Final Report from the 7th Great Lakes Ballast Water Collaborative Meeting: Silver Spring, Maryland

NOAA Science Center 1305 East-West Highway Silver Spring, Maryland 20910 March 3-4, 2014

Introduction

Approximately 50[1] representatives from the shipping industry, ballast water treatment technology industry, state and federal governments, and academia attended a meeting of the Great Lakes Ballast Water Collaborative (Collaborative) on March 3-4, 2014. This was the seventh meeting of the Collaborative, which was formed to facilitate the exchange of information and cultivate relationships between state, provincial and federal regulators, the shipping industry, research scientists, and other stakeholders.

Goals of the Meeting:

- Develop a better understanding of the U.S. Coast Guard's (USCG) type-approval process.
- Discuss the enforcement of the Environmental Protection Agency's (USEPA) Vessel General Permit and state 401 certifications and permits.
- Discuss Canada's regulatory environment as signatories to the International Maritime Organization's (IMO) Ballast Water Convention (IMO Convention).
- Develop a better understanding of the status of the IMO Convention and recent issues associated with it.
- Continue discussions about ballast water management system (BWMS) technology, development, and testing.

The Meeting

Craig Middlebrook, Deputy Administrator of the Saint Lawrence Seaway Development Corporation (SLSDC) started the meeting by thanking the organizers and hosts, acknowledging the "facilitation from the Minnesota Sea Grant Program's Dale Bergeron and Sharon Moen, the Knauss Fellowship, and particularly the diligence of Dr. Marvourneen Dolor, for making the meeting possible." He also acknowledged the partnership with the International Joint Commission (IJC) and the important role played by Mark Burrows over the years.

[1] Attendance was suppressed by a winter storm.

Middlebrook, who served as moderator, noted that five years and six meetings ago, the Collaborative hosted its first gathering in Detroit in 2009, and since then much progress has been made:

"In 2009, there was still no USCG final rule, the USEPA was a newcomer to ballast water discharge regulations, the United States and Canada hadn't yet implemented regulations, there were significant science gaps, little communication among stakeholders, and an overall lack of common understanding on the issues. But now, the USCG final rule is out, a U.S. type-approval process exists, common discharge standards have been established, we've improved our science-based knowledge, and built our communications and relationships," he said, reminding us that the biggest focus now is on implementation and moving forward. "We aren't all the way there yet, but we are making progress…we know the carriers, environmental advocates, and regulators are frustrated, but we can't lose our perspective and must continue to trust that things will work out."

Current Regulations and Policy Status

IMO Update

Chris Wiley (Transport Canada (TC)), and Chair of the IMO Ballast Water Working Group provided an update on the IMO.

- IMO has undergone reorganization; the Marine Environment Protection Committee (MEPC) now serves as the ballast review group.
- 38 countries representing 30 percent of global tonnage have joined the IMO Convention as of February 2014 (a minimum of 30 countries and 35 percent global tonnage is required), up from 35 countries and 28 percent of global tonnage[2].
- Although the Convention is still not ratified, there are hopes for ratification during 2014.
- There are currently sixteen facilities where IMO type-approval testing can be conducted, the most recent established by a Memorandum of Understanding (MOU) with Korea in 2013.
- 38 BWMSs have been type approved.

Wiley stated that several issues related to type approval are impeding the ratification of the Convention:

- Lack of type-approval testing transparency and availability of detailed test results (IMO is working to amend the current process to require more information, especially from hazard assessments).
- U.S. does not accept the current IMO G8 type-approval process.

[2] As of July 28, 2014, 40 countries representing 30.25 percent had ratified the convention. See http://www.imo.org/About/Conventions/StatusOfConventions/Pages/Default.aspx

- Concerns about the IMO type-approval process: IMO type-approval guidelines do not require testing across a wide range of operating conditions (e.g., salinities and temperatures) and there are undocumented claims that systems have already failed under real operating conditions; also concern about criteria for sampling ballast water during Port State inspections. IMO has requested specific information on type-approved systems that have failed to function properly, but as yet, none have been documented. A proposed MEPC Resolution (submitted to MEPC by the International Chamber of Shipping with other industry organizations) does not have an Administration associated with it and it is the Administrations that have the power to make changes.

Wiley noted that implementation dates for the Convention have slipped since 2004, but since it is not yet in force, dates cannot yet be changed in the original Convention text. Resolution 1088 (28), issued in December 2013 allows ships constructed before entry into force of the Convention to delay compliance with the D2 regulations until the first renewal survey following the date of entry.

Robert Lewis-Manning (Canadian Shipowners Association (CSA)) asked if Resolution 1088 might result in different enforcement for ships with delayed compliance from countries that have signed the Convention versus those from countries that haven't. According to Wiley the enforcement regime is fair and consistent world-wide, but does provide authorities for Port States to protect their environment. Although such discrimination would not be allowed, any vessels not in compliance with Port State requirements could be detained, and the Port State has the responsibility and authority to stop any discharge it believes is not in compliance. While there are some issues related to Port States doing things differently, IMO is working to better align them; for example, working collaboratively with sampling and measurement strategies. Similar concerns are also arising due to differences between countries' memoranda of understanding.

Wiley concluded his presentation, stating that he believes that valid ballast water sampling technologies and protocols are now available and that statistical certainty can be provided. He assured the group that the science is there to guarantee replicable and representative sampling.

Dr. Richard Everett (USCG) commented that Wiley captured the sense of anxiety at the IMO prior to adoption of Resolution 1088, but suggested that there have been unintended consequences - the Resolution released too much pressure and the industry has relaxed because enforcement has been deferred. He cautioned that everyone should still be working hard towards installing type-approved systems on ships, and that we should expect to see many more discussions, even after ratification. It needs to be recognized that the IMO G8 and the U.S. Environmental Technology Verification (ETV) program are not incompatible or in conflict, and that they reflect an evolution since G8 was finalized, especially since the U.S. ETV protocols are specific and require transparency. Unfortunately, some other countries are not being transparent about testing using G8. Changing the G8 process will be only marginally effective as long as individual countries can broadly interpret the requirements within the G8 type-testing framework.

Jon Stewart (International Maritime Technology Consultants (IMTC); Industry Advisor on the U.S. Delegation to the IMO's MEPC) commented that making changes to the Convention is inevitable and will have significant impacts on the implementation process. He believes it is better to continue moving forward, and believes it is now more valuable to join the Convention than not. However, once the Convention comes into force, the problem for North America will lie with policies and enforcement applied to the domestic trade. Under the Convention use of open ocean exchange is no longer a treatment option.

Transport Canada Update

Colin Henein (TC) discussed the status of developing a policy approach for implementing the IMO Convention, which Canada signed in 2010. Compliance under the Convention would allow for use of a BWMS, shore based treatment, and permanent retention of ballast water or any other method providing equal protection.

TC published a "Discussion Paper: Canadian Implementation of the Ballast Water Convention" in 2012:

- There were 20 public comments on the Discussion Paper that will be analyzed and considered, taking into account all current legal issues, science, technology, cost-benefit as well as binational and international compatibility. "We are still in the discussion stage, and have not yet formally proposed text for the regulations that will be needed to implement our ratification of the Convention".
- Binational compatibility and fair application to domestic flagged vessels are critical issues demanding attention. There is a risk of invasive species from coastal and international ships.
- TC asked for expert-review of the formal issues presented by CSA related to BWMSs and lakers, such as the feasibility for installing systems on Lakers, their efficacy in the Great Lakes, and obtaining US type approval. A report by Jad Mouawad (Mouawad Consulting, November 2013) assessed the efficacy of treatment processes for ships sailing in the Great Lakes region. Mouawad concluded that there are ballast water treatment processes consistent with treatment of the waters of the Great Lakes to the D-2 standard within the voyage lengths of Great Lakes ships. A second study is underway considering the issue of the feasibility of installing and operating BWMSs on ships operating on the Great Lakes.
- The Great Lakes are interconnected and therefore will mix to some degree independent of shipping activity. However, studies have shown that most species are localized and need to be physically transported in order to spread widely throughout Great Lakes systems - even the most mobile fish species in the Great Lakes have a maximum similarity of 54 percent between any two of the lakes.

