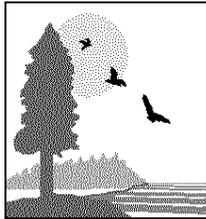


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March 14, 2011

File Ref: W9777.290

Ms. Iris Goodman  
Designated Federal Officer  
EPA Science Advisory Board (1400F)  
U.S. Environmental Protection Agency  
1200 Pennsylvania Avenue, N.W.  
Washington, D.C. 20460

**RE: Science Advisory Board Staff Office; Notification of Two Public Teleconferences of the Science Advisory Board Ecological Processes and Effects Committee Augmented for Ballast Water**

Dear Ms. Goodman and Committee Members:

The Marine Invasive Species Program of the California State Lands Commission (Commission) appreciates the opportunity to provide comment to the Science Advisory Board Ecological Processes and Effects Committee Augmented for Ballast Water (SAB) on the near-final report on ballast water treatment technology, also known as the "SAB Draft Report dated March 3, 2011 for EPEP Ballast Water Review."

Since 1999, California has been and remains a national and world leader in the development of effective science-based management strategies for preventing species introductions through vessel vectors. The Commission's Marine Invasive Species Program (MISP) pursues aggressive strategies to limit the introduction and spread of nonindigenous species (NIS), including recently establishing strict performance standards for the discharge of ballast water. California's performance standards serve to force the regulated industry to develop technology-based strategies to manage NIS in ballast water discharges.

California works cooperatively with the United States Coast Guard (USCG) and the EPA in order to advance a consistent, strong, enforceable, funded, national program that pushes technology and the science of vessel vector management forward, while ensuring that the state's existing, world-leading programs be allowed to continue. Based upon the MISP's extensive experience in the management and regulation of vessel vectors, Staff offers the following comments on the near-final SAB report on ballast water treatment technologies.

## General Comments

### **Comment 1 – Measurability does not necessarily equate to system performance limitations**

The report frequently confuses measurability (e.g. detection limits) with the performance ability of BWMSs. If the detection limits of current measurement methods are not sufficient to measure to standards stricter than the IMO D-2, conclusions should not be made about the ability or inability of systems to meet those standards, as the system's full potential cannot be known.

Specifically, the report at times indicates that the detection limits of current testing methods precludes the ability to evaluate if systems can meet stricter standards. At other times, the report concludes that BWMSs will never meet the stringent proposed USCG Phase II standards. For example:

Page 44, line 7-8 suggests evaluation to stricter standards cannot be done: "The detection limits for currently available test methods and approaches prevent a complete statistical assessment of whether BWMS can meet any stricter discharge standards."

Yet, page 44, line 10-12, concludes that standards cannot be met: "Available data also indicates that no current BWMS can meet the USCG Phase 2 standard, particularly for categories such as total bacteria."

Page 44, line 13-15 goes back to indicating that system performance cannot be known: "Because the only reliable data available to the Panel were on BWMSs that were able to meet D-2 standards, it is not possible to identify types or categories that will be unable to reliably reach any or all of the other discharge standards."

Similarly, page 36, lines 21-28 states that it is currently not possible to detect the achievement of a BWMS to 100x more stringent standard to the IMO D-2/USCG Phase 1 standard.

Given these facts there is no support for the conclusion included in the Executive Summary (p. 4, lines 11-15) that, "...five BWMS types may be able to reach 10x D-2/Phase 1 for the > 50 µm and 10 – 50 µm size classes sometime in the near future, if both treatment performance and testing approaches improve." If current BWMS performance is not known, projections about improvements to technologies and their future abilities should not be made. Similarly, the statement that, "...wholly new treatment systems need to be developed in order to meet more stringent proposed standards (i.e., standards that are 38 100x, or 1000x more stringent than D-2/Phase 1)," (p. 1, lines 37-39) is not supported.

### **Comment 2 - Development of novel treatment systems**

The conclusion that, "... due to technological, logistical, and personnel constraints imposed by shipboard operations, the Panel also concluded that wholly new treatment systems need to be developed in order to meet more stringent proposed standards (i.e., standards that are 100 x, or 1000 x more stringent than D-2/Phase 1)," (Executive Summary, p. 1, lines 37-39) is not supported by the information supplied in the report. There is no description related to specifically which logistical & personnel constraints are limiting (e.g. training? number of staff? time in port? time at sea?), and no evaluation of existing BWMS on how well they do or do not address the undefined constraints.

