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ADDITIONAL GUIDELINES FOR IMPLEMENTATION OF THE BWM CONVENTION

Establishing benchmarks in compliance testing by port State control

Submitted by the Institute of Marine Engineering, Science and Technology (IMarEST)

SUMMARY

Executive summary:	This document provides information on impediments to the passage of the Ballast Water Management Convention into law, stemming from perceived ambiguities in the standards themselves and a lack of consensus on sampling and analysis protocols for universal compliance assessment. It offers suggestions for a universal approach to the assessment of compliance and non-compliance, and how to enforce the Convention in a consistent and uniform manner worldwide.
Strategic direction:	2
High-level action:	2.0.1
Planned output:	2.0.1.8
Action to be taken:	Paragraph 29
Related documents:	BLG 16/4

Introduction

1 The current, slow pace of ratification of the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004 (BWM Convention) by the Member States of the International Maritime Organization (IMO) seems far removed from the optimistic attitude of nearly ten years ago, despite a general consensus that the problems associated with invasive species continue unabated. Impediments to the passage of the BWM Convention into law appear to be ambiguities in the standards themselves, leading to a lack of consensus on how and where to draw the line between compliance and non-compliance, and how to enforce the BWM Convention in a consistent and uniform manner worldwide. Sticking points include:

.1 the sampling effort required to process "representative" shipboard samples;

.2 the categorization of organisms in the regulations; and

.3 the means used to determine their viability following ballast water treatment.

2 When defining the terms that form the basis for the regulations and compliance assessment, it is critical that precision and accuracy be tempered with a measure of realism regarding the process of sampling and analysis. Practical realities include:

.1 the time available for compliance assessment while a ship is in port. The BWM Convention states that such assessment should not incur "undue delay"; and

.2 the worldwide deficit of available scientific expertise to accurately and expeditiously assess full compliance.

3 This document addresses the need to simplify and standardize the biological tests that form the basis of IMO and the United States Federal ballast water standards and that define compliance with the BWM Convention. It examines some of the terms and concepts that represent sticking points in developing universally acceptable criteria for full compliance assessment, and proposes some alternative approaches to these definitions.

Representative samples

4 Published standards stipulate that samples examined by port State control (PSC) for compliance assessment should be "representative" of the ship's ballast water discharge. The capture of a "representative" sample provides a good example of the problems facing the regulatory community and the scientists and technical staff responsible for assessing compliance in its most rigorous form. If it is determined that the ballast water sample taken for analysis is representative of the total complement of ballast aboard the ship, then nothing short of sampling the total ballast will suffice. This could mean sampling from each tank, some of which may contain different source water. Within-tank sampling, while quite common in early experimental and research applications, has now been superseded by in-line sampling at discharge, wherein the sample is defined as an integrated sub-sample "representative" of the volume discharged at any single deballasting event. Several studies have further extended the term to encompass a sample truly "representative" of the cross-section of the pipe, i.e. undistorted by laminar flow issues. A great deal of research effort has been expended on this subject, with a focus on not only obtaining a sample representative of the discharge stream, but one unencumbered by increased mortality associated with the collection process itself. Different interpretations of "representativeness" and associated legal challenges might be reasons for revisiting or even eliminating the term as related to sampling. It is not universally accepted that sampling very large volumes of water is merited. The Poisson distribution for rare (greater than 50 µm) organisms, often used to justify this approach, may not apply. There are many instances of changes in organism density according to whether the samples are collected at the beginning, middle or end of a deballasting operation. A simple redefinition of "representative" to include beginning, middle and end components or an integrated in-line sample (if feasible) might solve this, but it must include a realistic sampling/processing time, given the time constraints of shipboard testing.

