



MARINE ENVIRONMENT PROTECTION
COMMITTEE
53rd session
Agenda item 24

MEPC 53/24/Add.1
1 August 2005
Original: ENGLISH

**REPORT OF THE MARINE ENVIRONMENT PROTECTION COMMITTEE
ON ITS FIFTY-THIRD SESSION**

Attached are annexes 1 to 14 to the report of the Marine Environment Protection Committee on its fifty-third session (MEPC 53/24).

For reasons of economy, this document is printed in a limited number. Delegates are kindly asked to bring their copies to meetings and not to request additional copies.

ANNEX 1

RESOLUTION MEPC.123(53)

Adopted on 22 July 2005

**GUIDELINES FOR BALLAST WATER MANAGEMENT
EQUIVALENT COMPLIANCE (G3)**

THE MARINE ENVIRONMENT PROTECTION COMMITTEE,

RECALLING Article 38(a) of the Convention on the International Maritime Organization concerning the functions of the Marine Environment Protection Committee conferred upon it by the international conventions for the prevention and control of marine pollution,

RECALLING ALSO that the International Conference on Ballast Water Management for Ships held in February 2004 adopted the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004 (the Ballast Water Management Convention) together with four Conference resolutions,

NOTING that Regulation A-2 of the Ballast Water Management Convention requires that discharge of ballast water shall only be conducted through Ballast Water Management in accordance with the provisions of the Annex to the Convention,

NOTING FURTHER that Regulation A-5 of the Annex to the Ballast Water Management Convention provides that equivalent compliance with its provisions for pleasure craft used solely for recreation or competition or craft used primarily for search and rescue, less than 50 metres in length overall, and with a maximum Ballast Water capacity of 8 cubic metres, shall be determined by the Administration taking into account Guidelines developed by the Organization,

NOTING ALSO that resolution 1 adopted by the International Conference on Ballast Water Management for Ships invites the Organization to develop these Guidelines as a matter of urgency,

HAVING CONSIDERED the draft Guidelines for ballast water management equivalent compliance developed by the Ballast Water Working Group and the recommendation made by the Sub-Committee on Bulk Liquids and Gases at its ninth session,

1. ADOPTS the Guidelines for ballast water management equivalent compliance, as set out in the annex to this resolution;
2. INVITES Governments to apply the Guidelines as soon as possible, or when the Convention becomes applicable to them; and
3. AGREES to keep the Guidelines under review.

ANNEX

GUIDELINES FOR BALLAST WATER MANAGEMENT EQUIVALENT COMPLIANCE (G3)

1 Administrations shall take these Guidelines into account in determining whether ships satisfy the requirements of *Regulation A-5, Equivalent compliance* of the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004. Ships subject to these Guidelines should, insofar as practicable, comply with the Convention, and if that is not practicable, shall achieve equivalent compliance in accordance with Regulation A-5 and these Guidelines.

Definitions

2 For the purpose of these Guidelines the definitions in the Convention apply.

Application

3 These Guidelines apply to pleasure craft used solely for recreation or competition or craft used primarily for search and rescue less than 50 metres in overall length and with a maximum ballast water capacity of eight cubic metres. Overall length means the length of the hull excluding bowsprits, booms, bumpkins, pulpits, etc.

Exceptions

- 4 These Guidelines do not apply to the uptake or discharge of ballast water and sediments:
- .1 necessary for the purpose of ensuring the safety of a ship in emergency situations or saving life at sea;
 - .2 when being used for the purpose of avoiding or minimizing pollution incidents from the ship; and
 - .3 on the high seas of the same ballast water and sediments.
- 5 In addition, these Guidelines do not apply to:
- .1 the accidental discharge or ingress of ballast water and sediments resulting from damage to a ship or its equipment provided that all reasonable precautions have been taken before and after the occurrence of the damage or discovery of the damage or discharge for the purpose of preventing or minimizing the discharge and the owner or the person in charge did not wilfully cause such damage;
 - .2 the discharge of ballast water and sediments from a ship at the same location where the whole of that ballast water and those sediments originated provided that no mixing with unmanaged ballast water from other areas has occurred. In the context of these Guidelines, "same location" shall be taken to mean the same harbour, mooring or anchorage; and

- .3 the discharge of ballast water and sediments if the master reasonably decides that compliance with these Guidelines would threaten the safety or stability of the ship, its crew, or its passengers because of adverse weather, ship design or stress, equipment failure, or any other extraordinary condition.

Precautionary practices to minimize the uptake or transfer of harmful aquatic organisms and pathogens

Uptake of ballast water

6 Wherever possible, ballast water should be taken up outside of port waters and as far from the coast as practicable. In addition, consideration should be given to the use of dockside water supplies (e.g. water not taken directly from the harbour; such as fresh water, potable water, etc.) as the source for ballast water.

7 When loading ballast water, every effort should be made to avoid the uptake of potentially harmful aquatic organisms, pathogens and sediments that may contain such organisms. The uptake of ballast water should be minimized or, where practicable, avoided in areas and situations such as:

- .1 in areas identified by the port State in connection with warnings provided by ports concerning ballast uptake and any other port contingency arrangements in the event of emergency situations;
- .2 in darkness when organisms may rise up in the water column;
- .3 in very shallow water;
- .4 where propellers may stir up sediment;
- .5 areas with current large phytoplankton blooms (algal blooms, such as red tides);
- .6 nearby sewage outfalls;
- .7 where a tidal stream is known to be more turbid;
- .8 where tidal flushing is known to be poor; or
- .9 in areas close to aquaculture.

8 If it is necessary to take on and discharge ballast water in the same location, care should be taken to avoid unnecessary discharge of ballast water that has been taken up in another location.

Discharge of ballast water

9 To prevent, minimize and ultimately eliminate the transfer of harmful aquatic organisms and pathogens to the maximum extent practicable taking into account the nature of the ship Ballast Water should either be exchanged prior to discharge in accordance with Regulation B-4 or otherwise managed in accordance with the requirements of the Administration. Any chemical treatment shall only use Active Substances approved by the Organization pursuant to Regulation D-3 of the Convention.

Sediment control

10 Where practicable, routine cleaning of the ballast tank to remove sediments should be carried out under controlled arrangements, and suitable arrangements made for the environmentally sound disposal of any resulting sediments.

Compliance with other guidelines

11 Nothing in these Guidelines shall prevent a ship to which these Guidelines apply from using any method of Ballast Water Management approved under any other Guidelines issued by the Organization. If suitable new and emergent treatments and technologies prove viable, these should be evaluated with a view to be incorporated, as appropriate, into these Guidelines.

ANNEX 2

RESOLUTION MEPC.124(53)

Adopted on 22 July 2005

GUIDELINES FOR BALLAST WATER EXCHANGE (G6)

THE MARINE ENVIRONMENT PROTECTION COMMITTEE,

RECALLING Article 38(a) of the Convention on the International Maritime Organization concerning the functions of the Marine Environment Protection Committee conferred upon it by the international conventions for the prevention and control of marine pollution,

RECALLING ALSO that the International Conference on Ballast Water Management for Ships held in February 2004 adopted the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004 (the Ballast Water Management Convention) together with four Conference resolutions,

NOTING that Regulation A-2 of the Ballast Water Management Convention requires that discharge of ballast water shall only be conducted through Ballast Water Management in accordance with the provisions of the Annex to the Convention,

NOTING FURTHER that Regulation B-4 of the Annex to the Ballast Water Management Convention addresses the conditions under which ballast water exchange should be conducted, taking into account Guidelines developed by the Organization,

NOTING ALSO that resolution 1 adopted by the International Conference on Ballast Water Management for Ships invites the Organization to develop these Guidelines as a matter of urgency,

HAVING CONSIDERED the draft Guidelines for ballast water exchange developed by the Ballast Water Working Group and the recommendation made by the Sub-Committee on Bulk Liquids and Gases at its ninth session,

1. ADOPTS the Guidelines for ballast water exchange, as set out in the Annex to this resolution;
2. INVITES Governments to apply the Guidelines as soon as possible, or when the Convention becomes applicable to them; and
3. AGREES to keep the Guidelines under review.

ANNEX

GUIDELINES FOR BALLAST WATER EXCHANGE (G6)

1 INTRODUCTION

1.1 The purpose of these Guidelines is to provide shipowners and operators with general guidance on the development of ship specific procedures for conducting ballast water exchange. Whenever possible ship owner and operators should enlist the assistance of classification societies or qualified marine surveyors in tailoring ballast exchange practices for various conditions of weather, cargo and stability. The application of processes and procedures concerning ballast water management are at the core of the solution to prevent, minimize and ultimately eliminate the introduction of harmful aquatic organisms and pathogens. Ballast water exchange offers a means, when used in conjunction with good ballast water management practices, to assist in achieving this solution.

1.2 Ballast water exchange introduces a number of safety issues, which affect both the ship and its crew. These Guidelines are intended to provide guidance on the safety and operational aspects of ballast water exchange at sea.

1.3 Given that there are different types of ships, which may be required to undertake ballast water exchange at sea, it is impractical to provide specific guidelines for each ship type. Shipowners are cautioned that they should consider the many variables that apply to their ships. Some of these variables include type and size of ship, ballast tank configurations and associated pumping systems, trading routes and associated weather conditions, port State requirements and manning.

Application

1.4 The Guidelines apply to all those involved with ballast water exchange including, shipowners and operators, designers, classification societies and shipbuilders. Operational procedures and guidance reflecting the issues rose in these Guidelines should be reflected in the ships ballast water management plan.

2 DEFINITIONS

2.1 For the purposes of these Guidelines, the definitions in the International Convention for the Control and Management of Ships' Ballast Water and Sediments (the Convention) apply and:

- .1 "Ballast Water Tank" – means any tank, hold, or space used for the carriage of ballast water.

3 RESPONSIBILITIES

3.1 Shipowners and operators should ensure, prior to undertaking ballast water exchange, that all the safety aspects associated with the ballast water exchange method or methods used onboard have been considered and that suitably trained personnel are onboard. A review of the safety aspects, the suitability of the exchange methods being used and the aspects of crew training should be undertaken at regular intervals.

3.2 The Ballast Water Management Plan is to include the duties of key shipboard control personnel undertaking ballast water exchange at sea. Such personnel should be fully conversant with the safety aspects of ballast water exchange and in particular the method of exchange used on board their ship and the particular safety aspects associated with the method used.

3.3 In accordance with Regulation B-4.4 of the Convention if the master reasonably decides that to perform ballast water exchange would threaten the safety or stability of the ship, its crew or its passengers, because of adverse weather, the ship's design, stress, equipment failure, or any other extraordinary condition a ship shall not be required to comply with Regulations B-4.1 and B-4.2.

- .1 When a ship does not undertake ballast water exchange for the reasons stated in paragraph above, the reasons shall be entered in the Ballast Water Record Book.
- .2 The port or coastal State concerned may require that the discharge of ballast water must be in accordance with procedures determined by them taking into account the Guidelines for additional measures including emergency situations (G13).

4 BALLAST WATER EXCHANGE REQUIREMENTS

4.1 Exchange of ballast water in deep ocean areas or open seas offers a means of limiting the probability that harmful aquatic organisms and pathogens be transferred in ships ballast water.

4.2 Regulation D-1 of the Convention requires that:

- .1 ships performing ballast water exchange in accordance with this regulation shall do so with an efficiency of at least 95 per cent volumetric exchange of ballast water; and
- .2 for ships exchanging ballast water by the pumping-through method, pumping through three times the volume of each ballast water tank shall be considered to meet the standard described in paragraph 1. Pumping through less than three times the volume may be accepted provided the ship can demonstrate that at least 95 per cent volumetric exchange is met.

4.3 There are three methods of Ballast Water exchange which have been evaluated and accepted by the Organization. The three methods are the sequential method, the flow-through method and the dilution method. The flow-through method and the dilution method are considered as "pump through" methods.

4.4 The three accepted methods can be described as follows:

Sequential method – a process by which a ballast tank intended for the carriage of ballast water is first emptied and then refilled with replacement ballast water to achieve at least a 95 per cent volumetric exchange.

Flow-through method – a process by which replacement ballast water is pumped into a ballast tank intended for the carriage of ballast water, allowing water to flow through overflow or other arrangements.

Dilution method – a process by which replacement ballast water is filled through the top of the ballast tank intended for the carriage of ballast water with simultaneous discharge from the bottom at the same flow rate and maintaining a constant level in the tank throughout the ballast exchange operation.

5 SAFETY PRECAUTIONS ASSOCIATED WITH BALLAST WATER EXCHANGE

5.1 Three methods of carrying out ballast water exchange at sea have been identified as acceptable by the Organization. Each has particular safety aspects associated with it that should be considered when selecting the method(s) to be used on a particular ship.

5.2 When identifying the ballast water exchange method(s) for the first time for a particular ship, an evaluation should be made which should include:

- .1 the safety margins for stability and strength contained in allowable seagoing conditions, as specified in the approved trim and stability booklet and the loading manual relevant to individual types of ships. Account should also be taken of the loading conditions and the envisaged ballast water exchange method or methods to be used;
- .2 the ballast pumping and piping system taking account of the number of ballast pumps and their capacities, size and arrangements of ballast water tanks; and
- .3 the availability and capacity of tank vents and overflow arrangements, for the flow through method, the availability and capacity of tank overflow points, prevention of under and over pressurization of the ballast tanks.

5.3 Particular account should be taken of the following:

- .1 stability which is to be maintained at all times and not less than those values recommended by the Organization or required by the Administration;
- .2 longitudinal stress, and where applicable torsional stress values, not to exceed permitted values with regard to prevailing sea conditions;
- .3 exchange of ballast in tanks where significant structural loads may be generated by sloshing action in the partially filled tank to be carried out in favourable sea and swell conditions such that the risk of structural damage is minimized;
- .4 wave-induced hull vibrations when carrying out ballast water exchange;
- .5 limitations of the available methods of ballast water exchange in respect of sea and weather conditions;
- .6 forward and aft draughts and trim, with particular reference to bridge visibility, slamming, propeller immersion and minimum forward draft; and
- .7 additional work loads on the master and crew.

5.4 Having undertaken an evaluation for a particular ship and the exchange method or methods to be used, the ship should be provided with procedures, advice and information appropriate to the exchange method(s) identified and ship type in the Ballast Water Management Plan. The procedures, advice, and information in the Ballast Water Management Plan, may include but is not limited to the following:

- .1 avoidance of over and under-pressurization of ballast tanks;
- .2 free surface effects on stability and sloshing loads in tanks that may be slack at any one time;
- .3 maintain adequate intact stability in accordance with an approved trim and stability booklet;
- .4 permissible seagoing strength limits of shear forces and bending moments in accordance with an approved loading manual;
- .5 torsional forces;
- .6 forward and aft draughts and trim, with particular reference to bridge visibility, propeller immersion and minimum forward draft;
- .7 wave-induced hull vibrations when performing ballast water exchange;
- .8 watertight and weathertight closures (e.g. manholes) which may have to be opened during ballast exchange must be re-secured;
- .9 maximum pumping/flow rates – to ensure the tank is not subjected to a pressure greater than that for which it has been designed;
- .10 internal transfers of ballast;
- .11 admissible weather conditions;
- .12 weather routeing in areas seasonably affected by cyclones, typhoons, hurricanes, or heavy icing conditions;
- .13 documented records of ballasting and/or de-ballasting and/or internal transfers of ballast;
- .14 contingency procedures for situations which may affect ballast water exchange at sea, including deteriorating weather conditions, pump failure and loss of power;
- .15 time to complete the ballast water exchange for each tank or an appropriate sequence thereof;
- .16 continual monitoring of the ballast water operation; monitoring should include pumps, levels in tanks, line and pump pressures, stability and stresses;
- .17 a list of circumstances in which ballast water exchange should not be undertaken. These circumstances may result from critical situations of an exceptional nature or

force majeure due to stress of weather, known equipment failures or defects, or any other circumstances in which human life or safety of the ship is threatened;

- .18 ballast water exchange at sea should be avoided in freezing weather conditions. However, when it is deemed absolutely necessary, particular attention should be paid to the hazards associated with the freezing of overboard discharge arrangements, air pipes, ballast system valves together with their means of control, and the build up of ice on deck; and
- .19 personnel safety, including precautions which may be required when personnel are required to work on deck at night, in heavy weather, when ballast water overflows the deck, and in freezing conditions. These concerns may be related to the risks to the personnel of falling and injury, due to the slippery wet surface of the deck plate, when water is overflowing on deck, and to the direct contact with the ballast water, in terms of occupational health and safety.

5.5 During ballast water exchange sequences there may be times when, for a transitory period, one or more of the following criteria cannot be fully met or are found to be difficult to maintain:

- .1 bridge visibility standards (SOLAS V/22);
- .2 propeller immersion; and
- .3 minimum draft forward.

5.6 As the choice of acceptable ballast water exchange sequences is limited for most ships, it is not always practicable to dismiss from consideration those sequences where transitory non-compliance may occur. The practical alternative would be to accept such sequences provided an appropriate note is placed in the Ballast Water Management Plan to alert the ship's master. The note would advise the master of the nature of the transitory non-compliance, that additional planning may be required and that adequate precautions need to be taken when using such sequences.

5.7 In planning a ballast water exchange operation that includes sequences which involve periods when the criteria for propeller immersion, minimum draft and / or trim and bridge visibility cannot be met, the Master should assess:

- .1 the duration(s) and time(s) during the operation that any of the criteria will not be met;
- .2 the effect(s) on the navigational and manoeuvring capabilities of the ship; and
- .3 the time to complete the operation.

5.8 A decision to proceed with the operation should only be taken when it is anticipated that:

- .1 the ship will be in open water;
- .2 the traffic density will be low;

- .3 an enhanced navigational watch will be maintained including if necessary an additional look out forward with adequate communications with the navigation bridge;
- .4 the manoeuvrability of the vessel will not be unduly impaired by the draft and trim and or propeller immersion during the transitory period; and
- .5 the general weather and sea state conditions will be suitable and unlikely to deteriorate.

5.9 On oil tankers, segregated ballast and clean ballast may be discharged below the water line at sea by pumps if the ballast water exchange is performed under the provisions of Regulation D-1.1 of the International Convention for the Control and Management of Ships' Ballast Water and Sediments, provided that the surface of the ballast water has been examined either visually or by other means immediately before the discharge to ensure that no contamination with oil has taken place.

6 CREW TRAINING AND FAMILIARIZATION

6.1 Appropriate training for ships' masters and crews should include instructions on the safety issues associated with ballast water exchange based upon the information contained in these Guidelines. Instruction should be provided on the ships' Ballast Water Management Plan including the completion of required records.

6.2 Ships' officers and crew engaged in ballast water exchange at sea should be trained in and be familiar with the following as appropriate:

- .1 the ship's ballast pumping and piping arrangements, positions of associated air and sounding pipes, positions of all compartment and tank suction and pipelines connecting them to ship's ballast pumps and, in the case of use of the flow through method of ballast water exchange, the openings used for release of water from the top of the tank together with overboard discharge arrangements;
- .2 the method of ensuring that sounding pipes are clear, and that air pipes and their non-return devices are in good order;
- .3 the different times required to undertake the various ballast water exchange operations including the time to complete individual tanks;
- .4 the method(s) in use for ballast water exchange at sea if applicable with particular reference to required safety precautions; and
- .5 the need to continually monitor ballast water exchange operations.

7 FUTURE CONSIDERATIONS IN RELATION TO BALLAST WATER EXCHANGE

7.1 These Guidelines may be revised and updated in the light of possible technical evolutions with the ballast water exchange methods and of new ballast water management options.

ANNEX 3

RESOLUTION MEPC.125(53)

Adopted on 22 July 2005

**GUIDELINES FOR APPROVAL OF
BALLAST WATER MANAGEMENT SYSTEMS (G8)**

THE MARINE ENVIRONMENT PROTECTION COMMITTEE,

RECALLING Article 38(a) of the Convention on the International Maritime Organization concerning the functions of the Marine Environment Protection Committee conferred upon it by the international conventions for the prevention and control of marine pollution,

RECALLING ALSO that the International Conference on Ballast Water Management for Ships held in February 2004 adopted the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004 (the Ballast Water Management Convention) together with four Conference resolutions,

NOTING that Regulation A-2 of the Ballast Water Management Convention requires that discharge of ballast water shall only be conducted through Ballast Water Management in accordance with the provisions of the Annex to the Convention,

NOTING FURTHER that Regulation D-3 of the Annex to the Ballast Water Management Convention provides that Ballast Water Management Systems used to comply with this Convention must be approved by the Administration, taking into account Guidelines developed by the Organization,

NOTING ALSO that resolution 1 adopted by the International Conference on Ballast Water Management for Ships invites the Organization to develop these Guidelines as a matter of urgency,

HAVING CONSIDERED the draft Guidelines for Approval of Ballast Water Management Systems developed by the Ballast Water Working Group,

1. ADOPTS the Guidelines for approval of Ballast Water Management Systems, as set out in the Annex to this resolution;
2. INVITES Governments to apply the Guidelines as soon as possible, or when the Convention becomes applicable to them; and
3. AGREES to keep the Guidelines under review.

ANNEX

**GUIDELINES FOR APPROVAL OF
BALLAST WATER MANAGEMENT SYSTEMS (G8)**

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GUIDELINES FOR APPROVAL OF BALLAST WATER MANAGEMENT SYSTEMS (G8)

1 INTRODUCTION

General

1.1 These Guidelines for Approval of Ballast Water Management Systems are aimed primarily at Administrations, or their designated bodies, in order to assess whether ballast water treatment systems meet the standard as set out in Regulation D-2 of the "International Convention for the Control and Management of Ships' Ballast Water and Sediments," hereafter referred to as the "Convention". In addition, this document can be used as guidance for manufacturers and ship owners on the evaluation procedure that equipment will undergo and the requirements placed on Ballast Water Management Systems. These Guidelines should be applied in an objective, consistent and transparent way and their application should be evaluated periodically by the Organization.

1.2 Articles and Regulations referred to in these Guidelines are those contained in the Convention.

1.3 The Guidelines include general requirements concerning design and construction, technical procedures for evaluation and the procedure for issuance of the Type Approval Certificate of the Ballast Water Management System.

1.4 These Guidelines are intended to fit within an overall framework for evaluating the performance of Systems that includes the experimental shipboard evaluation of prototype Systems under the provisions of Regulation D-4, approval of Ballast Water Management Systems and associated systems that comply fully with the requirements of the Convention, and port State control sampling for compliance under the provisions of Article 9 of the Convention.

1.5 The requirements of Regulation D-3 stipulate that Ballast Water Management Systems used to comply with the Convention must be approved by the Administration, taking into account these Guidelines. In addition to such Ballast Water Management System approval, as set forth in Regulation A-2 and Regulation B-3, the Convention requires that discharges of ballast water from ships must meet the Regulation D-2 performance standard on an on-going basis. Approval of a system is intended to screen-out management systems that would fail to meet the standards prescribed in Regulation D-2 of the Convention. Approval of a system, however, does not ensure that a given system will work on all vessels or in all situations. To satisfy the Convention, a discharge must comply with the D-2 standard throughout the life of the vessel.

1.6 The operation of Ballast Water Management Systems should not impair the health and safety of the ship or personnel, nor should it present any unacceptable harm to the environment or to public health.

1.7 Ballast Water Management Systems are required to meet the standards of Regulation D-2 and the conditions established in Regulation D-3 of the Convention. These Guidelines serve to evaluate the safety, environmental acceptability, practicability and biological effectiveness of the systems designed to meet these standards and conditions. The

cost effectiveness of type-approved equipment will be used in determining the need for revisions of these Guidelines.

1.8 These Guidelines contain recommendations regarding the design, installation, performance, testing and approval of Ballast Water Management Systems.

1.9 To achieve consistency in its application, the approval procedure requires that a uniform manner of testing, analysis of samples, and evaluation of results is developed and applied. These Guidelines should be applied in an objective, consistent, and transparent way; and their suitability should be periodically evaluated and revised as appropriate by the Organization. New versions of these Guidelines should be duly circulated by the Organization. Due consideration should be given to the practicability of the Ballast Water Management Systems.

Goal and purpose

1.10 The goal of these Guidelines is to ensure uniform and proper application of the standards contained in the Convention. As such the Guidelines are to be updated as the state of knowledge and technology may require.

1.11 The purpose of these Guidelines is to:

- .1 define test and performance requirements for the approval of Ballast Water Management Systems;
- .2 assist Administrations in determining appropriate design, construction and operational parameters necessary for the approval of Ballast Water Management Systems;
- .3 provide a uniform interpretation and application of the requirements of Regulation D-3;
- .4 provide guidance to equipment manufacturers and ship owners in determining the suitability of equipment to meet the requirements of the Convention; and
- .5 assure that Ballast Water Management Systems approved by Administrations are capable of achieving the standard of Regulation D-2 in land-based and shipboard evaluations.

Applicability

1.12 These Guidelines apply to the approval of Ballast Water Management Systems in accordance with the Convention.

1.13 These Guidelines apply to Ballast Water Management Systems intended for installation on board all ships required to comply with Regulation D-2.

Summary of requirements

1.14 The land-based and shipboard approval requirements for Ballast Water Management Systems specified in these Guidelines are summarized below.

1.15 The manufacturer of the equipment should submit information regarding the design, construction, operation and functioning of the Ballast Water Management System in accordance with Part 1 of the annex. This information should be the basis for a first evaluation of suitability by the Administration.

1.16 The Ballast Water Management System should be tested for Type Approval in accordance with the procedures described in Parts 2 and 3 of the Annex.

1.17 Successful fulfilment of the requirements and procedures for Type Approval as outlined in Parts 2 and 3 of the Annex should lead to the issuance of a Type Approval Certificate by the Administration.

1.18 When a Type Approved Ballast Water Management System is installed on board, an installation survey according to section 8 should be carried out.

2 BACKGROUND

2.1 The requirements of the Convention relating to approval of Ballast Water Management Systems used by ships are set out in Regulation D-3.

2.2 Regulation D-2 stipulates that ships meeting the requirements of the Convention by meeting the ballast water performance standard must discharge:

- .1 less than 10 viable organisms per cubic metre greater than or equal to 50 micrometres in minimum dimension;
- .2 less than 10 viable organisms per millilitre less than 50 micrometres in minimum dimension and greater than or equal to 10 micrometres in minimum dimension; and
- .3 less than the following concentrations of indicator microbes, as a human health standard:
 - .1 Toxicogenic *Vibrio cholerae* (serotypes O1 and O139) with less than 1 Colony Forming Unit (cfu) per 100 millilitres or less than 1 cfu per 1 gramme (wet weight) of zooplankton samples;
 - .2 *Escherichia coli* less than 250 cfu per 100 millilitres; and
 - .3 Intestinal *Enterococci* less than 100 cfu per 100 millilitres.

3 DEFINITIONS

For the purpose of these Guidelines:

3.1 Active Substance means a substance or organism, including a virus or a fungus that has a general or specific action on or against Harmful Aquatic Organisms and Pathogens.

3.2 Ballast Water Management System (BWMS) means any system which processes ballast water such that it meets or exceeds the Ballast Water Performance Standard in Regulation D-2. The BWMS includes Ballast Water Treatment Equipment, all associated Control Equipment, Monitoring Equipment and Sampling Facilities.

