Wisconsin Ballast Water Treatment Feasibility Determination

Prepared by
Wisconsin Department of Natural Resources

INTRODUCTION

In 2008, the United States Environmental Protection Agency (USEPA) issued a Vessel General Permit (VGP) to regulate the incidental discharges from the normal operation of vessels, including ballast water, into waters of the United States (US), under the Federal Clean Water Act (CWA). However, there are no numeric discharge standards or compliance dates in the VGP. Some state governments, including Wisconsin, believe that the VGP does not require action that is necessary to protect the Great Lakes from the threat of aquatic invasive species. As a result, these states have created their own ballast water discharge permits or have issued conditional CWA Section 401 Water Quality Certification based on the responsibility to protect the waters of the Great Lakes states and fulfill the intent of the CWA.

In conjunction with its Wisconsin Pollutant Discharge Elimination System (WPDES) General Permit No. WI-0063835-01-0 for Ballast Water Discharge (General Permit), the Wisconsin Department of Natural Resources (WDNR) reviewed documentation and expert opinions on ballast water treatment technologies to determine the commercial availability of these technologies and feasibility of achieving the Wisconsin standard, as defined in Table A of the General Permit. (See Table A below.) WDNR's review and determination is based upon whether the following criteria are met:

A. Treatment technologies are able to meet the Wisconsin standards in Table A of the General Permit.
B. Treatment technologies are commercially available.
C. It is feasible to install the technologies onboard both new and existing vessels.
D. Sufficient time exists to comply with the discharge standard's effective dates.

Table A
Wisconsin Standard

Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type
Organisms > 50 µm in minimum dimension	Daily Average	< 1 Viable organism per 10 m^3	To be determined	Composite
Organisms 10 - 50 µm in minimum dimension	Daily Average	< 1 Viable organism per 10 ml	To be determined	Composite
Escherichia coli	Daily Average	< 126 cfu per 100 ml	To be determined	Composite
Intestinal enterococci	Daily Average	< 33 cfu per 100 ml	To be determined	Composite

If WDNR makes a finding that technology is not commercially available to comply with the Wisconsin standards in Table A, then the requirements in Section 4.1 will be modified pursuant to the permit modification process in s. 283.53, Wis. Stats., and the less stringent International Maritime Organization (IMO) standard, as portrayed in Table B of the General Permit, will apply. (See Table B below.) Treatment system manufacturers, researchers and companies that have vessels covered under the permit were encouraged to submit information to WDNR to assist in the treatment feasibility determination for complying with Wisconsin's proposed discharge standard in Table A of the General Permit.

Table B
IMO Standard

Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type
Organisms > 50 µm in minimum dimension	Daily Average	< 10 Viable organisms per m^3	To be determined	Composite
Organisms 10 - 50 µm in minimum dimension	Daily Average	< 10 Viable organisms per ml	To be determined	Composite
Escherichia coli	Daily Average	< 250 cfu per 100 ml	To be determined	Composite
Intestinal enterococci	Daily Average	< 100 cfu per 100 ml	To be determined	Composite

On January 13, 2010, WDNR presented a scope of work and requested that the Great Lakes Ballast Water Collaborative (Collaborative) act as the technical advisory committee to discuss the issues, research the feasibility of the criteria, and make recommendations based on the combined effort of experts in the field of ballast water treatment technology. The Collaborative consists of scientists, researchers, non-governmental organizations, vendors, naval architects, ship engineers, shipping industry representatives and federal, state and province regulators. In response to WDNR's request, the Collaborative met twice, in May (Montreal, Quebec) and in July (Duluth, Minnesota), and held a number of conference call discussions, addressing the listed criteria. Three workgroups were formed to try to answer specific questions within the criteria. WDNR's determination is based in part upon its review of currently available technical information and in part on the conclusions of the Collaborative's general discussions and workgroup efforts, detailed in two separate reports, which are incorporated by reference into this feasibility determination (Appendices A and B).

CRITERIA AND FINDINGS

Criterion A: Treatment technologies are able to meet the Wisconsin standards in Table A of the General Permit.

Key terms associated with this criterion:

- "Efficacy" means the ability of a system to treat ballast water to a level compliant with Wisconsin's performance standards.
- "IMO" or "IMO Standard" means the International Maritime Organization's proposed performance standards for the discharge of ballast water (Regulation D-2 of the Ballast Water Convention).
- "Type Approval" means certification that a ballast water treatment system has been thoroughly tested and verified to the point that the system passes and is approved by a regulatory entity [i.e., United States Coast Guard (USCG) and IMO].
- "Verification" means certification to a specific standard.