TC would like more input and comments to drive the process forward and will host a workshop, expected to occur during the summer of 2014, open to the three main shipping associations and any others that show interest and have something significant to offer. Henein closed, stating that nothing has been finalized and everything is still under consideration as the dialogue moves forward.

The audience queried Henein regarding the uncertainty of where Canadian jurisdiction begins and ends, and if a ship operating only in Canadian waters is excluded from the requirements of the Convention. He clarified that the Convention applies to ships unless they operate strictly within waters of a single country. TC is currently working on requirements for using BWMS technology that have not been tested to specifically treat Great Lakes freshwater. He stated that TC is seeking to align their regulations with the U.S. as much as possible within Canada's international obligations.

The topic of state sewage no discharge zones was raised and Henein noted that Canada is considering prohibiting the storage of sewage in ballast tanks to avoid interference with ballast water treatment systems. Lewis-Manning asked what would happen with treated sewage that couldn't be

discharged or stored anywhere else, and noted that prohibiting storage would ignore current regulations and creates a conundrum that requires further discussion.

USCG Update

Dr. Richard Everett (USCG) discussed the USCG Ballast Water Discharge Standard Final Rule, which was published in March 2012:

- The Final Rule does not mandate the use of a BWMS but requires that the discharge standard be met, and includes additional non-indigenous species reduction practices, ballast water management plans, provisions for extensions to the compliance date, and ballast water reporting and record keeping requirements.
- The Final Rule allows use of alternative management systems (AMS) for up to five years, or requesting an extension to the compliance date until type-approved BWMSs are available. Any extensions of compliance dates due to unavailability of approved treatment systems will be granted for no longer than the minimum time needed to come into compliance. So far there have been approximately 250 extension requests, with 110 issued .
- AMS designation allows temporary use of a BWMS that is type approved by a foreign administration in accordance with the IMO Convention; it must be shown to be at least as effective as ballast water exchange (BWE), and is viewed as an alternative to BWE, not "in lieu" of the Final Rule discharge standard.
- AMS designation can be granted to a BWMS that has foreign Administration type approval based on USCG review of associated test data and documentation; U.S. type approval is based on testing performed by an approved Independent Laboratory (IL) using USCG-specified methods and requirements.
- With an AMS, a ship is exempt from installing a U.S. type-approved BWMS for five years from the initial requirement. However, this is only intended as a bridging strategy, and it was expected that very few ships would use the AMS alternative.
- Availability of AMS will not prohibit a vessel owner from also receiving a compliance date extension from the USCG.
- AMS and Type Approval are separate programs. While AMS designation is often viewed as a first step towards U.S. type approval, it does not guarantee U.S. type approval; an AMS application requires the submission of an "existing data" application, which includes an assessment by the manufacturer of the degree to which the BWMS has been tested in accordance with USCG requirements.
- A formal program has been established to provide U.S. type-approval testing of BWMSs through ILs approved by the USCG. The program incorporates the USEPA's ETV program of land-based test protocols, which are consistent with the IMO Convention. After the draft ETV protocol was issued, the USCG ran validation tests to determine if it produced consistent results. Several years of testing demonstrated that the ETV protocols can be implemented consistently by different test facilities. Dr. Everett noted that the G8 process provides guidance for validation,

but it is less detailed and does not require the level of transparency required by U.S. type approval.

- There are two different methods for achieving USCG type approval:
  - The first is to submit all existing test data and information from previous type approval conducted through a foreign Administration, with a detailed explanation of how the procedures and data meet the USCG type-approval requirements. These records would be submitted to an approved IL for review and further testing. The ship owner must show the test results meet the USCG standard, and then allow the IL to confirm it.
  - The second method is to have the type-approval testing conducted by an IL directly. Two ILs have presently been approved by the USCG, including NSF International (since July 2012) and DNV (since June 2013). Each IL is actually an umbrella organization composed of multiple sub-contract test facilities. Another IL application is under review and an existing IL has another request to add a subcontracted facility to its approved contract.

Phyllis Green (National Park Service) asked how long compliance extensions will be, and if the USCG is working with shipping companies to ensure that they are moving towards getting BWMSs onboard.

Dr. Everett answered that, for example, if a ship dry-docks in 2014 and falls into the intermediate size-class, and there is no accepted compliance option, they can have an extension through January 2016. The USCG is neither encouraging nor discouraging installation of AMS prior to a vessel's compliance date. This is a decision ship owners need to make on the basis of flag requirements, BWMS market, and financial issues.

Another participant asked if a vessel installs an AMS, is it not held to the discharge standards or required to perform BWE? Dr. Everett answered that a ship with an AMS is not required to meet the discharge standard during the 5-year grandfather period after the initial compliance date, nor is the ship required to conduct BWE during the period prior to the initial compliance date. A ship with an AMS is allowed to use the AMS in lieu of either BWE or meeting the discharge standard – but only until the end of the 5-year grandfather period.

Debra DiCianna (American Bureau of Shipping (ABS)) commented there are limited choices of AMS and shipyards working on present contracts are running out of time based on contract delivery dates. They need to be able to make faster decisions. She asked: "Is it possible for the USCG to process AMS applications more quickly?"

David Reid (Saint Lawrence Seaway Development Corporation contractor) has asked if any AMS applications have been denied? Dr. Everett answered not yet, but if an AMS application comes in for a system with only a class society type approval it would be denied. The AMS needs to have an Administration type approval for acceptance.

Gary Croot (International Maritime Environmental and Safety Associates) asked about the salinity requirements of IMO type approval and systems accepted as AMS for use in the Great Lakes. Dr. Everett stated that IMO type approval requires testing at two salinities with at least 10 ppt difference. AMS designation comes with specified limits to approved use on the basis of what salinities were used for testing, and so an AMS only tested in brackish and marine water can't be used to treat fresh water. It is also unacceptable to add a brine tank or alternative system to the AMS in order to treat

freshwater unless such has been approved by the foreign administration and so indicated on the type-approval certificate.

Dr. Everett continued his discussion of the Final Rule, covering compliance and enforcement for type-approved systems:

The USCG will conduct port state control exams and domestic vessel inspections, and evaluate compliance with all required documentation, test crew knowledge, equipment condition and operational status, and also sample discharge as necessary. Specific sampling and analysis methods are in development.

The USCG is not changing compliance dates contained in the final rule. Making a change in requirements would require a rulemaking, which is a lengthy complex process.

AMS are subject to compliance assessment, though not discharge standards. Ships will need to have a detailed BWM plan established and an informed crew. This will be an evolving process.

ETV shipboard-testing protocols are not needed to type approve BWMSs and there is no preference for a specific type of treatment system technology. Approvals will not be held and released in "batches." A type-approval certification will be issued as soon as an application demonstrates that the system meets all criteria for U.S. type approval.

Someone asked, if you put in an AMS, would confirmation be needed that USCG requirements are met, is that possible, and how would it be confirmed? Is having a foreign flag approval acceptable? Dr. Everett answered that they would presume the foreign flag performed due diligence to make sure it meets the class society and Administration rules and looked at all the certifications and plans. It will be a learning process. In general, the USCG does not set requirements for the way in which equipment is installed on foreign flagged ships – the administrations and class societies do that. The USCG would, during port State control exams, note if a system appeared to be installed incorrectly or in an unsafe manner, and could follow up on that with the flag state. The USCG would also look to see if equipment is being maintained and operated in accordance with the type-approval certificate and any conditions thereon.

A final question asked about the status of transitioning from AMS to type-approved systems. Dr. Everett answered that USCG had one type-approval application in hand which is being assessed to determine if it was submitted correctly. The ILs are already overloaded with testing requests, and demands continue to increase. Also, existing test data (results of tests conducted for IMO type approval) can be given to an IL for evaluation without first having the IL retest a system.