3.3 The Ballast Water Management Plan is the document referred to in Regulation B-1 of the Convention describing the ballast water management process and procedures implemented on board individual ships.

3.4 Ballast Water Treatment Equipment means equipment which mechanically, physically, chemically, or biologically processes, either singularly or in combination, to remove, render harmless, or avoid the uptake or discharge of Harmful Aquatic Organisms and Pathogens within Ballast Water and Sediments. Ballast Water Treatment Equipment may operate at the uptake or discharge of ballast water, during the voyage, or at a combination of these events.

3.5 Control Equipment refers to the installed equipment required to operate and control the Ballast Water Treatment Equipment.

3.6 The Convention means the International Convention for the Control and Management of Ships' Ballast Water and Sediments.

3.7 Monitoring Equipment refers to the equipment installed for the assessment of the effective operation of the Ballast Water Treatment Equipment.

3.8 Sampling Facilities refers to the means provided for sampling treated or untreated ballast water as needed in these Guidelines and in the "Guidelines for Ballast Water Sampling" developed by the Organization.

3.9 Shipboard Testing is a full-scale test of a complete BWMS carried out on board a ship according to Part 2 of the annex to these Guidelines, to confirm that the system meets the standards set by Regulation D-2 of the Convention.

3.10 Treatment Rated Capacity (TRC) is the maximum continuous capacity expressed in cubic metres per hour for which the BWMS is type approved. It states the amount of ballast water that can be treated per unit time by the BWMS to meet the standard in Regulation D-2 of the Convention.

3.11 Land-based Testing is a test of the BWMS carried out in a laboratory, equipment factory or pilot plant including a moored test barge or test ship, according to Parts 2 and 3 of the Annex to these Guidelines, to confirm that the BWMS meets the standards set by Regulation D-2 of the Convention.

3.12 Viable Organisms are organisms and any life stages thereof that are living.

4 TECHNICAL SPECIFICATIONS

4.1 This section details general technical requirements which a BWMS should meet in order to obtain Type Approval.

Ballast Water Management Systems

4.2 The BWMS should not contain or use any substance of a dangerous nature, unless adequate arrangements for storage, application, mitigation, and safe handling, acceptable to the Administration, are provided to mitigate any hazards introduced thereby.

4.3 In case of any failure compromising the proper operation of the BWMS, audible and visual alarm signals should be given in all stations from which ballast water operations are controlled.

4.4 All working parts of the BWMS that are liable to wear or to be damaged should be easily accessible for maintenance. The routine maintenance of the BWMS and troubleshooting procedures should be clearly defined by the manufacturer in the Operating and Maintenance Manual. All maintenance and repairs should be recorded.

4.5 To avoid interference with the BWMS, the following items should be included:

- .1 every access of the BWMS beyond the essential requirements of paragraph 4.4, should require the breaking of a seal;
- .2 if applicable, the BWMS should be so constructed that a visual alarm is always activated whenever the BWMS is in operation for purposes of cleaning, calibration, or repair, and these events should be recorded by the Control Equipment;
- .3 in the event of an emergency, suitable by-passes or overrides to protect the safety of the ship and personnel should be installed; and
- .4 any bypass of the BWMS should activate an alarm, and the bypass event should be recorded by the Control Equipment.

4.6 Facilities should be provided for checking, at the renewal surveys and according to the manufacturer's instructions, the performance of the BWMS components that take measurements. A calibration certificate certifying the date of the last calibration check, should be retained on board for inspection purposes. Only the manufacturer or persons authorized by the manufacturer should perform the accuracy checks.

Ballast Water Treatment Equipment

4.7 The Ballast Water Treatment Equipment should be robust and suitable for working in the shipboard environment, should be of a design and construction adequate for the service for which it is intended and should be so installed and protected as to reduce to a minimum any danger to persons on board, due regard being paid to hot surfaces and other hazards. The design should have regard to materials used in construction, the purpose for which the equipment is intended, the working conditions to which it will be subjected and the environmental conditions on board.

4.8 The Ballast Water Treatment Equipment should be provided with simple and effective means for its operation and control. It should be provided with a control system that should be such that the services needed for the proper operation of the Ballast Water Treatment Equipment are ensured through the necessary automatic arrangements.

4.9 The Ballast Water Treatment Equipment should, if intended to be fitted in locations where flammable atmospheres may be present, comply with the relevant safety regulations for such spaces. Any electrical equipment that is part of the BWMS should be based in a non-hazardous area, or should be certified by the Administration as safe for use in a hazardous area. Any moving parts, which are fitted in hazardous areas, should be arranged so as to avoid the formation of static electricity.

Control and Monitoring Equipment

4.10 The BWMS should incorporate Control Equipment that automatically monitors and adjusts necessary treatment dosages or intensities or other aspects of the BWMS of the vessel, which while not directly effecting treatment are nonetheless required for proper administration of the necessary treatment.

4.11 The Control Equipment should incorporate a continuous self-monitoring function during the period in which the BWMS is in operation.

4.12 The Monitoring Equipment should record the proper functioning or failure of the BWMS.

4.13 To facilitate compliance with Regulation B-2, the Control Equipment should also be able to store data for at least 24 months, and should be able to display or print a record for official inspections as required. In the event the Control Equipment is replaced, means should be provided to ensure the data recorded prior to replacement remains available on board for 24 months.

4.14 It is recommended that simple means be provided aboard ship to check on drift by measuring devices that are part of the Control Equipment, repeatability of the Control Equipment devices, and the ability to re-zero the Control Equipment meters.

5 TYPICAL DOCUMENT REQUIREMENTS FOR THE PLAN APPROVAL PROCESS

5.1 The documentation submitted for approval should include at least the following:

- .1 a description of the BWMS. The description should include a diagrammatic drawing of the typical or required pumping and piping arrangements, and sampling facilities, identifying the operational outlets for treated ballast water and any waste streams as appropriate and necessary. Special considerations may have to be given to installations intended for ships that have unusual pumping and piping arrangements;
- .2 equipment manuals, supplied by manufacturers, containing details of the major components of the BWMS and their operation and maintenance;
- .3 a generic operations and technical manual for the complete BWMS. This manual should cover the arrangements, the operation and maintenance of the BWMS as a whole and should specifically describe parts of the BWMS which are not covered by the manufacturer's equipment manuals;

- .4 the operations section of the manual including normal operational procedures and procedures for the discharge of untreated water in the event of malfunction of the Ballast Water Treatment Equipment, maintenance procedures, and emergency action necessary for securing the ship;
- .5 methods for the conditioning of treated water prior to discharge should be provided, and assessment of discharged water should include a description of the effect of treatment on the ship's ballast water, in particular the nature of any treatment residuals and by-products and the water's suitability for discharge into coastal waters. A description should also be provided of any actions necessary to monitor, and if necessary "condition", treated water prior to discharge in order that it meets applicable water quality regulations;
- .6 a description of BWMS side streams (e.g., filtered material, centrifugal concentrate, waste or residual chemicals) including a description of the actions planned to properly manage and dispose of such wastes;
- .7 a technical section of the manual including adequate information (description and diagrammatic drawings of the monitoring system and electrical/electronic wiring diagrams) to enable faultfinding. This section should include instructions for keeping a maintenance record;
- .8 a technical installation specification defining, *inter alia*, requirements for the location and mounting of components, arrangements for maintaining the integrity of the boundary between safe and hazardous spaces and the arrangement of the sample piping; and
- .9 a recommended test and checkout procedure specific to the BWMS. This procedure should specify all the checks to be carried out in a functional test by the installation contractor and should provide guidance for the surveyor when carrying out the on-board survey of the BWMS and confirming the installation reflects the manufacturer's specific installation criteria.

6 APPROVAL AND CERTIFICATION PROCEDURES

6.1 A BWMS which in every respect fulfils the requirements of these Guidelines may be approved by the Administration for fitting on board ships. The approval should take the form of a Type Approval Certificate of BWMS, specifying the main particulars of the apparatus and any limiting conditions on its usage necessary to ensure its proper performance. Such certificate should be issued in the format shown in Appendix 1. A copy of the Type Approval Certificate of BWMS should be carried on board ships fitted with such equipment at all times.

6.2 A Type Approval Certificate of BWMS should be issued for the specific application for which the BWMS is approved, e.g., for specific ballast water capacities, flow rates, salinity or temperature regimes, or other limiting conditions or circumstances as appropriate.

6.3 A Type Approval Certificate of BWMS should be issued by the Administration based on satisfactory compliance with all the test requirements described in Parts 2, 3 and 4 of the Annex.

6.4 An Administration may issue a Type Approval Certificate of BWMS based on separate testing or on testing already carried out under supervision by another Administration.

6.5 The Type Approval Certificate of BWMS should:

- .1 identify the type and model of the BWMS to which it applies and identify equipment assembly drawings, duly dated;
- .2 identify pertinent drawings bearing model specification numbers or equivalent identification details;
- .3 include a reference to the full performance test protocol on which it is based, and be accompanied by a copy of the original test results;
- .4 identify if it was issued by an Administration based on a Type Approval Certificate previously issued by another Administration. Such a certificate should identify the Administration that conducted the tests on the BWMS and a copy of the original test results should be attached to the Type Approval Certificate of BWMS.

6.6 An approved BWMS may be Type Approved by other Administrations for use on their vessels. Should equipment approved by one country fail Type Approval in another country, then the two countries concerned should consult one another with a view to reaching a mutually acceptable agreement.

7 INSTALLATION REQUIREMENTS

Sampling facilities

7.1 The BWMS should be provided with sampling facilities so arranged in order to collect representative samples of the ship's ballast water.

7.2 Sampling facilities should in any case be located on the BWMS intake, before the discharging points, and any other points necessary for sampling to ascertain the proper functioning of the equipment as may be determined by the Administration.

8 INSTALLATION SURVEY AND COMMISSIONING PROCEDURES

8.1 Verify that the following documentation is on board in a suitable format:

- .1 a copy of the Type Approval Certificate of BWMS;
- .2 a statement from the Administration, or from a laboratory authorized by the Administration, to confirm that the electrical and electronic components of the BWMS have been type-tested in accordance with the specifications for environmental testing contained in Part 3 of the Annex;
- .3 equipment manuals for major components of the BWMS;

- .4 an operations and technical manual for the BWMS specific to the ship and approved by the Administration, containing a technical description of the BWMS, operational and maintenance procedures, and backup procedures in case of equipment malfunction;
- .5 installation specifications;
- .6 installation commissioning procedures; and
- .7 initial calibration procedures.

8.2 Verify that:

- .1 the BWMS installation has been carried out in accordance with the technical installation specification referred to in paragraph 8.1.5;
- .2 the BWMS is in conformity with the Type Approval Certificate of BWMS issued by the Administration or its representative;
- .3 the installation of the complete BWMS has been carried out in accordance with the manufacturer's equipment specification;
- .4 any operational inlets and outlets are located in the positions indicated on the drawing of the pumping and piping arrangements;
- .5 the workmanship of the installation is satisfactory and, in particular, that any bulkhead penetrations or penetrations of the ballast system piping are to the relevant approved standards; and
- .6 the Control and Monitoring Equipment operates correctly.

ANNEX

This annex provides detailed test and performance specifications for a BWMS and contains:

- PART 1 – Specifications for Pre-test Evaluation of System Documentation**
- PART 2 – Test and Performance Specifications for Approval of Ballast Water Management Systems**
- PART 3 – Specification for Environmental Testing for Approval of Ballast Water Management Systems**
- PART 4 – Sample Analysis Methods for the Determination of Biological Constituents in Ballast Water**

PART 1 – SPECIFICATIONS FOR PRE-TEST EVALUATION OF SYSTEM DOCUMENTATION

1.1 Adequate documentation should be prepared and submitted to the Administration as part of the approval process well in advance of the intended approval testing of a BWMS. Approval of the submitted documentation should be a pre-requisite for carrying out independent approval tests.

General

1.2 Documentation should be provided by the manufacturer/developer for two primary purposes: evaluating the readiness of the BWMS for undergoing approval testing, and evaluating the manufacturer's proposed test requirements and procedures for the test.

Readiness evaluation

1.3 The readiness evaluation should examine the design and construction of the BWMS to determine whether there are any fundamental problems that might constrain the ability of the BWMS to manage ballast water as proposed by the manufacturer, or to operate safely, on board ships. The latter concern should, in addition to basic issues related to the health and safety of the crew, interactions with the ship's systems and cargo, and potential adverse environmental effects, also consider the potential for longer term impacts to the safety of the crew and vessel through effects of the BWMS on corrosion in the ballast system and other spaces.

1.4 The evaluation should also address the degree, if any, to which the manufacturer's/developer's efforts during the research and development phase tested the performance and reliability of the system under operational shipboard conditions and should include a report of the results of those tests.

Test proposal evaluation

1.5 Evaluation of the test proposal should examine all of the manufacturer's stated requirements and procedures for installing, calibrating, and operating (including maintenance requirements) the BWMS during a test. This evaluation should help the test organization to identify any potential health or environmental safety problems, unusual operating requirements (labour or materials), and any issues related to the disposal of treatment by-products or waste streams.

Documentation

1.6 The documentation to be submitted should include at least the following:

- .1 **Technical Manual** – The technical description should include:
 - product specification;
 - process description;
 - operational instructions;
 - details (including Certificates where appropriate) of the major components and materials used;
 - technical installation specifications in accordance with manufacturers' specific installation criteria;
 - system limitations; and
 - routine maintenance and trouble-shooting procedures;
- .2 **BWMS Drawings** – Diagrammatic drawings of the pumping and piping arrangements, electrical/electronic wiring diagrams, which should include reference to any waste streams and sampling points;
- .3 **Link to the Ballast Water Management Plan** – Information regarding the characteristics and arrangements in which the equipment is to be installed as well as the scope of the ships (sizes, types and operation) for which the equipment is intended. This information can later form the link between the equipment and the ship's Ballast Water Management Plan; and
- .4 **Environmental and Public Health Impacts** – Potential hazards for the environment should be identified and documented based on environmental studies performed to the extent necessary to assure that no harmful effects are to be expected. In the case of Ballast Water Management Systems that make use of Active Substances or Preparations containing one or more Active Substances the procedure described in the "Procedure for the Approval of Ballast Water Management Systems that make use of Active Substances" should be followed. The equipment must then ensure that dosage of the Active Substance and the maximum allowable discharge concentration are kept under the approved criteria at all times.

1.7 The documentation may include specific information relevant to the test set-up to be used for land-based testing according to these Guidelines. Such information should include the sampling needed to ensure proper functioning and any other relevant information needed to ensure proper evaluation of the efficacy and effects of the equipment. The information

provided should also address general compliance with applicable environment, health and safety standards during the Type Approval procedure.

PART 2 – TEST AND PERFORMANCE SPECIFICATIONS FOR APPROVAL OF BALLAST WATER MANAGEMENT SYSTEMS

The Administration decides the sequence of land-based and shipboard testing.

2.1 Quality Assurance and Quality Control Procedures

2.1.1 The testing body performing the tests should have implemented appropriate quality control measures in accordance with recognized international standards acceptable to the Administration.

2.1.2 The approval testing process should contain a rigorous quality control/quality assurance program, consisting of:

- .1 Both a Quality Management Plan (QMP) and a Quality Assurance Project Plan (QAPP). Guidance on preparation of these plans, along with other guidance documents and other general quality control information are available from appropriate international organizations¹.
- .2 The QMP addresses the quality control management structure and policies of the testing body (including subcontractors and outside laboratories).
- .3 The QAPP is a project specific technical document reflecting the specifics of the BWMS to be tested, the test facility, and other conditions affecting the actual design and implementation of the required experiments.

2.2 Shipboard tests

2.2.1 A shipboard test cycle includes:

- .1 the uptake of ballast water of the ship;
- .2 the storage of ballast water on the ship;
- .3 treatment of the ballast water in accordance with paragraph 2.2.2.3 by the BWMS, except in control tanks; and
- .4 the discharge of ballast water from the ship.

Success criteria for shipboard testing

2.2.2 In evaluating the performance of BWMS installation(s) on a ship or ships, the following information and results should be supplied to the satisfaction of the Administration:

¹ Such as ISO/IEC 17025.

- .1 Test plan to be provided prior to testing.
- .2 Documentation that the BWMS is of a capacity within the range of the Treatment Rated Capacity for which it is intended.
- .3 The amount of ballast water tested in the test cycle onboard should be consistent with the normal ballast operations of the ship and the BWMS should be operated at the Treatment Rated Capacity for which it is intended to be approved.
- .4 Documentation of the results of three consecutive, valid test cycles showing discharge of treated ballast water in compliance with Regulation D-2.
- .5 Valid tests are indicated by uptake water, for both the control tank and ballast water to be treated, with viable organism concentration exceeding 10 times the values of Regulation D-2.1 and control tank viable organism concentration exceeding the values of Regulation D-2.1 on discharge.
- .6 Sampling regime:
 - .1 For the control tank:
 - .1 three replicate samples of influent water, collected over the period of uptake (e.g. beginning, middle, end).
 - .2 three replicate samples of discharge control water, collected over the period of discharge (e.g. beginning, middle, end).
 - .2 For treated ballast water:
 - .1 Three replicate samples of discharge treated water collected at each of three times during the period of discharge (e.g. 3 x beginning, 3 x middle, 3 x end).
 - .3 Sample sizes are:
 - .1 For the enumeration of organisms greater than or equal to 50 micrometres or more in minimum dimension, samples of at least one cubic metre should be collected. If samples are concentrated for enumeration the samples should be concentrated using a sieve no greater than 50 micrometres mesh in diagonal dimension.
 - .2 For the enumeration of organisms greater than or equal to 10 micrometres and less than 50 micrometres in minimum dimension, samples of at least one litre should be collected. If samples are concentrated for enumeration the samples should be concentrated using a sieve no greater than 10 micrometres mesh in diagonal dimension.
 - .3 For the evaluation of bacteria a sample of at least 500 millilitres should be taken from the influent and treated water.

- .7 The test cycles including invalid and unsuccessful test cycles are to span a trial period of not less than six months.
- .8 The applicant is requested to perform three consecutive test cycles that comply with Regulation D-2 and which are valid in accordance with paragraph 2.2.2.5. Any invalid test cycle does not affect the consecutive sequence.
- .9 The source water for test cycles shall be characterized by measurement of salinity, temperature, particulate organic carbon and total suspended solids.
- .10 For system operation throughout the trial period, the following information should also be provided:
 - .1 documentation of all ballast water operations including volumes and locations of uptake and discharge, and if heavy weather was encountered and where;
 - .2 the possible reasons for the occurrence of an unsuccessful test cycle, or a test cycle discharge failing the D-2 Standard should be investigated and reported to the Administration;
 - .3 documentation of scheduled maintenance performed on the system;
 - .4 documentation of unscheduled maintenance and repair performed on the system;
 - .5 documentation of engineering parameters monitored as appropriate to the specific system;
 - .6 documentation of functioning of the control and monitoring equipment.

2.3 Land-based testing

2.3.1 The test set-up including the Ballast Water Treatment Equipment should operate as described in the provided documentation during at least 5 valid replicate test cycles. Each test cycle should take place over a period of at least 5 days.

2.3.2 A land-based test cycle should include:

- .1 the uptake of ballast water by pumping;
- .2 the storage of ballast water for at least 5 days;
- .3 treatment of ballast water within the BWMS, except in control tanks; and
- .4 the discharge of ballast water by pumping.

2.3.3 Testing should occur using different water conditions sequentially as provided for in paragraphs 2.3.16 and 2.3.17.

2.3.4 The BWMS should be tested at its rated capacity or as given in paragraphs 2.3.12 to 2.3.14 of Part 2 of the annex to these Guidelines for each test cycle. The equipment should function to specifications during this test.

2.3.5 The analysis of treated water discharge from each test cycle should be used to determine that the average of discharge samples does not exceed the concentrations of Regulation D-2 of the Convention.

Land-based testing objectives, limitations and criteria for evaluation

2.3.6 The land-based testing serves to determine the biological efficacy of the BWMS under consideration for Type Approval. The approval testing aims to ensure replicability and comparability to other treatment equipment.

2.3.7 Any limitations imposed by the Ballast Water Management System on the testing procedure described here should be duly noted and evaluated by the Administration.

Land-based set-up

2.3.8 The test set-up for approval tests should be representative of the characteristics and arrangements of the types of ships in which the equipment is intended to be installed. The test set-up should therefore include at least the following:

- .1 the complete BWMS to be tested;
- .2 piping and pumping arrangements;
- .3 the storage tank that simulates a ballast tank, constructed such that the water in the tank must be completely shielded from light.

2.3.9 The control and treated simulated ballast tanks should each include:

- .1 a minimum capacity of 200 m³;
- .2 normal internal structures, including lightening and drainage holes;
- .3 standard industry practices for design, construction and surface coatings for ships; and
- .4 the minimum modifications required for structural integrity on land.

2.3.10 The test set-up should be pressure-washed with tap water, dried and swept to remove loose debris, organisms and other matter before starting testing procedures, and between test cycles.

2.3.11 The test set-up will include facilities to allow sampling as described in paragraphs 2.3.25 and 2.3.26 and provisions to supply influents to the system, as specified in paragraph 2.3.18 and/or 2.3.19. The installation arrangements must conform in each case with those specified and approved under the procedure outlined in section 7 of the main body to these Guidelines.

Ballast Water Treatment Equipment scaling

2.3.12 In-line treatment equipment may be downsized for land-based testing, but only when the following criteria are taken into account:

- .1 equipment with a TRC equal to or smaller than 200 m³/h should not be downscaled;
- .2 equipment with a TRC larger than 200 m³/h but smaller than 1000 m³/h may be downscaled to a maximum of 1:5 scale, but may not be smaller than 200 m³/h; and
- .3 equipment with a TRC equal to, or larger than, 1000 m³/h may be downscaled to a maximum of 1:100 scale, but may not be smaller than 200 m³/h.

2.3.13 The manufacturer of the equipment should demonstrate by using mathematical modelling and/or calculations, that any downscaling will not affect the ultimate functioning and effectiveness on board a ship of the type and size for which the equipment will be certified.

2.3.14 In-tank treatment equipment should be tested on a scale that allows verification of full scale effectiveness. The suitability of the test set-up should be evaluated by the manufacturer and approved by the Administration.

2.3.15 Larger scaling may be applied and lower flow rates used than provided for in 5.1, if the manufacturer can provide evidence from full-scale shipboard testing and in accordance with 5.2 that scaling and flow rates will not adversely affect the ability of the results to predict full-scale compliance with the standard.

Land-based test design - inlet and outlet criteria

2.3.16 For any given set of test cycles (5 replicates is considered a set) a salinity range should be chosen. Given the salinity, the test water used in the test set up described above should have dissolved and particulate content in one of the following combinations:

	Salinity		
	> 32 PSU	3 – 32 PSU	< 3 PSU
Dissolved Organic Carbon (DOC)	> 1 mg/l	> 5 mg/l	> 5 mg/l
Particulate Organic Carbon (POC)	> 1 mg/l	> 5 mg/l	> 5 mg/l
Total Suspended Solids (TSS)	> 1 mg/l	> 50 mg/l	> 50 mg/l

2.3.17 At least two sets of tests cycles should be conducted, each with a different salinity range and associated dissolved and particulate content as prescribed in paragraph 2.3.12. Tests under adjacent salinity ranges in the above table should be separated by at least 10 PSU².

2.3.18 Test organisms may be either naturally occurring in the test water, or cultured species that may be added to the test water. The organism concentration should comply with paragraph 2.3.19 below.

2.3.19 The influent water should include:

- .1 test organisms of greater than or equal to 50 micrometres or more in minimum dimension should be present in a total density of preferably 10^6 but not less than 10^5 individuals per cubic metre, and should consist of at least 5 species from at least 3 different phyla/divisions;
- .2 test organisms greater than or equal to 10 micrometres and less than 50 micrometres in minimum dimension should be present in a total density of preferably 10^4 but not less than 10^3 individuals per millilitre, and should consist of at least 5 species from at least 3 different phyla/divisions;
- .3 heterotrophic bacteria should be present in a density of at least 10^4 living bacteria per millilitre; and
- .4 the variety of organisms in the test water should be documented according to the size classes mentioned above regardless if natural organism assemblages or cultured organisms were used to meet the density and organism variety requirements.

2.3.20 The following bacteria do not need to be added to the influent water, but should be measured at the influent and at the time of discharge:

- .1 Coliform;
- .2 Enterococcus group;
- .3 *Vibrio cholerae*; and
- .4 Heterotrophic bacteria.

2.3.21 If cultured test organisms are used, then it should be ensured that local applicable quarantine regulations are taken into account during culturing and discharge.

Land-based monitoring and sampling

2.3.22 Change of numbers of test organisms by treatment and during storage in the simulated ballast tank should be measured using methods described in Part 4 of the Annex, paragraphs 4.5 to 4.7.

² For example, if one set of test cycles is carried out at >32 PSU and a second set at 3-32 PSU, the test cycle in the 3-32 PSU range needs to be at least 10 PSU less than the lowest salinity used in the test cycle in the >32 PSU range.

2.3.23 It should be verified that the treatment equipment performs within its specified parameters, such as power consumption and flow rate, during the test cycle.

2.3.24 Environmental parameters such as pH, temperature, salinity, dissolved oxygen, TSS, DOC, POC and turbidity (NTU)³ should be measured at the same time that the samples described are taken.

2.3.25 Samples during the test should be taken at the following times and locations: immediately before the treatment equipment, immediately after the treatment equipment and upon discharge.

2.3.26 The control and treatment cycles may be run simultaneously or sequentially. Control samples are to be taken in the same manner as the equipment test as prescribed in paragraph 2.3.25 and upon influent and discharge. A series of examples are included in Figure 1.

2.3.27 Facilities or arrangements for sampling should be provided to ensure representative samples of treated and control water can be taken that introduce as little adverse effects as possible on the organisms.

2.3.28 Samples described in paragraphs 2.3.25 and 2.3.26 should be collected in triplicate on each occasion.

2.3.29 Separate samples should be collected for:

- .1 organisms of greater than or equal to 50 micrometres or more in minimum dimension;
- .2 organisms greater than or equal to 10 micrometres and less than 50 micrometres in minimum dimension; and
- .3 for coliform, enterococcus group, *Vibrio cholerae* and heterotrophic bacteria.

2.3.30 For the comparison of organisms of greater than or equal to 50 micrometres or more in minimum dimension against the D-2 standard, at least 20 litres of influent water and 1 cubic metre of treated water, in triplicate respectively, should be collected. If samples are concentrated for enumeration, the samples should be concentrated using a sieve no greater than 50 micrometres mesh in the diagonal dimension.

2.3.31 For the evaluation of organisms greater than or equal to 10 micrometres and less than 50 micrometres in minimum dimension, at least 1 litre of influent water and at least 10 litres of treated water must be collected. If samples are concentrated for enumeration, the samples should be concentrated using a sieve no greater than 10 micrometres mesh in the diagonal dimension.

2.3.32 For the evaluation of bacteria, at least 500 millilitres of influent and treated water should be collected in sterile bottles.

³ NTU=Nominal Turbidity Unit.