Categorization of organisms

5 Three categories of organism essentially form the basis of the standard described in regulations D-2 of the BWM Convention and the United States Federal regulations: a greater than 50 µm size category, a 10 to 50 µm size category, and a small, usually less than 5 µm size category consisting of specific indicator bacteria. The United States regulations also

recognize "culturable heterotrophic bacteria", a heterogeneous group of free-living bacteria capable of growing in laboratory culture but differing taxonomically and possibly in culturability, depending on location. Two aspects of this categorization are problematic with respect to quantifying residual live organisms following treatment, namely, numerical standards for "rare" organisms, and published size categories for planktonic organisms. At present, regulators face an extremely difficult task in reconciling these problems unless significant changes are made to the standards.

Numerical standards

6 The standard described in regulation D-2 of the BWM Convention (and the US Federal standards) of not more than 10 viable organisms in the greater than 50 µm size category/m^3 in treated, discharged ballast water was conceived through a process which concluded that, for a variety of reasons, no treatment is likely to be perfect, and very low numbers may escape the treatment process. Chemical sterilization remains a hypothetical possibility, although neutralization of residuals in order to mitigate potentially toxic discharge remains a problem, and the current non-zero option seemed initially to be a reasonable compromise. Although there have been calls for sterilization of ballast water, numerous performance tests for Final Approval by IMO and type approval from various Administrations have shown that this degree of treatment remains elusive.

7 The 2010 proposal by the United States Coast Guard to introduce a standard for the greater than 50 µm size category 100 times more stringent than those in place, i.e. 0.1 viable organisms/m^3, was overwhelmingly voted down by professionals in the field, partly as an overreach in terms of treatment system performance, but primarily because it was not possible to even measure this standard, namely, a single viable organism in 10 m^3 (tonnes), with any degree of precision. Although the determination of such a rigorous standard is clearly unfeasible, measurement of even the existing numerical standard for this size category presents a daunting task, given the relatively short turnaround times in several instances (e.g. 6 to 8 hours (h) in Singapore) and the sheer volume of traffic (e.g. more than 34,000 annual ship visits in the United States alone[1]). The twin exigencies of collecting "representative" samples that relate precisely to numerical standards yet remain viable throughout the collection process dictate a sampling operation as long as 9 h. Attempts to speed up this process can result in significant increases in mortality associated with the sampling process, and may not align with the treatment system requirements for neutralization and discharge of safe ballast water. Neutralization of residuals, or the creation of unexpected disinfection by-products as a result of the treatment process, resulting in a potentially toxic discharge and non-compliance, is a component of this sampling issue.

Shipboard testing

8 At this point it should again be emphasized that the problems outlined above are primarily related to shipboard testing, where it is assumed that sampling and analyses are conducted during the vessel's normal operating routine. Included in this are the logistics of obtaining security clearance for a sampling team to board the vessel, enter the appropriate machinery space and set up sampling equipment, which can take 2 to 3 hours. It has been assumed that performance or type approval testing will provide the "blueprint" for compliance assessment by port State control.[1] However, clearly this is an overly simplistic approach.

9 Shipboard testing very often cannot replicate the somewhat controllable conditions that exist in land-based test facilities. Even these facilities have their drawbacks. Very often,

[1] *D.A. Wright (2012). Logistics of Compliance Assessment and Enforcement of the 2004 Ballast Water Convention. J. Mar. Eng. Technol. 11: 17-23.*

required "challenge water" densities are not met without adding cultured organisms and other components. Augmentation of organism densities in challenge water as a means of meeting published intake requirements requires a significant "leap of faith". Unnatural plankton assemblages often do not function as natural populations and can lead to unnatural die-off through predation and competition. The term "challenge water" implies that a threshold of evidence needs to be met when performance or type approval testing is carried out, although there is no a priori reason for specific baseline conditions to apply to shipboard compliance testing where no control is possible over existing biological conditions at the ballasting location during a vessel's normal routine.

