EPA SAB Ballast Water Advisory

Background and Glossary to accompany Subgroup Drafts:

This working draft describes: (1) background on Ballast Water Advisory activities of the EPA SAB EPEC, augmented for ballast water; (2) the regulatory context within which ballast water treatment technology is developed and used; (3) a simplified glossary of key regulatory terms as they relate to the regulation or management of ballast water, now or in the near future; and (4) the objectives of ongoing, contemporaneous Science Advisory Board (SAB) and National Academy of Sciences (NAS) panels convened to examine ballast water issues.

1. Background on Ballast Water Advisory activities:
Vessel ballast water discharges are a major source of nonidigenous species introductions to marine, estuarine, and freshwater ecosystems of the United States. Ballast water discharges are regulated by EPA under authority of the Clean Water Act (CWA) and the U.S. Coast Guard under authority of the Nonindigenous Aquatic Nuisance Prevention and Control Act, as amended (NANPCA). NANPCA generally requires vessels equipped with ballast water tanks and bound for ports or places in the United States after operating beyond the U.S. Exclusive Economic Zone to conduct a mid-ocean ballast water exchange, retain their ballast water onboard, or use an alternative environmentally sound ballast water management method approved by the U.S. Coast Guard. Under the authority of the CWA, EPA's Vessel General Permit, in addition to the mid-ocean exchange, requires the flushing and exchange of ballast water by vessels in Pacific near-shore voyages and saltwater flushing of ballast water tanks that are empty or contain only un-pumpable residual ballast water.

While useful in reducing the presence of potentially invasive organisms in ballast water, ballast water exchange and saltwater flushing can have variable effectiveness and may not always be feasible due to vessel safety concerns. On August 28, 2009, the U.S. Coast Guard proposed establishing standards for concentrations of living organisms that can be discharged in vessel ballast water (74 FR 44632), and some States have established standards of their own. In addition, a number of studies and reports have been published on the status and efficacy of ballast water treatment technologies, and data collected on the efficacy of certain systems is available.

EPA's Office of Water (OW) has requested SAB review of technical documents and available data on the efficacy of ballast water treatment systems and advice on improving the performance of such systems.

2. Existing regulations for ballast water treatment

A. U.S. Federal rules

In December 2008, US EPA issued the Vessel General Permit (VGP) as authorized under the Clean Water Act (CWA). Among other things, the CWA authorizes EPA to set technology-based effluent limits. The technology based discharge limits for ballast water in EPA's current VGP rely on "best management practices" (primarily use of ballast water exchange, or BWE) and do not include a Federal numeric discharge limit. The current VGP expires Dec. 19, 2013.

Existing US Coast Guard (USCG) rules governing ballast water as authorized under the National Invasive Species Act (NISA) also primarily rely on use of ballast water exchange. Though the exact BWE provisions are not identical, the general principle of BWE as used by EPA and USCG is very similar. In August 2009, the USCG proposed a revision to their existing rules under NISA to establish numeric concentration based limits for organisms in ballast water. That proposed rule, would initially require compliance with the Regulation D-2 standards contained in the February 2004 International Convention for the Management and Control of Ships' Ballast Water and Sediment (aka "Phase I standards") and then susbsequently require compliance with a standard 1000 times more stringent (aka "Phase II standard." The USCG has not yet finalized that proposed rulemaking, and in the meantime continues to require use of BWE.

B. Other regulatory frameworks: States and Congress

United States: Under the CWA, U.S. states have the authority to impose their own ballast water discharge standards through the CWA section 401 certification process applicable to Federally-issued "NPDES" permits such as the VGP. A number of States have exercised that authority by setting numeric limits for ballast water discharges into their waters and these numeric limits are included as a condition in the VGP. In addition, several states (e.g. California and some Great Lakes states) have enacted their own independent State laws to establish ballast water treatment standards. Thus, in practice, EPA's VGP standards establish the minimum standard (or "floor") for ballast water discharges, but States retain and have exercised their authority to set standards that are more stringent.