2.3.33 The samples should be analysed as soon as possible after sampling, and analyzed live within 6 hours or treated in such a way so as to ensure that proper analysis can be performed.

2.3.34 The efficacy of a proposed system should be tested by means of standard scientific methodology in the form of controlled experimentation, i.e. “experiments”. Specifically, the effect of the BWMS on organism concentration in ballast water should be tested by comparing treated ballast water, i.e. “treated groups”, to untreated “control groups”, such that:

- .1 one experiment should consist of a comparison between control water and treated water. Multiple samples, but at a minimum of three, of control and treated water within a single test cycle should be taken to obtain a good statistical estimate of the conditions within the water during that experiment. Multiple samples taken during a single test cycle should not be treated as independent measures in the statistical evaluation of treatment effect, to avoid “pseudo-replication”.

2.3.35 If in any test cycle the average discharge results from the control water is a concentration less than or equal to 10 times the values in Regulation D-2.1, the test cycle is invalid.

2.3.36 Statistical analysis of BWMS performance should consist of t-tests, or similar statistical tests, comparing control and treated water. The comparison between control and treated water will provide a test of unexpected mortality in the control water, indicating the effect of an uncontrolled source of mortality in the testing arrangement.

2.4 Reporting of test results

2.4.1 After approval tests have been completed, a report should be submitted to the Administration. This report should include information regarding the test design, methods of analysis and the results of these analyses.

2.4.2 The results of biological efficacy testing of the BWMS should be accepted if it is shown that the system has met the standard in Regulation D-2 in all test cycles as specified in paragraph 4.7 under land-based testing and shipboard testing as specified in section 2.2 of this Annex.

PART 3 — SPECIFICATION FOR ENVIRONMENTAL TESTING FOR APPROVAL OF BALLAST WATER MANAGEMENT SYSTEMS

Test specifications

3.1 The electrical and electronic sections of BWMS in the standard production configuration should be subjected to the programme of environmental tests set out in this specification at a laboratory approved for the purpose by the Administration or by the competent authority of the manufacturer’s home country.

3.2 Evidence of successful compliance with the environmental tests below should be submitted to the Administration by the manufacturer together with the application for type approval.

Test specification details

3.3 Equipment should operate satisfactorily on completion of each of the operating environment tests listed below.

Vibration tests

3.4 A resonance search should be made over the following ranges of oscillation frequency and amplitude:

- .1 2 to 13.3 Hz with a vibration amplitude of 1 mm; and
- .2 13.2 to 80 Hz with an acceleration amplitude of 0.7 g.

This search should be made in each of the three orthogonal planes at a rate sufficiently low to permit resonance detection.

3.5 The equipment should be vibrated in the above mentioned planes at each major resonant frequency for a period of two hours.

3.6 In the absence of any resonant frequency, the equipment should be vibrated in each of the planes at 30 Hz with an acceleration of 0.7 g for a period of two hours.

3.7 After completion of the tests specified in paragraph 3.5 or 3.6 a search should again be made for resonance and there should be no significant change in the vibration pattern.

Temperature tests

3.8 Equipment that may be installed in exposed areas on the open deck, or in an enclosed space not environmentally controlled should be subjected, for a period of not less than two hours, to:

- .1 a low temperature test at -25°C ; and
- .2 a high temperature test at 55°C .

3.9 Equipment that may be installed in an enclosed space that is environmentally controlled including an engine-room, should be subjected, for a period of not less than two hours, to:

- .1 a low temperature test at 0°C ; and
- .2 a high temperature test at 55°C .

3.10 At the end of each of the tests referred to in the subparagraphs above, the equipment should be switched on and it should function normally under the test conditions.

Humidity tests

3.11 Equipment should be left switched off for a period of two hours at a temperature of 55°C in an atmosphere with a relative humidity of 90%. At the end of this period, the

equipment should be switched on and should operate satisfactorily for one hour under the test conditions.

Tests for protection against heavy seas

3.12 Equipment that may be installed in exposed areas on the open deck should be subjected to tests for protection against heavy seas in accordance with 1P 56 of publication IEC 529 or its equivalent.

Fluctuation in power supply

3.13 Equipment should operate satisfactorily with:

- .1 a voltage variation of +/- 10% together with a simultaneous frequency variation of +/- 5%; and
- .2 a transient voltage of +/- 20% together with a simultaneous frequency transient of +/- 10%, with a transient recovery time of three seconds.

Inclination test

3.14 The BWMS should be designed to operate when the ship is upright and when inclined at any angle of list up to and including 15° either way under static conditions and 22.5° under dynamic conditions (rolling) either way and simultaneously inclined dynamically (pitching) 7.5° by bow or stern. The Administration may permit deviation from these angles, taking into consideration the type, size and service conditions of the ship and operational functioning of the equipment. Any deviation permitted is to be documented in the Type Approval Certificate.

Reliability of electrical and electronic equipment

3.15 The electrical and electronic components of the equipment should be of a quality guaranteed by the manufacturer and suitable for their intended purpose.

PART 4 – SAMPLE ANALYSIS METHODS FOR THE DETERMINATION OF BIOLOGICAL CONSTITUENTS IN BALLAST WATER

Sample processing and analysis

4.1 Samples taken during testing of BWMS are likely to contain a wide taxonomic diversity of organisms, varying greatly in size and susceptibilities to damage from sampling and analysis.

4.2 When available, widely accepted standard methods for the collection, handling (including concentration), storage, and analysis of samples should be used. These methods should be clearly cited and described in test plans and reports. This includes methods for detecting, enumerating, and identifying organisms and for determining viability (as defined in these Guidelines).

4.3 When standard methods are not available for particular organisms or taxonomic groups, methods that are developed for use should be described in detail in test plans and reports. The

descriptive documentation should include any experiments needed to validate the use of the methods.

4.4 Given the complexity in samples of natural and treated water, the required rarity of organisms in treated samples under Regulation D-2, and the expense and time requirements of current standard methods, it is likely that several new approaches will be developed for the analyses of the composition, concentration, and viability of organisms in samples of ballast water. Administrations/Parties are encouraged to share information concerning methods for the analysis of ballast water samples, using existing scientific venues, and papers distributed through the Organization.

Sample analysis

4.5 Sample analysis is meant to determine the species composition and the number of viable organisms in the sample. Different samples may be taken for determination of viability and for species composition.

4.6 Viability of an organism can be determined through live/dead judgement by appropriate methods including, but not limited to: morphological change, mobility, staining using vital dyes or molecular techniques.

4.7 A treatment test cycle should be deemed successful if:

- .1 it is valid in accordance with paragraph 2.2.2.5 or 2.3.35 as appropriate;
- .2 the average density of organisms greater than or equal to 50 micrometres in minimum diameter in the replicate samples is less than 10 viable organisms per cubic metre;
- .3 the average density of organisms less than 50 micrometres and greater than or equal to 10 micrometres in minimum diameter in the replicate samples is less than 10 viable organisms per millilitre;
- .4 the average density of *Vibrio cholerae* (serotypes O1 and O139) is less than 1 cfu per 100 millilitres, or less than 1 cfu per 1 gramme (wet weight) zooplankton samples;
- .5 the average density of *E. coli* in the replicate samples is less than 250 cfu per 100 millilitres; and
- .6 the average density of intestinal Enterococci in the replicate samples is less than 100 cfu per 100 millilitres.

4.8 It is recommended that a non-exhaustive list of standard methods and innovative research techniques be considered⁴.

⁴ Suggested sources may include but not be limited to:

- .1 The Handbook of Standard Methods For the Analysis of Water and Waste Water
- .2 ISO standard methods
- .3 UNESCO standard methods
- .4 World Health Organization
- .5 American Society of Testing and Materials (ASTM) standard methods
- .6 U.S. EPA standard methods
- .7 Research papers published in peer-reviewed scientific journals
- .8 MEPC papers.

APPENDIX

BADGE OR CIPHER

NAME OF ADMINISTRATION

TYPE APPROVAL CERTIFICATE OF BALLAST WATER MANAGEMENT SYSTEM

This is to certify that the Ballast Water Management System listed below has been examined and tested in accordance with the requirements of the specifications contained in the Guidelines contained in IMO resolution MEPC...(..). This certificate is valid only for the Ballast Water Management System referred to below.

Ballast Water Management System supplied by

Under type and model designation
and incorporating:

Ballast Water Management System manufactured by

to equipment/assembly drawing No. date

Other equipment manufactured by

to equipment/assembly drawing No. date

Treatment Rated Capacity m³/h

A copy of this Type Approval Certificate, should be carried on board a vessel fitted with this Ballast Water Management System at all times. A reference to the test protocol and a copy of the test results should be available for inspection on board the vessel. If the Type Approval Certificate is issued based on approval by another Administration, reference to that Type Approval Certificate shall be made.

Limiting Conditions imposed are described in the appendix to this document.

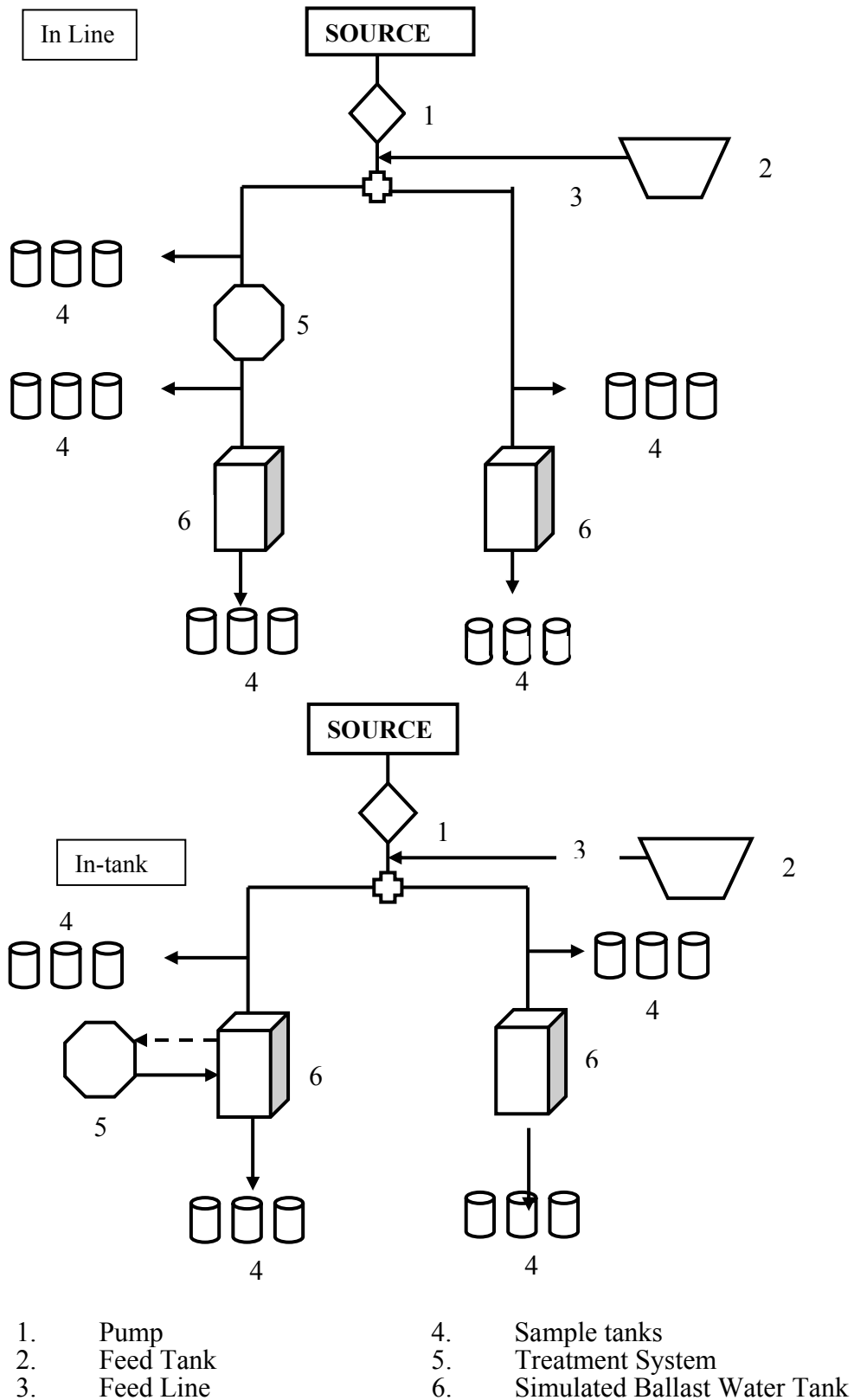
Official stamp Signed

Administration of

Dated this day of 20.....

Enc. Copy of the original test results.

Figure 1 Diagrammatic arrangement of possible land-based tests



ANNEX 4

RESOLUTION MEPC.126(53)

Adopted on 22 July 2005

**PROCEDURE FOR APPROVAL OF BALLAST WATER MANAGEMENT SYSTEMS
THAT MAKE USE OF ACTIVE SUBSTANCES (G9)**

THE MARINE ENVIRONMENT PROTECTION COMMITTEE,

RECALLING Article 38(a) of the Convention on the International Maritime Organization concerning the functions of the Marine Environment Protection Committee conferred upon it by the international conventions for the prevention and control of marine pollution,

RECALLING ALSO that the International Conference on Ballast Water Management for Ships held in February 2004 adopted the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004 (the Ballast Water Management Convention) together with four Conference resolutions,

NOTING that Regulation A-2 of the Ballast Water Management Convention requires that discharge of ballast water shall only be conducted through Ballast Water Management in accordance with the provisions of the Annex to the Convention,

NOTING FURTHER that Regulation D-3.2 of the Annex to the Ballast Water Management Convention provides that Ballast Water Management systems that make use of Active Substances or Preparations containing one or more Active Substances used to comply with this Convention, shall be approved by the Organization based on a Procedure developed by the Organization,

NOTING ALSO that resolution 1 adopted by the International Conference on Ballast Water Management for Ships invited the Organization to develop this Procedure as a matter of urgency,

HAVING CONSIDERED, at its fifty-third session, the draft Procedure for Approval of Ballast Water Management systems that make use of Active Substances developed by the Ballast Water Working Group,

1. ADOPTS the Procedure for approval of Ballast Water Management Systems that make use of Active Substances, as set out in the Annex to this resolution;
2. INVITES Governments to apply the Procedure as soon as possible, or when the Convention becomes applicable to them; and
3. AGREES to keep the Procedure under review.

ANNEX

**PROCEDURE FOR APPROVAL OF BALLAST WATER MANAGEMENT SYSTEMS
THAT MAKE USE OF ACTIVE SUBSTANCES (G9)**

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PROCEDURE FOR APPROVAL OF BALLAST WATER MANAGEMENT SYSTEMS THAT MAKE USE OF ACTIVE SUBSTANCES (G9)

1 INTRODUCTION

1.1 This procedure describes the approval and withdrawal of approval of Ballast Water Management systems that make use of Active Substances to comply with the Convention and their manner of application as set out in Regulation D-3 of the “International Convention for the Control and Management of Ships’ Ballast Water and Sediments”. The Convention requires that at withdrawal of approval, the use of the relevant Active Substance or Substances shall be prohibited within 1 year after the date of such withdrawal.

1.2 To comply with the Convention, Ballast Water Management systems that make use of Active Substances or Preparations containing one or more Active Substances shall be approved by the Organization, based on a procedure developed by the Organization.

1.3 The objective of this procedure is to determine the acceptability of Active Substances and Preparations containing one or more Active Substances and their application in Ballast Water Management systems concerning ship safety, human health and the aquatic environment. This procedure is provided as a safeguard for the sustainable use of Active Substances and Preparations.

1.4 This procedure is not intended for the evaluation of the efficacy of Active Substances. The efficacy of Ballast Water Management systems that make use of Active Substances should be evaluated in accordance with the “Guidelines for Approval of Ballast Water Management Systems”.

1.5 The goal of the procedure is to ensure proper application of the provisions contained in the Convention and the safeguards required by it. As such the procedure is to be updated as the state of knowledge and technology may require. New versions of the procedure will be circulated by the Organization following their approval.

2 DEFINITIONS

2.1 For the purposes of this procedure, the definitions in the Convention apply and:

- .1 “Active Substance” means a substance or organism, including a virus or a fungus that has a general or specific action on or against Harmful Aquatic Organisms and Pathogens.
- .2 “Ballast Water Discharge” means the ballast water as would be discharged overboard.
- .3 “Preparation” means any commercial formulation containing one or more Active Substances including any additives. This term also includes any Active Substances generated onboard for purposes of Ballast Water Management and any relevant chemicals formed in the Ballast Water Management system that make use of Active Substances to comply with the Convention.

- .4 “Relevant Chemicals” means transformation or reaction products that are produced during the treatment process or in the receiving environment and may be of concern to the aquatic environment and human health when discharged.

3 PRINCIPLES

3.1 Active Substances and Preparations may be added to the ballast water or be generated on board ships by technology within the Ballast Water Management system using an Active Substance to comply with the Convention.

3.2 Active Substances and Preparations accomplish their intended purpose through action on Harmful Aquatic Organisms and Pathogens in ships’ ballast water and sediments. However, if the ballast water is still toxic at the time of discharge into the environment, the organisms in the receiving water may suffer unacceptable harm. Both the Active Substance or Preparation as well as the Ballast Water Discharge should be subjected to toxicity testing in order to protect the receiving environment or human health from toxic effects due to the discharges. Toxicity testing is needed to determine if an Active Substance or Preparation can be used and under which conditions the potential of harming the receiving environment or human health is acceptably low.

3.3 Ballast Water Management systems that make use of Active Substances and Preparations must be safe in terms of the ship, its equipment and the personnel to comply with the Convention.

3.4 The approval of Active Substances and Preparations using viruses or fungi for use in Ballast Water Management Systems is not addressed in this procedure. The approval of such substances for Ballast Water Management should require an additional consideration by the Organization in compliance with Regulation D-3 of the Convention if the use of such substances is proposed.

4 GENERAL REQUIREMENTS

4.1 Identification

4.1.1 The proposal for approval of an Active Substance or a Preparation should include a chemical identification and description of the chemical components even if generated onboard. A chemical identification should be provided for any Relevant Chemicals.

4.2 Data-set for Active Substances and Preparations

4.2.1 A proposal for approval should include information on the properties or actions of the Preparation including any of its components as follows:

- .1 Data on effects on aquatic plants, invertebrates, fish, and other biota, including sensitive and representative organisms:
- acute aquatic toxicity;
 - chronic aquatic toxicity;
 - endocrine disruption;

- sediment toxicity;
- bioavailability/biomagnification/bioconcentration; and
- food web/population effects.

.2 Data on mammalian toxicity:

- acute toxicity;
- effects on skin and eye;
- chronic and long-term toxicity;
- developmental and reproductive toxicity;
- carcinogenicity; and
- mutagenicity.

.3 Data on environmental fate and effect under aerobic and anaerobic conditions:

- modes of degradation (biotic; abiotic);
- bioaccumulation, partition coefficient, octanol/water coefficient;
- persistence and identification of the main metabolites in the relevant media (ballast water, marine and fresh waters);
- reaction with organic matter;
- potential physical effects on wildlife & benthic habitats;
- potential residues in seafood; and
- any known interactive effects.

.4 Physical and chemical properties for the Active Substances and Preparations and the treated ballast water, if applicable:

- melting point;
- boiling point;
- flammability;
- density (relative density);
- vapour pressure, vapour density;
- water solubility / dissociation constant (pKa);
- oxidation/reduction potential;
- corrosivity to the materials or equipment of normal ship construction;
- autoignition temperature; and
- other known relevant physical or chemical hazards.

.5 Analytical methods at environmentally relevant concentrations.

4.2.2 A proposal for approval should include the above data set either for the Preparation or for each component separately, and a list of the name and relative quantities (in volumetric percentages) of the components should be also attached. As described in section 8.1, all proprietary data should be treated as confidential.

4.2.3 The tests for Active Substances and Preparations should be carried out in accordance with internationally recognized guidelines⁵.

4.2.4 The testing process should contain a rigorous quality control/quality assurance programme consisting of:

- .1 Both a Quality Management Plan (QMP) and a Quality Assurance Project Plan (QAPP). Guidance on preparation of these plans, along with other guidance documents and other general quality control information are available for download from the International Organization for Standardization (ISO) (www.iso.org).
- .2 The QMP addresses the quality control management structure and policies of the Test Organization (including subcontractors and outside laboratories).
- .3 The QAPP is a project specific technical document reflecting the specifics of the system to be tested, the test facility, and other conditions affecting the actual design and implementation of the required experiments.

4.2.5 Dossiers already used for registration of chemicals can be submitted by the applicant to satisfy the required data needed for the evaluation of Active Substances and Preparations according to this procedure.

4.2.6 The proposal should describe the manner of application of the Preparation for Ballast Water Management, including required dosage and retention time.

4.2.7 A proposal for approval should include (Material) Safety Data Sheets ((M)SDS).

4.3 Assessment report

4.3.1 A proposal for approval should include an assessment report. The assessment report should address the quality of the test reports, the risk characterization and a consideration of the uncertainty associated with the assessment.

5 RISK CHARACTERIZATION

5.1 Screening for persistency, bioaccumulation and toxicity

5.1.1 An assessment on the intrinsic properties of the Active Substance and/or Preparation such as persistency, bioaccumulation and toxicity should be conducted (see Table 1 in section 6).

- .1 Persistence tests:
Persistence should preferably be assessed in simulation test systems that determine the half-life under relevant conditions. Biodegradation screening tests may be used to show that the substances are readily biodegradable. The determination of the half-life should include assessment of relevant chemicals.

⁵ Preferably Organization for Economic Cooperation and Development (OECD) Guidelines for Testing of Chemicals (1993) or other equivalent tests.

- .2 Bioaccumulation tests:
The assessment of the (potential for) bioaccumulation should use measured bioconcentration factors in marine (or freshwater) organisms. Where these tests are not applicable, or if $\log P_{ow} < 3$, Bio Concentration Factor (BCF) values may be estimated using (Quantitative) Structure-Activity Relationship ((Q)SAR) models.
- .3 Toxicity tests:
Acute and/or chronic ecotoxicity data, ideally covering the sensitive life stages, should in principle be used for the assessment of the toxicity criterion.

5.2 Toxicity testing of the treated Ballast Water

5.2.1 Toxicity testing is necessary for the Active Substance, or Preparations (see sections 4.2.1 and 5.3) and the treated Ballast Water Discharge as covered in this section. The advantage of conducting toxicity testing on the Ballast Water Discharge is that it integrates and addresses the potential for interactions of the Active Substances and Preparations with the possible by-products.

- .1 For the basic approval process, the discharge testing should be performed in a laboratory using techniques and equipment to simulate Ballast Water Discharge following treatment by the Preparation.
- .2 For final approval, the discharge testing should be performed as part of the land-based type approval process using the treated ballast water discharge.

5.2.2 The applicant should provide both acute and chronic toxicity test data using standardized test procedures to determine the toxicity of the Preparation and Relevant Chemicals as used in conjunction with the Ballast Water Management System. This testing approach should be performed on the treated Ballast Water Discharge, as the Ballast Water Management system could either mitigate or enhance the adverse effects of the Preparation or Relevant Chemicals.

5.2.3 The discharge toxicity tests should be conducted on samples drawn from the land-based test set-up, which would be representative of the discharge from the Ballast Water Management system.

5.2.4 These toxicity tests should include chronic test methods with multiple test species (a fish, an invertebrate and a plant) that address the sensitive life-stage. The preference is to include both a sub-lethal endpoint (growth) and a survival endpoint. Either freshwater or marine test methods should be tested⁶.

5.2.5 The test results to be provided include: acute 24-hour, 48-hour, 72-hour, and 96-hour Lethal Concentration at which x % of the test organisms die (LCx), No Observed Adverse Effect Concentrations (NOAECs), chronic No Observed Effect Concentration (NOEC) and/or Effect Concentration at which x % of test organisms show effect (ECx), as appropriate based on the experimental design.

⁶ Currently there is no compelling physiological or empirical proof that marine organisms are more sensitive than freshwater organisms or vice versa. Should this however be demonstrated for the substance under consideration, this should be taken into account.

5.2.6 A dilution series including a 100% ballast water discharge would be tested to determine the no adverse effect level using the statistical endpoints (NOEC or ECx). An initial analysis could use a conservative approach where the dilution capacity would not be taken into consideration (no modelling or plumes analysis would be used). The rationale for taking a conservative approach is that there could be multiple discharges into one location (even though this is not necessarily the case).

5.2.7 The acute and chronic toxicity test data in conjunction with the information in Section 4.2.1 should be used to determine the holding time necessary to achieve the no adverse effect concentration upon discharge. Knowing the half-life (days), decay rate, dosage rate, volume of system and toxicity tests with time series, then a computational model can be used to determine the amount of time needed to hold the treated ballast water before discharge.

5.3 Risk characterization and analysis

5.3.1 For the basic approval process, fate and effect testing should be performed in the laboratory with Active Substances and Preparations. This section lists information that could be useful for a preliminary risk characterization.

5.3.2 Both the Active Substance or Preparation as well as the treated Ballast Water Discharge should be subject to toxicity testing in order to protect the receiving environment from toxic effects due to discharges.

5.3.3 The reaction with organic matter of Active Substances and Preparations that produce free radicals, should be addressed qualitatively so as to identify products of concern to the environment.

5.3.4 The rate of abiotic and biotic degradation of the Active Substances and Preparations under aerobic and anaerobic conditions should be assessed, resulting in the identification of relevant metabolites in the relevant media (ballast water, marine and fresh waters).

5.3.5 The rate of abiotic and biotic degradation of the Active Substances and Preparations under aerobic and anaerobic conditions should be assessed, resulting in the characterization of the persistence of the Active Substances, Preparations and Relevant Chemicals in terms of degradation rates under specified conditions (e.g. pH, redox, temperature).

5.3.6 The partition coefficients (solids-water partition coefficient (K_d) and/or organic carbon normalized distribution coefficient (K_{oc})) of the Active Substances, Preparations and Relevant Chemicals should be determined.

5.3.7 For Active Substances and Preparations, the potential for bioaccumulation should be assessed in marine or freshwater organisms (fish or bivalves) if the logarithm octanol/water partition coefficient (logP_{ow}) is >3.

5.3.8 Based on the information on fate and behavior of Active Substances and Preparations, the discharge concentrations at selected time intervals should be predicted.

5.3.9 The effect assessment of the Active Substances, Preparations and Relevant Chemicals is initially based on a dataset of acute and/or chronic ecotoxicity data for aquatic organisms, being primary producers (algae or sea grasses), consumers (crustaceans), predators (fish), and should

include secondary poisoning to mammalian and avian top-predators, as well as data for sediment species.

5.3.10 An assessment of secondary poisoning is redundant if the substance of concern demonstrates a lack of bioaccumulation potential (e.g., BCF <500 L/kg wet weight for the whole organism at 6% fat).

5.3.11 An assessment of sediment species is redundant if the potential of the substance of concern to partition into the sediment is low (e.g., K_{oc} <500 L/kg).

5.3.12 The effect assessment of the Active Substances, Preparations and Relevant Chemicals should include a screening on carcinogenic, mutagenic and endocrine disruptive properties. If the screening results give rise to concerns, this should give rise to a further effect assessment.