A workgroup of experts (Group 3 of the Ballast Water Collaborative Duluth Working Groups, which is incorporated by reference into this feasibility determination as Appendix C) reviewed and assessed the current verification capability for treatment systems in order to comply with a discharge standard of 100 times the IMO standard (Wisconsin standard from Table A).

Currently, the major obstacles to testing ballast water treatment systems (BWTSs) are:

- The large volumes of water necessary for a sample – At a 100 x IMO standard, a testing protocol would require a minimum of 30 cubic meters of water.
- Proper analysis of the volumes of water – Test methodologies are evolving, but there is still no standardized testing protocol.

It is currently not possible to verify that any available ballast water treatment system can meet the Wisconsin 100 x IMO standard. Enforcement actions would be limited to large, obvious violations such as discharging without any treatment, and they would be difficult for violations associated with meeting the limits such as a discharge which is treated but does not meet the treatment standard.

Recommendation for Department Determination (Criterion A)

The workgroup's assessment is that no formal protocols are currently in place for verifying treatment efficacy necessary for type approval to 100 x IMO on a consistent basis. Therefore, the conclusion is that treatment technologies are not able to demonstrate compliance with the Wisconsin standards in Table A of the General Permit.

Criterion B: Treatment technologies are commercially available.

Key terms associated with this criterion:

- "Commercially Available" means the system has been adequately tested, vetted and certified (i.e., Type-Approval to the IMO D-2 standard); is available for purchase, delivery and installation; is sold by multiple vendors and is in sufficient supply to meet demands.
- "Rated" means the system has received type approval certification based on IMO standards.

A workgroup of experts (Group 1 of the Ballast Water Collaborative Duluth Working Groups) reviewed and identified "commercially available" BWTSs that have been "rated" to meet or exceed 100 x IMO.

The factors considered in determining whether a treatment technology is commercially available were:

- Safety
- Affordability
- Cost effectiveness
- Fresh water compatibility
- Water temperature variability
- Product availability
- Vendor availability
- Insurability
- Maintenance
- Technology and vessel compatibility

On August 27, 2009, the United States Coast Guard (USCG) proposed discharge standards and BWTS verification methods, to be implemented in two phases. The proposed rule has not yet been adopted. The USCG is not confident that any of the current systems can meet IMO and USCG Phase 1 standards. The following concerns have been raised during the USCG studies and tests of BWTSs:

- The systems could not consistently meet the given criteria.
- Quality Assurance/Quality Control is not in place.
- Test methodologies are not repeatable.
- Data could not be validated.

None of the systems tested by USCG could meet the 100 x IMO Wisconsin standard. These results were confirmed by a subgroup of the USEPA Science Advisory Board Ecological Processes and Effects Committee (EPA SAB EPEC) that studied over 30 types of BWTSs. Initial results of the study, which are incorporated by reference into this feasibility determination (Appendix D), will show that, when testing out to 10 x IMO, 100 x IMO and 1000 x IMO, all BWTSs tested either: 1) may have the potential to meet the standard (but it can not be verified), or 2) are unlikely to or will not meet the standard.

(The final report is to be published Summer, 2011.) The USCG does not believe any BWTS can currently meet 100 x IMO. Since there are currently no testing protocols for evaluating whether or not a BWTS can achieve 100 x IMO, the claims by some BWTS manufacturers that their products are capable of reaching the 100 x IMO standard can not be scientifically proven.

Testing protocols [i.e., USEPA's Environmental Technology Verification (ETV), incorporated by reference into this feasibility determination (Appendix E)] were recently finalized and published by USEPA. BWTS vendors would need to rigorously test their systems prior to WDNR relying on the claims that the BWTS complies with 100 x IMO. However, protocols to test to this standard are still in development.

In addition, insurance companies will not insure US vessels without USCG type approval of a BWTS. Without insurance, the vessels cannot operate. Thus, USCG type approval of a BWTS is necessary before it can be installed onboard.

