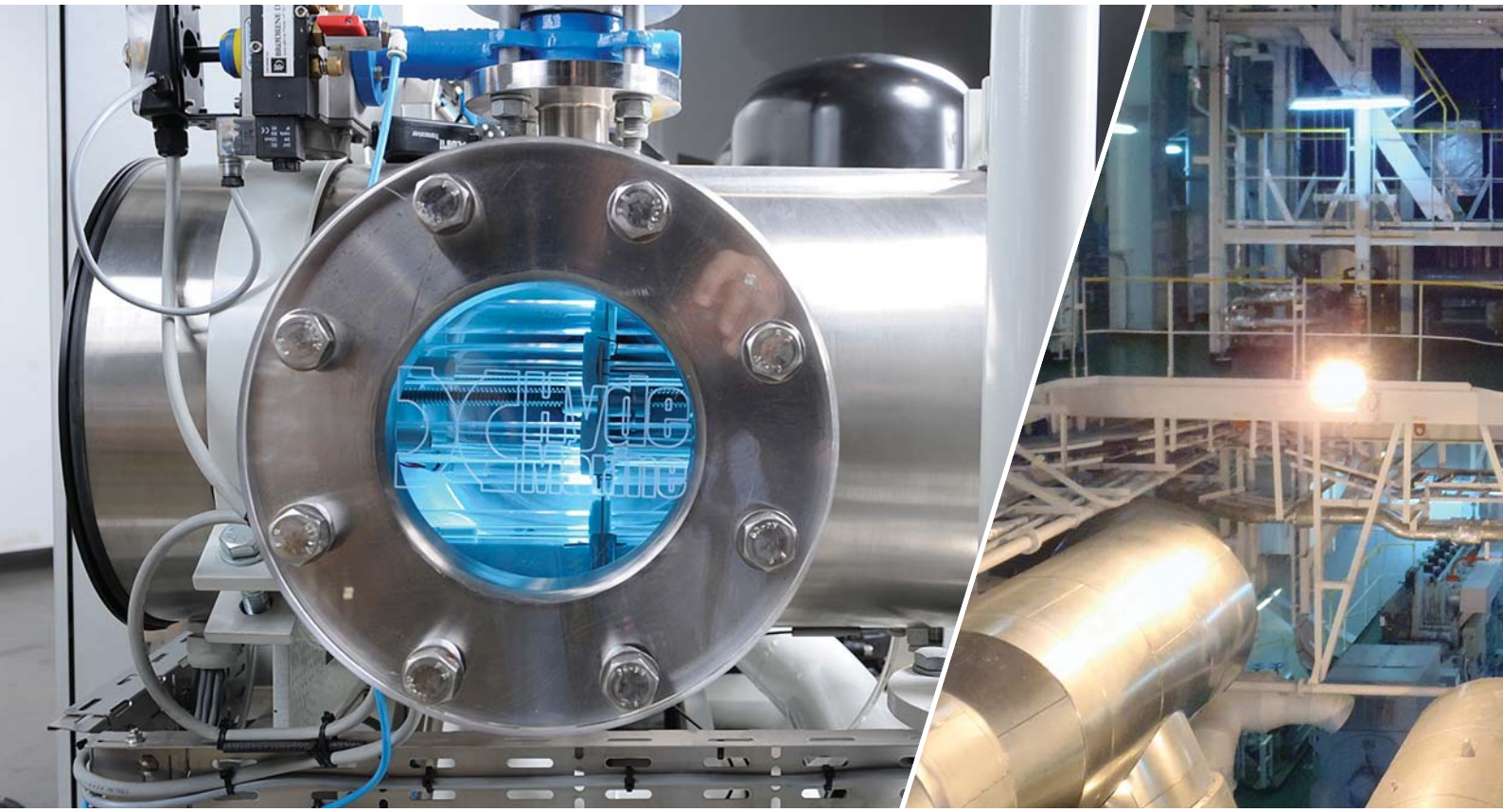

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