5.3.13 The effect assessment of the Active Substances, Preparations and Relevant Chemicals, taking the indicated information into account, should be based on internationally recognized guidance⁷.

5.3.14 The results of the effect assessment are compared to the results of the discharge toxicity testing. Any unpredicted results (e.g., lack of toxicity or unexpected toxicity in the discharge assessment) should give rise to a further elaboration on the effect assessment.

5.3.15 An analytical method suitable for monitoring Active Substances and Preparations in ballast water discharges should be available.

6 EVALUATION CRITERIA

The Organization should evaluate the application for approval based on the criteria in this section.

6.1 The information that has been provided should be complete, of sufficient quality and in accordance with this procedure.

6.2 That this information does not indicate possible unacceptable adverse effects to environment, human health, property or resources.

6.3 Ship and personnel safety

6.3.1 In order to protect the ship and personnel safety the technical group should evaluate the physical and chemical hazards (see paragraph 4.2.1.4) to ensure that potential hazardous properties of the Active Substances, Preparations or Relevant Chemicals formed in the treated ballast water should not create any unreasonable risk to the ship and personnel. Proposed procedures for the use and technical equipment introduced needs to be taken into account.

6.3.2 For the protection of personnel involved in the handling and storage of the Active Substances and Preparations, the proposal should include relevant ((M)SDS). The Organization should evaluate (M)SDS, mammalian toxicity data and chemical properties hazards (see paragraphs 4.2.1.2 and 4.2.1.4) and ensure that potential hazardous properties of the Active

⁷ Such as relevant OECD guidelines or equivalent.

Substances, Preparations or Relevant Chemicals should not create any unreasonable risk to the ship or personnel. This evaluation should take into account the different circumstances that a ship or personnel may face in its trade (e.g., ice, tropical, humidity, etc.).

6.4 Environmental protection

6.4.1 In order to approve the application, the Organization should determine that the Active Substances, Preparations or Relevant Chemicals are not Persistent, Bioaccumulative and Toxic (PBT). Preparations that exceed all these criteria (Persistence, Bioaccumulation and Toxicity) in the table below are considered PBT.

Table 1 Criteria for identification of PBT substances

Criterion	PBT criteria
Persistence	Half-life: > 60 days in marine water, or > 40 days in freshwater*, or > 180 days in marine sediment, or > 120 days in freshwater sediment*
Bioaccumulation	BCF > 2,000 or $\text{LogP}_{\text{octanol/water}} \geq 3$
Toxicity	Chronic NOEC < 0.01 mg/l

* For the purpose of marine environmental risk assessment half-life data in freshwater and freshwater sediment can be overruled by data obtained under marine conditions.

6.4.2 The Organization should determine the overall acceptability of the risk the Preparation may pose in its use for Ballast Water Management. It should do so by comparing the information provided and the undertaken assessment of PBT and the discharge with scientific knowledge of the Active Substances, Preparations and Relevant Chemicals concerned. The risk evaluation should qualitatively take into account cumulative effects that may occur due to the nature of shipping and port operations.

6.4.3 The risk evaluation should consider the uncertainties involved in the application for approval, and as appropriate, provide advice on how these uncertainties can be dealt with.

7 REGULATION OF THE USE OF ACTIVE SUBSTANCES AND PREPARATIONS

7.1 Handling of Active Substances and Preparations

7.1.1 The proposal for approval of Active Substances and Preparations should include information on their intended use and application. The quantity of Active Substances and Preparations to be added to the ballast water and the maximum allowable concentration of the Active Substances therein should be described in the instructions provided by the manufacturer. The system should ensure that the maximum dosage and maximum allowable discharge concentration are not exceeded at any time.

7.2 Hazard documentation and labelling

7.2.1 The proposal should include ((M)SDS) as required. The (M)SDS should describe appropriate storage and handling together with the effects of degradation and chemical reactivity during storage and should be included in the instructions provided by the manufacturer.

7.2.2 Documentation of hazards or the (M)SDS should conform to the UN Globally Harmonized System of Classification and Labelling of Chemicals (GHS) and the relevant IMO regulations (e.g. the IMDG Code) and guidelines (e.g. the GESAMP Hazard Evaluation Procedure). Where these regimes are not applicable, relevant national or regional regimes should be followed.

7.3 Procedures and use

7.3.1 Detailed procedures and information for safe application of Active Substances and Preparations on board should be supplied and comply with the approval conditions such as maximum allowable concentration and maximum discharge concentration, if any.

8 APPROVAL

8.1 Basic approval

8.1.1 All proprietary data should be treated as confidential by the Organization and its Technical Group, the Competent Authorities involved, and the evaluating regulatory scientists, if any.

8.1.2 Procedure to be followed:

- .1 The manufacturer should evaluate the Active Substances or Preparations and the potential discharge in accordance with the approval criteria specified in this procedure.
- .2 Upon completion, the manufacturer should prepare an Application on the Active Substances and Preparations and submit it to the Member of the Organization concerned.
- .3 The Administration having received a satisfactory application should as soon as possible propose an approval to the Organization.
- .4 Members of the Organization may propose an approval.
- .5 The Organization should announce and set the time frame for the evaluation of Active Substances and Preparations.
- .6 Parties, Members of the Organization, the United Nations and its Specialized Agencies, intergovernmental organizations having agreements with the Organization and non-governmental organizations in consultative status with the Organization may submit information that is relevant to the evaluation.

- .7 The Organization should establish a Technical Group in accordance with its rules of procedure ensuring that proprietary data should be treated as confidential.
- .8 The Technical Group should review the comprehensive proposal along with any additional data submitted and report to the Organization whether the proposal has demonstrated a potential for unreasonable risk for environment, human health, property or resources in accordance with the criteria specified in this procedure.
- .9 The Technical Group's report should be in written form and circulated to the Parties, Members of the Organization, the United Nations and its Specialized Agencies, intergovernmental organizations having agreements with the Organization and non-governmental organizations in consultative status with the Organization, prior to its consideration by the competent Committee.
- .10 The Committee of the Organization should decide whether to approve any proposal, introduce any modifications thereto, if appropriate, taking into account the Technical Group's report.
- .11 The Member of the Organization that submitted the application to the Organization should inform in writing the applicant about the decision made with regard to the respective Active Substance or Preparation and their manner of application.
- .12 Active Substances or Preparations receiving basic approval by the Organization may be used for prototype or type approval testing based on the guidelines developed by the Organization⁸. An Active Substance or Preparation may be used for Prototype or Type Approval testing for the approval of different BWMS without going through basic approval again.

8.2 Final approval

8.2.1 In accordance with Regulation D-3.2, a Ballast Water Management system using an Active Substance or Preparation to comply with the Convention (which received basic approval) must be approved by the Organization. For this purpose, the Member of the Organization submitting an application should conduct the Type Approval tests in accordance with Guidelines for Approval of Ballast Water Management Systems. The results should be conveyed to the Organization for confirmation that the residual toxicity of the discharge conforms to the evaluation undertaken for Basic Approval. This would result in Final Approval of the Ballast Water Management system in accordance with Regulation D-3.2. Active Substances or Preparations that have received Basic Approval by the Organization may be used for evaluation of Ballast Water Management systems using Active Substances or Preparations for Final Approval.

⁸ Guidelines for approval of prototype ballast water treatment technologies and Guidelines for approval of Ballast Water Management Systems.

8.3 Notification of approval

8.3.1 The Organization will record the Basic and Final Approval of Active Substances and Preparations and Ballast Water Management systems that make use of Active Substances and circulate the list once a year including the following information:

- Name of Ballast Water Management system that make use of Active Substances and Preparations;
- Date of approval;
- Name of manufacturer; and
- Any other specifications, if necessary.

8.4 Modification

8.4.1 Manufacturers should report any modifications in names, including trade and technical name, composition or use of the Active Substances and Preparations in the Ballast Water Management systems approved by the Organization, to the Member of the Organization. The Member of the Organization should inform the Organization accordingly.

8.4.2 Manufacturers intending to significantly change any part of a Ballast Water Management System that has been approved by the Organization or the Active Substances and Preparations used in it should submit a new application.

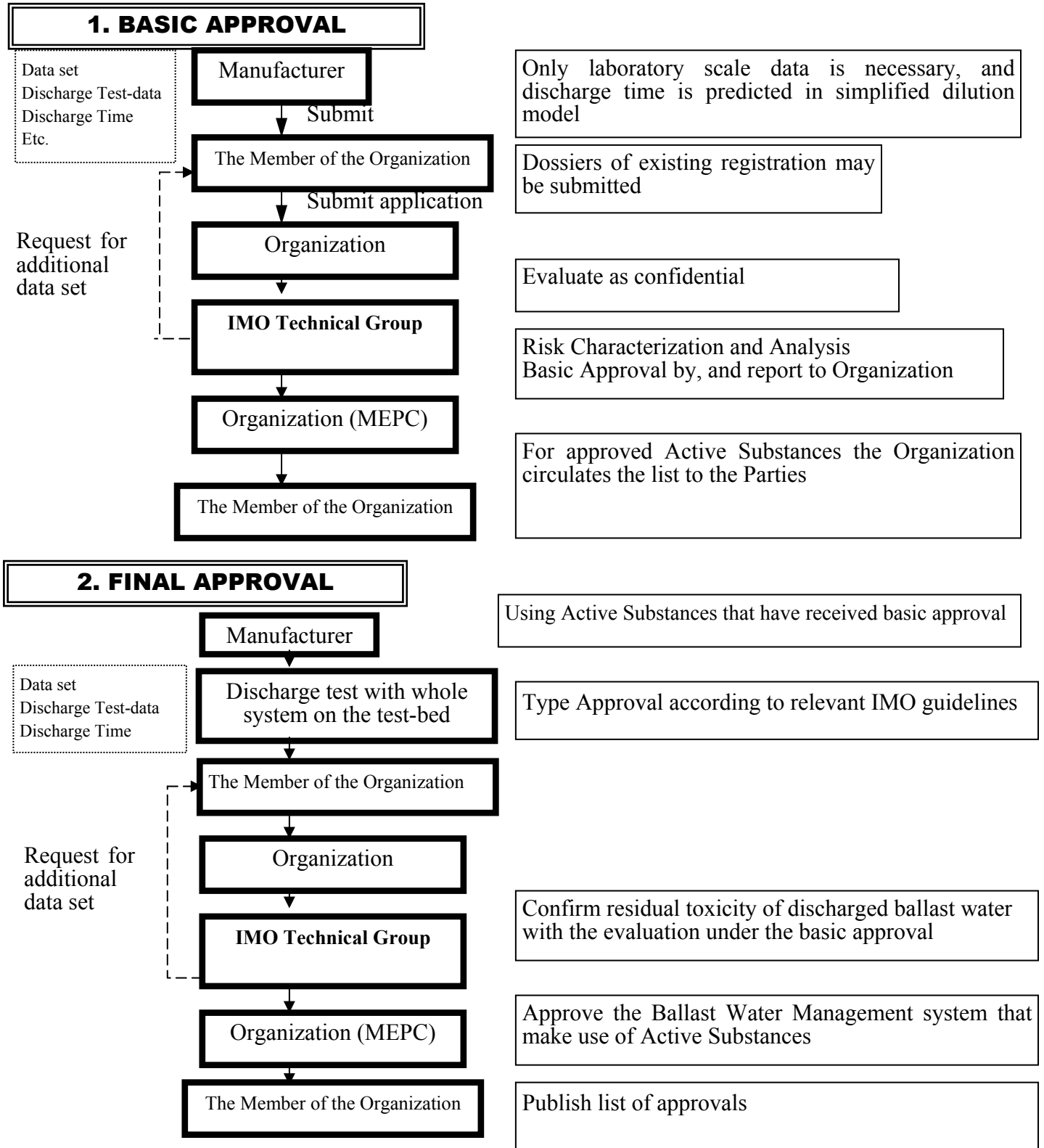
8.5 Withdrawal of approval

8.5.1 The Organization may withdraw any approval in the following circumstances:

- .1 If the Active Substances and Preparations or Ballast Water Management system that make use of Active Substances no longer conforms to requirements due to amendments of the Convention.
- .2 If any data or test records differ materially from data relied upon at the time of approval and are deemed not to satisfy the approval condition.
- .3 If a request for withdrawal of approval is made by the Member of the Organization on behalf of the manufacturer.
- .4 If unreasonable harm to environment, human health, property or resources is demonstrated by any Member of the Organization or observer to have been caused by the approved Ballast Water Management system that make use of Active Substances or Preparations.

Appendix

Approval Scheme for Active Substance or Preparation and Ballast Water Management systems that make use of Active Substances



ANNEX 5

RESOLUTION MEPC.127(53)

Adopted on 22 July 2005

**GUIDELINES FOR BALLAST WATER MANAGEMENT AND DEVELOPMENT
OF BALLAST WATER MANAGEMENT PLANS (G4)**

THE MARINE ENVIRONMENT PROTECTION COMMITTEE,

RECALLING Article 38(a) of the Convention on the International Maritime Organization concerning the functions of the Marine Environment Protection Committee conferred upon it by the international conventions for the prevention and control of marine pollution,

RECALLING ALSO that the International Conference on Ballast Water Management for Ships held in February 2004 adopted the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004 (the Ballast Water Management Convention) together with four Conference resolutions,

NOTING that Regulation A-2 of the Ballast Water Management Convention requires that discharge of ballast water shall only be conducted through Ballast Water Management in accordance with the provisions of the Annex to the Convention,

NOTING FURTHER that Regulation B-1 of the Annex to the Ballast Water Management Convention provides that each ship shall have on board and implement a ballast water management plan approved by the Administration, taking into account Guidelines developed by the Organization,

NOTING ALSO that resolution 1 adopted by the International Conference on Ballast Water Management for Ships invites the Organization to develop these Guidelines as a matter of urgency,

HAVING CONSIDERED the draft Guidelines for ballast water management and development of ballast water management plans developed by the Ballast Water Working Group and the recommendation made by the Sub-Committee on Bulk Liquids and Gases at its ninth session,

1. ADOPTS the Guidelines for ballast water management and development of ballast water management plans, as set out in the Annex to this resolution;
2. INVITES Governments to apply the Guidelines as soon as possible, or when the Convention becomes applicable to them; and
3. AGREES to keep the Guidelines under review.

ANNEX

DRAFT GUIDELINES FOR BALLAST WATER MANAGEMENT AND THE DEVELOPMENT OF BALLAST WATER MANAGEMENT PLANS (G4)

1 INTRODUCTION

1.1 Ballast water is essential to control trim, list, draught, stability, or stresses of the ship. However, ballast water may contain aquatic organisms or pathogens which, if introduced into the sea including estuaries, or into fresh water courses, may create hazards to the environment, human health, property or resources, impair biological diversity or interfere with other legitimate uses of such areas.

1.2 The selection of appropriate methods of ballast water management should take into account the need ensure that Ballast Water Management practices used to comply with this Convention do not cause greater harm than they prevent to the environment, human health, property or resources of any States and the safety of ships.

1.3 The objectives of these Guidelines are to assist Governments, appropriate authorities, ships masters, operators and owners, and port authorities, as well as other interested parties, in preventing, minimizing and ultimately eliminating the risk of introducing harmful aquatic organisms and pathogens from ships' ballast water and associated sediments while protecting ships' safety in applying the International Convention for the Control and Management of Ships' Ballast Water and Sediments (hereinafter referred to as the "Convention").

1.4 These guidelines consist of two parts:

Part A – "Guidelines for Ballast Water Management", which contains guidance on the general principles of Ballast Water Management; and

Part B – "Guidelines for the development of Ballast Water Management Plans", which contains guidance on the structure and content of Ballast Water Management Plans required by Regulation B-1 of the Convention.

2 DEFINITIONS

2.1 For the purposes of these Guidelines, the definitions in the Convention apply.

2.2 Ballast Water Tank means any tank, hold, or space used for the carriage of ballast water.

3 APPLICATION

3.1 The Guidelines apply to all ships and to Flag Administrations, port States, coastal States, ship owners, ship operators, ships' personnel involved in Ballast Water Management, ship designers, ship builders, classification societies as well as other interested parties.

PART A – GUIDELINES FOR BALLAST WATER MANAGEMENT

1 SHIP OPERATIONAL PROCEDURES

1.1 Precautionary practices

Avoiding unnecessary discharge of ballast water

1.1.1 If it is necessary to take on and discharge ballast water in the same port to facilitate safe cargo operations, care should be taken to avoid unnecessary discharge of ballast water that has been taken up in another port.

1.1.2 Managed ballast water which is mixed with unmanaged ballast water is no longer in compliance is no longer in compliance with Regulations D-1 and D-2 of the Annex to the Convention.

Minimizing the uptake of harmful aquatic organisms, pathogens and sediments

1.1.3 When loading ballast, every effort should be made to avoid the uptake of potentially harmful aquatic organisms, pathogens, and sediment that may contain such organisms. The uptake of ballast water should be minimized or, where practicable, avoided in areas and situations such as:

- .1 in areas identified by the port State in connection with advice provided by ports under paragraph 2.2.2;
- .2 in darkness when organisms may rise up in the water column;
- .3 in very shallow water;
- .4 where propellers may stir up sediment; or
- .5 where dredging is or recently has been carried out.

1.2 Ballast water management options

1.2.1 Ballast Water Exchange

1.2.1.1 Ballast water exchange is to be conducted in accordance with Regulation B-4 of the Convention and in accordance with the Guidelines for Ballast Water Exchange.

1.2.1.2 The voyage should be planned taking into account when ballast water exchange in accordance with Regulation B-4 of the Convention can be carried out.

1.2.1.3 Because of the possibility that partially exchange may encourage re-growth of organisms, ballast water exchange should only be commenced in any tank if there is sufficient time to complete the exchange to comply with the standard in Regulation D-1 and the ship can comply with the distance from land and minimum water depth criteria in Regulation B-4. As many complete tanks should be exchanged to the standard in Regulation D-1 as the time allows,

if for any tank the standard in Regulation D-1 can not be fully met the exchange should not be commenced for that tank.

1.2.1.4 If ballast water exchange is not undertaken for the reasons in Regulation B-4.4, i.e. if the master reasonably decides that such exchange would threaten the safety or stability of the ship, its crew, or its passengers because of adverse weather, ship design or stress, equipment failure, or any other extraordinary condition, then details of the reasons ballast water exchange was not undertaken are to be recorded in the Ballast Water Record Book.

1.2.1.5 A port State may designate areas in which exchange may be conducted taking into account the Guidelines on designation of areas for ballast water exchange. Designated areas should only be used for those ballast water tanks that are intended to be discharged in the port of that State and that could not be exchanged in accordance with Regulation B-4.1 of the Convention.

1.2.2 Ballast Water Management Systems

1.2.2.1 Ballast Water Management Systems installed for compliance with Regulation B-3 are to be approved in accordance with Regulation D-3. Such systems are to be operated in accordance with the system design criteria and the manufacturer's operational and maintenance instructions. The use of such systems should be detailed in the ship's Ballast Water Management Plan. All failures and malfunctions of the system are to be recorded in the Ballast Water Record Book.

1.2.3 Discharge to ballast water reception facilities

1.2.3.1 If ballast water reception facilities provided by a port State are utilized, Regulation B-3.6 applies.

1.2.4 Prototype ballast water treatment technologies

1.2.4.1 Prototype ballast water treatment technologies should be used within a programme approved by the Administration in accordance with Regulation D-4.

1.3 Sediment management

1.3.1 Regulation B-5 requires that all ships shall remove and dispose of sediments from spaces designated to carry ballast water in accordance with the ballast water management plan.

1.3.2 All practical steps should be taken during ballast uptake to avoid sediment accumulation, however, it is recognized that sediment will be taken on board and will settle on tank surfaces. When sediment has accumulated, consideration should be given to flushing tank bottoms and other surfaces when in suitable areas, i.e. areas complying with the minimum depth and distance described by Regulations B-4.1.1 and B-4.1.2.

1.3.3 The volume of sediment in a ballast tank should be monitored on a regular basis.

1.3.4 Sediment in ballast tanks should be removed in a timely basis in accordance with the Ballast Water Management Plan and as found necessary. The frequency and timing of removal

will depend on factors such as sediment build up, ship's trading pattern, availability of reception facilities, work load of the ship's personnel and safety considerations.

1.3.5 Removal of sediment from ballast tanks should preferably be undertaken under controlled conditions in port, at a repair facility or in dry dock. The removed sediment should preferably be disposed of in a sediment reception facility if available, reasonable and practicable.

1.3.6 When sediment is removed from the ship's ballast tanks and is to be disposed of by that ship at sea, such disposal should only take place in areas outside 200 nm from land and in water depths of over 200 m.

1.3.7 Regulation B-5 requires that ships constructed in or after 2009 should, without compromising safety or operational efficiency, be designed and constructed with a view to minimize the uptake and undesirable entrapment of sediments, facilitate removal of sediments, and provide safe access to allow for sediment removal and sampling, taking into account the Guidelines for sediments control on ships (G12). This also applies to ships constructed prior to 2009, to the extent practicable.

1.4 Additional Measures

1.4.1 Ships to which additional measures apply, under Regulation C-1, should take them into account in the ships voyage planning. Actions taken to comply with any additional measures should be recorded in the Ballast Water Record Book.

1.5 Exemptions

1.5.1 Regulation A-4 provides that an exemption may be granted from the requirements of Regulations B-3 or C-1 by a Party or Parties to a ship in specific circumstances. Applications for and the granting of such exemptions should be completed in accordance with the Guidelines for risk assessment (G7).

1.5.2 Ships granted an exemption referred to in paragraph 1.5.1 above should record the exemption in the Ballast Water Record Book and what actions have been taken with regards to the ships ballast water.

2 RECORDING PROCEDURES

2.1 Procedures for ships

2.1.1 To facilitate the administration of ballast water management and treatment procedures on board each ship, a responsible officer is to be designated in accordance with Regulation B-1 to ensure the maintenance of appropriate records and to ensure that ballast water management and/or treatment procedures are followed and recorded.

2.1.2 When carrying out any ballast water operation the details are to be recorded in the Ballast Water Record Book together with any exemptions granted in accordance with Regulation B-3 or C-1.

2.1.3 Where a port State requires information on ships ballast operations, relevant documentation, which takes account of the information requirements of the Convention, should be made available to the port State.

2.2 Procedures for port States

2.2.1 Port States should provide ships with details of their requirements concerning ballast water management including:

- .1 the location and terms of use of areas designated for ballast water exchange under Regulation B-4.2 of the Convention;
- .2 any additional measures determined under Regulation C-1 of the Convention;
- .3 warnings concerning ballast uptake and any other port contingency arrangements in the event of emergency situations; and
- .4 the availability, location, capacities of reception facilities that are provided for the environmentally safe disposal of ballast water and/or sediments, under Article 5 and Regulation B-3.6.

2.2.2 To assist ships in applying the precautionary practices described in section 1.1 of Part A, port States are required by Regulation C-2 of the Convention to endeavour to notify mariners of area(s), where ships should not uptake Ballast Water due to known conditions. Similar notification should be given for areas where the uptake of ballast water should be minimized, such as:

- .1 areas with outbreaks, infestations or known populations of harmful organisms and pathogens;
- .2 areas with current phytoplankton blooms (algal blooms, such as red tides);
- .3 nearby sewage outfalls;
- .4 areas where a tidal stream is known to be the more turbid;
- .5 areas where tidal flushing is known to be poor;
- .6 nearby dredging operations; and
- .7 nearby or in sensitive or estuarine sea areas.

3 TRAINING AND EDUCATION

3.1 Regulation B-6 requires that officers and crew shall be familiar with their duties in the implementation of Ballast Water Management particular to the ship on which they serve. Owners, managers, operators, and others involved in officer and crew training for ballast water management should consider the following:

3.2 Training for ships' masters and crews as appropriate should include instructions on the requirements of the Convention, the ballast water and sediment management procedures and the Ballast Water Record Book particularly having regard to matters of ship safety and maintenance of records in accordance with the information contained in these Guidelines.

3.3 The Ballast Water Management Plan should include training and education on ballast water management practices and the systems and procedures used on board the ship.

PART B – GUIDELINES FOR THE DEVELOPMENT OF BALLAST WATER MANAGEMENT PLANS

1 INTRODUCTION

1.1 These Guidelines have been developed to assist with the preparation of a ship's Ballast Water Management Plan (hereafter referred to as the "Plan"). The Plan must be approved by the Administration in accordance with Regulation B-1 of the Convention.

1.2 This Part is comprised of three primary sections:

- .1 General: this section provides the objectives and a general overview of the subject matter and introduces the reader to the basic concept of the Guidelines and the Plan that is expected to be developed from them. This section also contains guidance on updating and use of the Plan.
- .2 Mandatory provisions: this section provides guidance to ensure that the mandatory provisions of Regulation B-1 of the Annex to the Convention are met.
- .3 Non-mandatory provisions: this section provides guidance concerning the inclusion of other information in the Plan. This information, although not required under Regulation B-1 of the Convention, may be found useful by local authorities in ports visited by the ship, or may provide additional assistance to the ship's master.

1.3 The format for a Ballast Water Management Plan is given in Appendix 1.

2 GENERAL

2.1 Concept of the Guidelines

2.1.1 These Guidelines are intended to provide a basis for the preparation of the Plans for individual ships. The broad spectrum of ships for which Plans are required makes it impractical to provide specific guidelines for each ship type. For a Plan to be effective and to comply with Regulation B-1 of the Annex of the Convention, it must be carefully tailored to the particular ship for which it is intended. Properly used, the Guidelines will ensure that all appropriate issues that may be applicable to a particular ship are considered in developing the Plan.

2.1.2 The issues that may require consideration include but are not limited to: type and size of ship, volume of ballast carried and total capacity of tanks used for ballast, ballast pumping

capacity, ship and crew safety issues, voyage type and length, the ship's typical operational requirements, and ballast water management techniques used on board.

2.2 Concept of the Plan

2.2.1 The Plan is required to be onboard the ship and available to guide personnel in safe operation of the Ballast Water Management system employed on a particular ship. Effective planning ensures that the necessary actions are taken in a structured, logical, and safe manner.

2.2.2 For the Plan to accomplish its purpose, it must be:

- .1 realistic, practical, and easy to use;
- .2 understood by ship's personnel engaged in ballast water management, both on board and ashore;
- .3 evaluated, reviewed, and updated as necessary; and
- .4 consistent with the operational ballasting requirements of the ship.

2.2.3 The Plan envisioned by Regulation B-1 of the Annex to the Convention is intended to be a simple document. Inclusion of extensive background information on the ship, its structure, etc., should be avoided, as this is generally available elsewhere. If such information is relevant, it should be kept in annexes, or an existing document or manual reference should be made to the location of the information.

2.2.4 The Plan is a document to be used on board by the ship's personnel engaged in ballast water management. The Plan must therefore be available in a working language of the ship's personnel. A change in the personnel and or the, working language or would require the issuance of the Plan in the new language(s).