### **Comment 3 – Omission of smaller organism size classes**

The report contains little information, statistics, measurability and system performance for organism size classes  $\leq 10 \mu\text{m}$ , including information for microbial indicator species (*E. coli*, Intestinal Enterococci, *V. cholerae* O1 & O139). This is true, even though these organism classes represent a majority of the IMO performance standards (4 out of 6 total). Further, chapters 3 and 4 do not clarify if information on these organism classes is accounted for in those evaluations. Information for all classes of organisms should be included for a complete evaluation. The focus of the report should not only be the  $>50 \mu\text{m}$  size class.

### **Comment 4 – Onshore treatment**

The authors consider onshore treatment to be promising. We agree, but believe that the report makes unsubstantiated statements about the ability of onshore Facilities to reach higher ballast water treatment standards than shipboard systems. No data has been presented to support this statement. Unless the report can include performance data side-by-side between shipboard treatment systems and onshore Facilities, these statement should be removed.

### **Comment 5 – Limited availability of system performance data**

The report makes broad conclusions about the ability and availability of ballast water treatment systems to meet a variety of ballast water treatment systems. These conclusions are based on a small subset of the available data on ballast water treatment performance. Only 9 reliable data sets were collected, however 51 treatment systems were identified as under development or available for purchase. Whole categories of treatment systems were not reviewed for this report. Therefore this report cannot be considered a comprehensive review of the current and foreseeable progress toward meeting ballast water discharge standards more stringent than IMO.

### **Comment 6 – Failure to recognize successes**

Ultimately the goal of all ballast water treatment systems is to kill organisms entrained in ballast water and prevent or reduce the introduction of species into recipient environments. Although only a small amount of data is available for this report, there is no recognition of the fact that significant progress has been made in reducing organism concentrations in treated ballast water discharges. A useful overview of treatment systems should not only point out deficiencies and areas needing improvement, but should also highlight successes that have been achieved in both system development and testing.

### Specific Comments

Pg 1, line 20 – The statement that information was compiled on 51 treatment systems is misleading. 51 treatments may have been initially examined, but data packages were received for only 15 systems, and only 9 of those were considered reliable. Nowhere in the executive summary is it stated that all the conclusions about the availability of treatment systems are based on this small sample of data.

Pg 7, lines 36-39 - There is not adequate supporting evidence for the conclusion, “Meeting increasingly stringent performance standards will require that BWMS perform nearly perfectly, nearly all of the time. Existing ship ballast water management systems and practices do not support this level of control or performance; a fundamental shift in system design and operational practices would be needed.” Inadequate information is provided indicating how the performance of control systems or system design for BWMSs were evaluated, thus it is

unknown how or why such elements are currently inadequate. No information is clearly provided indicating how “operational practices” hinder BWMS performance. Further, earlier claims indicating that the performance of BWMSs to stricter performance standards cannot be evaluated, suggest that such conclusions cannot be made.

Pg 13, lines 15-36 – The Federal overview provided is inadequate. The section does not sufficiently describe the dual regulation of ballast water by EPA and USCG. The reader needs further information to understand how ballast water treatment systems may be evaluated/approved similarly or differently by EPA and USCG and how this may play into the availability and use of treatment systems by vessels operating in US waters.

Pg 13, Section 2.3.1, beginning line 41 – U.S. States may establish standard either through Section 401 processes or as separate laws. USCG laws (NANCPA and NISA) do not limit states rights. This section needs clarification. It would be useful to provide examples of state standards that are set in law (such as those in California).

Pg 14, Table 2.1 –The California interim standard for organisms greater than 50 microns is “no detectable living organisms.” There is no volumetric requirement associated with this standard. The standard is not “no detectable living organisms” per cubic meter. Similarly the California Final Standard is set as “zero detectable living organisms for all organism size classes.” There is no volume associated with this standard.