10 As the move is made from "R and D" and performance/type approval testing to compliance assessment, there will no longer be access to challenge (untreated uptake) water as a benchmark for the measurement of treatment efficacy. Full compliance will be judged simply through the analysis of discharged water, regardless of where that water came from and its biological richness at time of uplift. Where shipboard trials have formed part of the type approval process, differential productivity of challenge water has led to differences of opinion over the validity of shipboard tests in this context. In very oligotrophic areas the point has been made that, for at least some of the regulated classes or organisms, densities in ballast water at uplift are too close to, or may actually be below, the target level for successful treatment, thereby offering an insufficiently robust challenge to the treatment system. Although this viewpoint has merit, it might also be argued that land-based testing should supply the degree of rigour needed for exhaustive performance testing, while shipboard testing focuses primarily on the logistics of ballast water management system (BWMS) usage under routine operating conditions as the vessel plies its regular trade.

Port State control aspects

11 Much can be learned through shipboard testing that is not possible with land-based tests. Are crew members familiar with the routine operation and maintenance of the BWMS? What logs exist? If piping, pumps and valves have dual uses, e.g. for both grey and black water management, can different procedures lead to a bypass of the treatment system under certain circumstances? Many of these issues have been encapsulated as a proposed sequence of tiered assessments designed to rapidly identify gross non-compliance (exceedance (*sic*)). Such an approach was one of the issues considered by a correspondence group under the leadership of the European Commission (EC), formed at BLG 15 and consisting of 36 Member States, two intergovernmental organizations and eight non-governmental organizations (NGOs). This major initiative resulted in a report reported in document BLG 16/4.[2] The report acknowledged differences in opinion on the definition of a representative sample, and concluded that the collection and analysis of very large samples over several hours to days were practically impossible. It recognized the differences between type approval testing and measures taken by port State control (PSC) authorities as follows:

> "Type Approval testing makes use of methods that measure the performance of systems with relatively narrow ranges of uncertainty. PSC testing, particularly if systems have been subjected to very rigorous type approval testing, may opt to make use of more rapid or economical test methods that have higher detection limits or wider ranges of uncertainty".

12 In document BLG 16/4, it was acknowledged that there may be differences of approach among PSC authorities; some may opt to measure just one or a subset of the standards. It supported the idea that emphasis should be given to a rapid method of

[2] *Report of the Correspondence Group to finalize the development of a BWM circular on ballast water sampling and analysis. Submitted by the European Commission. BLG 16/4 26, October 2011.*

assessing gross non-compliance "… so long as the results and methodology are robust enough". This last statement is important, because such an assessment could be grounds for stopping a deballasting operation, with potentially expensive consequences, and possibly subject to legal challenge. If such challenges are made, the numerical standards and the degree of "exceedance" will be important factors in assessing penalties. So, too, will be the errors associated with the analyses. Document BLG 16/4 conceded that large errors may be associated with the small number that comprises the greater than 50 µm standard, although no error is attached to the standard.

13 This creates a potentially contradictory situation. Although type approval is based on rigorous testing against published standards, PSC testing may not be robust enough to unequivocally enforce those standards in their entirety. Indeed, an argument could be made that the standards themselves are unenforceable, both from the standpoint of achieving the numerical goal, given the errors involved, and the equivocal nature of the purely size-based categorization of plankton organisms. It is recommended that the emerging rapid assessment techniques that can be used shipboard, or by the PSC, be embraced as measurements which provide insights into the operational performance and the logistics of BWMS usage under routine conditions. Not all measurements are made for strict compliance, but use of these measurements and devices will likely improve the responsiveness required, and begin to embed routine practices of the crew, which are part of the dialogue during inspections and PSC interactions.

Size-based categories for planktonic organisms

14 Several examples illustrate problems associated with a size-based approach for entrained organisms described in regulation D-2. Although there is an implicit assumption that the greater than 50 µm size category comprises relatively rare zooplankton, and that the 10 to 50 µm category comprises much more numerous phytoplankton, including protists, the terms zooplankton, phytoplankton and protists do not appear in the published regulations. Although the size categories were designed to simplify the analytical process, in many cases the opposite has occurred, and there are several exceptions to the current categorization that have a significant impact on the analysis of entrained organisms and the interpretation of data. For example:

.1 phytoplankton (dinoflagellates) significantly greater than 50 µm sometimes comprise close to 30% of total phytoplankton;