2.2.5 The Plan should be readily available for inspection by officers authorized by a Party to the Convention.

2.3 Exemptions

2.3.1 Regulation A-4 allows that exemption may be granted to a ship from Regulation B-3 or C-1.

2.3.2 Details of exemptions should be retained with the Plan.

2.3.3 Any exemption granted is to be recorded in the Ballast Water Record Book.

2.4 Additional Measures

2.4.1 The Convention, in Regulation C-1 Additional Measures, gives a Party individually or jointly with other Parties, the right to introduce measures in addition to those in Section B. Such Additional Measures are to be communicated to the Organization at least 6 months prior to the projected date of implementation.

2.4.2 The Plan should be accompanied by a most recent list of Additional measures, as communicated by the Organization relevant to the ship's trade. The Plan should contain details and advice on the actions a ship must take to comply with any additional measures that may be required in accordance with Regulation C-1 and for any emergency or epidemic situations.

2.5 Review of the Plan

2.5.1 Regular review of the Plan by the owner, operator, or master should be conducted to ensure that the information contained is accurate and updated. A feedback system should be employed which will allow quick capture of changing information and incorporation of it into the Plan.

2.5.2 Changes to the provisions of this Plan will need Administration approval.

3 MANDATORY PROVISIONS

3.1 This section provides individual guidelines for the seven mandatory provisions of Regulation B-1 of the Annex to the Convention. In addition, it provides information to assist ships personnel in managing ballast water and sediments.

3.2 Regulation B-1 of the Annex to the Convention provides that the Plan shall be specific to each ship and shall at least:

- .1 detail safety procedures for the ship and the crew associated with Ballast Water Management as required by the Convention;
- .2 provide a detailed description of the actions to be taken to implement the Ballast Water Management practices required by the Convention;
- .3 detail the procedures for the disposal of sediments at sea and to shore;
- .4 include the procedures for co-ordinating shipboard Ballast Water Management that involves discharge to the sea with the authorities of the State into whose waters such discharge will take place;
- .5 designates the officer on board in charge of ensuring that the Plan is properly implemented;
- .6 contain the reporting requirements for ships provided for under the Convention; and
- .7 be written in the working language of the ship. If the language used is not English, French or Spanish, a translation into one of these languages should be provided.

3.3 The Ballast Water Management Plan should give guidance on the ballast handling procedures to be followed, including:

- .1 uptake of ballast water;

- .2 step-by-step procedures and sequences for the Ballast Water Management System used; and
- .3 any operational or safety restrictions including those associated with the Ballast Water Management System used. This will also assist ship's personnel when responding to enquiries from inspection officers authorized by a Party.

3.4 Safety aspects of the Ballast Water Management system used should include, as applicable, guidance on:

- .1 stability to be maintained at all times to values not less than those recommended by the Organization (or required by the Administration);
- .2 approved longitudinal stress and, where applicable, torsional stress values are to be maintained within permitted values;
- .3 transfer or exchange of ballast that can generate significant structural loads by sloshing action in partially-filled tanks. If these operations include partially-filled tanks, consideration should be given to carrying out the operation in favourable sea and swell conditions such that the risk of structural damage is minimized;
- .4 wave-induced hull vibrations when carrying out ballast water exchange;
- .5 forward and aft draughts and trim, with particular reference to bridge visibility, slamming and minimum forward draft;
- .6 the effects of any potential hazards and occupational health that may affect ship's personnel shall also be identified together with any safety precautions that need to be taken; and
- .7 the possible effects of tank over pressurization.

3.5 If a ship is able to complete at least 95 per cent volumatic exchange in less than three pumped volumes, documentation indicating that this ballast water exchange process has been approved under Regulation D-1.2 should be provided in the Plan.

3.6 The Plan should also include procedures for the disposal of sediments and in particular:

- .1 on the sediment removal or reduction at sea, and when cleaning of the ballast tanks to remove sediments;
- .2 regarding the safety consideration to be taken if tank entry is required to remove sediments; and
- .3 regarding the use of port reception facilities for sediments.

3.7 The Plan should clearly identify the officer in charge of ballast water management and outline his/her duties which should include:

- .1 ensuring that the Ballast Water Management performed follows the procedures in the Plan;
- .2 ensuring that the Ballast Water Record Book and any other necessary documentation are maintained; and
- .3 being available to assist the inspection officers authorized by a Party for any sampling that may need to be undertaken.

3.8 The Plan should contain guidance on the recording requirements according to ship's Ballast Water Record Book provided for under this Convention including details of exemptions granted to the ship.

3.9 In addition to the above, the Plan should include the following:

- .1 A foreword which should provide the ship's crew with explanations on the need for ballast water management and for record keeping. The foreword should include a statement that, "This Plan must be kept available for inspection on request by an authorized authority".
- .2 Ship particulars including at least:
 - .1 ships' name, flag, port of registry, Gross Tonnage, IMO number*, length (BP), beam, international call sign; deepest ballast drafts (normal and heavy weather);
 - .2 the total ballast capacity of the ship in cubic meters and other units if applicable to the ship;
 - .3 a brief description of the main ballast water management method(s) used on the ship; and
 - .4 identification (rank) of the officer in charge for implementing the Plan.
- .3 Information on Ballast Water Management System used on board, including:
 - .1 ballast tank arrangement;
 - .2 ballast capacity plan;
 - .3 a ballast water piping and pumping arrangement, including air pipes and sounding arrangements;
 - .4 ballast water pump capacities;

* In accordance with resolution A.600(15) IMO Ship Identification Number Scheme.

- .5 the Ballast Water Management System used on board, with references to operational and maintenance manuals held on board;
 - .6 installed ballast water treatment systems; and
 - .7 a plan and profile of the ship, or a schematic drawing of the ballast arrangement.
- .4 Information on the ballast water sampling points, including:
- .1 A list or diagrams indicating the location of sampling and access points in pipelines and ballast water tanks, to enable crew members to assist the authorized officers of a Party that have reason to obtain samples.
 - .2 This section should make clear that sampling of ballast water is primarily a matter for the authorized inspection officers, and there is unlikely to be any need for crew members to take samples except at the express request, and under the supervision, of the authorized inspection officers.
 - .3 The authorized inspection officers should be advised of all safety procedures to be observed when entering enclosed spaces.
- .5 Provisions for crew training and familiarization, including:
- .1 requirements of a general nature regarding Ballast Water Management;
 - .2 training and information on ballast water management practices;
 - .3 ballast water exchange;
 - .4 ballast water treatment systems;
 - .5 general safety considerations;
 - .6 the Ballast Water Record Book and maintenance of records;
 - .7 the operation and maintenance of installed ballast water treatment systems;
 - .8 safety aspects associated with the particular systems and procedures used onboard the ship which affect the safety or human health of crew and passengers and/or the safety of the ship;
 - .9 precautions for entering tanks for sediment removal;
 - .10 procedures for the safe handling and packaging of sediment; and
 - .11 storage of sediment.

4 NON-MANDATORY INFORMATION

4.1 In addition to the provisions required by Articles and regulations of the Convention, the owner/operator may include in the Plan, as appendices, additional information such as: provision of additional diagrams and drawings, shipboard equipment and reference materials. National or regional requirements that differ from the Convention may also be recorded for reference.

4.2 Non-mandatory information may also include manufactures manuals (either as extracts or complete) or reference to the location on board of such manuals and other relevant material.

APPENDIX

STANDARD FORMAT FOR THE BALLAST WATER MANAGEMENT PLAN

PREAMBLE

The ballast water management plan should contain the information required by Regulation B-1 of the Convention.

For guidance in preparing the plan the following information is to be included. The plan should be specific to each ship.

INTRODUCTION

At the beginning of each plan, wording should be included to reflect the intent of the following text.

1 This Plan is written in accordance with the requirements of Regulation B-1 of the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004 (the Convention) and the associated Guidelines.

2 The purpose of the Plan is to meet the requirements for the control and management of ship's ballast water and sediments in accordance with the Guidelines for Ballast Water Management and the Development of Ballast Water Management Plans resolution MEPC XX(YY) (The Guidelines). It provides standard operational guidance for the planning and management of ships' ballast water and sediments and describes safe procedures to be followed.

3 This Plan has been approved by the Administration and no alteration or revision shall be made to any part of it without the prior approval of the Administration.

4 This Plan may be inspected on request by an authorized authority.

Note: The Plan is to be written in the working language of the crew, if the text is not in English, French, or Spanish, the plan is to include a translation into one of these languages.

SHIP PARTICULARS

At least the following details should be included:

Ships' name;

Flag;

Port of registry;

Gross Tonnage;

IMO number*;

* In accordance with resolution A.600(15), IMO Ship Identification Number Scheme.

Length (BP);
Beam;
International call sign;
Deepest ballast drafts (normal and heavy weather);
Total ballast capacity of the ship in cubic meters and other units if applicable to the ship;
A brief description of the main ballast water management method(s) used on the ship; and
Identification (rank) of the appointed ballast water management officer.

INDEX

An index of sections should be included to reference the content of the Plan.

PURPOSE

Should contain a brief introduction for the ship's crew, explaining the need for ballast water management, and the importance of accurate record keeping.

PLANS/DRAWINGS OF THE BALLAST SYSTEM

Plans or drawings of the ballast system for example:

- 1) ballast tank arrangement;
- 2) ballast capacity plan;
- 3) a ballast water piping and pumping arrangement, including air pipes and sounding arrangements;
- 4) ballast water pump capacities;
- 5) the ballast water management system used onboard, with references to detailed operational and maintenance manuals held on board;
- 6) installed ballast water treatment systems; and
- 7) a plan and profile of the ship, or a schematic drawing of the ballast arrangement.

DESCRIPTION OF THE BALLAST SYSTEM

A description of the ballast system.

BALLAST WATER SAMPLING POINTS

Lists and/or diagrams indicating the location of sampling and access points in pipelines and ballast water tanks.

A note that sampling of ballast water is primarily a matter for the authorized authority, and there is unlikely to be any need for crew members to take samples except at the express request, and under the supervision, of the authorized authority.

OPERATION OF THE BALLAST WATER MANAGEMENT SYSTEM

A detailed description of the operation of the Ballast Water Management System(s) used on board.

Information on general ballast water management precautionary practices.

SAFETY PROCEDURES FOR THE SHIP AND THE CREW

Details of specific safety aspects of the ballast water management system used.

OPERATIONAL OR SAFETY RESTRICTIONS

Details of specific operational or safety restrictions including those associated with the management system which affects the ship and or the crew including reference to procedures for safe tank entry.

DESCRIPTION OF THE METHOD(S) USED ON BOARD FOR BALLAST WATER MANAGEMENT AND SEDIMENT CONTROL

Details of the method(s) used on board for the management of ballast and for sediment control including step-by-step operational procedures.

PROCEDURES FOR THE DISPOSAL OF SEDIMENTS

Procedures for the disposal of sediments at sea and to shore.

METHODS OF COMMUNICATION

Details of the procedures for co-ordinating the discharge of ballast in waters of a coastal State.

DUTIES OF THE BALLAST WATER MANAGEMENT OFFICER

Outline of the duties of the designated officer.

RECORDING REQUIREMENTS

Details of the record-keeping requirements of the Convention.

CREW TRAINING AND FAMILIARIZATION

Information on the provision of crew training and familiarization.

EXEMPTIONS

Details of any exemptions granted to the ship under Regulation A-4.

APPROVING AUTHORITY

Details and stamp of approving authority.

ANNEX 6

PROGRAMME FOR DEVELOPMENT OF THE GUIDELINES FOR UNIFORM IMPLEMENTATION OF THE BWM CONVENTION				
SUBJECT	REF.	STATUS	TYPE OF ACTION	TIMELINE
Guidelines for sediments reception facilities (G1)	Art. 5	Referred to FSI 14	Input from FSI 14 invited. Committee to adopt guidelines for sediments reception facilities at MEPC 55.	June 2006 October 2006
Guidelines for Ballast Water Sampling (G2) <i>[Guidelines for sampling of ballast water and analysis for Port State Control (G2)]</i>	Art. 9	Under development, latest version in document [MEPC 53/2/7]	Intersessional correspondence group established during MEPC 53. continue work during BLG 10. consideration by FSI. Committee to adopt guidelines for sampling of ballast water.	July 2005 April 2006
Guidelines for ballast water management equivalent compliance (G3)	Reg. A-5	Completed	To be adopted by resolution MEPC (53).	July 2005
Guidelines for Ballast Water Management and Development of Ballast Water Management Plans (G4) <i>[Ballast Water Management Plan Guidelines (G4)]</i>	Reg. B-1	Completed	To be adopted by resolution MEPC (53).	July 2005
Guidelines for ballast water reception facilities (G5)	Reg. B-3	Referred to FSI 14	Input from FSI 14 invited. Committee to adopt guidelines for ballast water reception facilities at MEPC 55.	June 2006 October 2006
Guidelines for Ballast Water Exchange (G6)	Reg. B-4	Completed	To be adopted by resolution MEPC (53).	July 2005
Guidelines for Risk Assessment under Regulation A-4 (G 7) <i>[Guidelines for risk assessment (G7)]</i>	Reg. A-4	Under development, latest version in document [MEPC 53/2/13 (annex 1)]	Intersessional correspondence group established during MEPC 53. BWWG established during BLG 10 to review the draft guidelines. Committee to adopt guidelines for risk assessment at MEPC 55.	July 2005 April 2006 October 2006

PROGRAMME FOR DEVELOPMENT OF THE GUIDELINES FOR UNIFORM IMPLEMENTATION OF THE BWM CONVENTION				
SUBJECT	REF.	STATUS	TYPE OF ACTION	TIMELINE
Guidelines for approval of Ballast Water Management Systems (G8)	Reg. D-3.1	Completed	To be adopted by resolution MEPC (53).	July 2005
Procedure for Approval of Ballast Water Management Systems that make use of Active Substances (G 9) <i>[Procedure for approval of active substances (G9)]</i>	Reg. D-3.2	Completed	To be adopted by resolution MEPC (53).	July 2005
Guidelines for approval and oversight of prototype ballast water treatment technology programmes (G10) <i>[Guidelines for approval of prototype ballast water treatment technologies]</i>	Reg. D-4	Completed	Final consideration with the view of adoption by MEPC resolution at MEPC 54.	March 2006
Guidelines for Ballast Water Exchange Design and Construction Standards (G11)	Reg. B-5.2	Completed by WG during 4th intersessional meeting	Input from BLG 10 invited. Committee to adopt guidelines on ballast water exchange design and construction standards at MEPC 55.	February 2006 October 2006
Guidelines for sediment control on ships (G12)	Reg. B-5	Completed by the WG during BLG 9	Input from BLG 10 invited. Committee to adopt guidelines for sediment control on ships at MEPC 55.	February 2006 October 2006
Guidelines for additional measures including emergency situations (G13)	Reg. C-1	Under development, latest version in document [MEPC 53/2/13 (annex 3)]	BWWG established during BLG 10 to further develop the Guidelines. Input from FSI 14 invited. Committee to adopt G13 at MEPC 55.	April 2006 June 2006 October 2006
Guidelines on designation of areas for ballast water exchange (G14)	Reg. B-4.2	Under development, latest version in document (MEPC 53/2/23)	Intersessional correspondence group established during MEPC 53. BWWG established during BLG 10 to review the draft guidelines. Committee to adopt Guidelines on designation of areas for ballast water exchange at MEPC 55.	July 2005 April 2006 October 2006

* The old titles of the guidelines are given in square brackets italics.

ANNEX 7

DRAFT ASSEMBLY RESOLUTION

NEW LEGALLY BINDING INSTRUMENT ON SHIP RECYCLING

THE ASSEMBLY,

RECALLING Article 15(j) of the Convention on the International Maritime Organization concerning the functions of the Assembly in relation to regulations and guidelines concerning maritime safety, the prevention and control of marine pollution from ships and other matters concerning the effect of shipping on the marine environment,

RECALLING ALSO resolution A.962(23) by which it adopted the IMO Guidelines on Ship Recycling with the aim of providing guidance to the involved stakeholders as to “best practice”, which takes into account the ship recycling process throughout the life cycle of the ship,

NOTING the roles of the International Labour Organization and the Basel Convention in matters related to ship recycling,

RECOGNIZING the urgent need for the Organization to contribute to the development of an effective solution to the issue of ship recycling, which will minimize, in the most effective, efficient and sustainable way, the environmental, occupational health and safety risks related to ship recycling, taking into account, at the same time, the particular characteristics of world maritime transport and the need for securing the smooth withdrawal of ships that have reached the end of their operating lives,

CONSIDERING that the above objective may be best achieved by establishing a new IMO instrument with a view to providing legally binding and globally applicable ship recycling regulations for international shipping and for ship recycling facilities,

RECOGNIZING ALSO the significant progress made by the Marine Environment Protection Committee, at its fifty-third session, in considering the development of the appropriate mandatory requirements on ship recycling, including a preliminary draft of a possible structure for the new instrument on ship recycling,

HAVING CONSIDERED the recommendation made by the Marine Environment Protection Committee at its fifty-third session,

1. REQUESTS the Marine Environment Protection Committee to develop a new legally binding instrument on ship recycling that would provide regulations for:

- .1 the design, construction, operation and preparation of ships so as to facilitate safe and environmentally sound recycling, without compromising the safety and operational efficiency of ships;

- .2 the operation of ship recycling facilities in a safe and environmentally sound manner; and
- .3 the establishment of an appropriate enforcement mechanism for ship recycling (certification/reporting requirements);

2. REQUESTS ALSO the Marine Environment Protection Committee to work towards completion of the above-mentioned draft instrument in time for its consideration and adoption in the biennium 2008-2009;

3. REQUESTS FURTHER the Marine Environment Protection Committee to continue co-operating with the International Labour Organization and the appropriate bodies of the Basel Convention in this field with the aim of avoiding duplication of work and overlapping of responsibilities and competencies between the three Organizations; and

4. URGES Governments and all involved stakeholders, in the meantime, to continue to apply the IMO Guidelines, without delay.

ANNEX 8

DRAFT ASSEMBLY RESOLUTION

**AMENDMENTS TO THE IMO GUIDELINES ON SHIP RECYCLING
(RESOLUTION A.962(23))**

THE ASSEMBLY,

RECALLING Article 15(j) of the Convention on the International Maritime Organization concerning the functions of the Assembly in relation to regulations and guidelines concerning maritime safety and the prevention and control of marine pollution from ships and other matters concerning the effect of shipping on the marine environment,

RECALLING ALSO resolution A.962(23) by which it adopted the IMO Guidelines on Ship Recycling,

RECALLING FURTHER that, at its twenty-third session, when adopting resolution A.962(23), it requested the Marine Environment Protection Committee to keep this matter under review with a view to further developing the Guidelines in the future,

RECOGNIZING the need to keep the IMO Guidelines on Ship Recycling updated in the light of experience gained in their implementation,

HAVING CONSIDERED the recommendations made by the Marine Environment Protection Committee at its fifty-third session,

1. ADOPTS amendments to the IMO Guidelines on Ship Recycling (resolution A.962(23)), as set out in the Annex to the present resolution;
2. URGES Governments to apply forthwith the IMO Guidelines on Ship Recycling (resolution A.962(23)) as amended by this resolution; and
3. REQUESTS the Marine Environment Protection Committee to keep the revised IMO Guidelines on Ship Recycling under review and to amend them as necessary in the light of experience gained from their implementation.

ANNEX

**AMENDMENTS TO THE IMO GUIDELINES ON SHIP RECYCLING
(RESOLUTION A.962(23))**

1 In Section 3 - Definitions, the definition of “Ship” is amended to read as follows:

“*Ship* means a vessel of any type whatsoever operating in the marine environment and includes hydrofoil boats, air-cushion vehicles, submersibles, floating craft and fixed or floating platforms.”

2 The following text is added at the end of paragraph 5.2.1:

“Any changes relating to these “ship details” should be recorded. In the case of ships subject to SOLAS chapter XI-1, regulation 5, this requirement should be satisfied by the surrender, to the recycling facility, of a copy of the Continuous Synopsis Record (CSR) and the Certificate of Build produced by the ship builder.”

3 Paragraph 5.5 is renumbered as 5.3 and is amended to read as follows:

“Part 1 of the inventory of potentially hazardous materials present in the ship’s structure and equipment should be prepared:

- .1 for new ships by the shipbuilder, in consultation with the equipment manufacturers, at the construction stage, and passed to the shipowner;
- .2 for existing ships by the shipowner, as far as is practicable and reasonable, by reference to the ship’s plans, drawings, manuals, technical specifications and ship stores manifests, in consultation with the shipbuilder, equipment manufacturers and others as appropriate.”

4 Paragraph 5.3 is renumbered as 5.4 and is amended to read as follows:

“Any changes relating to Part 1 of the inventory should be recorded so as to provide updated and current information together with a history of the changes.”

5 Paragraph 5.4 is renumbered as 5.5.

6 Paragraph 5.6 is replaced by the following:

“Inventories of operationally generated wastes (Part 2 of the inventory) and potentially hazardous items carried as stores (Part 3 of the inventory) should be prepared by the shipowner prior to or during the final voyage to the recycling facility and handed to the recycling facility on delivery of the ship, as part of the Green Passport.”

7 Paragraph 9.4.1.2 is amended to read as follows:

“The recycling State should introduce national regulations in relation to the condition of ships purchased for recycling, both at the time of purchase and at the time of delivery. In

effect, the recycling State should lay down any conditions it considers necessary prior to finalization of the contract.”

- 8 Paragraph 9.4.1.3 is amended to read as follows:

“The Green Passport, including its inventory of potentially hazardous materials, which should be delivered to the recycling facility by the last owner of the ship, gives information which might be demanded by the recycling State as to the materials on the ship. The recycling State should ensure that recycling facilities can safely and legally manage any potentially hazardous wastes which might be generated during the recycling operation prior to finalization of the contract.”

- 9 Paragraph 9.4.3.1 is amended to read as follows:

“Recycling States should, in their national legislation, lay down the conditions under which ships may be imported into their State for recycling and, equally, define and enforce appropriate worker health and safety requirements.”

- 10 Paragraph 9.4.3.4 is replaced by the following:

“Recycling States should require recycling facilities to verify the Green Passport of every ship prior to finalization of the contract to ensure that any potentially hazardous materials identified as being on board the ship can be safely and legally managed in an environmentally sound manner. The verification process should specify that the actual condition of the ship is consistent with these and other relevant international guidelines, and that national requirements are fulfilled. The recycling facility is responsible for the proper management of any materials declared in the Green Passport, covered by the Recycling Plan or generated during the recycling operation.”

- 11 Paragraph 9.4.4.3 is amended to read as follows:

“The recycling facility should seek appropriate guidance from the recycling State on relevant legislation and standards. This may assist the facility in determining whether to conclude any contract. The facilities themselves are responsible for handling the ship and ensuring that the recycling operation is in compliance with national legislation and other national requirements.”

- 12 Paragraph 9.8.2 is amended to read as follows:

“At the end of a ship’s operating life the shipowner is responsible for delivery of the ship as described in the contract, including all the documents in accordance with these Guidelines and the recycling facility is responsible for accepting the ship if it meets the terms and conditions outlined in the contract. Although contractual matters are the purview of the parties involved, it is recommended that sellers (shipowners) and purchasers (recycling facilities) use a standard contract that deals with all the relevant issues. BIMCO has revised its standard contract covering the sale of ships for recycling, DEMOLISHCON, to incorporate, in the standard terms and conditions, reference to these Guidelines.”

ANNEX 9**INTERIM GUIDELINES FOR VOLUNTARY SHIP CO₂ EMISSION INDEXING
FOR USE IN TRIALS**

1 The Conference of Parties to the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto, held from 15 to 26 September 1997 in conjunction with the Marine Environment Protection Committee's fortieth session, adopted, Conference resolution 8, on CO₂ emissions from ships. The resolution invites the Marine Environment Protection Committee to consider what CO₂ reduction strategies may be feasible in light of the relationship between CO₂ and other atmospheric and marine pollutants, especially NO_x since NO_x emissions may exhibit an inverse relationship to CO₂ reduction.

2 IMO Assembly resolution A.963(23) on "IMO Policies and Practices Related to the Reduction of Greenhouse Gas Emissions from Ships" urged the Marine Environment Protection Committee (MEPC) to identify and develop the mechanism or mechanisms needed to achieve the limitation or reduction of Greenhouse Gas (GHG) emissions from international shipping and, in doing so, to give priority to the establishment of a GHG baseline; and the development of a methodology to describe the GHG efficiency of a ship in terms of GHG emission index for that ship. In developing the methodology for the GHG emission indexing scheme, MEPC should recognize that CO₂ is the main greenhouse gas emitted by ships.

3 As urged by the Assembly, MEPC 53 approved Interim Guidelines for Voluntary Ship CO₂ Emission Indexing for Use in Trials.

4 The Interim Guidelines should be used to establish a common approach for trials on voluntary CO₂ emission indexing, which will enable shipowners to evaluate the performance of their fleet with regard to CO₂ emissions. As the amount of CO₂ emitted from a ship is directly related to the consumption of bunker fuel oil, the CO₂ indexing will also provide useful information on a ship's performance with regards to fuel efficiency.

5 These Guidelines shall be updated, taking into account:

- Operational experiences from trials of the index for different ship types, as reported to MEPC by industry, organizations and Administrations;
- Progress in ISO regarding ship's CO₂ performance;
- Any other relevant developments.

6 Industry, organizations and interested Administrations are invited to promote the use of the attached Interim Guidelines in trials and report their experiences back to MEPC 58 (October 2008).

ANNEX

Interim Guidelines for Voluntary Ship CO₂ Emission Indexing for the Use in Trials

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APPENDIX – Calculation of CO₂ Index based on operational data

1 INTRODUCTION

In 1997 IMO adopted a resolution on CO₂ emissions from ships⁹. This resolution invites the Marine Environment Protection Committee (MEPC) to consider what CO₂ reduction strategies would be feasible for ships.

IMO Assembly further adopted resolution A.963(23) on IMO policies and practices related to the reduction of greenhouse gas emissions from ships, which requests the MEPC to develop a greenhouse gas emission index for ships, and guidelines for application of that index.

This document constitutes the guidelines for the application of an IMO CO₂ emissions index for ships. It sets out:

- what the objectives of the IMO CO₂ emissions index are,
- how a ship's CO₂ performance should be measured, and
- how the index could be used to promote low-emission shipping, in order to help limit the impact of shipping on global climate change.

2 OBJECTIVES

The objective of these Guidelines is to provide the users with guidance on achieving the targets set by IMO resolution A.963(23). The Guidelines provide assistance in the process of establishing a mechanism to achieve the limitation or reduction of greenhouse gas emissions from shipping.

This guideline presents the concept of an index for the energy efficiency of a ship in operation, limited to an expression of efficiency expressed in way of CO₂ emitted per unit of transport work. The Guidelines are intended as an objective, performance-based document for guidance on monitoring of the efficiency of ship operation.

These Guidelines are recommendatory in nature and present a possible application of an index. However, ship owners are invited to implement these Guidelines in their environmental management systems and adopt the principles herein for performance monitoring.

3 DEFINITIONS

3.1 Index definition

In its most simple form *the Carbon Dioxide Transport Efficiency Index* is defined as the ratio of mass of CO₂ per unit of transport work:

$$\text{Index} = m_{\text{CO}_2} / (\text{transport work})$$

For more details of index calculation see 3.2-3.4 and Appendix 1.