<u>USEPA Vessel General Permit Update</u>

Craig Middlebrook introduced Dr. Ryan Albert (USEPA) to discuss the 2013 Vessel General Permit (VGP2):

- USEPA used the Clean Water Act (CWA) and technology-based limits to set standards. A USEPA Science Advisory Board report indicated that technology does not currently exist to meet a discharge standard more stringent than IMO D2. The USEPA looked at different models and methods to determine an achievable scientifically defensible effluent limit, but found that it was infeasible to calculate a numeric water quality based effluent limit. They are working to identify the next

steps and the best practices for moving forward, in addition to identifying specific research questions that must still be answered.

- Monitoring under VGP2 is different from that required by the USCG because the CWA requires compliance self-monitoring. Biological monitoring is limited to twice during the first year, and once per year thereafter for vessels that are deemed to have high quality data. The recent USEPA response to clarify enforcement policy (enforcement will be a "low priority") applies to vessels meeting other VGP2 conditions that have also received a USCG extension. The USEPA continues to closely coordinate with the USCG and other authorities in order to maximize consistency where appropriate.

Jeff Stollenwerk (Minnesota Pollution Control Agency (MPCA)) asked about what legal challenges the USEPA faces right now, and how responsibilities are divided. Dr. Albert is aware of four groups currently challenging the best available technology approach and, in one case, criticizing the compliance schedule as too lenient.

In reference to USEPA's announced "low priority" policy for compliance enforcement, Mouawad expressed concerns about potential legal impacts if ship owners are allowed to operate out of compliance. He recommended shortening extensions. Dr. Albert answered that they are aware of the USCG extensions, and that everyone will be in a better situation once there is a USCG type-approved system available. Until then, the USEPA will continue evaluating all information.

DiCianna asked about the requirements for monitoring on a ship using an AMS - if a ship has the option to use BWE instead of the AMS, why would they want to use a BWMS with its added requirement for monitoring? How does the USEPA view this issue, and will monitoring still be required? Dr. Albert answered that he doesn't think the monitoring requirement is too cumbersome, since biological monitoring is only done 1-2 times per year. USEPA will be looking for summary operational data such as minimums and maximums of chlorine dose or other indicators that the BWMS has been operating to specs.

Dr. Albert answered a question about the schedule for small vessel permits, stating he hoped small vessel permits would be available this summer.

Stewart asked about impacts to non-compliant ships beyond EPA's regulatory "low priority" enforcement - there are commercial considerations related to contracts (will a client contract to use a ship documented as out of compliance with the law?) and insurance (will the Class Societies provide insurance for a non-compliant ship?). Has USEPA given this consideration? Dr. Albert stated that in terms of the Protection and Indemnity issue, as USEPA becomes more educated about the maritime industry, the maritime industry will also become more educated about the Clean Water Act. Stewart offered to reach out to USEPA to informally meet and discuss the implications and try to work something out. But, he noted, the USEPA should also keep in mind that there is more pressure and thus interest in getting working technology on board ships than there is in conducting monitoring and enforcing discharge and biological standards.

Another attendee also pointed out that if a ship owner receives an extension from the USCG, they will still have to report to USEPA that they are out of compliance with the VGP. He felt this is important to keep in mind, because the report of noncompliance is in the public record. Under the CWA, citizen groups can sue permittees for being out of compliance, which highlights the risks to ship owners who do not install AMS or type-approved BWMSs. Dr. Albert confirmed that noncompliance must be reported and it has to be publically available.

A question was asked if the only current requirement is for vessel operators to perform self-monitoring of BWMS performance. Dr. Albert answered that for right now, if a ship is using an approved BWMS (or AMS), it only needs to report data demonstrating that the system is functioning according to specs and the results of biological monitoring required by the permit. Monitoring requirements will evolve over the years as methods to monitor improve.

Stollenwerk asked if all state 401 certifications require monitoring and verification of all size classes. Sarah LeSage (Michigan) answered that for Michigan, until procedures are established and a protocol is in place, monitoring is waived, but it is hoped that these will be incorporated in the future.

Dr. Everett noted that several methods and approaches to monitoring are being considered, and it is likely that there will be a decision in the near future on which procedures to use. The USCG wants to make decisions easy for the states, so what monitoring tools and information do the states need? Stewart suggested that it would probably be best for the states to defer monitoring method development to organizations that have and are investing the resources to do so, e.g., USEPA and USCG. Once methods and protocols have been verified and are documented with protocols for use, the states can adopt them as appropriate for their monitoring needs.

The discussion ended with a statement from the audience that the industry should continue to work and move forward with the USEPA, USCG and other agencies. Although it can be challenging, all are putting forth good faith efforts to achieve an acceptable end point.

Dr. Albert closed by announcing that USEPA is preparing a basic ballast water self-monitoring guide and other resources designed for use by vessel operators.

Updates from States

Wisconsin

Susan Sylvester:

- There were four challenges (3 citizen groups, 1 industry challenge) to Wisconsin's 401 certification for VGP2. Local non-governmental organizations and shippers appeared before an Administrative Judge, who ultimately found in Wisconsin's favor. A settlement was reached with the shippers and the 401 certification was finalized in November 2012. The new date for the ballast water management regulations to come into effect was December 1, 2013 for existing vessels.
- Under the settlement, shippers agreed to make good-faith efforts to install treatment systems at the earliest date possible after a system is approved and available and competitive for a particular vessel. The permit would expire by January 31, 2015, which is well before the 2016 limit from the USCG.
- To date there are 358 permitted vessels, and 189 inspections have been conducted on 147 different vessels (58 in 2013, 72 in 2012, and 59 in 2011). Less than 1 percent of those vessels were found out of compliance, and all inspections were followed-up with a letter of recommendations for improvements to the current BW management plan.

Sylvester encouraged states to adopt regulations requiring testing in freshwater conditions and allowing BWE.

Henein asked if the inspections are based on VGP2 and 401 requirements, or are unique to Wisconsin. Sylvester answered that the requirements of the state permit and the 401 certification for the VGP2 are the same and inclusive, but are conducted under authority of Wisconsin's permit. She noted that it is valuable to share with other states because most don't have inspectors checking all of the things that Wisconsin does.

UPDATE: Wisconsin DNR is working on redrafting the state WPDES permit. The public notice will be put out in December 2014 and the permit will be reissued in January 2015.

Ohio

Paul Novak stated that Ohio's 401 certification under VGP2 was approved in September 2012. It prohibits the discharge of saltwater in harbors and the discharge of sediment, and there are also chlorine and bromine restrictions. There were no appeals to the 401 certification.

Michigan

Sarah LeSage:

- The MI law has been in place since 2005 to prevent the introduction of aquatic invasive species (AIS), the permit was effective in 2007 and was reissued in 2012 for port operations.
- Salties must use one of four discharge treatment methods, have no discharge, or submit a request for an alternative method.
- The VGP2 401 certification was submitted in September 2012 to the EPA. As an incentive it included an exemption from future changes to the Michigan standards for the life of the system and from live organism monitoring using MDEQ monitoring protocols, for ships installing a BWMS before December 31, 2014.

LeSage stated that looking forward, states need to work together to implement treatment-based discharge limits and make progress towards installation and proper operation of BWMSs. There is a strong need to further develop discharge limits to protect water quality and to establish consistent BW discharge limits on a regional basis.

A question was asked about the time it took to finalize individual State 401 certifications. The answers from different states varied between 30-180 days depending on public comments. Sylvester said Wisconsin must give a 30-day public notice, but that Wisconsin always gets challenged, and therefore it can take six to twelve months. Jen Nalbone (New York) said their certification took 60-90 days.

A participant asked if there is consistent application of BW discharge limits on a regional basis. LeSage answered there is still a need for consistency across the region, and while the technology-based effluent limit is pretty solid, implementation timing remains a critical issue at present.

A final question was asked about how many citizen action suits there have been relative to permitting. Sylvester answered that there were a total of three in Wisconsin for VGP2, and challenges to both the first and second VGP certifications were settled in favor of the state. LeSage commented that all state regulations are different, and although the CWA allows for citizen suits, she is unaware of any that have been brought against ship owners for non-compliance under the VGP.