Currently the best and most effective way to remove non-indigenous species from ballast water is the Best Management Practice (BMP) of mid-ocean Ballast Water Exchange (BWE) or saltwater flushing (for vessels with No Ballast On Board, or NOBOBs), required by the USCG [33 CFR §151.1510(a)(1)] for all ocean-going vessels entering US waters, until ships are required by IMO to have onboard BWTSs in 2016. (WDNR's General Permit requires BWTSs be installed on board all ocean-going vessels by 2012 for new vessels and by 2014 for existing vessels.) In BWE, ballast water (presumably coastal water) is exchanged with open-ocean water during a voyage. This reduces the number of coastal organisms, which are potential invasive threats. This has been an effective practice to help reduce the threat of aquatic non-indigenous species to US waters. The USCG plans to sunset the BWE requirement when the final rule is adopted because the requirement was intended to be only an interim solution. However, WDNR believes this is a BMP that should be sustained long-term, in addition to other requirements, in an effort to better protect the waters of Wisconsin from the threat of aquatic non-indigenous species. The idea of utilizing BWE combined with BWTSs for effective control of ballast water and better protection against the introduction of harmful aquatic organisms and pathogens is supported by the recent research of Dr. Sarah Bailey (Great Lakes Institute of Environmental Research), which is incorporated by reference into this feasibility determination under Additional Resources.

Recommendation for Department Determination (Criterion B)

The workgroup's assessment is that there are many factors to consider in determining whether treatment technologies are commercially available. The conclusion is that they are not commercially available at 100 x IMO treatment levels at this time.

Criterion C: It is feasible to install the technologies onboard both new and existing vessels.

Key terms associated with this criterion:

- "Feasibility" means the extent to which it is technically, economically and legally possible or reasonable.
- "Practicable" means safely and economically possible, with an appropriate timeline.

A workgroup of experts (Group 2 of the Ballast Water Collaborative Duluth Working Groups) examined the key components of the installation process from the vessel owner's perspective. It also reviewed the factors affecting timing and how the lifespan of the vessel compares with the lifespan of the system. It would not be cost-effective to install a new system on a vessel that will be retired within a few years. EPA SAB EPEC has come to similar conclusions.

Regulatory uncertainty was identified as being the largest obstacle for installation feasibility. When a national standard is adopted and an approved technology is available, the timeline for the installation of a BWTS will still be 3 to 5 years after that, due to the following steps in the installation process:

- Vessel-specific evaluations
- BWTS selection
- Design and installation plans and specifications
- System purchase
- Installation contractor selection
- BWTS delivery and installation

BWTS suitability depends on a number of factors which vary from vessel to vessel, including ballast pumping rates and volumes, trade routes and ballast water retention time associated with the trade routes, and vessel life cycle and economic considerations that would help determine the ideal time to install a BWTS.

Primarily because of insurance issues, it is unlikely that a BWTS would be installed onboard before it has been type approved by the USCG. For a product to be USCG type approved, it must have demonstrated that it complies with all relevant regulations and requirements, has successfully completed the required tests, and is enrolled in a follow-up program that monitors for quality control. This program monitors product uniformity in order to ensure that there is no deviation from the approved design. In addition, the USCG will only type approve to a federal standard, not to a state standard, such as the 100 X IMO Wisconsin standard.

There is only one freshwater testing facility (Great Ships Initiative in Superior, WI), and vessels entering the Great Lakes will need to install BWTSs that have been approved through freshwater testing. There are no testing facilities in the world that have the ability to test to standards more stringent than IMO. In addition, until the USCG rules establishing US testing standards are promulgated, there are no approved US testing methods that are

even available. To date, no one BWTS has passed Type Approval to the IMO D-2 standard for saltwater, brackish and freshwater systems.

To facilitate BWTS testing and approval, the USCG Shipboard Technology Evaluation Program (STEP), which is incorporated by reference into this feasibility determination (Appendix F), promotes the development and testing of treatment technology until the USCG rule is adopted for type approval. STEP allows owners of vessels the opportunity to install, operate and evaluate experimental BWTSs for use in US waters. STEP offers access to vessels for further research and development of experimental technology and serves as an interim step to type approval.

Recommendation for Department Determination (Criterion C)

The workgroup determined that it is not yet practicable to install the BWTS technologies onboard existing or new vessels. Thus, the conclusion is that it is not feasible to install the technologies onboard both new and existing vessels.

Criterion D: Sufficient time exists to comply with the discharge standard's effective dates.

On July 17, 2009, IMO's Marine Environment Protection Committee (MEPC59) concluded sufficient technologies were available for installation on vessels constructed in 2010. The MEPC59 report is incorporated by reference into this feasibility determination (Appendix G). Research conducted by Dr. Bailey supports the MEPC59 findings. Additionally, there are BWTSs which have received Type Approval to the IMO D-2 standard. WDNR proposes to accept Type Approval to the IMO D-2 standard as an equivalent to receiving USCG Type Approval, for the purposes of meeting compliance with the General Permit. The compliance dates in the General Permit will remain. The IMO discharge standard for treatment systems becomes effective in 2012 for new ocean-going vessels and in 2014 for existing ocean-going vessels.