Pg 15, Section 2.3.2 – This section may be a better fit if included in Section 6.6 (pg 108). The charge questions clearly delineate that this report will focus on a review of ballast water treatment systems. The risk management section begins to discuss other sub-vectors associated with vessel movement (i.e. fouling). This may serve to confuse the focus of the report. This section would be better suited towards the end of the report, after the charge questions are addressed, to point out that while the focus of the report is on ballast water treatment that the management of vessels as a whole is essential to reduce the risk of species introductions.

Pg 18, lines 28-30 – This section seems out of context. There has been no discussion of onshore or land-based treatment options thus far. Clarify or remove.

Pg 19, line 7 – Recommend replacing “hull fouling” with “vessel fouling” or “biofouling.” Fouling organisms may be found on many wetted surfaces other than hull (e.g. propeller, stabilizers...).

Pg 19, lines 29-38 – The authors should clarify that these are water quality issues. Not all systems that use active substances include the use of decontamination agents. Systems that create low oxygen environments or change the pH can also impact receiving waters.

Pg 23, lines 21-31 – As written, this section seems to indicate that the only way to do credible system testing is to focus on zooplankton-sized organisms. In reality standards encompass a variety of size classes. The bacterial indicator species standards can be tested for without much difficulty based on well-established, standardized tests. The volumes for the 10-50 micron size classes are much more practical to handle even though scientists are still developing tests to easily determine viability. The report’s focus on zooplankton detracts from the success occurring at treating and detecting treatment performance for the other size classes. The section needs to

break out what is involved in credible testing, and then it should discuss how zooplankton create a particularly challenging statistical situation.

Pg 37, lines 12-18 – The statement that it is impracticable to measure for the 1000x standard may be correct for the greater than 50 micron size standard due to sampling volumes, but is not necessarily correct for smaller organism size classes. This caveat needs to be added to the text.

Pg 38, Section 4.3 – The methods of analysis for this entire section are not clear. It would be very difficult for anyone to replicate the analysis presented in this report based on the information provided. We recommend adding additional text, or perhaps an example in the appendix, to describe how data were analyzed in order to come up with the rankings provided in Table 4.1.

Pg 40, lines 19-20 – As previously discussed in the General Comment, it is important not to confuse technical ability of the system to meet a standard with our ability to measure compliance with the standard. This statement will confuse readers and needs clarification.

Pg 40, line 37 – Reference should be to California State Lands Commission 2010, not Dobroski et al. 2010.

Pg 41, Table 4.1 – No citations are provided for the information presented in this table. It makes it extremely difficult for anyone to conduct a similar evaluation of the available data if the authors do not provide references to the reports examined for this analysis. Also, it is not clear if the reviewers focused on data for all organism size classes or whether the focus was on data for the greater than 50 micron size class. The authors should have conducted the review of data for all organism size classes. This information needs to be included.

Pg 41, lines 9-13 – There seems to be confusion about whether systems cannot actually meet more stringent standards or if we don't have methods to determine if they can meet the standards. Scientists have no methods to account for total viable bacteria at this point (although the authors fail to make this point in the text), so it seems difficult to make a statement that the standard cannot be met. Please provide reasoning.

Pg 45, lines 32- 36 – Given the fact that only 9 systems have reliable data, it seems a bit of a reach to say that "it is highly unlikely that any of the systems listed in Table 4.1 could provide organism removal to the level of 100x or 1000x..." The authors may be able to make this conclusion for the systems that have provided data, but the extrapolation to all systems listed in the report is unwarranted and misleading.

Pg 46, lines 5-14 – The argument for why systems cannot meet higher standards is not supported based on the information provided. The authors noted that systems have not been tested for the higher standards and that limits of existing assessment methods inhibit our ability to determine if systems have reached the higher standards. This does not mean they the systems cannot meet the standards; we just don't have the capability to test for it at this time. A more open ended conclusion is appropriate based on the information presented.

Pg 47, Table 4.2 – Are the considerations presented in Table 4.2 the opinion of the reviewers or based on information presented in reports and in the available data? If reports were used to

guide these considerations, please cite accordingly. Or clarify if the considerations are the opinion of the reviewers.