⁹ Resolution 8 of the 1997 International Conference of Parties to MARPOL 73/78.

3.2 Fuel consumption

Fuel consumption, FC, is defined as all fuel consumed at sea and in port or for a period in question, e.g. a day, by main and auxiliary engines including boilers and incinerators.

3.3 Distance sailed

Distance sailed, means the actual distance sailed in nautical miles (deck log-book data) for the voyage or period in question.

3.4 Ship and cargo types

The Guidelines are applicable for all ships performing transport work.

Ships:

- | | |
|------------------|---|
| 1. Bulk | Tankers and bulk carriers |
| 2. General cargo | Container ships, reefers, general cargo, car carriers and specialized ships |
| 3. Passenger | Passenger ships, ro-ro passenger ships |

Cargo:

- | | |
|------------------|---|
| 1. Bulk cargo | All liquid and solid bulk cargo |
| 2. General cargo | General cargo which will include TEUs (including the return of empty units), break bulk, heavy lifts, frozen and chilled goods, timber and forest products, cargo carried on freight vehicles, cars and freight vehicles on ro-ro ferries |
| 3. Passenger | The number of passengers carried |

3.5 Cargo

Generally, cargo could be defined in terms of cargo mass.

For bulk and general cargo ships, the mass of transported cargo should be defined in metric tonnes (t).

For ships carrying a combination of containers and other cargoes a TEU mass of 10 t should be applied for loaded TEUs and 2 t for empty TEUs.

For other types of ship, the following units could be applied:

- For bulk carriers and tankers: cubic metres (m³)
- For passenger vessels: number of passengers
- For car ferries and car carriers: number of car units or occupied lane metres
- For container ships: number of TEUs (empty or full)
- For railway and ro-ro vessels: number of railway cars and freight vehicles, or occupied lane metres

4 ESTABLISHING CO₂ OPERATIONAL INDEX

In order to establish the CO₂ index, the following main steps needs to be executed:

- .1 Define data sources for data collection.
- .2 Collect data.
- .3 Convert data to appropriate format.
- .4 Calculate CO₂ index.

For existing ships, the CO₂ index should represent an average value of the energy efficiency of the ship operation over a period of one-year. Guidance on the calculation procedure for the index is provided in the Appendix.

For newly built ships the CO₂ index should represent an average value of the energy efficiency of the ship operation over a period of not less than six months.

5 DATA RECORDING AND DOCUMENTATION PROCEDURES

The data recording method used in particular ship types must be uniform so that information can be easily collated and analysed to facilitate the extraction of the required information. The collection of data from ships should include the distance travelled, the quantity and type of fuel used, and all fuel information that may affect the amount of carbon dioxide emitted. Fuel information is provided on the bunker delivery notes that are required under regulation 18 of MARPOL Annex VI.

The unit used for distance travelled and quantity of fuel should be expressed in nautical miles and metric tonnes. The cargo should be expressed as stated in paragraph 3.5.

It is important that sufficient information is collected on the ship with regard to fuel type and quantity, distance travelled and cargo type so that the efficiency of the ship can be compared with other modes of transport.

The distance travelled should be calculated by actual distance travelled, as contained in the ships log-book.

Amount and type of fuel used (bunker delivery notes) and distance travelled (according to the ships log-book) should be documented by the ship based on the format described in the Appendix.

6 MONITORING AND VERIFICATION

Documented procedures to monitor and measure, on a regular basis, should be developed and maintained. Elements to be considered when establishing procedures for monitoring are:

- Identification of operations/activities with impact on the performance;
- Identification of data sources and measurements that are necessary, and specification of the format;
- Identification of frequency and personnel performing measurements; and
- Maintain quality control procedures for verification procedures.

The results of this self-critical analysis should be reviewed and used as indicators of the system's success and reliability, as well as identifying those areas in need of corrective action or improvement.

Records are expected to exist to serve as verification of the system operating. For example, records include audit reports and training records. Unlike controlled documents, records are "once and done" documents, resulting from the execution of some process or procedure. Procedures in this element are required for the maintenance of records.

It is important that the source of figures established are properly recorded, the basis on which figures have been calculated and any decisions on difficult or "grey" areas of data. This will provide assistance on areas for improvement and be helpful for any later external verification.

If only internal verification of reports are applied initially, measuring and reporting systems should be developed to allow effective external verification at a later stage. It should be considered stating, for the benefit of external stakeholders, why a report has not been independently verified and the company's future intentions in this regard.

7 APPLICATION OF GUIDELINES

Methodology and application of ship CO₂ indexing as described in this guideline, provides a transparent and recognized approach for assessment of the GHG efficiency of a ship with respect to CO₂ emissions. These Guidelines are considered applicable for ship owners with an implemented environmental management system.

Implementation of the CO₂ index in an established environmental management system should be performed in line with the implementation of any other chosen indicator and follow the main elements of the recognized standards (planning, implementation and operation, checking and corrective action, management review).

When using the CO₂ index as performance indicator, the index should be given a perspective relative to absolute data and trend data:

- The main indicator may be greenhouse gas emissions from energy use.
- Absolute data may be total tonnes of annual CO₂ emissions.
- The CO₂ index may represent the normalized data (CO₂ per tonne mile).
- Trend data may be the index value compared with previous years.

Internal performance criteria and targets could be established as a benchmark for the CO₂ index.

Results from monitoring and measurements could be reported to the management. A management review may include the review of targets, objectives, and CO₂ index to establish the continued suitability in light of changing environmental impact and concerns, regulatory developments, concerns among interested parties, market pressures, internal changes/organizational activity changes, and changes in the environment.

Communication in an environmental management system includes the communication of internal and external environmental information to management, and the communication from management to others of their intentions regarding environmental impacts. Communication could include procedures for internal reporting as well as external reporting on environmental activities of the organization.

APPENDIX

Calculation of CO₂ index based on operational data

General

The objective of the appendix is to provide guidance on calculation of the CO₂ index based on data from the operation of the ship.

Data sources

Primary data sources selected could be the ship log-book (bridge log-book, engine log-book, deck log-book and other official records).

Fuel mass to CO₂ mass conversion by carbon content of fuel

Though having many different physical characteristics, fuel oil mainly consist of hydrocarbons, e.g. C₁₅H₃₂. C has an atomic weight of 12.011, while Hydrogen (H) has 1. This yields carbon with a mass fraction limited to the range of 85 % to 87.5 %, where diesel oil is in the higher % range and heavy fuel oil in the lower % range. When combusted hydrocarbons react with oxygen (O), which have an atomic weight of 15.9994 then for each CO₂ one C is needed. Using the atomic weights the ratio between CO₂ and carbon is:

$$(12.011 + 2 \times 15.9994) / 12.011 = 44.01/12.01 = 3.664$$

Multiplying with the mass fraction of carbon in the fuel we get the specific emission of CO₂ (C_{carbon}). C_{carbon} for a fuel with 85% carbon content will be:

$$\begin{aligned} C_{\text{carbon}} &= 3.664 \times 0.85 = 3.114 \text{ t CO}_2 / \text{t fuel} \\ &= 3.114 \times 10^6 \text{ g CO}_2 / \text{t fuel} \end{aligned}$$

for heavy fuel oil with a carbon content of 85% by mass.

It is recommended to use direct carbon calculations.

If this data are not easily available in a first approach the following default values can be used for the carbon content and the factor C_{Carbon}: μ .

Type of fuel	ISO Specification	Carbon content m/m	C _{Carbon} [g CO ₂ / t Fuel]
1 Diesel/Gasoil	ISO 8217 Grades DMX through DMC	0.875 ¹	3,206,000
2 Light Fuel Oil (LFO)	ISO 8217 Grades RMA through RMD	0.86 ²	3,151,040
3 Heavy Fuel Oil (HFO)	ISO 8217 Grades RME through RMK	0.85 ¹	3,114,400
4 Liquid Petrol Gas (LPG)		0.81 ¹	2,967,840
5 Natural Gas		0.80 ²	2,931,200

Calculation of the CO₂ Index

The basic expression for the Index is defined as:

$$\text{Index} = \frac{\sum_i FC_i \times C_{Carbon}}{\sum_i m_{cargo,i} \times D_i} \quad (\text{gram CO}_2/\text{tonne identical mile})$$

Data covering a voyage or period, e.g. a day, in question with corresponding data on fuel consumption/cargo carried and distanced sailed for each voyage in a continuous sailing pattern could be collected as shown in the reporting sheet below.

CO₂ Index reporting sheet

NAME AND TYPE OF SHIP:						
Voyage or day (i)	Fuel consumption (FC) at sea and in port in tonnes				Voyage or time period data	
	Fuel type ()	Fuel type ()	Fuel type ()	...	Cargo (m) (tonnes or units)	Distance (D) (NM)
1						
2						
3						
4						
..						
..						

¹ Revised 1996 IPCC Guidelines for national GHG inventories (accessible through the IPCC website www.ipcc.ch).

² European Commission Decision of C(2004) 130 final. Establishing Guidelines for the monitoring and reporting of greenhouse gas emissions.

If data is collected as fuel used in tonnes per voyage, cargo in tonnes and distance in nautical miles, the formula will be:

$$Index = \frac{(\sum_i FC \times C_{Carbon})_{Fuel\ type1} + (\sum_i FC \times C_{Carbon})_{Fuel\ type2} + (\sum_i FC \times C_{Carbon})_{Fuel\ type3} + \dots}{\sum_i m_{cargo,i} \times D_i}$$

when summing for all voyages $i=1 - n$.

NOTE: For voyages with $m_{cargo} = 0$, it is still necessary to include the fuel used during this voyage in the summation above the line.

Example:

A simple example including one ballast voyage, for illustration purpose only, is provided below. The example illustrates the application of the formula based on the data reporting sheet.

NAME AND TYPE OF SHIP:						
Voyage or day (i)	Fuel consumption (FC) at sea and in port in tonnes				Voyage data	
	Fuel type (HFO)	Fuel type (HDO)	Fuel type ()	...	Cargo (m) (tonnes units)	Distance (D) (NM)
1	20	5			25000	300
2	20	5			0	300
3	50	10			25000	750
4	10	3			15000	150
..						
..						

$$I = \frac{100 \times 3,114,400 + 23 \times 3,206,000}{(25,000 \times 300) + (0 \times 300) + (25,000 \times 750) + (15,000 \times 150)} = 13.5 \text{ CO}_2/\text{t fuel (gCO}_2/\text{tonne n.m.)}$$

Conversion from g/tonne-mile to g/tonne-km

The CO₂ index may be converted from g/tonne-mile to g/tonne-km by multiplication by 0.54.

ANNEX 10

RESOLUTION MEPC.128(53)

Adopted on 22 July 2005

**AMENDMENTS TO THE REVISED SURVEY GUIDELINES UNDER THE
HARMONIZED SYSTEM OF SURVEY AND CERTIFICATION
(RESOLUTION A.948(23)) FOR THE PURPOSE OF MARPOL ANNEX VI**

THE MARINE ENVIRONMENT PROTECTION COMMITTEE,

RECALLING Article 38(a) of the Convention on the International Maritime Organization concerning the functions of the Marine Environment Protection Committee (the Committee) conferred upon it by the international conventions for the prevention and control of marine pollution from ships,

RECALLING ALSO resolution A.948(23) by which the Assembly adopted the revised survey guidelines under the harmonized system of survey and certification,

RECALLING FURTHER that MARPOL Annex VI entered into force on 19 May 2005,

NOTING that amendments to MARPOL Annex VI on the introduction of the Harmonized System of Survey and Certification (HSSC) were adopted by resolution MEPC.132(53) which are expected to enter into force on 22 November 2006,

NOTING ALSO that the Assembly, when adopting resolution A.948(23), requested the Maritime Safety Committee and the Marine Environment Protection Committee to keep the Revised Survey Guidelines under review and amend them as necessary,

HAVING CONSIDERED the draft amendments to the revised survey guidelines under the HSSC prepared by the Sub-Committee on Flag State Implementation at its thirteenth session,

1. ADOPTS amendments to the revised survey guidelines under the HSSC, as set out in the Annex to this resolution;
2. INVITES Governments to apply the Guidelines, as soon as possible.

ANNEX

**AMENDMENTS TO THE REVISED SURVEY GUIDELINES UNDER THE
HARMONIZED SYSTEM OF SURVEY AND CERTIFICATION
(RESOLUTION A.948(23)) FOR THE PURPOSE OF MARPOL ANNEX VI**

- 1 In the Contents, the following new section 3 is added after existing section 2 in Annex 3:
- “(A) **3 GUIDELINES FOR SURVEYS FOR INTERNATIONAL AIR POLLUTION PREVENTION CERTIFICATE AND THE NO_x TECHNICAL CODE**
- (AI) 3.1 Initial surveys
- (AA) 3.2 Annual surveys
- (AIn) 3.3 Intermediate surveys
- (AR) 3.4 Renewal surveys”
- 2 In section **GENERAL**:
- .1 in paragraph 2.8.1, a new line is added after “MARPOL 73/78/90, Annex II, regulation 10(1)(a)” as follows:
- “MARPOL Annex VI, regulation 5(1)(a)”
- .2 in paragraph 2.8.3, a new line is added after “MARPOL 73/78/90, Annex II, regulation 10(1)(b)” as follows:
- “MARPOL Annex VI, regulation 5(1)(b)”
- .3 in paragraph 2.8.4, a new line is added after “MARPOL 73/78/90, Annex II, regulation 10(1)(c)” as follows:
- “MARPOL Annex VI, regulation 5(1)(c)”
- .4 in paragraph 2.8.5, a new line is added after “MARPOL 73/78/90, Annex II, regulation 10(1)(d)” as follows:
- “MARPOL Annex VI, regulation 5(1)(d)”
- .5 in paragraph 3.2, after existing text “Annex I regulation 21” add the following new text “and Annex VI regulation 19.”
- .6 in paragraph 3.8, after the existing text “(N) for the International Pollution Prevention Certificate for Carriage of Noxious Liquid Substances in Bulk;” add the following new line:

“(A) for the International Air Pollution Prevention Certificate;”

- .7 in paragraph 4.8.1, after the existing text “MARPOL 73/78/90 Annex II regulation 10(2)(c),” the following new text is added:

“MARPOL Annex VI regulation 6(1),”

- .8 in paragraph 5.2:

- .1 in the references, after the existing text “MARPOL 73/78/90 Annex II,” the following new line is added:

“MARPOL Annex VI regulation 9(3),”

- .2 in the guideline, after the existing text “MARPOL 73/78/90 Annex II regulations 12(5) and (6),” the following new text is added:

“MARPOL Annex VI regulations 9(4) and (5),”

- .3 in the guideline, after the existing text “MARPOL 73/78/90 Annex II regulation 12(2)(b),” the following new text is added:

“MARPOL Annex VI regulation 9(2)(b),”

- .9 in paragraph 5.4, after the existing text in the references “MARPOL 73/78/90 Annex II regulation 12(6),” the following new text is added:

“MARPOL Annex VI regulation 9(6)”

- .10 in paragraph 5.5, third line from top, after the existing text “MARPOL 73/78/90 Annex II regulation 12(7),” the following new text is added:

“MARPOL Annex VI regulation 9(7)”

- 3 In Annex 1 “**SURVEY GUIDELINES UNDER THE 1974 SOLAS CONVENTION, AS MODIFIED BY THE 1988 PROTOCOL RELATING THERETO**”:

- .1 the following new subparagraph *.8bis* is added after existing paragraph 1.2.1.8:

“(EA) *.8bis* checking, when appropriate, the validity of the International Air Pollution Prevention Certificate;”

- .2 the following new subparagraph *.8bis* is added after existing paragraph 2.2.1.8:

“(CA) *.8bis* checking, when appropriate, the validity of the International Air Pollution Prevention Certificate;”

- .3 the following new subparagraph *.8bis* is added after existing paragraph 4.2.1.8:
“(RP) *.8bis* checking, when appropriate, the validity of the International Air Pollution Prevention Certificate;”
- .4 the following new subparagraph *.5bis* is added after existing paragraph 5.2.1.5:
“(PR) *.5bis*: checking, when appropriate, the validity of the International Air Pollution Prevention Certificate;”
- 4 In Annex 2 “**SURVEY GUIDELINES UNDER THE 1966 LOAD LINE CONVENTION, AS MODIFIED BY THE 1988 PROTOCOL RELATING THERETO**”:
- .1 the following new subparagraph *.8bis* is added after existing paragraph 1.2.1.8:
“(LA) *.8bis* checking, when appropriate, the validity of the International Air Pollution Prevention Certificate;”
- 5 In Annex 3 “**SURVEY GUIDELINES UNDER THE 1973/78 MARPOL CONVENTION**”:
- .1 the following new subparagraph *.7bis* is added after existing paragraph 1.2.1.7:
“(OA) *.7bis*: checking, when appropriate, the validity of the International Air Pollution Prevention Certificate;”
- .2 the following new subparagraph *.6bis* is added after existing paragraph 2.2.1.6:
“(NA) *.6bis* checking, when appropriate, the validity of the International Air Pollution Prevention Certificate;”
- .3 **the following new section 3 is added:**
- “(A) **3 GUIDELINES FOR THE SURVEYS FOR THE INTERNATIONAL AIR POLLUTION PREVENTION CERTIFICATE AND THE NO_x TECHNICAL CODE**
- (AI) **3.1 Initial surveys – see part “General”, section 4.1**
- (AI) **3.1.1** For air pollution prevention the examination of plans and designs should consist of:
- (AI) .1 examining the arrangements for systems using ozone-depleting substances (regulation 12 of Annex VI);
- (AI) .2 examining the arrangements for Sulphur Oxides exhaust gas cleaning systems or other technological methods, if applicable (regulation 14 of Annex VI);

- (AI) .3 examining the arrangements for vapour collection systems, if applicable (regulation 15 of Annex VI and MSC/Circ.585);
- (AI) .4 examining the arrangements for shipboard incinerators, if applicable (regulation 16 of Annex VI);
- (AI) **3.1.2** For air pollution prevention the survey should consist of:
 - (AI) .1 Ozone-depleting substances (regulation 12 of Annex VI):
 - (AI) .1 confirming the satisfactory installation and operation of systems using ozone depleting substances and there are no emissions of ozone depleting substances.
 - (AI) .2 Nitrogen oxide emissions from Diesel engines (regulation 13 of Annex VI):
 - .1 confirmed that all engines which are required to be certified are pre-certified in accordance with section 2.2 of the NO_x Technical Code.
 - (AI) .1.1 *If engine parameter check method is used:*
 - (AI) .1.1.1 an on-board verification survey in accordance with paragraph 6.2 of the NO_x Technical Code.
 - .1.2 *If the simplified method is used:*
 - (AI) .1.2.1 an on-board verification survey in accordance with paragraph 6.3 of the NO_x Technical Code.
 - (AI) .3 Sulphur Oxides (regulation 14 of Annex VI):
 - (AI) .3.1 confirming the satisfactory installation and operation of the fuel switching arrangements when tanks are provided for low and normal sulphur content fuel;
 - (AI) .3.2 confirming the satisfactory installation and operation of the exhaust gas cleaning system (if fitted);
 - (AI) .4 Volatile Organic Compounds (regulation 15 of Annex VI) (if applicable):
 - (AI) .4.1 confirming the satisfactory installation of the vapour collection piping;
 - (AI) .4.2 confirming the satisfactory installation and operation of the means provided to eliminate the collection of condensation in the system, such as drains in low points of the line end;
 - (AI) .4.3 confirming the satisfactory installation of the piping to ensure it is electrically continuous and electrically bonded to the hull;

- (AI) **.4.4** confirming the satisfactory installation and operation of the isolation valves at the vapour manifolds;
- (AI) **.4.5** confirming that the ends of each line are properly identified as vapour collection lines;
- (AI) **.4.6** confirming that the vapour collection flanges are in accordance with the IMO guidelines and industrial standards;
- (AI) **.4.7** confirming that where portable vapour lines are provided that they are electrically continuous;
- (AI) **.4.8** confirming the satisfactory installation and operation of the closed gauging system and the readouts in the cargo control area;
- (AI) **.4.9** confirming the satisfactory installation and operation of the overflow control system;
- (AI) **.4.10** confirming the satisfactory installation and operation of both the audible and visual alarms, that the alarms are properly labelled; that the power failure alarm operates and that there is a means to check the operation of the alarms;
- (AI) **.4.11** confirming the satisfactory installation and operation of the high and low pressure alarms provided for each main vapour line and that these alarms operate at the correct set points;
- (AI) **.5** Shipboard Incinerators (regulation 16 of Annex VI) (installed on or after 1 January 2000):
 - (AI) **.5.1** confirming the satisfactory installation and operation of each incinerator;
 - (AI) **.5.2** confirming that warning and instruction plates are satisfactorily secured in prominent positions on or near the incinerator;
 - (AI) **.5.3** confirming that the manufacturers name, incinerator model number/type and capacity in heat units per hour is permanently marked on the incinerator;
 - (AI) **.5.4** confirming the satisfactory operation of the following alarms and safety devices are in good condition and fully operational;
 - (AI) **.5.4.1** flue gas high temperature alarms and shutdowns;
 - (AI) **.5.4.2** combustion temperature controls and shutdowns;
 - (AI) **.5.4.3** combustion chamber negative pressure;
 - (AI) **.5.4.4** flame safeguard control, alarms and shutdowns;
 - (AI) **.5.4.5** all alarms both visual and audible are functioning and they indicate the cause of their failure;
 - (AI) **.5.4.6** power loss alarms and auto shutdown arrangements;

- (AI) **.5.4.7** charging arrangements;
- (AI) **.5.4.8** low fuel oil pressure alarm/shutdown;
- (AI) **.5.4.9** emergency stop switch and electrical isolating arrangements;
- (AI) **.5.4.10** interlocks;

- (AI) **.5.5** confirming the satisfactory installation of drip trays under each burner, pump, and strainer.

- (AI) **3.1.3** For air pollution prevention the check that certificates and other relevant documentation have been placed on board should consist of:
 - (AI) **.1** review (AA) 3.2.2.2 except for the bunker delivery notes and the records required in (AA) 3.2.2.2.3 and (AA) 3.2.2.2.7.

- (AI) **3.1.4** For air pollution prevention the completion of the initial survey should consist of:
 - (AI) **.1** after satisfactory survey the International Air Pollution Prevention Certificate should be issued.

- (AA) **3.2** **Annual surveys** – see “General”, section 4.2

- (AA) **3.2.1** For air pollution prevention the examination of current certificates and other records should consist of:
 - (AA) **.1** checking the validity, as appropriate, of the Cargo Ship Safety Equipment Certificate, the Cargo Ship Safety Radio Certificate and the Cargo Ship Safety Construction Certificate or the Cargo Ship Safety Certificate;
 - (AA) **.2** checking the validity of the Safety Management Certificate (SMC) and that a copy of the Document of Compliance (DOC) is on board, where applicable;
 - (AA) **.3** checking the validity of the International Load Line Certificate or International Load Line Exemption Certificate;
 - (AA) **.4** checking the validity of the International Oil Pollution Prevention Certificate;
 - (AA) **.5** checking the certificates of class, if the ship is classed with a classification society;
 - (AA) **.6** checking, when appropriate, the validity of the International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk or the Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk;
 - (AA) **.7** checking that the ship’s complement complies with the Minimum Safe Manning Document (SOLAS 74/88, regulation V/13(b));

- (AA) .8 checking that the master, officers and ratings are certificated as required by the STCW Convention;
- (AA) .9 checking whether any new equipment has been fitted and, if so, confirm that it has been approved before installation and that any changes are reflected in the appropriate certificate;
- (AA) 3.2.2 For air pollution prevention the annual survey should consist of:
- (AA) .1 General:
- (AA) .1.1 confirm that no changes have been made or any new equipment installed which would affect the validity of the certificate;
- (AA) .2 Documentation:
- (AA) .2.1 confirm that there are Engine International Air Pollution Prevention (EIAPP) Certificates for each engine, required to be certified, as described in Chapter 2.1 of the NO_x Technical Code;
- (AA) .2.2 confirm that there is on board an approved technical file for each engine required to be certified;
- (AA) .2.3 confirm that there are bunker delivery notes on board and fuel oil samples are kept under the ships control (regulation 18 of Annex VI);
- (AA) .2.4 confirm that there is for each Exhaust Gas Cleaning System (EGCS)-SO_x either a SO_x Emission Control Area (SECA) Compliance Certificate for the EGCS-SO_x, or an Onboard Monitoring Manual (OMM) as appropriate, plus in either cases a SECA Compliance Plan (regulation 14(4)(b) of Annex VI);
- (AA) .2.5 confirm that there is an IMO Type Approval Certificate for each incinerator on board (regulation 16(2)(a) of Annex VI);
- (AA) .2.6 confirm that there is a record book of engine parameters for each engine required to be certified in the case where the engine parameter check method is used as a mean of onboard NO_x verification (NO_x Technical Code, paragraph 6.2.3);
- (AA) .2.7 confirm that there is a record of fuel change over this record should take form of a log-book as described by the Administration (regulation 14.6 of Annex VI)*;
- (AA) .2.8 confirm that there is a transfer procedure for the VOC collection system;

* This information could be contained in the engine room log-book, the deck log-book, the official log-book, the oil record book or a separate log-book solely for this purpose.

- (AA) **.2.9** confirm that there is an instruction manual for each incinerator if required (regulation 16(7) of Annex VI);
- (AA) **.3** Ozone-depleting substances:
 - (AA) **.3.1** confirm that no new installation or equipment except those covered by (AA) 3.2.2.3.1 have been fitted to the ship after 19 May 2005. (regulation 12.1 of Annex VI);
 - (AA) **.3.2** confirm that no installations containing hydrochlorofluocarbons (HCFCs) have been fitted after 1 January 2020;
 - (AA) **.3.3** examine externally any installation or equipment as far as practicable to satisfactory maintenance to ensure that there are no emission of ozone-depleting substances.
- (AA) **.4** Nitrogen oxide emissions from each Diesel engines:
 - (AA) **.4.1** *If engine parameter check method is used:*
 - (AA) **.4.1.1** review engine documentation contained in the technical file and the record book of engine parameters to check, as far as practicable, engine rating, duty and limitation/restrictions as given in the technical file;
 - (AA) **.4.1.2** confirm that the engine has not undergone any modifications or adjustments outside the options and ranges permitted in the technical file since the last survey;
 - (AA) **.4.1.3** conduct survey as detailed in the technical file;
 - (AA) **.4.2** *If the simplified method is used:*
 - (AA) **.4.2.1** review engine documentation contained in the technical file;
 - (AA) **.4.2.2** confirm that the test procedure has been approved by the Administration;
 - (AA) **.4.2.3** confirm that the analysers, engine performance sensors, ambient condition measurement equipment, span check gases and other test equipment are the correct type and have been calibrated in accordance with the NO_x Technical Code;
 - (AA) **.4.2.4** confirm that the correct test cycle, as defined in the engine's technical file, is used for this onboard confirmation test measurements;
 - (AA) **.4.2.5** ensure that a fuel sample is taken during the test and submitted for analysis;
 - (AA) **.4.2.6** witness the test and confirm that a copy of the test report has been submitted for approval on completion of the test.