Recommendation for Department Determination (Criterion D)

Based on the above information as well as evaluation of other states' research and requirements (including California, New York, Minnesota and the National Park Service, which is hereby incorporated by reference into this feasibility determination under Additional Resources), WDNR's conclusion is that sufficient time does exist to comply with the IMO discharge standard's effective dates.

DEPARTMENT DETERMINATION

Based on this feasibility determination and the efforts and recommendations of the Collaborative, as well as other information, WDNR determines that treatment technologies are not currently able to meet the Wisconsin standards in Table A of the General Permit (Criterion A). In addition, treatment technologies are not commercially available at this time (Criterion B). Furthermore, it is not yet feasible to install the technologies onboard both new and existing vessels (Criterion C). Therefore, the WDNR will propose to modify the General Permit such that the International Maritime Organization (IMO) standard in Table B applies. In addition, WDNR will propose to require mid-ocean Ballast Water Exchange (or saltwater flushing for no-ballast-on-board vessels) as a Best Management Practice to be continued after Ballast Water Treatment System technology is available and implemented. The WDNR determines that sufficient time exists to comply with the current discharge standard's effective dates (Criterion D), and, therefore, WDNR will retain the compliance schedule in Section 5 of the current Ballast Water Discharge General Permit. The General Permit modification is available for public comment beginning December 14, 2010 through January 26, 2011.

Signed by: Russell A. Rasmussen Date: December 14, 2010

Russell A. Rasmussen
Bureau of Watershed Management Director

Approved by: Date: 12/14/2010

Bruce J. Baker
Water Division Administrator

Incorporated by reference to this feasibility determination, the following appendices are submitted:

APPENDICES

Appendix A Report from the Great Lakes Ballast Water Collaborative Meeting: Montreal (including attachments)

http://www.greatlakes-seaway.com/en/pdf/Ballast_Water_Collaborative_Meeting_Report_05-18-10.pdf

Appendix B Report from the Great Lakes Ballast Water Collaborative Meeting: Duluth

http://www.greatlakes-seaway.com/en/pdf/Ballast_Collaborative_Report_and_WGReports_Duluth(Final).pdf

Appendix C Ballast Water Collaborative Duluth Working Groups

http://dnr.wi.gov/org/water/wm/ww/gpindex/BallastWaterDuluthGroups.pdf

Appendix D EPA SAB EPEC Ballast Water Advisory Documents (Drafts)

http://yosemite.epa.gov/sab/sabproduct.nsf/PeopleSearch/4C81DE70BB5ABD04852576D90054E925?OpenDocument

http://yosemite.epa.gov/sab/sabproduct.nsf/PeopleSearch/412EAA9F2963E095852577AD00520D31?OpenDocument

Appendix E Generic Protocol for the Verification of Ballast Water Treatment Technology

http://www.epa.gov/nrmrl/pubs/600r10146/600r10146.pdf

Appendix F Shipboard Technology Evaluation Program

http://www.uscg.mil/hq/cg5/cg522/cg5224/step.asp

Appendix G Report of the Marine Environment Protection Committee on its Fifty-Ninth Session

http://www.shippingandco2.org/SEEMP-28July09.pdf

ADDITIONAL RESOURCES

American Bureau of Shipping. 2010. Guide for Ballast Water Exchange.

Bailey, Sarah. 2010, publication pending. Development of Guidelines and Other Documents for Uniform Implementation of the 2004 BWM Convention.

Code of Federal Regulations. 2010. 33 CFR §151.1510.

International Maritime Organization. 2004. Convention BWM/CONF/36 International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004.

Lloyd's Register. 2010. Ballast Water Treatment Technology: Current Status.

National Park Service. 2010. Bridging Ballast Water Treatment Technology Gaps: Moving from Proof of Concept to Full Implementation of Great Lakes Ballast Water Skid Mounted Treatment Systems Within 24 to 36 Months!

Great Lakes Ballast Water Collaborative Home Page: http://www.greatlakes-seaway.com/en/environment/ballast_collaborative.html

NEWS RELEASE

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DATE: **For release in the December 21, 2010 Wisconsin DNR Weekly News**

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SUBJECT: **Changes proposed to ballast water rules**

MADISON – Wisconsin is proposing to change its requirements for oceangoing ships arriving in its Great Lakes waters. The change would set ballast water discharge standards to those required by the International Maritime Organization. The proposed change reflects the latest science about reducing the risk from invasive species carried in the ships' ballast water, state officials say.