Congress has also considered enacting new legislation over the past several years to establish ballast water treatment standards; none of these bills have been enacted as of October 15, 2010. Discussions by states, Congress, and the USCG proposed rulemaking have included references to more stringent ballast water standards, known colloquially as "100x D-2" or "1000x D-2" referring, respectively, to standards that are two to three orders of magnitude more stringent than the existing IMO D-2 guidelines.

International standards / treaties: In the international arena, the February 2004 International Convention for the Control and Management of Ships' Ballast Water and Sediments contains concentration-based limits on organisms in ballast water as set out in Regulation D-2 of that treaty. The treaty is not yet in force internationally, however, these "D-2" concentration-based

limits are in practical effect the de facto standard that international equipment manufacturers are designing their equipment to meet. .

3. Glossary of Terms. A discussion of ballast water treatment requires a working knowledge of the basic vocabulary used in describing existing and potential regulations for ballast water management, both within the U.S. and internationally. To clarify the terms used in this draft , we provide the following annotated glossary of basic ballast water terminology. It offers a succinct definition, within the context of their relevance to the regulation or management of ballast water, now or in the near future.

IMO: refers to the "International Maritime Organization." The IMO is a subsidiary body of the UN that was created by an international Convention (treaty) adopted in 1948 and which now has 169 member States. It first met in 1959 and its principal responsibility is to develop and maintain the international regulatory framework for shipping with respect to safety, environmental concerns, legal matters, technical co-operation, and maritime security. This is accomplished through a variety of international treaties negotiated under the auspices of the IMO, including the February 2004 International Convention for the Control and Management of Ships' Ballast Water and Sediments. The IMO operates primarily through a number of committees and subcommittees with specialized expertise in a range of areas, with the Marine Environment Protection Committee (MEPC) being the principal IMO committee with responsibility for environmental issues associated with shipping. For more information: http://www.imo.org/home.asp

IMO-D2: refers to Regulation D-2 of the February 2004 International Convention for the Control and Management of Ships' Ballast Water and Sediments, which contains ballast water discharge standards expressed as concentrations of organisms per unit of volume for three different organism size groupings. Although the US is not a Party to the treaty, nor has it entered into force yet internationally, the D-2 standards are in practical effect the de facto international standard that treatment equipment manufacturers are designing their equipment to meet. A table containing the IMO D-2 standards is set out in the next paragraph.

IMO D-2 / P-1 (aka USCG Phase 1). These terms are sometimes used in combination because their specifications are very similar. However, to be explicit, ***IMO D-2*** is defined as shown above.

P-1/USCG/Phase 1 refers to ballast water discharge standards contained in the US Coast Guard's August 28, 2009, notice of proposed rulemaking. Because this is a proposed rulemaking that has not yet been finalized, these Phase 1 standards are not currently (i.e., as of Oct 15, 2010) legally binding. For more information, refer to 74 Federal Register 44632. The table below contains the standards as stated in IMO D-2 and in the proposed USCG Phase 1, arrayed so as to enable their direct comparison.

IMO Regulation D-2 Standard	USCG Proposed Phase 1 Standards
Discharge less than 10 viable organisms per cubic metre greater than or equal to 50 micrometres in minimum dimension	For organisms larger than 50 microns in minimum dimension: Discharge less than 10 per cubic meter of ballast water;
Discharge less than 10 viable organisms per milliliter less than 50 micrometres in minimum dimension and greater than or equal to 10 micrometres in minimum dimension	For organisms equal to or smaller than 50 microns and larger than 10 microns: Discharge less than 10 per milliliter (ml) of ballast water; and
Discharge of the indicator microbes shall not exceed the specified concentrations described in the following paragraph: Indicator microbes, as a human health standard, shall include: .1 Toxicogenic *Vibrio cholerae* (O1 and O139) with less than 1 colony forming unit (cfu) per 100 milliliters or less than 1 cfu per 1 gram (wet weight) zooplankton samples ; .2 *Escherichia coli* less than 250 cfu per 100 milliliters; .3 Intestinal Enterococci less than 100 cfu per 100 milliliters.	Indicator microorganisms must not exceed: (i) For Toxicogenic *Vibrio cholerae* (serotypes O1 and O139): A concentration of <1 colony forming unit (cfu) per 100 ml; (ii) For *Escherichia coli:* A concentration of <250 cfu per 100 ml; and (iii) For intestinal enterococci: A concentration of <100 cfu per 100 ml.