New York

Jen Nalbone:

- New York shifted its priorities towards BWMS compliance and monitoring between VGP (2008) and VGP2 (2013).
- The Port of Albany along with the State University of New York, are studying the feasibility of treating ballast water through the port water-treatment facility in Albany (85 percent of maritime cargo weight was outbound from 2010-2012). The study determined that a large amount of piping would be needed (10,000 ft) along with two fuel tanks for BW storage, and pre-treatment through a 20-micron drum microscreen. The report will eventually be made publically available (note: state shore-side BW treatment reviews have also included modifications to vessels, as well as considering logistical considerations and energy use. Both CA and WI have done formal evaluations).

Minnesota

Jeff Stollenwerk:

- A local non-governmental organization filed a suit against the state for not requiring ballast discharge permits for vessels; the Court ordered the state to implement NPDES permits. USEPA ruled the state didn't have the authority to issue NPDES permits, so the Court ordered the state to issue permits under existing state authority.
- Now MN permits satisfy state legislative regulations.
- By 2013, MN permit requirements were already consistent with most of the terms and conditions of VGP2. However, the 401 certification for VGP2 was challenged in the state court of appeals over the state's determination that the VGP2 would comply with state water quality standards; the MPCA decision to issue the 401 certification was affirmed.
- MN VGP2 401 certification is consistent with other Great Lakes states' requirements; BWMS installation is required after March 30, 2018 for vessels exempted under VGP2.
- To summarize, there are still variations among the Great Lakes states' VGP2 certifications, but overall, the requirements under VGP2 are much more consistent. The Great Lakes states are finding common ground to keep moving forward.

A question was asked if AIS are considered a pollutant under Minnesota law; the answer was yes.

California

Nicole Dobroski:

- While California is not a Great Lakes state, they have been in the forefront of ballast water management and AIS issues in the U.S., and they have shared information with the Great Lakes states on their ballast treatment and regulatory experiences since the beginning of the Great Lakes Ballast Water Collaborative.

- The California Marine Invasive Species Act and the Coastal Ecosystem Protection Acts (2003, 2007) set strict standards for ballast water discharge into California waters (initially 100 to 1000 times lower limits than IMO D2; zero detectible discharge of organisms by 2020):

    - Implementation had to be delayed starting in 2007 due to lack of technology to meet the strict standards.
    - In 2010, California identified technology that could 'potentially' meet the standards.
    - Implementation was delayed again due to lack of approved systems.
    - The standards have not been changed, and now the deadline for meeting standards is January 1, 2016 or 2018 depending on ship size.
    - Currently there is no technology available to meet all of California's performance standards.
    - 85 percent of incoming ships do not discharge ballast water and are thus in compliance.

- The current challenge is that the type approval testing required by the USCG and IMO don't address California standards: some of the California standards are below detection limits and there are no established compliance assessment protocols.

- Right now, California has alternatives for BWE. There is an application for the use of experimental treatment systems for a five-year equivalency to California standards. But retention of ballast waster remains the most protective strategy, since 85 percent of vessels arriving in California retain their ballast, though all vessels still pose a biofouling risk.

- A study was conducted by Glosten Associates of the vital stain FDA (fluorescein diacetate, a viability stain) bulk assay method for compliance monitoring, as well as feasibility of shore-based treatment. The results identified a commercial FDA unit that meets the requirements, but it needs to be smaller and more portable to be suitable for routine use.

- Next steps are to publish the treatment technology assessment report (due on July 1, 2014), evaluate compliance assessment methods with ETV to create a methods guide, and incorporate the results from the shore-based feasibility study.

The first question from participants was how much of the 85 percent of ships retaining ballast water is due to regulation, and how does it impact commerce. The answer was that it is actually a function of cargo operations [import rather than export of cargo], and the statistic hasn't changed in over 14 years, so there is no discernible impact to commerce.

Middlebrook asked what the reaction is from different quarters regarding the constant changes in the implementation dates. Dobroski acknowledged that environmental groups are not happy with the delays, but they understand the reality of the situation. There has been no political momentum to change the standard or meet it, but they haven't been sued yet.

A question was asked whether California has been proactive with outreach on the ballast water issues. Dobroski indicated that they work frequently with a variety of organizations, keep their advisory groups updated, and maintain an active website to provide as much up-to-date information

as possible, but as long as the standards set by the California legislature are in the law, there is little else California can do.

Stewart asked if they are actively sampling the 15 percent of ships that are discharging. Dobroski answered that they sample to test salinity, but not discharge standards. They will only begin boarding vessels after the standards are actually implemented.

Dr. Reid commented that he has heard the Port of Vancouver is seeing an increase in ships diverting there from the U.S. in order to avoid U.S. and Pacific state ballast water regulations. Has California noticed anything like that? Dobroski said no, and California's cargo numbers have not decreased. It was suggested that this could perhaps be investigated at the Pacific Ballast Water Meeting in April 2014.

Bergeron asked if California has any assessment strategies for compliance. Dobroski acknowledged that they are important and California is working to establish some form of compliance assessment strategies/protocols.

Science and Technology Status

Due to the inclement weather, Dr. Mario Tamburri (Maritime Environmental Resource Center) was unable to attend the meeting.

Danielle Chesky (Great Ships Initiative (GSI), Northeast Midwest Institute) began the discussion of the status of scientific and technological findings regarding ballast water transfer, monitoring, and treatment issues.

- GSI performed a round robin set of validation tests on filters for BWMSs, for which the results are out for review with expected publication in the spring of 2014. The testing measured the operating performance and biological parameters that can inform the design of future BWMSs. The testing also validated the discharge sample system for GSI.
- There is an ongoing research to determine the risk associated with the release of different numbers of live organisms ("risk-release"), and identifying how "clean" is clean. These studies will generate critical and valuable data that the group feels is missing.
- GSI is also conducting a harbor quality classification project, investigating 36 different harbors, for which there is a draft report under review. Any harbor that provided data, including tonnage and ship traffic was included.
- Priority activities to continue in 2014 include U.S. type-approval certification testing, bench-scale testing of UV dose-effectiveness, land-based tests for pre-type approval, and continuing with risk-release investigations.

The following questions from the group were posed to Chesky:

When will data be available? Chesky answered that the researchers need to complete the testing, and this also depends on the availability of source- and meta-data that also must be analyzed.

Has an information request been sent out to constituents? Chesky answered that they have solicited specific information that is needed, but are open to any data that can be made available.

Dr. Sarah Bailey (Fisheries and Oceans Canada) provided an overview/summary of recent and ongoing Canadian studies related to ballast water, with the presentation focusing on results of a recent risk assessment and shipboard trials to examine a combination ballast water management strategy (exchange plus treatment).

- Current projects listed, but not discussed in detail, include cold-water testing of BWMSs, and examining technology that might be helpful with the early detection of new species or compliance testing, such as the Flow-Cam®, a laser-optical plankton counter and FDA staining for viability assessment of freshwater samples.
- As part of a national risk assessment, the relative risks for spreading non-indigenous species through different ballast water pathways in Canada were estimated (note: the risk assessment went through a stringent peer review process but the results and conclusion presented are those of the authors, and may not reflect the view of the entire department). The risk assessment considered all shipping pathways across Canada, but this presentation focused on the results relevant to the Great Lakes.
    - The risk assessment considered the potential for arrival and survival of nonindigenous zooplankton and phytoplankton (not microbes) as well as the magnitude of consequences of these aquatic invasive species (AIS), and incorporated uncertainty.
    - The risk assessment recognized that there are potential risks for spreading AIS via hull fouling, but determined that data was insufficient to complete an informative risk assessment for biofouling at this time.
    - Because invasions are a stochastic process, and there is currently insufficient data to confidently quantify the probability of invasion for any particular inoculum density, the risk assessment used a relative risk approach, with Great Lakes' international vessels (exchanged ballast water) used as the 'low risk' bench mark.
    - A probability distribution and Monte Carlo resampling process was used to estimate the number of AIS discharged for each ballast release, thereby incorporating high variability in available data.
    - The risk assessment process was repeated multiple times to examine risk for different taxa (phytoplankton, zooplankton) at different timescales (annual, per discharge event) under different management scenarios (exchange, treatment).
    - Results indicate that current requirements for exchange by transoceanic vessels reduce risk of invasions to freshwater ecosystems (e.g., Great Lakes), but are less effective in reducing risk to marine ecosystems. Lakers pose the highest invasion risk for zooplankton AIS but lowest for phytoplankton AIS for both annual and per-event temporal scales.
    - Further, the abundance of zooplankton AIS would be significantly reduced for all pathways if the IMO D2 standards are implemented, while the abundance of phytoplankton AIS would be reduced only for half of the pathways compared to management using BWE.
- In collaboration with scientists from Germany and Slovenia, Canada has been examining the feasibility and efficacy of managing freshwater ballast using exchange in combination with a BWMS.