Pg 48, lines 3-6 – Again, information not supported by citations or references. What is the source of information for the statement, “deoxygenation, if operated properly, can dramatically reduce uniform corrosion rates, but alternatively may results in increased corrosion rates due to either the cycling hypoxic...” Is this statement based on existing data?

Pg 46, Section 4.8 – This section does not appear to address concerns related to the water quality of treated ballast water discharges. While the issues discussed in this section may not impact the performance of the system, water quality issues are highly relevant to the applicability of systems (as brought up in the conclusion statement for this section). Almost everything can be killed in ballast water if sufficiently high levels of biocides are employed, but impacts to the receiving environment are too great to ever consider using such a highly toxic system. This section largely ignores that water quality standards in receiving waters may impact which systems can be used by vessels operating in selected waters. We do not expect this panel to review all available water quality standards, but the report should acknowledge that this will be an issue when determining system availability. Already one system has been pulled from the market because, while it was highly effective at treating ballast water, it had the potential to be toxic in freshwater and very cold environments.

Pg 51, lines 7-8 – The authors note that “Combinations of some systems above may results in improved performance, and we recommend that trials be conducted to determine optimum combinations.” The authors fail to note that some of the existing 51 systems listed in Table 4.1 are combinations of such technologies. The data on these systems was not made available for this report, but it is possible that existing technologies have achieved some levels of improved performance over those few discussed in detail in this report.

Pg 51, lines 10-11 – Insufficient evidence is presented to support that statement that altogether new technologies will be needed for 100X and 1000X IMO regulations. The report makes it clear that: 1) data has been examined for only a small subset of existing technologies, 2) data collected thus far has only been from testing conducted for the IMO standards, and 3) existing methods of evaluation are insufficient (levels of detection are not low enough) to determine if systems can meet standards of 100X or 1000X IMO. The statements make it clear that a significant amount of additional testing is necessary and that we need to continue to develop new and enhanced methods of quantifying organisms in ballast water discharge, but the authors fail to make a clear argument as to why new technologies are necessary.

Pg 53, line 17-19 – The information on numbers of systems that have Type Approval is not provided for other treatment methods discussed (such as filtration + UV or oxidant-based systems). We recommend standardizing the approach to presenting this information for all types of systems. Also, only one deoxygenation system provided reliable data for this report. Which type of deoxygenation method was used by that system?

Pg 58, lines 15-16 – See comment for pg 51, lines 10-11.

Pg 58, lines 18-26 –This information is not highlighted sufficiently in the executive summary or other portions of the report. As written, the report appears to say that the challenge of meeting more stringent discharge standards is not only a function of the design of ballast water

treatment systems but also the design of piping and plumbing of existing and new vessels. Thus vessels as a whole may need some plumbing designs into order to increase efficacy of treatment. This information has not received much, if any, public attention but should be emphasized here.

Pg 58-61, "Perspective on More Stringent Standards" – While this information is useful and provides valuable information and perspective for those reading the report, the detail presented may cause confusion when it comes to understanding the direct answers to the charge questions. This section may be better suited for the appendix.

Pg 61, lines 16-20 – Although this information is not technology-based, it does play into a risk management strategy, and should be brought up and discussed in Section 2.3.2.

Pg 62, "Idealized shore-side plant" – The authors should also consider presenting an idealized shipboard facility or an idealized barge-mounted facility. There are additional options for treatment other than shipboard treatment, but the authors focus here solely on shore-side treatment and do not provide evidence as to why an idealized shore-based facility would be superior to something such as an idealized shipboard or barge-mounted facility.

Pg 63, lines 9-10 – This broad statement is not backed by any information cited in the text. What are the capabilities of existing onshore water treatment facilities? Are the methods of treatment at these facilities equally effective in freshwater vs. saltwater environments? Will these systems be effective for the virus and total bacteria standards in the USCG Phase-2 standards? This conclusion statement has no basis without this type of additional information.

Pg 63, "Concepts for Meeting a More Stringent Ballast Water Standard" – Similar to our comments for "Pg 58-61, Perspective on More Stringent Standards" – this information is useful and provides a level of consideration of approaches not discussed in other reports or publications. However, the level of detail may be more appropriate for an appendix than the body of the report.