100x D-2. This phrase is a shorthand way of saying 100 times more stringent than the standards contained in IMO D-2. However, note that this terminology as commonly used is **ONLY** with respect to the two larger organism size groupings contained in IMO D-2 (i.e., it does **NOT** also mean 100 times more stringent for the D-2 indicator microorganisms). **100x D-2** has been discussed in other fora such as past Congressional bills and state requirements.

1000x D- 2. This phrase is a shorthand way of saying 1000 times more stringent than the standards contained in IMO D-2. However, this terminology as commonly used is **ONLY** refers to the two larger organism size groupings contained in IMO D-2 (i.e., it does **NOT** also mean 1000 times more stringent with respect to the D-2 indicator microorganisms). **1000x D-2** has been discussed in other fora such as the potential Phase II standards in the USCG August 2009 proposed rule or as described in state requirements.

Type approval refers to the process under which a type of equipment is tested and certified by the Flag state or its authorized representative (such as a Class society) as meeting an applicable standard specified in treaty, law or regulation. Such testing and certification is conducted on a sample piece of equipment which in all material respects is identical to the follow-on production units. In the case of ballast water treatment equipment, in the international arena the type approval tests are conducted under the "G8 Guidelines." These guidelines serve to implement procedural requirements as described in Regulation D-3(1) of the February 2004 International

Convention for the Control and Management of Ships' Ballast Water and Sediments. Type approval testing (also sometimes referred to as "efficacy testing") under G8 Guidelines involves both land-based and shipboard testing according to the procedures in those Guidelines to verify the tested equipment's ability to meet the **IMO D-2** ballast water discharge standards. In the US, a domestic counterpart procedure does not yet exist for ballast water treatment equipment, but a type approval procedure was proposed as part of the Coast Guard's August 28, 2009, notice of proposed rulemaking.

G-9 approval, both "Basic Approval" *and* ***"Final Approval":*** Under Regulation D-3(2)]of the February 2004 International Convention for the Control and Management of Ships' Ballast Water and Sediments, ballast water treatment systems that make use of "active substances" (biocides) to comply with the Convention are subject to approval by the Marine Environment Protection Committee (MEPC) of the IMO with respect to health, environmental, and safety issues associated with the biocide. This review and approval is conducted under the "G9 Guidelines," which were developed by MEPC to implement the Regulation D-3(2) process. Those G9 Guidelines are available at http://www.regulations.gov/search/Regs/home.html#documentDetail?R=09000064807e890e.

Under the G9 Guidelines, laboratory or bench-scale testing is conducted in order to receive "*Basic Approval*;"in contrast, "*Final Approval* "requires testing an actual piece of equipment. In practice, although G9 approval decisions are made by MEPC, MEPC uses the services of the Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP) to conduct the technical reviews and make approval or denial recommendations to MEPC. (GESAMP is a technical advisory body, established in 1969, that advises the United Nations system, including IMO, on the scientific aspects of marine environmental protection). The G-9 approval process applies only to those ballast water treatment systems that make use of biocides to comply with the Convention and this process addresses only biocide-related health, environmental, and safety issues, not the efficacy of the ballast water treatment per se. ***Type-approval*** procedures, as described above, applies to all ballast water treatment systems in order to verify the ability of the tested equipment to meet the IMO D-2 standards and ***Type-approval*** is still required for systems that have received G9 Final Approval.