- Three shipboard trials, using two different BWMSs (filtration + electrochlorination, filtration + UV) had been completed as of Feb 2014, using an in-line, isokinetic, representative sampling approach.
- Analyses include examination of taxonomic composition of ballast water communities to determine if there is a risk reduction resulting from the salinity effects of exchange, in addition to expected declines in density resulting from BWMS use.

The following questions were posed by various participants:

Results have shown that no new species have been introduced since 2006, so how can we actually improve upon that? Dr. Bailey answered that multiple lines of evidence show that invasions have decreased in the Great Lakes with ballast exchange, however, the invasion rate is likely greater than zero, and we won't be surprised when a new species is reported in the future.

Why should we bother improving on something that's already working? When is it going to be enough? Dr. Bailey responded that yes, exchange is working for the Great Lakes, but not for all pathways, and not for marine ports across Canada.

Is there a distinction between the Great Lakes and the marine coasts? Dr. Bailey explained that there is a distinction between the lakes and coasts in terms of expected survival of organisms discharged in ballast water; for the Great Lakes (or freshwater ecosystems), we presently assume species in exchanged ballast have low survival because they are marine organisms discharged into fresh water. While it is easier to implement a uniform global standard as opposed to establishing different standards for different locations, we have been examining exchange plus treatment because it may offer greater protection for the Great Lakes than treatment alone, but it is not expected to add much benefit for marine environments. Ultimately, enhanced management efforts in the lakes will help stem introductions elsewhere too.

Since Lake Superior receives the most ballast water, why isn't it more invaded? Dr. Bailey explained that the in-tank survival component could be lower despite higher introduction volumes. Risk assessments use volume and plankton density to estimate arrival potential, but due to the wide variety of taxa being transported, survival potential can be assessed only at a coarse level. Invasion risk can also be lowered by biotic resistance, but this could not be factored in (note: "biotic resistance" refers to the ability of native ecological communities to resist invaders, preventing them from successfully establishing after an introduction).

Henein brought up the policy perspective of the results, speculating that if you have a species invasion at an isolated location, the economic impact will hit locally, but it won't be felt elsewhere. But if you take that invasion and move it to more locations, you multiply the economic impact and increase the chances it will be spread further because you've multiplied the number of source locations. This can become significant when considering Great Lakes system scales. Since the lakes are not considered to be a well-mixed system, we need to identify and interdict major vectors. This risk assessment is saying that for any new AIS introduction, regardless of the original source and mechanism, it can be expected that Great Lakes ships will move the AIS around, and probably faster than we can identify and track. We don't want to become complacent because we've achieved some degree of risk reduction. We will have new invasions, and so we need to address the risks now.

Jim Weakley (Lake Carriers Association (LCA)) brought up his concern with the implied expectation that we can do the impossible. He worried that we applaud ourselves for having strict regulations, but then we can't meet them. The carriers are frustrated that they can't move forward and be

rewarded for working to meet regulation standards because they are impossible to meet. Where is the compromise?

Dr. Bailey responded that during the preparation of the risk assessment there were other scientists who didn't want to label any pathway as low risk, and wanted to conclude, based on the results that regulations need to be even stricter. There is tension in both directions.

Another participant brought up risk reduction vs. rapid-response, and asked if it isn't just a big balancing act? Dr. Bailey explained that placing focus on reducing survival during introduction events (such as by using exchange to make sure the discharge is saltwater into freshwater), rather than focusing efforts after arrival is key. Rapid response would be an eradication program after arrival, but this is rarely feasible. The effectiveness of rapid response is limited if invader organisms are already present in large numbers before being noticed. We need to intervene before AIS leave the pathway, and ultimately, the results of research indicate that exchange combined with treatment is expected to significantly reduce risk to the lakes.

A final comment referenced a recent report from Lake Erie, which looked at the impacts of the farming industry that is damaging lake resources. Essentially, it shows that nothing is more certain than change. But we appreciate the effort to stay ahead of it.

March 4, 2014: Day 2, NOAA Science Center

Craig Middlebrook (SLSDC) welcomed everyone to the second day of the meeting, and introduced Peg Brady, the Senior Policy Liaison with the U.S. Department of Commerce, National Invasive Species Council and Aquatic Nuisance Species Task Force and Division Chief for NOAA Fisheries Strategic Planning.

Brady provided an overview from NOAA Fisheries, reiterating that invasive species transport and pathways affect national trust resources, habitats and also marine fisheries. We have to look at all possible pathways of introduction, including those discussed in yesterday's session, as well as the pet trade and even tsunami debris on the West Coast.

Science and Technology Status (continued)

Dr. Richard Everett (USCG) discussed recent research and development initiatives related to ballast water.

- A Laker Engineering Study was conducted, under which they identified representative ship types and evaluated the available BWMSs for suitability to Laker use. Five ship types were chosen based on size, equipment type, and trade-route. They then conducted conceptual retrofit evaluations for the selected representative ship types and estimated the costs for each ship type and ballast water treatment system combination. The study included comparison of two potential shore-side treatment methods - transfer of ballast water to municipal waste-water management facilities versus transfer of ballast water to specific ballast water treatment facilities. This required evaluation of infrastructure needs and costs for each approach, shipboard fittings necessary to allow discharge of ballast water to shore, and cost estimates to vessels using these treatment options.
- The USCG is investigating new compliance tools for validating ballast water discharge, refining biology-based sampling and analysis methods, and improving the effectiveness of regulatory frameworks. Phase 1 of the study, funded by the Great Lakes Research Initiative (GLRI), broadly seeks tools and methods for assessing discharge compliance, in order to identify promising technologies. Ideal candidates would be funded to develop marketable versions that demonstrate an ability to detect discharge standard compliance for one or more size classes. Successful candidates will be given ten months to present a tool; Phase 2 is an operational evaluation of compatibility with vessel inspection and exam methods. Ideal operations of BWMS testing would be both robust yet simple to use, requiring minimal training, minimal maintenance, and adding value to the inspection.
- Research to improve ballast water sampling and analysis protocols was conducted for the USCG by the Naval Research Laboratory (Key West, FL). Sampling utilized a shipboard filter skid with a flow-through assembly to minimize the volume of water handled and the effects on organisms in the ballast water. Sample port refinements for the study included design simplification, sizing simplification, and reducing the effects of flow variation. The final sampling protocol includes validation criteria, identifying an indicative size class of sampled organisms, and determining the comparability among the different treatment methods (i.e. UV and oxidant treatments). The results have been published in various journals:

- First, M.R. et al.; 2012. Validation of a closed-housing filter skid for in-line sampling of aquatic organisms. J. Plankt. Res. 34 (4): 321–331).
- Drake, L.A. et al., 2014. Validation trials of a shipboard filter skid (p3SFS) demonstrate its utility for collecting living zooplankton. Mar. Poll. Bull. 79: 77-86.
- First. M.R. & L.A. Drake, 2014. Life after treatment: detecting living microorganisms following exposure to UV light and chlorine dioxide. J. Appl. Phycol. 26: 227–235.