.2 more than 90% of phytoplankton in many coastal areas are less than 10 µm. This size category in relation to eukaryotic planktonic organisms is completely missing from published standards, despite being a dominant component of the flora and fauna in several cases. Some toxic dinoflagellates are smaller than 10 µm. Many other potentially harmful species fall in the 2 to 10 µm size category. Therefore, it should be included in treatment tests;

.3 more than 50% of zooplankton are often less than 50 µm. Large numbers of marine nematodes, rotifers, and protozoans less than 50 µm per m^3, at least in the "minimum dimension", could survive treatment and yet the ballast would meet the standard described in regulation D-2 of the Convention; and

.4 the presence of a bloom of large dinoflagellates in the Northeast Pacific may raise the density of organisms in the greater than 50 µm size range from perhaps more than $102/m^3$ to more than $108/m^3$. Thus, to satisfy the numerical standard for compliance, a mortality rate of 99.9999999% would need to be recorded. This degree of precision is impossible. The greater than 50 µm size category was clearly created to address relatively rare zooplankton and not very high densities such as phytoplankton blooms.

15 From the regulatory standpoint this would mean that the entrainment of a bloom of large dinoflagellates would lead to a high probability of failure to comply, unless the BWMS was virtually perfect. On the other hand, very large numbers of small zooplankton, 10 to 50 µm (or even less than 10 µm) in the minimum dimension, could survive in a ballast water sample that was in compliance, because the standard for this size category is 10^6 times higher than the greater than 50 µm standard. From a practical standpoint, the most difficult aspect of this dilemma is the identification of large, living, non-motile protists that may require the use of vital stains to establish viability. Live nematodes, rotifers and many protozoans in the less than 50 µm and greater than 10 to size category are highly motile and, therefore, much more easy to identify as viable.

16 Biodiversity for the larger size classes is now defined as a minimum requirement. However, there is no consequence of using highly diverse plankton apparent in the results of successful tests. Clearly, a BWMS that is tested with a rich diversity of organisms is tested better, and more relevant to the real world of shipping, than a system that is consistently tested in poor water. Calculating diversity into efficacy (a weighted efficacy) would provide a better measure of how a BWMS functions. This would be applicable to both land-based and shipboard tests. The biodiversity-efficacies may also give insight into differences between "test facilities" test water, and the differences between test waters and real-world ballast water, and could be helpful in answering the question of how well BWMS are tested, or how well they will perform on board a ship. A composite efficacy, one number that combines the efficacies of all four size classes (bacteria (less than 2), 2 to 10, 10 to 50 and greater than 50 µm), might be a standard by which systems can be compared directly. Because efficacies differ between size classes (e.g. 2 to 10 (greater than 2) and great than 50 µm (greater than 4)), extra weight might be given to size classes with higher efficacy requirements (> 50 µm). A shipboard composite efficacy can be calculated accordingly. Furthermore, there are no diversity requirements for heterotrophic bacteria at intake in BWMS tests. This omission should be re-examined.

17 Two further complications relate to organisms that, while very small in minimum dimension, and very often less than 10 µm, are characteristically found in a configuration that would be easily captured by a 10 µm, or even a 50 µm filter. Several diatom and dinoflagellate species are colonial in character and consist of multiple cells arranged in a long thin strand or three-dimensional geometric shapes that facilitate capture by 10 µm and often 50 µm sieves. Technically, each component of a colony should count as a separate cell, an assumption that is supported by the fact that vital stains often will stain a subset of elements within a colony; these, presumably, are the live cells. The majority of marine nematodes are less than 10 µm in the smallest dimension, yet are readily caught by greater than 10 sieves, much in the same way that spaghetti noodles are held by a colander. Many, perhaps the majority, of these animals may be too small to qualify for even the 10 to 50 µm category.