- (AA) **.4.3** *If the direct measurement and monitoring method is used:*
- (AA) **.4.3.1** review engine documentation method and technical file and verify that the direct measurement and monitoring manual is approved by the Administration;
- (AA) **.4.3.2** the procedures to be checked in the direct monitoring and measure method and the data obtained as given in the approved onboard monitoring manual should be followed;
- (AA) **.5** Sulphur Oxides:
- (AA) **.5.1** review bunker notes for the use of the correct sulphur content fuel for the area of operation;
- (AA) **.5.2** confirm that where there are tanks fitted for low and normal sulphur content fuel that fuel switching arrangement or procedures are provided and operational;
- (AA) **.5.3** verify that there are records of the change over to and from low sulphur fuel during transit through a SO_x emission control area;
- (AA) **.5.4** alternative to .2 and .3 above, where EGCS-SO_x or other equivalent devices are fitted, confirmation from the approved procedures for the equipment that it is in a satisfactory condition and operated in accordance with the required documentation.
- (AA) **.6** Volatile Organic Compounds (VOCs):
- (AA) **.6.1** confirm that the vapour collect system, if required, is approved taking into account MSC/Circ.585 “Standards for Vapour Emission Control Systems”;
- (AA) **.6.2** confirm from a general examination that the vapour collection piping is in a satisfactory condition;
- (AA) **.6.3** confirm that there is a means provided to eliminate the collection of condensation in the system, such as drains in low points of the line end. The drains should be checked to ensure they function correctly;
- (AA) **.6.4** confirm that the piping is electrically bonded to the hull and that the bonding is intact;
- (AA) **.6.5** confirm that the isolation valves at the vapour manifolds are operational and that the valve position indicators operate correctly;
- (AA) **.6.6** confirm that the ends of each line is properly identified as vapour collection lines;

- (AA) **.6.7** confirm that the vapour collection flanges are in accordance with the IMO guidelines and industrial standards;
- (AA) **.6.8** confirm that where portable vapour lines are provided that they are in good condition;
- (AA) **.6.9** confirm that the closed gauging system is operational and the readouts in the cargo control area are functional;
- (AA) **.6.10** confirm that there is an overflow control system provided and that it is operational;
- (AA) **.6.11** confirm that the alarm system is operational, both audible and visual alarms operate, the alarms are properly labelled; the power failure alarm operates and that there is a means to check the operation of the alarms and that this means is operational;
- (AA) **.6.12** confirm that there are high and low pressure alarms provided for each main vapour line and that these alarms operate at the correct set points;
- (AA) **.6.13** confirm that the high level and high high level (overflow) alarms act independently of each other.
- (AA) **.7** Incinerators (installed on or after 1 January 2000):
 - (AA) **.7.1** confirm from an external examination that each incinerator is in a generally satisfactory condition and free from leaks of gas or smoke;
 - (AA) **.7.2** confirm that the warning and instruction plates are legible and secured in prominent positions on or near the incinerator;
 - (AA) **.7.3** confirm that the manufacturers name, incinerator model number/type and capacity in heat units per hour is permanently marked on the incinerator;
 - (AA) **.7.4** confirm that the incinerator casing insulation arrangements are in good condition;
 - (AA) **.7.5** confirm as far as it is practicable, that the following alarms and safety devices are in good condition and fully operational;
 - (AA) **.7.5.1** flue gas high temperature alarms and shutdowns;
 - (AA) **.7.5.2** combustion temperature controls and shutdowns;
 - (AA) **.7.5.3** combustion chamber negative pressure;
 - (AA) **.7.5.4** flame safeguard control, alarms and shutdowns;

- (AA) **.7.5.5** all alarms both visual and audible are functioning and they indicate the cause of their failure;
- (AA) **.7.5.6** power loss alarms and auto shutdown arrangements;
- (AA) **.7.5.7** charging arrangements;
- (AA) **.7.5.8** low fuel oil pressure alarm/shutdown;
- (AA) **.7.5.9** emergency stop switch and electrical isolating arrangements;
- (AA) **.7.5.10** interlocks;
- (AA) **.7.6** confirm that drip trays are fitted under each burner, pump, and strainer and that they are in good condition;
- (AA) **3.2.3** For air pollution prevention the completion of the annual survey should consist of:
 - (AA) **.1** after a satisfactory survey, the International Prevention of Air Pollution certificate should be endorsed;
 - (AA) **.2** if a survey shows that the condition of the ship or its equipment is unsatisfactory - see "General", section 4.8.
- (AIn) **3.3** **Intermediate survey** – see "General", section 4.3
 - (AIn) **3.3.1** For air pollution prevention the examination of current certificates and other records should consist of:
 - (AIn) **.1** the provisions of (AA) 3.2.1.
 - (AIn) **3.3.2** For air pollution prevention the intermediate survey should consist of:
 - (AIn) **.1** the provisions of (AA) 3.2.2.
 - (AIn) **3.3.3** For air pollution prevention the completion of the intermediate survey should consist of:
 - (AIn) **.1** after a satisfactory survey, the International Prevention of Air Pollution Certificate should be endorsed;
 - (AIn) **.2** if a survey shows that the condition of the ship or its equipment is unsatisfactory see "General", section 4.4.
- (AR) **3.4** **Renewal surveys** – see "General", section 4.5
 - (AR) **3.4.1** For air pollution prevention the examination of current certificates and other records should consist of:

- (AR) .1 the provisions of (AA) 1.2.1 except the validity of the International Air Pollution Prevention Certificate.
- (AR) **3.4.2** For air pollution prevention the renewal survey should consist of:
- (AR) .1 the provisions of (AA) 3.2.2;
- (AR) .2 confirming, if necessary by simulated test or equivalent, the satisfactory operation of the vapour collection systems' closed gauging system and associated readouts;
- (AR) .3 confirming, if necessary by simulated test or equivalent, the satisfactory operation of the vapour collection systems' overflow control and it's audible and visual alarms;
- (AR) .4 confirming, if necessary by simulated test or equivalent, the satisfactory operation of the vapour collection systems' high and low pressure alarms for each main vapour line;
- (AR) .5 confirm that the vapour collection systems piping is electrically continuous;
- (AR) .6 confirm that the portable vapour lines are electrically continuous;
- (AR) .7 confirming, if necessary by simulated test or equivalent, the satisfactory operation of the following alarms and safety devices:
- (AR) .7.1 flue gas high temperature alarms and shutdowns;
- (AR) .7.2 combustion temperature controls and shutdowns;
- (AR) .7.3 combustion chamber negative pressure;
- (AR) .7.4 flame safeguard control, alarms and shutdowns;
- (AR) .7.5 all alarms both visual and audible are functional and they indicate the cause of their failure;
- (AR) .7.6 power loss alarms and auto shutdown arrangements;
- (AR) .7.7 charging arrangements;
- (AR) .7.8 low fuel oil pressure alarm/shutdown;
- (AR) .7.9 emergency stop switch and electrical isolating arrangements;
- (AR) .7.10 interlocks.
- (AR) **3.4.3** For air pollution prevention the completion of the renewal survey should consist of:
- (AR) .1 after satisfactory survey the International Prevention of Air Pollution Certificate should be issued.

6 In Annex 4 “**SURVEY GUIDELINES UNDER THE MANDATORY CODES**”:

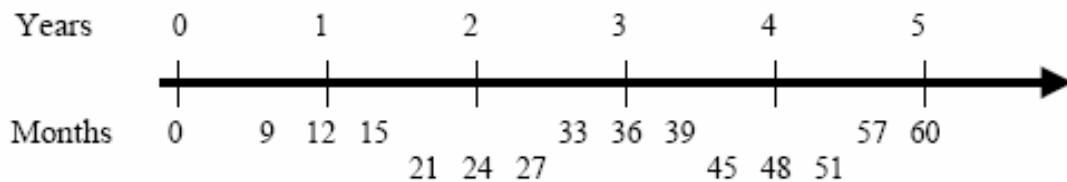
.1 the following new subparagraph *.6bis* is added after existing paragraph 1.2.1.6:

“(DA) *.6bis* checking, when appropriate, the validity of the International Air Pollution Prevention Certificate;”

.2 the following new subparagraph *.6bis* is added after existing paragraph 2.2.1.6:

“(GA) *.6bis* checking, when appropriate, the validity of the International Air Pollution Prevention Certificate;”

7 In appendix “**THE HARMONIZED SYSTEM OF SURVEY AND CERTIFICATION - DIAGRAMMATIC ARRANGEMENT**”:



the following new lines are added after existing line “MARPOL Annex II”:



ANNEX 11

RESOLUTION MEPC.129(53)

Adopted on 22 July 2005

GUIDELINES FOR PORT STATE CONTROL UNDER MARPOL ANNEX VI

THE MARINE ENVIRONMENT PROTECTION COMMITTEE,

RECALLING Article 38(a) of the Convention on the International Maritime Organization concerning the functions of the Marine Environment Protection Committee conferred upon it by the international conventions for the prevention and control of marine pollution,

RECALLING ALSO that, by the Protocol of 1997 to amend the International Convention for the Protection of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (the 1997 Protocol), Annex VI was added to the Convention,

NOTING that MARPOL Annex VI entered into force on 19 May 2005,

NOTING ALSO that articles 5 and 6 of the MARPOL Convention and regulations 10 and 11 of MARPOL Annex VI provide control procedures to be followed by a Party to the 1997 Protocol with regard to foreign ships visiting its ports,

RECOGNIZING the need to provide basic guidance on the conduct of port State control inspections for MARPOL Annex VI and ensure consistency in the conduct of these inspections, the recognition of deficiencies of a ship, its equipment, or its crew, and the application of control procedures,

HAVING CONSIDERED the draft Guidelines for port State control for MARPOL Annex VI prepared by the Sub-Committee on Flag State Implementation at its thirteenth session,

1. ADOPTS the Guidelines for port State control for MARPOL Annex VI, as set out in the Annex to this resolution;
2. INVITES Governments, when exercising port State control for MARPOL Annex VI, to apply the aforementioned Guidelines and to provide the Organization with information on their application; and
3. AGREES that, at a later stage, the Guidelines be adopted as amendments to resolution A.787(19) on Procedures for port State control, as amended by resolution A.882(21).

ANNEX

GUIDELINES FOR PORT STATE CONTROL UNDER MARPOL ANNEX VI

Chapter 1 GENERAL

1.1 This document is intended to provide basic guidance on the conduct of port State control inspections for compliance with MARPOL Annex VI (hereinafter referred to as “the Annex”) and afford consistency in the conduct of these inspections, the recognition of deficiencies and the application of control procedures.

1.2 The regulations of MARPOL Annex VI contain the following compliance provisions:

- .1 an IAPP Certificate is required for all ships of 400 GT or above engaged in international voyages. Administrations may establish alternative appropriate measures to demonstrate the necessary compliance in respect of ships under 400 GT engaged in international voyages;
- .2 in the case of the NO_x controls, these apply to all diesel engines over 130 kW (other than those used solely for emergency purposes) installed on ships constructed on or after 1 January 2000, and diesel engines subject to ‘major conversion’ (as defined by the Annex) on or after that date;
- .3 only those incinerators installed on or after 1 January 2000 are required to comply with the associated requirements (appendix IV to the Annex), however, the restrictions as to which materials may be incinerated apply to all incinerators; and
- .4 tanker vapour emission control systems are only required where their fitting is specified by the relevant authority.

1.3 Chapters 1 (General), 4 (Contravention and detention), 5 (Reporting requirements) and 6 (Review procedures) of the Procedures for Port State Control adopted by resolution A.787(19), as amended by resolution A.882(21), also apply to these Guidelines.

Chapter 2 INSPECTIONS OF SHIPS REQUIRED TO CARRY THE IAPP CERTIFICATE

2.1 Initial inspections

2.1.1 On boarding and introduction to the master or responsible ship’s officer, the port State control officer (PSCO) should examine the following documents:

- .1 the International Air Pollution Prevention Certificate (IAPP Certificate) (regulation VI/6), including its Supplement* ;
- .2 the Engine International Air Pollution Prevention Certificate (EIAPP Certificate) (paragraph 2.2 of the NO_x Technical Code) including its Supplement, for each applicable diesel engine;
- .3 the Technical File (paragraph 2.3.6 of the NO_x Technical Code) for each applicable diesel engine;
- .4 the record book of diesel engine parameters for each diesel engine (paragraph 6.2.3.3 of the NO_x Technical Code) demonstrating compliance with regulation VI/13 by means of the diesel engine parameter check method;
- .5 approved documentation relating to exhaust gas cleaning systems, or equivalent means, to reduce SO_x emissions (regulation VI/14(4), (b) or (c));
- .6 the bunker delivery notes and associated samples (regulation VI/18);
- .7 the copy of the type approval certificate of any shipboard incinerator installed on or after 1 January 2000 (for the incinerators with capacities up to 1,500 kW) (resolutions MEPC.76(40) and MEPC.93(45)); and
- .8 any notification to the ship's flag Administration issued by the master or officer in charge of the bunker operation together with any available commercial documentation relevant to non-compliant bunker delivery.

The PSCO should ascertain the date of construction and installation of equipment on board which are subject to the provisions of the Annex, in order to confirm which regulations of the Annex are applicable.

2.1.2 As a preliminary check, the IAPP Certificate's validity should be confirmed by verifying that the Certificate is properly completed and signed and that required surveys have been performed.

2.1.3 Through examining the Supplement to the IAPP Certificate, the PSCO may establish how the ship is equipped for the prevention of air pollution.

2.1.4 If the certificates and documents are valid and appropriate, and the PSCO's general impressions and visual observations on board confirm a good standard of maintenance, the PSCO should generally confine the inspection to reported deficiencies, if any.

2.1.5 In the case where the bunker delivery note or the representative sample as required by regulation 18 of this Annex presented to the ship are not in compliance with the relevant

* Under regulation 6(2) of MARPOL Annex VI, ships constructed before 19 May 2005 shall be issued with the IAPP Certificate not later than the first scheduled dry docking after 19 May 2005, but in no case later than 19 May 2008. Ships flying the flag of a State which is not a Party to MARPOL Annex VI and which do not carry an IAPP Certificate after the above dates should be treated in accordance with chapter 3 of these Guidelines.

requirements, the master or officer in charge of the bunker operation should have documented that through a Notification to the ship's Flag Administration with copies to the port authority under whose jurisdiction the ship did not receive the required documentation pursuant to the bunkering operation and to the bunker deliverer. A copy should be retained onboard the ship, together with any available commercial documentation, for the subsequent scrutiny of port State control.

2.1.6 If, however, the PSCO's general impressions or observations on board give clear grounds (see paragraph 2.1.7) for believing that the condition of the ship or its equipment do not correspond substantially with the particulars of the certificates or the documents, the PSCO should proceed to a more detailed inspection.

2.1.7 "Clear grounds" to conduct a more detailed inspection include:

- .1 evidence that certificates required by the Annex are missing or clearly invalid;
- .2 evidence that documents required by the Annex are missing or clearly invalid;
- .3 the absence of principal equipment or arrangements specified in the certificates or documents;
- .4 the presence of equipment or arrangements not specified in the certificates or documents;
- .5 evidence from the PSCO's general impressions or observations that serious deficiencies exist in the equipment or arrangements specified in the certificates or documents;
- .6 information or evidence that the master or crew are not familiar with essential shipboard operations relating to the prevention of air pollution, or that such operations have not been carried out;
- .7 evidence that the quality of fuel oil, delivered to and used on board the ship, appears to be substandard; or
- .8 receipt of a report or complaint containing information that the ship appears to be substandard.

2.2 More detailed inspections

2.2.1 The PSCO should verify that:

- .1 there are effectively implemented maintenance procedures for the equipment containing ozone-depleting substances; and
- .2 there are no deliberate emissions of ozone-depleting substances.

2.2.2 In order to verify that each installed diesel engine with a power output of more than 130 kW is approved by the Administration in accordance with the NO_x Technical Code and maintained appropriately, the PSCO should pay particular attention to the following:

- .1 examine such diesel engines to be consistent with the EIAPP Certificate and its Supplement, Technical File and, if applicable, Engine Record Book;
- .2 examine diesel engines specified in the Technical Files to verify that no unapproved modifications, which may affect on NO_x emission, have been made to the diesel engines;
- .3 in the case of ships constructed before 1 January 2000, verify that any diesel engine which has been subject to a major conversion, as defined in regulation VI/13, has been approved by the Administration; and
- .4 emergency diesel engines intended to be used solely in case of emergency are still in use for this purpose.

2.2.3 The PSCO should check whether the quality of fuel oil used on board the ship, conforms to the provisions of regulations VI/14 and VI/18*, taking into account appendix IV to the Annex. Furthermore, the PSCO should pay attention to the record required in regulation VI/14(6) in order to identify the sulphur content of fuel oil used while the ship is within SO_x emission control areas, or that other equivalent approved means have been applied as required.

2.2.4 If the ship is a tanker, as defined in paragraph (12) of regulation VI/2, the PSCO should verify that the vapour collection system approved by the Administration, taking into account MSC/Circ.585, is installed, if required under regulation VI/15.

2.2.5 The PSCO should verify that shipboard incineration of sewage sludge or sludge oil in boilers or marine power plants is not undertaken while the ship is inside ports, harbours or estuaries (regulation VI/16(5)).

2.2.6 The PSCO should verify that the shipboard incinerator, if required by regulation VI/16(2), is approved by the Administration. For these units, it should be verified that the incinerator is properly maintained, therefore the PSCO should examine whether:

- .1 the shipboard incinerator is consistent with the certificate of shipboard incinerator;
- .2 the operational manual, in order to operate the shipboard incinerator within the limits provided in appendix IV to the Annex, is provided; and
- .3 the combustion chamber flue gas outlet temperature is monitored as required (regulation VI/16(9)).

2.2.7 If there are clear grounds as defined in paragraph 2.1.6, the PSCO may examine operational procedures by confirming that:

- .1 the master or crew are familiar with the procedures to prevent emissions of ozone-depleting substances;

* It should be noted that in the case where bunker delivery note or representative sample as required by regulation VI/18 are not in compliance with the relevant requirements, the master or crew should have documented that fact. Where fuel oil supply was undertaken in a port under the jurisdiction of a Party to the 1997 Protocol, the PSCO should report that non-compliance to the appropriate authority responsible for the registration of fuel oil suppliers (regulation VI/18(8)(a)).

- .2 the master or crew are familiar with the proper operation and maintenance of diesel engines, in accordance with their Technical Files;
- .3 the master or crew have undertaken the necessary fuel oil changeover procedures, or equivalent, associated with demonstrating compliance within an SO_x emission control area;
- .4 the master or crew are familiar with the garbage screening procedure to ensure that prohibited garbage is not incinerated;
- .5 the master or crew are familiar with the operation of the shipboard incinerator, as required by regulation VI/16(2), within the limits provided in appendix IV to the Annex, in accordance with its operational manual;
- .6 the master or crew are familiar with the regulation of emissions of volatile organic compounds (VOCs), when the ship is in ports or terminals under the jurisdiction of a Party to the 1997 Protocol to MARPOL 73/78 in which VOCs emissions are to be regulated, and are familiar with the proper operation of a vapour collection system approved by the Administration (in case the ship is a tanker as defined in regulation VI/2(12)); and
- .7 the master or crew are familiar with bunker delivery procedures in respect of bunker delivery notes and retained samples as required by regulation VI/18.

2.3 Detainable deficiencies

2.3.1 In exercising his/her functions, the PSCO should use professional judgment to determine whether to detain the ship until any noted deficiencies are corrected or to allow it to sail with certain deficiencies which do not pose an unreasonable threat of harm to the marine environment. In doing this, the PSCO should be guided by the principle that the requirements contained in the Annex, with respect to the construction, equipment and operation of the ship, are essential for the protection of the marine environment and that departure from these requirements could constitute an unreasonable threat of harm to the marine environment.

2.3.2 In order to assist the PSCO in the use of these guidelines, there follows a list of deficiencies, which are considered to be of such a serious nature that they may warrant the detention of the ship involved:

- .1 absence of valid IAPP Certificate, EIAPP Certificates or Technical Files^{*};
- .2 a diesel engine, with a power output of more than 130 kW, which is installed on board a ship constructed on or after 1 January 2000, or a diesel engine having undergone a major conversion on or after 1 January 2000, which does not comply with the NO_x Technical Code;

* Under regulation 6(2) of MARPOL Annex VI, ships constructed before 19 May 2005 shall be issued with the IAPP Certificate no later than the first scheduled dry docking after 19 May 2005, but in no case later than 19 May 2008. Ships flying the flag of a State which is not a Party to MARPOL Annex VI and which do not carry an IAPP Certificate after the above dates should be treated in accordance with chapter 3 of these Guidelines.

- .3 the sulphur content of any fuel oil being used on board exceeds 4.5% m/m.
- .4 non-compliance with the relevant requirements while operating within an SO_x emission control area;
- .5 an incinerator installed on board the ship on or after 1 January 2000 does not comply with requirements contained in appendix IV to the Annex, or the standard specifications for shipboard incinerators developed by the Organization (resolutions MEPC.76(40) and MEPC.93(45));
- .6 the master or crew are not familiar with essential procedures regarding the operation of air pollution prevention equipment as defined in paragraph 2.2.7 above.

Chapter 3 INSPECTIONS OF SHIPS OF NON-PARTIES TO THE ANNEX AND OTHER SHIPS NOT REQUIRED TO CARRY THE IAPP CERTIFICATE

3.1 As this category of ships is not provided with the IAPP Certificate, the PSCO should judge whether the condition of the ship and its equipment satisfies the requirements set out in the Annex. In this respect, the PSCO should take into account that, in accordance with article 5(4) of the MARPOL Convention, no more favourable treatment is to be given to ships of non-Parties.

3.2 In all other respects the PSCO should be guided by the procedures for ships referred to in chapter 2 and should be satisfied that the ship and crew do not present a danger to those on board or an unreasonable threat of harm to the marine environment.

3.3 If the ship has a form of certification other than the IAPP Certificate, the PSCO may take such documentation into account in the evaluation of the ship.

ANNEX 12

RESOLUTION MEPC.130(53)

Adopted on 22 July 2005

GUIDELINES FOR ON-BOARD EXHAUST GAS-SO_x CLEANING SYSTEMS

THE MARINE ENVIRONMENT PROTECTION COMMITTEE,

RECALLING Article 38(a) of the Convention on the International Maritime Organization concerning the functions of the Marine Environment Protection Committee (the Committee) conferred upon it by international conventions for the prevention and control of marine pollution,

RECALLING ALSO that the Conference of Parties to the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78), held in September 1997, adopted the Protocol of 1997 to amend MARPOL 73/78 with a new Annex VI on the Prevention of Air Pollution from Ships,

NOTING that the 1997 Conference by regulation 14(4)(b) of Annex VI, agreed that ships within a SO_x emission control area are permitted to operate with an exhaust gas cleaning system approved by the Administration and taking into account guidelines to be developed by the Organization,

BEING AWARE that the Protocol of 1997 entered into force on 19 May 2005 and that exemptions from the requirements for SO_x emission control areas will cease on 18 May 2006,

HAVING CONSIDERED the recommendation made by the Sub-Committee on Ship Design and Equipment at its forty-eighth session,

1. ADOPTS the Guidelines for exhaust gas-SO_x cleaning systems, as set out in the Annex to this resolution;
2. INVITES Governments to apply the Guidelines from the date of their adoption.

ANNEX

**GUIDELINES FOR EXHAUST GAS-SO_x CLEANING SYSTEMS -
MARPOL ANNEX VI, REGULATION 14(4)(b)**

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GUIDELINES FOR EXHAUST GAS-SO_x CLEANING SYSTEMS - MARPOL ANNEX VI, REGULATION 14(4)(b)

INTRODUCTION

Regulation 14(4) of Annex VI to MARPOL 73/78 requires ships within SO_x emission control areas to either use fuel oil with a sulphur content not exceeding 1.5% or apply an exhaust gas (SO_x) cleaning system (EGCS-SO_x) to reduce the total emission of SO_x to 6.0g/kWh. (6.0 g SO_x/kWh or less should be calculated as the total weight of sulphur dioxide emission). The EGCS-SO_x unit is to be approved by the Administration taking into account guidelines developed by the Organization.

Similar to a NO_x emission reduction system, a EGCS-SO_x unit may be type approved subject to periodic parameter and emission checks or the system may be equipped with a continuous emission monitoring system. These guidelines have been developed with the intention of being objective and performance oriented. Introduction of the SO₂ (ppm) / CO₂ (%) ratio method would simplify the monitoring of SO_x emission and facilitate type approval of the EGCS-SO_x unit. See Appendix I for the rationale explaining the use of SO₂ (ppm) / CO₂ (%) as the basis for system monitoring.

These Guidelines are recommendatory in nature, however, Administrations are invited to base their implementation on these guidelines.

SAFETY NOTE

Due attention is to be given to the safety implications related to the handling and proximity of exhaust gases, the measurement equipment and the storage and use of cylindered pure and calibration gases. Sampling positions and access staging should be such that this monitoring may be performed safely. In locating discharge outlet of waste water used in the EGCS-SO_x unit, due consideration should be given to the location of the ship's sea water inlet and other implications of the acidic nature of such water.

SCHEME A – EGCS-SO_x UNIT TYPE APPROVAL AND CERTIFICATION

Unit certification of Exhaust Gas-SO_x Cleaning Systems (EGCS-SO_x) by the Administration with subsequent in service verification at survey intervals by indirect means together with unit use monitoring.

1 GENERAL

1.1 Purpose

The purpose of these Guidelines is to specify the requirements for the design, testing, survey and certification of exhaust gas cleaning-SO_x systems (EGCS-SO_x) to ensure that they comply with the requirements of regulation 14(4)(b) of Annex VI of MARPOL 73/78.

1.2 Application

1.2.1 These Guidelines apply to any EGCS-SO_x unit as fitted to fuel oil combustion machinery, excluding shipboard incinerators, installed onboard a ship which is to operate within a SO_x Emission Control Area (SECA).

1.2.2 These Guidelines cover only the certification, survey, and testing of the EGCS-SO_x unit for compliance with regulation 14(4)(b) of Annex VI.

1.3 Definitions

“ppm” means “parts per million”. It is assumed that ppm is measured by gas analysers on a molar basis, assuming ideal micro-moles of substance per mole of total amount (μmol/mol), but ppm is used in order to be consistent with units in the NO_x Technical Code.

“Fuel oil combustion unit” means any engine, boiler, gas turbine, or other fuel oil fired equipment.

2 SURVEY AND CERTIFICATION

2.1 General

2.1.1 Prior to use within a SECA, each EGCS-SO_x unit should be issued with a SECA Compliance Certificate (SCC) by the Administration.

2.1.2 The EGCS-SO_x unit should be subject to survey on installation and at Initial, Annual/Intermediate and Renewals Surveys by the Administration, irrespective of whether or not the ship is in a SECA at the time of Survey.

2.1.3 The ship's SCC should be duly endorsed at each survey as required by 2.1.2.

2.1.4 In accordance with regulation 10, EGCS-SO_x units may also be subject to inspection by PSC when operating within a SECA.