Pg 66, lines 1-2 – The summary states that the conceptual treatment system "is presented solely to assist in the evaluation of how more stringent treatment standards might impact vessel arrangements, operations, and costs." Yet, lines 22-24 (pg 63) state that the conceptual system neither estimated "capital nor operating costs." Thus, the conclusion that this concept provides information relative to costs is inappropriate.

Pg 66, lines 34-37 – This bullet point confuses two important issues – the performance of the treatment system and the ability to detect and measure organism concentrations in ballast. As discussed throughout the comments, these issues must be addressed separately when considering whether or not systems will be available to meeting ballast water standards.

Pg 68, lines 10-12 – We are not aware of, nor has the report indicated the availability of, any shore-based treatment facilities that exist for treating segregated ballast water [Note: we are aware of at least one facility in Alaska geared towards treating un-segregated (dirty) ballast]. Therefore it is confusing to read this statement that shipboard constraints need to be considered relative to "potential increased usage of shore-based treatment facilities." It would be more appropriate to say that shipboard constraints should be considered relative to the development and construction of shore-based facilities.

Pg 68, lines 23-28 – Please provide references for this information.

Pg 68, lines 29-31 – What is the reasoning behind the statement that “Pragmatically, it may be best to focus on eliminating larger organisms in ballast water...then assessing the extent to which smaller organisms (e.g. bacteria, viruses) survive the treatment...” Are these larger organisms more invasive than smaller organisms? If the goal is to prevent or reduce species introductions, then the focus should first be on the size class that is most invasive, but this information is not provided to the reader. Certainly it is more difficult to detect if systems have reached standards for this larger size class because of the small numbers present in treated ballast and the large volumes of water that must be sampled to determine performance at treating this size class.

Pg 71, line 18 – The statement that “there is no formal environmental assessment approval program for BWMSs” is confusing. Are the authors referring to approval for water quality/toxicological purposes or approval of a system for biological efficacy relative to a performance standard? This paragraph is comparing two different types of standards. The first sentence of the paragraph refers to biological performance while the rest appears to discuss water quality issues. As the federal government (EPA and USCG) has not yet adopted performance standards, obviously no treatment systems have yet been federally approved to meet biological performance standards. Additionally, at this time there are no approval programs in place for water quality purposes (unless a biocide needs registration under FIFRA). Vessel discharges must meet applicable water quality standards. This paragraph needs clarification to separate out approvals for biological efficacy vs. approvals for water quality.

Pg 76, line 5 – The California standards are not suggested, they are established in statute. Additionally the California standards were not implemented through the Clean Water Act Section 401 certification process. They were enacted in separate California statute and then implemented via California regulation.

Pg 80, lines 2-17 – This approach could have major implications for causing “false positives” for failure to comply with performance standards. UV systems are a major subset of available treatment systems, and many organisms treated by this approach may not display destruction of cellular components. Thus these organisms may be scored as “viable when collected” when they are actually dead or dying. Unless the committee can provide evidence that these “false positives” would not frequently occur, it seems premature to recommend preserving samples immediately.

Pg 90, lines 20-24 – This summary is not necessary. The rest of the report does not use this type of summary paragraph.

Pg 91, “Transfer and Reception” – This section fails to discuss that transfer and reception connections must be standardized. If the vessel’s connecting pipe doesn’t match up with the reception facility, then transfer will not be possible. This standardization will require world-wide effort to ensure that as vessels travel from country to country that there are no problems with the ability of vessel to hook up to necessary reception facilities.

Pg 92, line 18 – Are port-based vessel Facilities less effective or suitable than on-shore facilities? Why are they not included in the discussion? A report by McMullin et al. (2008)

addressed the feasibility of facilities at the Port of Milwaukee and found that the most cost-effective and practical approach to treatment involved the discharge of ballast to a barge to store or treat the ballast before possible further treatment onshore.

Pg 94, lines 21-27 – Unless studies have been performed to compare ballast water treatment performance between shipboard and onshore facilities, there is no basis for the assertion that onshore facilities are more effective than shipboard facilities. Please include this data.