Possible approaches to improve the regulations

Move process away from numerical standards

18 Although several of these issues might seem at first sight to be unnecessarily detailed for a broad universal set of regulations requiring universal and uniform application, it is precisely this sort of detail that could form the basis for legal challenge based on the argument that the regulations are too complex and the line between compliance and non-compliance too difficult to characterize unequivocally. Such arguments could, conceivably, be used even in the face of gross non-compliance if the definition of full compliance was unclear. There is, therefore, a clear case for greatly simplifying sampling and analytical procedures used for PSC indicative testing to determine compliance with the BWM Convention. In our considered opinion this should move the process away from the numerical standards that currently form the basis of regulation D-2 and the United States regulations. Some changes to the standards themselves should be given serious consideration on the understanding that standards cannot be altered until/unless the BWM Convention enters into force, so any alteration of potentially "unworkable" standards should be postponed until this occurs. Any transition period involving such changes should be matched by a period of grace wherein potential "violators" of the BWM Convention would not suffer serious penalties. We propose that a matrix of acceptable biological endpoints would replace the current numerical counting system. Such endpoints should take into account issues of latent (delayed) mortality and regrowth.

Clarify meaning of "***live***"

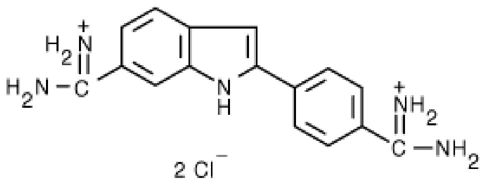
19 Several recent comprehensive studies have been conducted of technologies with sufficient detection capabilities to accurately determine the presence of residual viable organisms in treated ballast water discharge at levels comparable to existing standards.[3] However, many of these analytical methods cannot be directly calibrated against current standards that rely on specific numbers of "live" organisms. The term "live" in this context requires clarification and some have argued that "viable" may be a better term in the sense that, if the reproductive potential of a released organism is compromised, it can be considered as functionally non-viable.

Operational definition of size fractions and standardization of analytical techniques

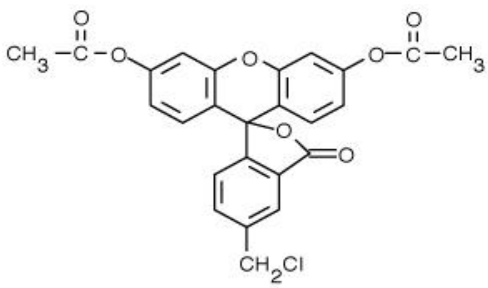
20 Any analytical method adopted by PSC authorities needs to be calibrated against published standards with sufficient reliability to withstand a potential legal challenge. Some have argued that a move away from numerical standards is merited because of the sampling effort required to achieve the appropriate degree of statistical rigor. The organism-specific approach also brings with it size-related problems, mentioned previously, associated with defining minimum dimensions based on a cell-by-cell or organism-by-organism microscopic examination. Although it is assumed that size-related standards are designed to capture relatively rare zooplankton in the greater than 50 µm and relatively numerous "phytoplankton" in the 10 to 50 µm category, clearly there are many exceptions to this assumption. Particularly in view of the overlap of some regionally dense phytoplankton in the greater than 50 µm size group, it has been argued that the terms zooplankton and phytoplankton should appear in the standards. In our view such a change should be approached with caution. Although large (50 µm) dinoflagellates, present in numbers exceeding 10^7/mL, can create significant problems in determining live/dead status with acceptable precision, such a situation may simply present an argument for an efficient filter as part of the BWMS.