- A study by the Smithsonian Environmental Research Center is evaluating the concentration and diversity of organisms in ballast water discharged in U.S. waters. Ports evaluated included the Chesapeake Bay, San Francisco Bay, Valdez in Alaska, and Tampa Bay. The study compared historical concentration levels from the pre-BWE era, current levels under BWE, and potential concentrations modeled under future regulatory conditions. A companion study also looks at the rates of AIS invasions at the same ports. Dr. Everett stated that the preliminary results include some unexpected results and require further evaluation.
- The USCG examined the potential effects of a proposed third lock in the Panama Canal. This would mean changes to vessel traffic patterns and introduce additional risks of ship-mediated invasions in U.S. waters due to an expected greater throughput of vessels, shifts in trade routes, increased port visitations, and changes in environmental conditions during transit.

This concluded Dr. Everett's presentation.

Jon Stewart asked if the filter skid project and the German project were coordinated, due to their apparent similarities. Dr. Everett answered that such projects often exhibit a kind of convergent evolution that drives them towards similar products, but they are still independent. That they are similar is not a surprise, and time will show if one turns out to be a better approach than the other, or if there will be viable alternatives to reference in the future.

Middlebrook noted how much time and effort has been devoted to developing the land-based test protocols and asked if development of ship-based test protocols would require similar time and effort? Dr. Everett acknowledged that land-based testing began in 2001 and wasn't published as an approved protocol until 2010, which was far too long. The ETV program (under which the test protocols have been developed) is great for building consensus-based standards for performance technologies, but relies on volunteers, which increases development time. After the protocol procedures were drafted, it took two years to validate them, during which problems were identified that required revisions to the final protocol. Dr. Everett explained that ship-board testing for type approval is already included with the regulations. Once the new ETV protocols are established, they may be incorporated into revised/new rules. However, shipboard testing for compliance is different and tools for that are under development. Validation of compliance protocols for ship-based compliance testing should not take as long as the land-based type-approval development, because we have a much better knowledge base for BWMSs now than we did in 2001. The tools are already in use in other oceanographic capacities, and only require adaptation for compliance uses. Thus, the overall process should be less time-intensive.

Phyllis Green (National Park Service (NPS)) provided an update for a research collaboration between the NPS and U.S. Geological Survey (USGS) to evaluate use of NaOH (sodium hydroxide) and stack gas as a possible treatment process on high volume, high flow-rate ships.

- Testing of a prototype NaOH system was downsized to the *Ranger 3*, a smaller ship. They tested mortality of one zooplankton, with promising results. Because of downscaling, 100 percent mortality was achieved by dosing with NaOH to a pH of 11.06. The next step is scaling back up.
- NPS is also involved in developing emergency ballast water treatment for use when a permanent treatment system fails. They would like to demonstrate the flexibility of the emergency treatment protocol to both the USCG and USEPA, and are actively looking for additional ships on which to conduct demonstrations.

Green concluded, "While we have a good definition of success, we still need to agree on a definition of failure. If the definition of failure is a new invader arriving, we need to prevent failure."

Green was asked what the next steps are, and what they hope to accomplish. She answered that Noel Bassett (American Steamship Company) has made an investment to put NaOH-based treatment systems on his ships while in winter lay-up. GSI is providing testing support; they expect the systems to be operating by mid-summer 2014 and hitting discharge standards by July. The plan is to collect many data points and keep biocide injections low. After GSI has completed its work, summary findings will be available, but co-publishing a full detailed report with the USGS is a very rigorous process and will probably take twelve months after testing is completed.

Craig Middlebrook alerted the audience that the Ballast Water Working Group Report for 2013 was published in February 2014. The Working Group includes the USCG, TC, and both the U.S. and Canadian Seaway Corporations, and was established in 2008 to enforce saltwater flushing regulations and inspect all international vessels coming into the Great Lakes. He stated that compliance has been increasing in the international community, reaching 97-98 percent in the last four years. All noncompliant vessels are managed so that no unexchanged ballast water has been discharged in the Great Lakes during that time period.

Carrier Perspectives

Marc Gagnon (Fednav Ltd.) is responsible for the compliance of about 80 ships, including 42 owned, 16 long-term chartered, and 20 short-term chartered.

The coming into force of the discharge standard presents major challenges to his operations.

- With the EPA regulations coming into effect from 2016-18, 32 of his ships will need to be dry-docked and if a BW treatment system cannot be installed, after this point they will be considered non-compliant. Gagnon stated that he fears missing the deadline and doesn't know the best way to handle the issue. Despite the ability to report non-compliance with light enforcement measures, this doesn't help them get there.
- With regards to the USCG type approval, there are no systems even in the approval process yet to propose to their vendors, and they are worried about using a system that eventually doesn't get type approved. AMS devices were originally considered a good investment, but now they are being advised to wait for official type approval.
- A third problem is that it is not fully up to the carriers to determine what treatment system they install and use—the shipyard makes that decision. When they build ships in other countries, for example in Japan, the shipyard wants to install the cheapest systems even if they don't know if the systems will meet U.S. standards. They were told to make a system

decision by March, 2014, but still don't have the necessary info to make a sound decision. They have ships going all over the world in different water conditions and don't know how they can guarantee they will work everywhere.

Ultimately, the shipping industry isn't afraid of the regulations, rather they are afraid of uncertainty, and they aren't prepared for the fast approaching deadlines. Fednav tested its own system—a hybrid that uses a chlorine injection and BWE, which has given successful results and would be acceptable during an interim period. Vendors need to work faster and push to get a freshwater system approved by the USCG. Fednav has no way to know how long this will take, and feel they are taking huge risks.

Gagnon concluded by stating that this situation is bad for everyone involved from owners and vendors to the IMO, the USEPA, and the USCG.

Robert Lewis-Manning (CSA) gave his perspective on the regulations requiring compliance within the next four years:

2014 – Transport Canada will issue its ballast water regulations;

2015 – The IMO Convention comes into force; Wisconsin revises its permit;

2016 – The number of ships affected by ballast water regulations grows;

2017 – The VGP3 draft permit will be released:

2018 – Minnesota's permit affects all vessels in the Great Lakes; and the VGP3 will come into effect.

- There will be a lot of work for regulators and industry over the next four years. The technological challenge is significant, and it is not easy or cheap to build new ships and outfit them with new treatment systems, or retrofit old ones.
- Someday there will be a U.S. type-approved system for use in the Great Lakes, but it probably won't be compatible with all Great Lakes vessels (i.e., lakers). Regulators may push towards the first design approved, but then the builders will push back and say it doesn't work for all ship types and ballast systems. Essentially there will be a continuous stream of discussion and learning.
- Ship owners are facing tough decisions, with scant information to make them. Owners and vendors will have to rationalize and minimize mistakes.

Lewis-Manning concluded that owners are always looking at new technology and options to improve treatment, and the reality is everyone is dealing with these challenges.

Jim Weakley (LCA) stated that some representatives of the Canadian shipping industry are selling a narrative that U.S. regulations discriminate against the Canadian laker fleet. He stated that some in the Canadian administration have endorsed this narrative and are suggesting retaliation against the U.S. fleet. The LCA has lobbyists working with TC and also making sure the U.S. Government is aware of Canada's situation. Weakley offered a challenge to vendors: given that lakers move up to 10,000 tons of ballast water an hour, a system that can handle 79,000 gallons per minute is needed.

Green commented that when NPS is working with a shipyard, they request a minimum of 3 bids. She asked if the industry can get ahead of their shipyard contracts and get these options available

during dry-docking? Gagnon answered that to carriers, it makes more sense to stay with a manufacturer they know and have used. It also makes sense if they can have the same system across a whole fleet. It is easier to start with what the yard gives them and then retrofit after, if needed. It's a question of trust, money, and keeping it as simple as possible for the crew.

Middlebrook commented that each of the carriers articulated challenges and asked if there is one thing over the next year that could be improved or fixed, what would that be?

Lewis-Manning answered that they need a solution to non-compliance in the short-term in order to provide a framework for testing towards compliance. Weakley added that being in non-compliance just goes against multiple laws and is not the way the marine transportation system and industry works. He feels that they need a way to get out of being non-compliant.