Pg 94, “Comparison of cost of on-shore facilities to shipboard BWMS” – This is the only section in the report that addresses cost of treating ballast water. While we agree that a comprehensive comparison of the cost of onshore facilities is necessary, we recommend that this information be included in a separate white paper and not in this report, unless, discussions are included in other parts of the report to address costs associated with the different types of ballast water treatment systems and costs associated with testing etc... It seems inappropriate to only discuss economics in this section, when it will clearly be a deciding factor in regards to all aspects of system purchase, installation, testing and compliance enforcement.

Pg 94, lines 38-39 – Is the screening-level analysis referred to in this sentence the 1993 AQIS report discussed in the Appendix? The citation should be clearly made in this section. The AQIS report, while useful as a historical reference, does not seem appropriate for analysis of current-day costs of either onshore or shipboard ballast water treatment. This analysis was conducted prior to the development of any international, federal or state ballast water management laws and before the development of any current ballast water treatment systems. Simply adapting the costs presented in the AQIS report to 2010 dollars does not take into account the large changes in technologies, and presumably the cost with development and purchase of such technologies, that has occurred during the last 17-18 years.

Pg 98, lines 2-4 – What are the costs of treatment installations? Unless this report presents up-to-date numbers for the installation of various treatment systems, this statement has no data to support it.

Pg 101, Figure 6.8, Number of Installations – All vessels will not necessarily need to install treatment systems. Vessels that are able to use permanent ballast tanks or move ballast among tanks may be able to avoid the need to discharge ballast. Some vessel may also use municipal water as ballast and therefore not need to treat before discharging. Finally, there has been some movement to develop ballast-less ships and these vessels would not require a treatment system.

Pg 103, lines 2-3 – We see no evidence in Section 6.4 that Facilities will be able to reach higher ballast water treatment standards than shipboard systems. No data has been presented to support this statement. Unless the report can include performance data side-by-side between shipboard treatment systems and Facilities, this statement should be removed.

Pg 105, lines 1-2 – Current law requires coastal vessels operating on the US West Coast, that intend to discharge ballast water, conduct a ballast water exchange more than 50 nm from shore. California, Oregon and Washington have high compliance rates with coastal ballast water management requirements. Other countries, such as Canada, are looking very closely at requiring exchange in addition to treatment to ensure that stringent ballast water standards are

Ms. Iris Goodman  
March 14, 2011  
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met (as discussed later in this report). This section of the report does not give this potentially valuable management strategy sufficient weight.

Pg 107, Section 6.5.5 – This section seems to be tucked in at the end, when in fact, it describes important ways of potentially increasing the efficacy of ballast water treatment systems. This information should be included earlier in the report when methods of improving system performance are discussed.

Pg 108, Section 6.6 – We recommend taking the information presented in Section 2.3.2 and including it in this section. Section 2.3.2 seems out of place and disrupts the flow of the initial portions of the report.

Pg 111, Section 6.7 – This section includes no summary of the information gathered from the review of system performance data. Instead it jumps from a summary of what is wrong with available data to alternatives to shipboard treatment. There is no recognition of the fact that great strides have been made in the development of shipboard ballast water treatment technologies. While only limited data was available for this analysis, it is still clear that the shipboard treatment is substantially and significantly reducing the numbers of aquatic organisms in ballast water. This will result in a reduction in the number of organisms being discharged into US waters and will likely result in a decrease in the introductions of new species. This success should be celebrated.

Additionally, this section seems to have been hastily assembled. There are duplicative bullet points, and the charge questions – the reason for development of this report - are not referred to nor answered.

Pg 112, line 29-30 – Be more specific about how onshore treatment will be more adaptable than shipboard treatment. It not clear based on the information presented.

#### References Cited in Comments

McMullin, J., V. Loete, R. Larson, S. Sylvester, and D. Drew. 2008. Port of Milwaukee Onshore Ballast Water Treatment. 17 pp.

Thank you for consideration of these comments. If you have any questions, please do not hesitate to contact me.

Sincerely,

Maurya B. Falkner  
Marine Invasive Species Program Manager  
Marine Facilities Division

CC: Kevin Mercier, Acting Chief, Marine Facilities Division