3 *Gollasch, S. and David, M. (2010). Testing Sample Representativeness of a Ballast Water Discharge and Developing Method for Indicative Analysis. Final Report to the European Maritime Safety Agency, Lisbon, Portugal, September 2010.*

21 A more practical solution to working with a size-related standard would be to operationally define less than 50 µm and 10 to 50 µm fractions (including both zooplankton and phytoplankton) using cut-off filters as part of PSC sample collection and processing. Such a method would facilitate the use of analytical procedures measuring live biomass without reference to specific numbers of organisms, although such an approach would need to be calibrated against numerical standards, assuming these remain part of performance/approval testing. In view of the dominance of organisms of less than 10 µm in many areas, it is recommended that this procedure be extended to this size class also. Such an assessment of viability could probably comprise a matrix of biological endpoints. To achieve this, it is very important that test laboratories and others likely to be involved with PSC compliance assessment adopt a collaborative approach to quantify the degree of correlation among the various analytical techniques. For example, there is currently a lack of consensus on staining techniques. While the Environment Technology Verification (ETV) Protocol adopted by the United States Coast Guard stipulates the use of a fluorescein diacetate (FDA)/chloromethyl fluorescein diacetate (CMFDA) mixture, consensus on the utility of this mixture as a vital stain is lacking. FDA and CMFDA are being investigated in several European test centres with variable results. Although many agree that FDA/CMFDA shows promise as a "universal" type of stain that works for most types of phytoplankton, false positives (fluorescent staining of dead organisms) remain a problem. Similar problems have been identified using the cell-impermeant green nucleic acid stain Sytox® Green, and some ambiguities with this stain have been pointed out.[4]



Sytox® Green



CMFDA

22 A mixture of the cell-impermeant Sytox® Green and the cell-permeant stain Sytox® Orange is under investigation by at least one testing laboratory. Janus-green B (i.e. 8-(4-Dimethylaminophenyl) diazenyl-*N*,*N*-diethyl-10-phenylphenazin-10-ium-2-amine chloride) is a vital mitochondrial stain used to identify live arthropods, protozoans, rotifers and mollusks in some testing labs. Diaminodiphenazine chloride (neutral red) is commonly employed as a vital stain for zooplankton,[5] but has been used in ballast water testing to identify live members of such divergent phyla as *Bacillariophyta, Chlorophyta, Chrysophyta, Cryptophyta, Euglenophyta*, *Pyrrophyta* and *Xanthophyta,* several of which have been designated protists, possessing both phytoplankton and zooplankton characteristics.

23 Ideally, from a legal standpoint there should be a single universally applied protocol for compliance assessment. However, the current variance among BWMS testing centres stems in part from the fact that such facilities usually occupy well-established locations with well-known, often long-established records of ambient water conditions and the flora and fauna characteristic of that region. Analytical techniques that might effectively characterize the flora and fauna at one location may be quite inappropriate for another location with quite

4 *Zetsche, E-M and F.J.R. Meysman 2012. Dead or alive? Viability assessment of micro – and mesoplankton. J. Plankton Res. 34, 493-509.*

5 *Elliot, D.T. and Tang, K.W. (2009). Simple staining method for differentiating live and dead marine zooplankton in field samples. Limnol. Oceanogr.: Methods, 7, 585-594.*

different physical and biological conditions. Testing laboratories understandably choose analytical techniques best suited to their location and water conditions. Unlike performance or type approval testing, where biological and chemical characteristics of the test water are well known and may be artificially amended, compliance may in future be assessed at any one of 450 major ports worldwide, out of several thousand, on vessels carrying water from all parts of the globe, including many where the flora and fauna are poorly known and mixtures of source water(s) may be common. Disparities in source water and types of entrained organisms are likely to result in varying responses to different analytical techniques. Thus, it seems unlikely that a universal "one-size-fits-all" analytical process can be achieved. Nevertheless, it is important that, whichever criteria are chosen as determinants of compliance, sufficient commonality exists to assure the application of a reasonably uniform standard among PSC. To achieve this benchmark of uniformity there should be a common analytical denominator to determine the equivalence of different analytical methods. It should be remembered that PSC authorities have ultimate discretion as to how to interpret standards and may choose a variety of options to shorten and simplify the assessment process. Each PSC authority is responsible for more than just the BWM Convention compliance; local ordinances and water quality standards may determine both sampling requirements and any enforcement actions. Therefore, it is logical that a similar "tiered system" of interaction between vessels and the PSC authority will exist.