IMO challenge conditions: This refers to the challenge water (influent) conditions specified in the G8 (type approval) Guidelines established by the IMO's Marine Environment Protection Committee. Those G8 guidelines are available at http://www.regulations.gov/search/Regs/home.html#documentDetail?R=09000064807e8904

The challenge water conditions are specified in the Annex to those Guidelines at paragraph 2.2.2.5 (for shipboard testing) and paragraphs 2.3.3 and 2.3.17 – 2.3.22 (for land-based testing).

ETV challenge conditions: This refers to the challenge water (influent) conditions specified in EPA's Environmental Technology Verification (ETV) draft Generic Protocol for Verification of Ballast Water Treatment Technologies, available on-line at; http://standards.nsf.org/apps/group_public/download.php/7597/Draft%20ETV%20Ballast%20W

ater%20Prot-v4%202.pdf. The challenge water conditions are set out in § 5.2 of that draft ETV protocol.

4. Ongoing Reviews Related to Ballast Water Issues:

There are currently two contemporaneous reviews of ballast water issues: one by SAB EPEC and one by the National Research Council (NRC). The objectives of the respective reviews can be generally summarized as:

1*) SAB EPEC, augmented for ballast water:* What is the performance of shipboard ballast water treatment systems that have available effluent testing data? What is the potential performance of shipboard systems without reliable testing data? What are the principal technological impediments or constraints to improved shipboard ballast water treatment technologies? What are the principal limitations to available treatment studies and how might these limitations be overcome in future assessment of ballast water treatment technologies?

2) NRC Panel: What are the appropriate methods to assess the risk that invasive species found in ballast water discharges will successfully establish themselves in new locations?

Appendix:
EPA SAB EPEC Charge questions – full text

Charge question 1: *Performance of shipboard systems with available effluent testing data.*

1. a. For the shipboard systems with available test data, which have been evaluated with sufficient rigor to permit a credible assessment of performance capabilities in terms of effluent concentrations achieved (living organisms/unit of ballast water discharged or other metric)?

1. b. For those systems identified in (1a), what are the discharge standards that the available data credibly demonstrate can be reliably achieved (e.g., any or all of the standards shown in Table 1 of the White Paper? Furthermore, do data indicate that certain systems (as tested) will not be able to reliably reach any or all of the discharge standards shown in that table?

1. c. For those systems identified in (1a), if any of the system tests detected "no living organisms" in any or all of their replicates, is it reasonable to assume the systems are able to reliably meet or closely approach a "no living organism" standard or other standards identified in Table 1 of the White Paper, based on their engineering design and treatment processes?

Charge question 2: *Potential performance of shipboard systems without reliable testing data.*

2. Based on engineering design and treatment processes used, and shipboard conditions/constraints, what types of ballast water treatment systems (which may include any or all the systems listed in Table 4 of the White Paper) can reasonably be expected to reliably achieve any of the standards shown in Table 1 of the White Paper, and if so, by what dates? Based on engineering design and treatment processes used, are there systems which conceptually would have difficulty meeting any or all of the discharge standards in Table 1 of the White Paper?

Charge question 3: System development.

3 a. For those systems identified in questions 1 a. and 2, are there reasonable changes or additions to their treatment processes which can be made to the systems to improve performance?

3 b. What are the principal technological constraints or other impediments to the development of ballast water treatment technologies for use onboard vessels to reliably meet any or all of the discharge standards presented in Table 1 of the White Paper and what recommendations does the SAB have for addressing these impediments/constraints? Are these impediments more significant for certain size classes or types of organisms (e.g., zooplankton versus viruses)? Can currently available treatment processes reliably achieve sterilization (no living organisms or viable viruses) of ballast water onboard vessels or, at a minimum, achieve zero or near zero discharge for certain organism size classes or types?

4. What are the principal limitations of the available studies and reports on the status of ballast water treatment technologies and system performance and how can these limitations be overcome or corrected in future assessments of the availability of technology for treating ballast water onboard vessels?