The proposed modifications to a general permit issued by the Wisconsin Department of Natural Resources to large oceangoing commercial ships will be the subject of a public hearing January 26 in Superior.

Large commercial ships take on and release water to help balance the vessels as cargo is loaded on and off. Along with the water, plants, animals and pathogens are taken in and released as well. Ballast water is the primary way aquatic invasive species such as the zebra mussel, round goby and spiny water flea have been introduced into the Great Lakes over the last century.

Wisconsin issued a ballast water discharge general permit effective February 1, 2010, with a requirement to determine, by the end of 2010, if effective treatment systems would be available by the implementation date.

The department engaged the Ballast Water Collaborative, a group of experts from academia, government, the shipping industry, testing facilities, treatment vendors and nonprofit organizations in an unprecedented in-depth discussion and review of ballast water treatment technologies and the science available to measure their effectiveness. The collaborative concurred with the latest science and technology reports that treatment systems have not been approved to the level Wisconsin's standard required and cannot be measured to that level to prove the treatment effectiveness. The group concluded that technology does not yet exist to verify whether a treatment system can rid ballast water of organisms effectively enough to meet Wisconsin's standard. A feasibility report [http://dnr.wi.gov/org/water/wm/ww/drafts/BallastWaterFeasibilityReport.pdf] based on the findings is available on the DNR website. This standard is set at a level of 100 times the International Maritime Organization standard.

After considering the best science and technology now available, Wisconsin is proposing to set the discharge standard in the permit modification to the international standard. Under the proposal, Wisconsin would continue to require oceangoing ships to treat ballast water to reduce the remaining organisms to a level that meets the international numerical standard.

To provide added protection, Wisconsin is also proposing to continue requiring ships to flush their ballast tanks at sea. This ballast water exchange process is now required by the federal government but is likely to change when revised federal rules are final, according to Matt Frank, secretary of the Wisconsin Department of Natural Resources.

“We want to be confident that we’re getting the highest level of protection possible, and right now that includes making sure ballast water exchange continues, even if the final federal rules drop that requirement,” said Frank. “The latest research suggests that ballast water exchange, combined with the required international standard, may result in better protection for our Great Lakes and inland waters.”

Breaking research shows that exchanging ballast water at sea can reduce, typically by 95 to 99 percent, the number of invasive species that have the greatest chance of surviving and causing trouble in freshwater bodies, according to Sarah Bailey, PhD, a research scientist for of Fisheries and Oceans Canada, and a member of the collaborative.

Earlier research raised questions about the effectiveness of ballast water exchange. Bailey’s research is showing that when the exchange is done right, the plants, animals and pathogens are purged at sea as the ballast water is exchanged; organisms remaining in the tank are then subjected to the saltwater taken in, which kills and weakens many of them,

“We've been completing analysis of flushing and we’re finding such exchange is much more protective of freshwater ports than marine ports,” said Bailey. “This idea of combining exchange with treatment may be a more meaningful increase in protection because you’re now addressing two of the three factors necessary for a successful invasion, not just one.”

The three factors are: how many of a particular species are released over time; whether environmental conditions (including salinity and temperature) are hospitable to a species; and whether the food chain is conducive to the survival and growth of a species.

In issuing its general permit, Wisconsin joined Minnesota, Michigan and New York in regulating large oceangoing ships entering Great Lakes waters to provide greater protection than provided by federal permit requirements. After more than a decade the federal government is still working on developing ballast water regulations.

Meanwhile, Wisconsin and other Great Lakes states, the federal government and the shipping industry jointly support the Great Ships Initiative, a research effort designed to find the most cost-effective treatment technology for freshwater shipping on the Great Lakes. It is expected that these research efforts will lead to better and quicker protection of the Great Lakes from aquatic invasive species.

Certain Wisconsin requirements for handling ballast tank sediment, seawater, and other substances took effect on February 1, 2010, and applied both to oceangoing ships and to the ships that travel only within the Great Lakes. Other requirements will phase in over time, specifically the numerical treatment standard that would apply only to oceangoing ships. New ships must meet the requirement in 2012 and existing ships in 2014. These implementation dates will remain effective in the proposed permit modification.

“If proposed changes to the permit requirements are made,” Frank noted, “Wisconsin still has one of the most protective ballast water permits in the Great Lakes.”

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