24 Most will rely on non-analytical methods such as reporting and inspections; i.e. a vessel owner or ship's master will submit a report on the type of certified BWMS on board and documentation demonstrating appropriate use and maintenance. Enforcement officials may board vessels and inspect the certified BWMS to verify use and appropriate operations and maintenance. Indirect or indicative water quality measures may be collected autonomously, or by inspectors, that demonstrate appropriate treatment conditions have been achieved (e.g. particle counters, total residual oxidant (TRO), oxidation reduction potential sensors for chlorine and ozone treatments, dissolved oxygen and/or pH sensors for deoxygenation treatments, and radiometers or measures of power output and water transmittance for UV treatments). These types of instruments are available commercially, in wide use in oceanography and industrial applications, and can be adapted for ballast water.

Improve direct measurement methodology for live/viable biomass

25 The primary choke-point, however, relates to direct measurement of live or viable biomass in water to be discharged in a port, and it is the simplification and standardization of these methods that is the primary focus of this document. Given the fact that different PSC measures for full compliance testing to the standard described in regulation D-2 of the BWM Convention and the United States Federal standard will continue to be employed, for reasons previously described, it is critical to consider how analytical methods for compliance assessment can be streamlined yet reasonably standardized.

26 This could be attempted in various ways, many of which have their roots in environmental toxicology:

1. **use of single size-class determination of viability with extrapolation to other groups**. An example would be the determination of live organisms only in the greater than 50 µm category on the assumption that this size range is the least sensitive. High mortality in this group would predict successful eradication of other groups. This is equivalent to the use of indicator species in an environmental toxicology context;

2. **creation of a single benchmark indicator** against which other biological endpoints can be reliably quantified. This is analogous to the use of a reference toxicant in environmental toxicology, thereby tying a variety of mortality assessments to a single common denominator; and

3. **creation of a matrix of multi-co-linear biological end-points**, collectively having reliable predictive value for viable biomass. This is similar to the use of multiple regression analysis to assess the respective contributions of multiple independent variables (toxicants) to a dependent variable (mortality). In its most complex form it would be analogous to deriving estimation algorithms for lowest concentration minimum reporting levels of trace chemicals in drinking water.[6]

27 In view of the diverse nature of the world's ballast water with respect to the various classes of organisms, reliance on results from a single size-class (option .1 above) would be inappropriate. It is, therefore, critical that consensus is reached on a common set of analyses reflecting a broad biological spectrum that will withstand legal scrutiny. Although a single "common denominator" type of analysis (option .2) is attractive, it may not be practical in view of the heterogeneity of ballast water samples worldwide, and the solution is more likely to be a hybrid of options .2 and .3.

Conclusion: critical need for worldwide uniformity in defining compliance

28 It is critical to achieve consensus on this issue in order to approach a single standard, as this may have significant ramifications in case of a legal challenge. Ship operators need to have confidence that, although PSC authorities will have flexibility in their approach to enforcement, there is worldwide uniformity in defining full compliance. It is essential to emphasize that full compliance would only very rarely be tested in every aspect. This can only be accomplished through a significant degree of collaboration among testing centres and others charged with compliance assessment through ballast water examination. Considerable effort needs to be expended on split-sample analysis and "ring tests" involving multiple laboratories. As long as there is substantial disagreement and lack of evidential certainty on how exactly to define the line between compliance and non-compliance, the BWM Convention may be vulnerable to legal challenge and this uncertainty will continue to provide the incentive to delay and obfuscate. However, the regulatory community needs to be able to speak as one voice on this subject.

Action requested of the Sub-Committee

29 The Sub-Committee is invited to note the information contained in this document.

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[6] *United States EPA (2004). Statistical Protocol for the Determination of the Single-Laboratory Lowest Concentration Minimum Reporting Level (LCMRL) and Validation of Laboratory Performance at or Below the Minimum Reporting Level (MRL). United States Environmental Protection Agency Office of Ground Water and Drinking Water Standards and Risk Management Division Technical Support Center, Cincinnati, OH 45268. EPA Document # 815-R-05-006.*