Henein commented that it is difficult to alter a legal framework to create flexibility. The IMO General Assembly passed the Ballast Water Management Convention, and they are working towards more flexibility. They recognize that it is easier for flexibility through enforcement rather than finding it within existing rules. Are there other options that aren't based on enforcement? He doesn't think Congress will change the ballast water landscape, especially with regards to the Clean Water Act.

Lewis-Manning responded that ship owners aren't good at research and development, not that they aren't innovative, but it works better when the process is risk free and the economics win. They've tried to brainstorm alternatives to see if individual permits are available under the VGP. But this is not really a quick process, and it is fraught with other challenges once other stakeholders are brought in. There are no obvious alternatives outside of a consent decree, but we have to be noncompliant to get there, and that is just not how the marine community is used to working.

A concern was raised about what the IL market will look like in the future, since it is presently difficult to schedule facilities for testing because ILs are so busy processing applications. How do the carriers perceive this working? The response from the carrier representatives was that this might be better directed towards the vendors. Stewart commented that the focus should be on compliance and what might be possible to help the process move forward. There have been legitimate attempts by owners to be involved with demonstrations and studies. Owners are asking for interim compliance options within the regulatory framework, but there appear to be none. Carriers will have to be out of compliance, pay fines, and work out how to come back into compliance. There are limited options.

Weakley commented that he had heard from TC that if a carrier can't meet the standards, they should not enter Canadian waters.

Concern was expressed about the lack of awareness on the part of foreign flagged vessels about the current North American ballast water management regime. Caroline Gravel (Canadian Shipping Federation) said she felt this is inaccurate - ship owners she interacts with are acutely aware of the current regulatory environment. In fact, she said, international carriers are very engaged at the MEPC level at IMO.

Weakley stated that as of December 2013, at least one major association hadn't informed members and owners of these new regulations yet. Canadian owners may be well informed, but they are the exception.

Lewis-Manning added that the overall understanding of the CWA is minimal for nations outside of North America, and that the owners need to step up, even though they are further removed from the ruling process. It's not on the immediate horizon for international carriers.

Dr. Albert sees the Great Lakes stakeholders as the most engaged, but other trade associations are also well-informed. USEPA has had many conversations, both domestically and internationally. But, he would agree that for 80-90 percent of international tonnage there is some confusion about how the IMO "extension" will apply in the U.S. However, at a minimum, major ship owners are definitely aware.

DiCianna commented that TC's experience with international carriers supports the idea that the international community is slow to be aware, but such a lag is not unusual and they are definitely closing the gap.

Vendor Perspectives

Jon Stewart (IMTC) introduced the vendors' perspectives. He is no longer a vendor, but he was a BWMS developer in the late 1990s. He now represents the BWMS technology developers in the U.S. through his work with the IMO. He and Gary Croot (IMTC) were participants on half of the current AMS applications, so they consider themselves to be very involved and current on the issues.

- The ballast water treatment regulations and impending standards have left the vendors, as whole, in an impossible position. They are responsible for putting compatible equipment on ships and for regulatory compliance of treated ballast water on discharge. These are significant challenges.
- The Great Lakes as a freshwater environment is considered a niche market because the majority of ships and BWMSs around the world only need to operate in marine (i.e., saltwater or brackish) systems. It is a commercial risk for developers to focus on the minimal number of ships (comparatively) that enter the Great Lakes, so it is understandable that the technology developers don't look at the particular needs of the Great Lakes as they proceed with development. However, there has been a commendable effort by some companies to develop and type approve BWMSs that will work in the cold, fresh water of the Great Lakes.
- The systems and processes best suited for use in the Great Lakes will use a combination of UV treatment and electrochlorination.
- The biggest impediment to the industry is the challenge of obtaining type approval. Currently UV systems need more testing to meet the type-approval requirements outlined in the ETV protocols. Only a small number of systems are currently being tested in freshwater, and performance in freshwater needs to be confirmed before they can be tested for type approval.

Gary Croot offered comments as someone with experience working with many international vendors of different sizes and offering different technologies.

- The biggest issue is having adequate methodology to ensure that testing of systems is robust and confirms that they work. Proof is the key to confirming they will meet the discharge standards.

- Vendors have invested in testing to ensure compliance following the G8 guidelines, but additional testing is now required to become U.S. type approved. So now, all of this money has gone into testing, but no one will buy their products until they become AMS or U.S. type approved, so they aren't seeing the return on their initial investments. They don't see the incentive to spend even more on further testing. They just want to know when they will be able to sell these systems.
- The other issue, which has been mentioned before, is that there are up to 80,000 trading vessels in the global market that will need to install at least one, if not multiple treatment systems, and only 150 of those come into the Great Lakes. Systems on those vessels (coming to the Great Lakes) will have to manage discharges of a range of salinities, including fresh to brackish, and typically cold.

Dr. Reid asked if venders have considered the potential liability if one of their systems, tested through G8 and not the more rigorous U.S. ETV requirements, fails to meet the discharge standard under all actual operating conditions.

Stewart answered that it will be hard to know if a system is failing, because there is no testing regime in place in the U.S. and Canada that will demonstrate noncompliance. Even if there is a gross exceedance, it is unlikely that anyone will know it has failed. It is currently difficult to demonstrate success and failure of a BWMS.

Henein commented that in a broader sense, the biggest impediment we face with regards to BWMSs is the low confidence that systems will meet standards under all operating conditions (vs. during test situations). Where do the vendors see their role in overcoming these perceptions?

Croot stated that it is not a lack of confidence by the vendors, rather a lack of trust. Vendors need test data to prove their product is effective, for example, a report from the USEPA that confirms the confidence to the buyer. He personally thinks some systems aren't going to pass future testing, but certainly others will, based on their current data packages.

Another comment from the group stated that data and method transparency are key requirements for a decision maker to approve a system. As U.S. type-approval approaches, transparency is a requirement. Every technology has limitations, but properly conducted type approval will identify the edges of limitations and help in making future development decisions.

A representative from Hyde Marine stated that they are fortunate to have a large customer base using their systems on ships, but Hyde is not able to test the operation and discharge every time they board a ship. Very often it is not logistically possible, even though they would like to have more data.

Stewart added that not everyone operates to the same model for ships, and they will also follow different models of stewardship. Therefore different companies have different ways that they will approach markets. Here, these people want to be good examples of industry, be it from the commercial or technology side, but for the rest of the world there is no guarantee. This is why we have to have imposed limits and pre-defined doses. There will be times that these systems will be exceeded. In type approval, it is understood that a type-approved system will not perform 100 percent of the time, depending on water conditions. This needs to be acknowledged in our enforcement policies, and we should only be punishing those who aren't trying.

Henein stated that carriers run the risk of installing an AMS early to meet the deadline, but then face having to replace it if it fails testing later. He believes the vendor should make it right and fix the system, but asked for the vendor perspective on this - would actually fix it or give up. What are the parameters for a vendor decision when a system is not working – how do they choose between installing a new system or just servicing the failed system?

Croot answered that it depends on system regulations, and if a recall needs to be issued. The real question is whether the carrier should be held responsible for a failing system or the vendor that supplied it? Very few carriers would enter commercial contracts without a warranty and other requirements and clauses that would cover those scenarios and uncertainties regarding pending type approval. Some vendors will agree and some will walk away. It is too early in the market to fully define an answer to this issue.

Audience discussion suggested that a reliable vendor will stand behind their product. Carriers believe that a good vendor will make the needed regulatory fixes to their product. If something is under warranty that isn't working, there will be no economic benefit to the manufacturer until it is, and so you would think the vendors would do whatever it takes to get there. Stewart suggested that a grandfathering option would help the vendors know that their testing efforts are worthwhile by ensuring that they will be excluded from compliance problems. That option would make dealing with the regulatory environment worthwhile. STEP (Shipboard Technology Evaluation Program, USCG) was an attempt at this, but STEP isn't big enough for what is going on now.

Chesky asked if there has been a change in the vendor market for type approval in the last six months, including other freshwater ports.

Stewart answered that there has been a recent aggressive uptick in interest for type-approval testing. IMO did not require freshwater testing in the G8 process, only that two different test salinities be used, at least 10 ppt apart. Requiring freshwater-approved systems is the new thing now.

