Efficacy of Ballast Water Treatment Systems: a Report by the EPA Science Advisory Board (July 12, 2011)

Summary and Discussion

Science Advisory Board
Ballast Water Advisory Panel

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Science Advisory Board
Responses to Charge Questions

(1) Based on the information provided, five of 34 categories of assessed BWMS achieved reductions in organism concentrations sufficient to comply with the first standard proposed by the USCG (i.e., the 'Phase 1' standard). Although current test methods and detection limits preclude a complete statistical assessment of whether a BWMS meets any standard more stringent than Phase 1, the Panel concluded that none of the assessed BWMS can meet a standard that is 100 or 1000 times more stringent. Furthermore, it is not reasonable to assume that the assessed BWMS are able to reliably meet or closely approach a "no living organism" standard.

Science Advisory Board
Responses to Charge Questions

(2) Current BWMS are based on reasonable engineering designs and standard water treatment processes, but significant difficulties are encountered in adapting standard water treatment technologies to shipboard operation (e.g., range of environmental conditions encountered, vessel operational parameters, and vessel design characteristics).

Science Advisory Board
Responses to Charge Questions

(3) Reasonable changes in existing BWMS are likely to result in incremental improvements, but are not likely to lead to 100 or 1000 times further reductions in organism concentrations. Because of technological, logistical, and personnel constraints imposed by shipboard operations, wholly new systems need to be developed to meet proposed standards that are 100 or 1000 times more stringent than Phase 1. The Panel provided some ideas on designs for potential new systems, recognizing that time will be required to develop and test new approaches to determine their practicality and cost.

Science Advisory Board
Responses to Charge Questions

(4) The Panel reviewed the many limitations associated with existing data for ballast water treatment performance and provided advice on how to correct these limitations in future assessments; the Panel recommends using improved testing protocols for verifying discharge concentrations, exploring the use of surrogate performance measures, and developing reliable protocols for compliance monitoring.

Science Advisory Board
Additional Recommendations

The EPA should adopt a risk-based approach to minimize the impacts of invasive species from vessel discharges. Rather than relying solely on numeric discharge standards, EPA should also consider methods to reduce invasion events, process and environmental monitoring, containment, and eradication.

Insufficient attention has been given to integrated sets of practices and technologies, including: managing uptake to reduce organisms, operational adjustments and innovative ship designs to minimize or eliminate ballast water, voyage-based risk and/or hazard assessments, and onshore ballast water reception facilities.

Science Advisory Board
Sample Volumes and Statistics

The Panel also concludes that the D-2/Phase 1 performance standards for discharge quality are currently measurable, based on data from land-based and shipboard testing. However, current methods (and associated detection limits) prevent testing of BWMS to any standard more stringent than D-2/Phase 1 and make it impracticable for verifying a standard 100 or 1000 times more stringent.

While “zero detectable discharge” might initially seem a desirable standard, it is not statistically verifiable. Further, verification of standards that set very low organism concentrations may require water samples that are too large to be logistically feasible. However, when small sample volumes are used, the probability of detecting an organism is low even when the actual organism concentration is relatively high.

Science Advisory Board
Great Lakes Specific Concerns

Vessel type and operations can dictate BWMS applicability.

Bulk carriers that operate solely within the fresh, often cold, waters of the Great Lakes can have ballast volumes up to 50,000 m^3, high pumping rates, uncoated ballast tanks, and separate sea chests and pumps for each ballast tank, and short ballast hold times. Given these characteristics, a number of ballast water treatment limitations are imposed.

Inland waterways and coastal barges commonly use ballast tanks or fill cargo spaces with water for trim and stability, or to prevent excessive motions in heavy seas. However, the application of BWMS on these vessels presents significant logistical challenges because they typically do not have their own source of power or ballast pumps and are unmanned.

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Great Lakes Ballast Water Collaborative
27 September 2011