Croot responded that sometimes it is beneficial to be the first system in the door, but sometimes that system becomes a guinea pig and will have a lot of kinks to work out, along with backlash to deal with. There is definitely a reluctance to be the guinea pig right now to implement a new procedure (i.e., ETV protocol) with new labs. But when that happens, the dominos will start falling and things will happen and the process will move forward.

Middlebrook asked if incentives are possible in the context of the Great Lakes or even generally, and if so, what would they look like, and how would we get them out there?

Stewart answered that it depends, because while monetary incentives may help, grandfathering is preferred as a regulatory incentive. Also, there needs to be a definitive barrier for ships not even attempting to meet requirements, and rewards for those making the effort. Unfortunately this may not be a practical reality.

Class Perspectives

Debra DiCianna (ABS) was introduced to speak about the Class Society perspective on ballast water management in the Great Lakes.

- They are looking for bridging strategies to work with regulators to help ship owners understand what's going on with discharge standard requirements and timelines. Based on the ship owners' more general statements, they find the existing process difficult. Regulators

need to be more specific and give the owners better details. This is a continuous learning process.

- ABS has done approximately 200 installations on vessels so far, and only one system had a safety recall and the vendor paid the cost.
- All these Class Societies have their own type approval process for BWMSs, and they (ABS) are trying to determine if they're doing it consistently. So far they are finding differences, so ultimately the Class Societies doing type approvals must improve their consistency.
- ABS is currently looking at safety, educating surveyors and engineers, and trying to be more interactive with owners. Some carriers are now coming to ABS and asking for system recommendations.
- ABS is also trying to communicate better with everyone involved to get systems installed on ships, have the ships use the systems, and then report back and communicate issues. There will be value in reporting and working through BWMS issues to improve to the overall process in the future.

LCDR Ken Hettler (USCG) made a statement that he is involved with setting up ILs, and is willing to answer any inquiries about the process.

New State Initiative

Susan Sylvester (Wisconsin) described a new initiative being coordinated by the Great Lakes Commission. The Commission is planning to build on past meetings between USEPA and the states to inform VGP2. The new initiative, coined the *Ballast Water Task Force*, would provide a formal mechanism for states to work with USEPA and provide input on future VGPs. Sylvester indicated that the goal is to have robust participation by all eight Great Lakes states, particularly Illinois, Indiana and Pennsylvania, which are currently not engaged.

Proposals for Moving Forward

Craig Middlebrook opened the topic of how to move forward from here, stating that we have acute challenges to confront, timing in particular. While there has been a lot of progress, the timing isn't allowing us to really move forward in a useful way. Carriers will need to work out a compliance schedule that fits with the flexibility to experiment. The goal here is to close those gaps.

Dale Bergeron said that all can agree that it is frustrating to not have a single solution or pathway to successful ballast water treatment. By recognizing that it is a never-ending process, we can continue to move forward even when things aren't perfect, modifying our options as the science and technology point the way. He noted that those involved are not afraid of the regulation itself, but rather the uncertainty that the current process has created, and despite the Great Lakes being a niche market, this should not be an insurmountable barrier to Great Lakes success. He concluded noting, as a unique and interdependent community we are still moving forward, communicating and growing an awareness of the critical need for a simultaneous and seamless system of collaboration across vendors, carriers, and US and Canadian regulators. We must continue to identify gaps in the process, work to address the issues from multiple fronts, and support regulatory flexibility as we continue to explore our best available options.

Weakley stated that he supports having more BWMSs onboard ships now, but reinforced that vendors need an incentive, such as grandfathering protection. This would be a win-win for every stakeholder in the room and support confidence in the current process.

Dr. Everett expressed an interest in the issue of incentives, and also speeding up flow towards type approval. While developer issues may introduce their own delays, allowing grandfathering would help get more systems on ships faster. But there is still the question: does getting more AMS on ships help move towards achieving type approval? And, after type approved systems are available, he would need concrete information for why using a type-approved system is not possible.

Croot spoke up as a representative of suppliers of equipment and ship owners currently involved in applying for extensions. The possibility of investing in a system now and later having to backtrack is a concern and business risk. This means using extension requests to get around having to install systems now. As long as a system remains IMO type approved, if you can grant them an extension letter, the risk is eliminated and they can move forward with installation. Requesting an extension is the only option right now. Scientists need more platforms to take more samples too. AMS could have been effective, but it's been watered down by accepting too many systems. Since some AMS have already been recalled, the authority and confidence in AMS has been reduced and will hinder a grandfathering measure.

Stewart stated that we need more experience to understand system performance and improve performance assessment. Vendors need to be able to enter the program with both front and back end benefits, and this will generate value for everyone. While not sure how to frame these needs specifically, they should include equal conditions, contributions, and takeaways.

Dr. Everett added that he understands the benefit of incentives to the owner and manufacturer, but it doesn't do anything to speed up the actual type approval process. Would conducting further research and development to update systems and then take them to approval be acceptable, or do they just need more money for testing towards approval now with existing technology? What would support an increase in type approval activity?

A representative of the vendors answered that revenue is coming in to improve the technology, but without feedback from current installed system users, improvements can't move forward. Also, testing of their BWMSs during development was focused on marine conditions, not freshwater. Now they can't afford to go back to testing in fresh water.

Another vendor representative admitted that they won't invest until there is an end point in sight. There needs to be more funding if they are to continue on the right path. Since it doesn't appear that the larger corporations are investing in the testing either, no one appears to see value in being the first.

Chris Wiley asked if there are any potential financial assistance or compensation programs available from the federal or state governments to help both venders and carriers initiate the type-approval process?

Danielle Chesky answered that in the past, government has funded research and testing by GSI (pre-type approval).

Craig Middlebrook asked if the GLRI has considered supporting work that looks at this ballast water management conundrum.

Dr. Albert answered that GLRI has been very supportive of ballast water efforts. If a compelling case could be made that leads to an end goal of placing systems on ships, GLRI could be a possible source of funding, since invasive species are a big priority worth supporting.

Green stated that the NPS partnerships work because regulatory risks haven't hit them yet. If the right mechanism to remove risk is there, more people will come to the table. But Operations Departments are different than Regulatory, and so this isn't addressing the real issue. The NPS has good framework for testing and regulations, but it's complex, and not feasible on this scale.

Green added that it would be great to see the Collaborative and the Commission activities be successful; she also suggested that IMO sponsor a dialogue to address what should be done when systems don't work. Discussion should go beyond just best management practices.

Conclusion

In his concluding remarks, Middlebrook offered his sincere thanks to Dr. Marvourneen Dolor, Mark Burrows and the IJC, Dale Bergeron and Minnesota Sea Grant, and Peg Brady and NOAA for their planning and support for this meeting.

He summarized the intended goals, which were to gain a better understanding of:

- The USCG Type Approval Process
- The USEPA's VGP2
- Canada's development of ballast water regulations
- The Great Lakes States' current positions
- The vendors' perspectives
- The status of the IMO regime and its future directions
- How everything will come together and work out

Middlebrook then presented a collaborative model: In a region of multiple jurisdictions where ballast water regulatory authority is widely dispersed and information and knowledge are evolving, it is essential to do the following:

- Build and strengthen relationship and partnerships
- Create a forum for candid and unbiased discussion
- Exchange substantive information and data
- Emphasize inclusive participation
- Strive for flexibility and informality

He identified the following as metrics for success:

- Connect key decision makers
- Build effective working relationships
- Bridge key information gaps
- Develop a more common understanding
- Reduce general level of uncertainty
- Raise the profile of our region's concerns

- Produce practical and immediate implementation strategies

Middlebrook closed by stating that there were many difficult but absolutely necessary conversations presented. Hopefully everyone felt engaged in this dialogue and will bring it home and make efforts to keep it moving forward. The difficulties we've encountered should not be underestimated. On a positive note, the first step to solving a problem is a concrete recognition of what it is, who your allies are, and how you can work with them to overcome these obstacles. By all of us participating in the Great Lakes Ballast Water Collaborative, he felt this is something we can accomplish.