2.2 Procedures for the certification of an EGCS-SO_x unit

2.2.1 In order to meet the requirements of 2.1.1 either prior to, or after installation onboard, each EGCS-SO_x unit should be certified as meeting the emission limit of 6.0 g SO_x/kWh under the operating conditions and restrictions as given by the EGCS-SO_x Technical Manual (ETM) as approved by the Administration.

2.2.2 Determination of the emission value should be in accordance with the provisions of these Guidelines.

2.2.3 Each EGCS-SO_x unit meeting the requirements of 2.2.1 should be issued by the Administration with a SCC.

2.2.4 Application for a SCC should be made by the EGCS-SO_x manufacturer, shipowner or other party.

2.2.5 Subsequent EGCS-SO_x units of the same design and rating as that certified under 2.2.1 may be issued with SCC by the Administration without the need for testing in accordance with 2.2.1 subject to section 4.2 of these Guidelines.

2.2.6 EGCS-SO_x units of the same design, but with ratings different from that certified under 2.2.1 may be accepted by the Administration subject to section 4.3 of these Guidelines.

2.2.7 EGCS-SO_x units which treat only part of the exhaust gas flow of the uptake in which they are fitted should be subject to special consideration by the Administration to ensure that under all defined operating conditions that the overall emission value of the exhaust gas down stream of the system is no more than 6.0 g SO_x /kWh.

2.3 EGCS-SO_x Technical Manual

2.3.1 Each EGCS-SO_x unit is to be supplied with a EGCS-SO_x Technical Manual (ETM) provided by the Manufacturer. This ETM should, as a minimum, contain the following information:

- (a) the identification of the unit (manufacturer, model/type, serial number and other details as necessary) including a description of the unit and any required ancillary systems;
- (b) the operating limits, or range of operating values, for which the unit is certified. These should, as a minimum, include:
 - (i) maximum and, if applicable, minimum mass flow rate of exhaust gas;
 - (ii) the power, type and other relevant parameters of the fuel oil combustion unit for which the EGCS-SO_x unit is to be fitted. In the cases of boilers, the maximum air/fuel ratio at 100% load should also be given. In the cases of diesel engines whether the engine is of 2 or 4 stroke cycle;
 - (iii) maximum and minimum wash water flow rate, inlet pressures and minimum inlet water alkalinity (pH);
 - (iv) exhaust gas inlet temperature ranges and maximum exhaust gas outlet temperature with the EGCS-SO_x unit in operation;
 - (v) exhaust gas differential pressure range and the maximum exhaust gas inlet pressure with the fuel oil combustion unit operating at MCR or 80% of power rating whichever is appropriate;
 - (vi) salinity levels or fresh water elements necessary to provide adequate neutralizing agents; and
 - (vii) other factors concerning the design and operation of the EGCS-SO_x unit relevant to achieving a maximum emission value no higher than 6.0 g SO_x/kWh;

- (c) any requirements or restrictions applicable to the EGCS-SO_x unit or associated equipment necessary to enable the unit to achieve a maximum emission value no higher than 6.0 g SO_x/kWh;
- (d) maintenance, service or adjustment requirements in order that the EGCS-SO_x unit can continue to achieve a maximum emission value no higher than 6.0 g SO_x/kWh;
- (e) the means by which the EGCS-SO_x unit is to be surveyed to ensure that its performance is maintained and that the unit is used as required (see section 6);
- (f) through range performance variation in wash water characteristics;
- (g) design requirements of the wash water system; and
- (h) the SCC.

2.3.2 The ETM should be approved by the Administration.

2.3.3 The ETM should be retained onboard the ship onto which the EGCS-SO_x unit is fitted. The ETM should be available for surveys as required.

2.3.4 Additions, deletions or amendments to the ETM should be approved by the Administration. Where additions, deletions or amendments to the ETM are separate to the ETM as initially approved, they should be retained with the ETM and should be considered as part of the ETM.

2.3.5 As an alternative to the maximum emission rate stipulated in 2.3.1(b)(vii) of 6.0 g SO_x/kWh, SO₂ (ppm) / CO₂ (%) ratio of 65 or below, measured downstream of EGCS-SO_x unit may be used.

3 EMISSION LIMIT

3.1 Each EGCS-SO_x unit should be capable of reducing emissions to no more than 6.0 g SO_x/kWh at any load point when operated in accordance with the criteria as given within 2.3.1(b), as specified in paragraphs 3.2 through 3.5 of these Guidelines, and as excepted in paragraphs 3.7 and 3.8.

3.2 EGCS-SO_x units fitted to main propulsion diesel engines should meet the requirements of 3.1 at all loads between 25-100% of the load range of the engines to which they are fitted.

3.3 EGCS-SO_x units fitted to auxiliary diesel engines should meet the requirements of 3.1 at all loads between 10-100% of the load range of the engines to which they are fitted.

3.4 EGCS-SO_x units fitted to diesel engines which supply power for both main propulsion and auxiliary purposes should meet the requirements of 3.3.

3.5 EGCS-SO_x units fitted to boilers should meet the requirements of 3.1 at all loads between 10-100% of the load range (steaming rates) of the boilers to which they are fitted.

3.6 In order to demonstrate performance, emission measurements should be undertaken, with the agreement of the Administration, at a minimum of four load points. One load point is to be at 95-100% of the maximum exhaust gas mass flow rate for which the unit is to be certified. One load point is to be within $\pm 5\%$ of the minimum exhaust gas mass flow rate for which the unit is to be certified. The other two load points are to be equally spaced between the maximum and minimum exhaust gas mass flow rates. Where there are discontinuities in the operation of the system the number of load points should be increased, with the agreement of the Administration, so that it is demonstrated that the required performance over the stated exhaust gas mass flow rate range is retained. Additional intermediate load points should be tested if there is evidence of an emission peak below the maximum exhaust gas mass flow rate and above, if applicable, the minimum exhaust gas flow rate. These additional tests should be sufficient number as to establish the emission peak value.

3.7 For loads below those specified in 3.2 to 3.5, the EGCS-SO_x unit should continue in operation. In those cases where the fuel oil combustion equipment may be required to operate under idling conditions, the SO₂ emission concentration (ppm) at standardized O₂ concentration (15.0% diesel engines, 3.0% boilers) should not exceed 50 ppm.

3.8 Alternatively to the provisions of 3.2-3.5 and 3.7, each EGCS-SO_x unit should be capable of reducing emissions to 65 or below, in SO₂ (ppm) / CO₂ (%) ratio at any load point when operated in accordance with the criteria as given within 2.3.1(b) and 2.3.4.

4 APPROVAL OF AN EGCS-SO_x UNIT

4.1 Unit approval

4.1.1 An EGCS-SO_x unit should be capable of meeting the limit value of 6.0 g SO_x/kWh (other than as given in section 3) with fuel oils of up to 4.5% m/m sulphur and for the range of operating parameters, as listed in 2.3.1(b), for which they are to be approved.

4.1.2 Where testing is not to be undertaken with fuel oils of 4.5% m/m sulphur content or above, testing should be undertaken to demonstrate the effect of fuel oil sulphur content on system performance. In such cases a minimum of two tests, in accordance with section 3 as appropriate, should be performed. These need not be sequential and could be undertaken on two different, but identical, EGCS-SO_x units. The minimum sulphur content of the fuel oil used in one test should not be less than 2.0% m/m sulphur. The other fuel oil should have a sulphur content of at least 1.0% m/m sulphur above that of the lower sulphur content fuel oil. The EGCS-SO_x unit manufacturer should justify, on the basis of the above considerations, and other testing as may be required, that the EGCS-SO_x unit would meet the required limit of 6.0 g SO_x/kWh when used with a fuel oil of 4.5% m/m sulphur.

4.1.3 The maximum and, if applicable, minimum exhaust gas mass flow rate of the unit should be stated. The effect of variation of the other parameters defined in 2.3.1(b) should be justified by the equipment manufacturer. The effect of variations in these factors is to be assessed by testing or otherwise as appropriate. No variation in these factors, or combination of variations in these factors, should be such that the emission value of the EGCS-SO_x unit would be in excess of 6.0 g SO_x/kWh.

4.1.4 Data obtained in accordance with this section should be submitted to the Administration for approval together with the ETM.

4.2 Serially manufactured units

In the case of nominally similar EGCS-SO_x units of the same mass flow ratings as that certified under 4.1, and to avoid the testing in accordance with 2.2.1 each EGCS-SO_x unit, the equipment manufacturer may submit, for acceptance by the Administration, a conformity of production arrangement. The certification of each EGCS-SO_x unit under this arrangement should be subject to such surveys that the Administration may consider necessary as to assure that each EGCS-SO_x unit has an emission value of not more than 6.0 g SO_x/kWh when operated in accordance with the parameters defined in 2.3.1(b).

4.3 Product range approval

4.3.1 In the case of an EGCS-SO_x unit of the same design, but of different maximum exhaust gas mass flow capacities, the Administration may accept, in lieu of tests on an EGCS-SO_x unit of all capacities in accordance with section 4.1, tests of EGCS-SO_x systems of three different capacities provided that the three tests are performed at intervals including the highest, lowest and one intermediate capacity rating within the range.

4.3.2 Where there are significant differences in the design of EGCS-SO_x units of different capacities, this procedure should not be applied unless it can be shown, to the satisfaction of the Administration, that in practice those differences do not materially alter the performance between the various EGCS-SO_x unit types.

4.3.3 For EGCS-SO_x units of different capacities, the sensitivity to variations in the type of combustion machinery to which they are fitted should be detailed together with sensitivity to the variations in the parameters listed in 2.3.1(b). This should be on the basis of testing, or other data as appropriate.

4.3.4 The effect of changes of EGCS-SO_x capacity on wash water characteristics should be detailed.

4.3.5 All supporting data obtained in accordance with this section, together with the ETM for each capacity unit, should be submitted to the Administration in accordance with 4.1.6.

4.3.6 An SO₂ (ppm) / CO₂ (%) ratio of 65 may be used for emission limit value specified in 4.1.2, 4.1.3 and 4.2.

5 EMISSION TESTING

5.1 Emission testing should follow the requirements of the NO_x Technical Code, chapter 5, and associated Appendices, except as provided for in these Guidelines.

5.2 CO₂, O₂ and SO₂ should be measured. CO₂ and O₂ as % to a precision of +/-1% of the true reading for a signal averaging time of 10 seconds, but not less than a lower detectable limit of 5 ppm.

5.3 SO₂ should be measured on a dry or wet basis using analysers operating on NDIR or NDUV principles and with additional equipment such as dryers as necessary. Other systems or analysers may be accepted, subject to the approval of the Administration, provided they yield equivalent results to those of the equipment referenced above.

5.4 An exhaust gas sample for SO₂ should be obtained from a representative sampling point downstream of the EGCS-SO_x unit.

5.5 SO₂ should be monitored on-line using either cross-duct or extractive sample systems.

5.6 Extractive exhaust gas samples for SO₂ determination should be maintained at a sufficient temperature to avoid condensed water in the sampling system and hence loss of SO₂.

5.7 If an extractive exhaust gas sample for determination needs to be dried prior to analysis it should be done in a manner which does not result in loss of SO₂ in the sample as analysed.

5.8 Where SO₂ is measured by a cross-duct system, the water content in the exhaust gas stream at that point is also to be determined in order to correct the reading to a dry basis value.

5.9 Where the exhaust gas mass flow is to be calculated in accordance with the NO_x Technical Code, Appendix 6, the complete combustion case calculations may be used. The exhaust gas mass flow (GEXHW) should be determined in respect of the mass flow into the EGCS-SO_x unit.

5.10 In applying the NO_x Technical Code, equation 15, the dry basis SO₂ concentration should be converted to a wet basis value using the dry/wet correction factor applicable to the exhaust gas at entry into the EGCS-SO_x unit (NO_x Technical Code, equation 11, CO = 0):

$$w = 0.002855, u = w/\text{exhaust gas density in g/m}^3 \text{ at } 0^\circ\text{C and } 101.3 \text{ kPa}$$

5.11 The fuel oil as used in the test should be a residual blend product. A representative sample of that fuel should be analysed in order to establish its chemical composition (carbon, hydrogen and sulphur) together with the other parameters as necessary to establish its grade in accordance with the ISO 8217 specification.

5.12 For diesel engines the power should be the uncorrected brake power.

5.13 For boilers the “power” should be determined based on the fuel rate and assumed brake specific fuel consumption of 200 g/kWh.

5.14 The determined emission value at each test point should be equal to, or less than, 6.0 g SO_x/kWh.

5.15 In lieu of the testing procedure laid down in 5.9 to 5.10 and 5.12 to 5.14, compliance may be demonstrated by continuous monitoring of SO₂ and CO₂ concentration in the exhaust gas downstream of the EGCS-SO_x unit and demonstrating that the SO₂ (ppm) / CO₂ (%) ratio, at each test point is 65 or below.

5.16 Should the SO₂ (ppm) / CO₂ (%) ratio method be used:

- (a) The conditions stipulated in 5.4 and 5.5 should also apply to the measurement of CO₂ (%) and it is recommended that SO₂ and CO₂ samples should be obtained at the same location.
- (b) Measurement of SO₂ and CO₂ should either be carried out above the respective dew points or on a fully dry basis recognizing that the conditions stipulated in 5.6-5.8 should also apply to the measurement of CO₂ (%).
- (c) The carbon and hydrogen content of the test fuel as stipulated in 5.11 need not be determined.
- (d) Calculation of the SO₂/CO₂ ratio should comply with the requirements of Scheme B, section 10.

6 PROCEDURES FOR DEMONSTRATING COMPLIANCE WITH EMISSION LIMIT ON BOARD

6.1 For each EGCS-SO_x unit, the ETM should contain a verification procedure for use at surveys as required. This procedure should not require specialized equipment or an in depth knowledge of the system. Where particular devices are required they should be provided and maintained as part of the system. The EGCS-SO_x unit should be designed in such a way as to facilitate inspection as required. The basis of this verification procedure is that if all relevant components and operating values or settings are within those as approved, then the performance of the EGCS-SO_x system is within that required without the need for actual exhaust emission measurements. It is also necessary to ensure that the EGCS-SO_x unit is fitted to an item of fuel oil combustion equipment for which it is rated - this forms part of the SCP.

6.2 Included in the verification procedure should be all components and operating values or settings which may affect the operation of the EGCS-SO_x unit and its ability to meet the required emission limit.

6.3 The verification procedure should be submitted by the EGCS-SO_x manufacturer and approved by the Administration.

6.4 The verification procedure should cover both a documentation check and a physical check of the EGCS-SO_x unit.

6.5 The Surveyor should verify that each EGCS-SO_x unit is installed in accordance with the ETM and has a SCC as required.

6.6 At the discretion of the Administration, the Surveyor should have the option of checking one or all of the identified components, operating values or settings. Where there is more than one EGCS-SO_x unit, the Administration may, at its discretion, abbreviate or reduce the extent of the survey on board however the entire survey should be completed for at least one of each type of EGCS-SO_x unit on board provided that it is expected that the other EGCS-SO_x units perform in the same manner.

6.7 The EGCS-SO_x unit should include means to automatically record when the system is in use. This should automatically record, as a minimum, wash water pressure and flow rate at the

EGCS-SO_x unit's inlet connection, pH of wash water at the EGCS-SO_x unit's inlet and outlet connections, exhaust gas pressure before and pressure drop across the EGCS-SO_x unit, fuel oil combustion equipment load, and exhaust gas temperature before and after the EGCS-SO_x unit. The data recording system should comply with the requirements of Scheme B, sections 12 and 13.

6.8 If a continuous exhaust gas monitoring system is not fitted, it is recommended that a daily spot check of the exhaust gas quality in terms of SO₂ (ppm) / CO₂ (%) ratio, is used to verify compliance in conjunction with parameter checks stipulated in 6.7. If a continuous exhaust gas monitoring system is fitted, only daily spot checks of the parameters listed in paragraph 6.7 would be needed to verify proper operation of the EGCS-SO_x unit.

6.9 If the EGCS-SO_x manufacturer is unable to provide assurance that the EGCS-SO_x unit will meet the limit value of 6g SO_x/kWh or SO₂ (ppm) / CO₂ (%) ratio of 65 or below between surveys, by means of the verification procedure stipulated in 6.1, or if this requires specialist equipment or in-depth knowledge, it is recommended that continuous exhaust gas monitoring of each EGCS-SO_x unit be used to assure ship operators of compliance when operating within a SECA and in the event of port State authority inspection.

6.10 An EGCS-SO_x Record Book should be maintained by the shipowner recording maintenance and service of the unit. The form of this record should be submitted by the EGCS-SO_x manufacturer and approved by the Administration. This record book should be available at surveys as required and may be read in conjunction with engine room log-books and other data as necessary to confirm the correction operation of the EGCS-SO_x unit. Alternatively, this information is to be recorded in the vessel's planned maintenance record system as approved by the Administration.

7 WASH WATER MONITORING

7.1 The clean seawater supply to the EGCS-SO_x unit and the wash water being discharged should also be monitored, at a defined frequency appropriate to the sensors used, for pH and oil content together with other parameters which may have an adverse impact on ecosystems in the area in which the ship operates taking into account the requirements of section 17. The data provided by this monitoring should be used by the ship in assessing the acceptability of water discharge against criteria which may be developed by individual port State authorities.

7.2 The wash water monitor and data recording system should comply with the requirements of Scheme B, sections 12 and 13.

SCHEME B – CONTINUOUS MONITORING OF SO_x EMISSIONS

Compliance demonstrated in service by continuous exhaust gas monitoring. Monitoring system should be approved by the Administration and the results of that monitoring available to the Administration as necessary to demonstrate compliance as required.

Additionally for all ships which are to use an EGCS-SO_x unit, in part or in total, in order to comply with the requirements of regulation 14(4) there should be a SECA Compliance Plan (SCP) for the ship, approved by the Administration, detailing how:

- (a) compliance is to be achieved;
- (b) that compliance is to be demonstrated.

8 GENERAL

This Scheme should be used to demonstrate that the emissions from an item of fuel oil combustion equipment fitted with an EGCS will, with that system in operation, result in an emission value of SO₂ (ppm) / CO₂ (%) ratio of 65 or below at any load point, including during transient operation and thus compliance with the requirements of regulation 14(4)(b) of MARPOL Annex VI.

9 EXHAUST GAS MEASUREMENT

Exhaust gas composition, (SO₂ plus CO₂) measurement should be at an appropriate position after the EGCS-SO_x unit and comply with the requirements of 5.2 and 5.16, Scheme A.

10 CALCULATION OF EMISSION RATE

10.1 SO₂ (ppm) and CO₂ (%) to be continuously monitored and recorded onto a data recording and processing device at a rate which should not be less than 0.005 Hz.

10.2 If more than one analyser is to be used to determine the SO₂/CO₂ ratio, these should be tuned to have similar sampling and measurement times and the data outputs aligned so that the SO₂/CO₂ ratio is fully representative of the exhaust gas composition.

11 WASH WATER MONITORING

The clean seawater to the EGCS-SO_x unit and the wash water being discharged should also be monitored, at a defined frequency appropriate to the sensors used, for pH and oil content together with other parameters which may have an adverse impact on ecosystems in the area in which the ship operates. The data provided by this monitoring should be used by the ship in assessing the acceptability of water discharge against criteria which may be developed by individual port State authorities.

12 DATA RECORDING AND PROCESSING DEVICE

12.1 The recording and processing device should be of robust, tamper proof design with read only capability.

12.2 The recording and processing device should record the data required by section 10.1 against UTC and ships position by a Global Navigational Satellite System (GNSS).

12.3 The recording and processing device should be capable of preparing reports over specified time periods.

12.4 Data should be retained for a period of not less than 18 months from the date of recording. If the unit is changed over that period, the shipowner should ensure that the required data is retained onboard and available as required.

12.5 The device should be capable of downloading a copy of the recorded data and reports in a readily useable format. Such copy of the data and reports should be available to the Administration or port State authority as requested.

13 ON-BOARD MONITORING MANUAL

13.1 An On-board Monitoring Manual (OMM) should be prepared to cover each item of fuel oil combustion equipment, which should be identified, for which compliance is to be demonstrated by this Scheme.

13.2 The OMM should, as a minimum, include:

- (a) the sensors to be used in evaluating EGCS performance and discharge water, their service, maintenance and calibration requirements;
- (b) the positions from which exhaust emission measurements are to be taken together with details of any necessary ancillary services such as sample transfer lines and sample treatment units and any related service or maintenance requirements;
- (c) the analysers to be used, their service, maintenance, and calibration requirements;
- (d) analyser zero and span check procedures; and
- (e) other information or data relevant to the correct functioning of the monitoring system or its use in demonstrating compliance.

13.3 The OMM should specify how the monitoring is to be surveyed.

13.4 The OMM should be approved by the Administration.

14 SECA COMPLIANCE PLAN (SCP)

For all ships which are to use an EGCS-SO_x unit, in part or in total, in order to comply with the requirements of regulation 14(4) there should be a SECA Compliance Plan (SCP) for the ship, approved by the Administration.

15 SHIP COMPLIANCE

15.1 The SCP should list each item of fuel oil combustion equipment which is to meet the requirements for operating in a SECA by means of an approved EGCS-SO_x unit.

15.2 Under Scheme A, the SCP should present continuous monitoring data demonstrating that the parameters in paragraph 6.7 are maintained within the manufacturer's recommended specifications. Under Scheme B, this would be demonstrated using daily recordings.

15.3 Under Scheme B, the SCP should present continuous monitoring demonstrating that the SO₂ (ppm) / CO₂ (%) ratio is 65 or below. Under Scheme A, this would be demonstrated using daily recordings.

15.4 There may be some equipment such as small engines and boilers to which the fitting of EGCS-SO_x units would not be practical, particularly where such equipment is located in a position remote from the main machinery spaces. All such fuel oil combustion units should be listed in the SCP. For these fuel oil combustion units which are not to be fitted with EGCS-SO_x units, compliance may be achieved by means of regulation 14(4)(a) while operating within a SECA. Alternatively, compliance may be achieved based on total ship emissions as described in paragraphs 15.7 and 15.8.

15.5 Ship construction requirements generally require that each fuel oil combustion unit should have its own exhaust gas system venting to the atmosphere. Therefore compliance by the ship may be demonstrated by each item of fuel oil combustion equipment meeting the requirements of either Scheme A or Scheme B. Alternatively, compliance may be demonstrated on the basis of total emissions generated by the ship as noted in paragraphs 15.7 and 15.8.

15.6 If each fuel oil combustion unit meets the requirements of either regulation 14(4)(a) or 14(4)(b) the ship is considered to be in compliance with the requirements.

15.7 Recognizing that the limit given in regulation 14(4)(b) is for the ship, not each individual item of combustion equipment, the shipowner should have the opportunity to balance performance which considerably exceeds the requirement of 6.0 g SO_x/kWh or SO₂ (ppm) / CO₂ (%) ratio of 65 or below against that of equipment, potentially not fitted with EGCS-SO_x units, which does not meet that requirement. These cases should be subject to special consideration by the administration. In particular the SCP should detail how the actual emissions from each fuel oil combustion unit are to be aggregated together to obtain an overall, real time, emission value for the ship which does not exceed 6.0 g SO_x/ kWh or SO₂ (ppm) / CO₂ (%) ratio of 65 or below.

15.8 Since the emission value in regulation 14(4)(b) is an alternative to that given in regulation 14(4)(a), not an equivalent, compliance in excess of that required by means of regulation 14(4)(a) in respect of fuel oil burning units, such as given in section 2.3, should only be set against the requirements of regulation 14(4)(b) where it can be clearly documented as to the actual sulphur content of the fuel oil being used at any time together with the requirement that the specific fuel consumption rate (g fuel/kWh) of that equipment is capable of determination on a real time basis (calibration requirements of such equipment to comply with those as given in the NO_x Technical Code).

15.9 At no time during operation in a SECA should the total ship emissions, as described in paragraph 15.5, exceed the requirement of 6.0 g SO_x/kWh or exceed the SO₂ (ppm) / CO₂ (%) ratio of 65 or below. Shipowners are advised to consider worst case operating scenarios, such as manoeuvring or high power operation, in their SO_x control strategies.

16 DEMONSTRATION OF COMPLIANCE

16.1 The SCP should refer to, not reproduce, the ETM and Record Book as specified under that Scheme. Alternatively, this information is to be recorded in the ship's planned Maintenance Record System, as allowed by the Administration.

16.2 For all fuel oil combustion equipment listed under 15.1, details should be provided demonstrating that the rating and restrictions for the EGCS-SO_x unit as approved, 2.3.1(b), are complied with.

16.3 The wash water flow rate and pressure at the EGCS-SO_x unit inlet connections, pH of the wash water at the EGCS-SO_x unit's inlet and outlet connections, exhaust gas pressure before and pressure drop across the EGCS-SO_x unit, fuel oil equipment load, and other parameters as considered necessary, should be monitored and recorded continuously while within a SECA in order to demonstrate compliance.

16.4 The SCP should refer to the On-board Monitoring Manual as approved by the Administration and the input data and resulting reports.

17 WASH WATER

EGCS-SO_x unit's wash water systems should:

- (a) eliminate, or reduce to a level at which they are not harmful, hydrocarbons, carbon residue, ash, vanadium, other heavy metals, and other substances contained within EGCS-SO_x unit's wash water that may have an adverse impact on ecosystems if discharged overboard,
- (b) ensure that the approach adopted, to control wash water quality and residual waste is not achieved in a way that causes pollution in other areas or environmental media,
- (c) also taking into account guidelines to be developed by the Organization.

18 WASH WATER RESIDUES

18.1 Residues generated by the EGCS-SO_x unit should be land disposed. Such residues should not be discharged to the sea or incinerated on board.

18.2 The record keeping requirements in respect of the disposal of wash water residues are to take into account guidelines to be developed by the Organization.

APPENDIX

SO₂ OVER CO₂ MONITORING METHOD

1 Correspondence between 65 (¹ppm/%) SO₂/CO₂ and 1.5% sulphur in fuel is demonstrated by first calculating the mass ratio of fuel sulphur to fuel carbon, which is tabulated in Table 1 for various fuels and fuel sulphur contents; including 1.5% sulphur for both distillate and residual fuels. These ratios were used to solve for the corresponding SO₂ and CO₂ concentrations in exhaust, which are tabulated in Table 2. Molecular weights (MW) were taken into account to convert mass fractions to mole fractions. For the 1.5% sulphur fuels in Table 2, the amount of CO₂ is set first at 8% and then changed to 0.5% to show that there is no effect due to changes in excess air. As expected, the absolute SO₂ concentration changes, but the SO₂/CO₂ ratio does not. This indicates that the SO₂/CO₂ ratio is independent of fuel-to-air ratios. Therefore, SO₂/CO₂ ratio can be used robustly at any point of operation, including operation where no brake power is produced.

Note that the SO₂/CO₂ ratio varies slightly from distillate to residual fuel. This occurs because of the very different atomic hydrogen-to-carbon ratios (H:C) of the two fuels. Figure 1 illustrates the extent of the SO₂/CO₂ ratios' sensitivity to H:C over a broad range of H:C and fuel sulphur concentrations. From Figure 1, it can be concluded that for fuel sulphur levels less than 3.00% S, the difference in S/C ratios for distillate and residual fuel is less than 5.0%.

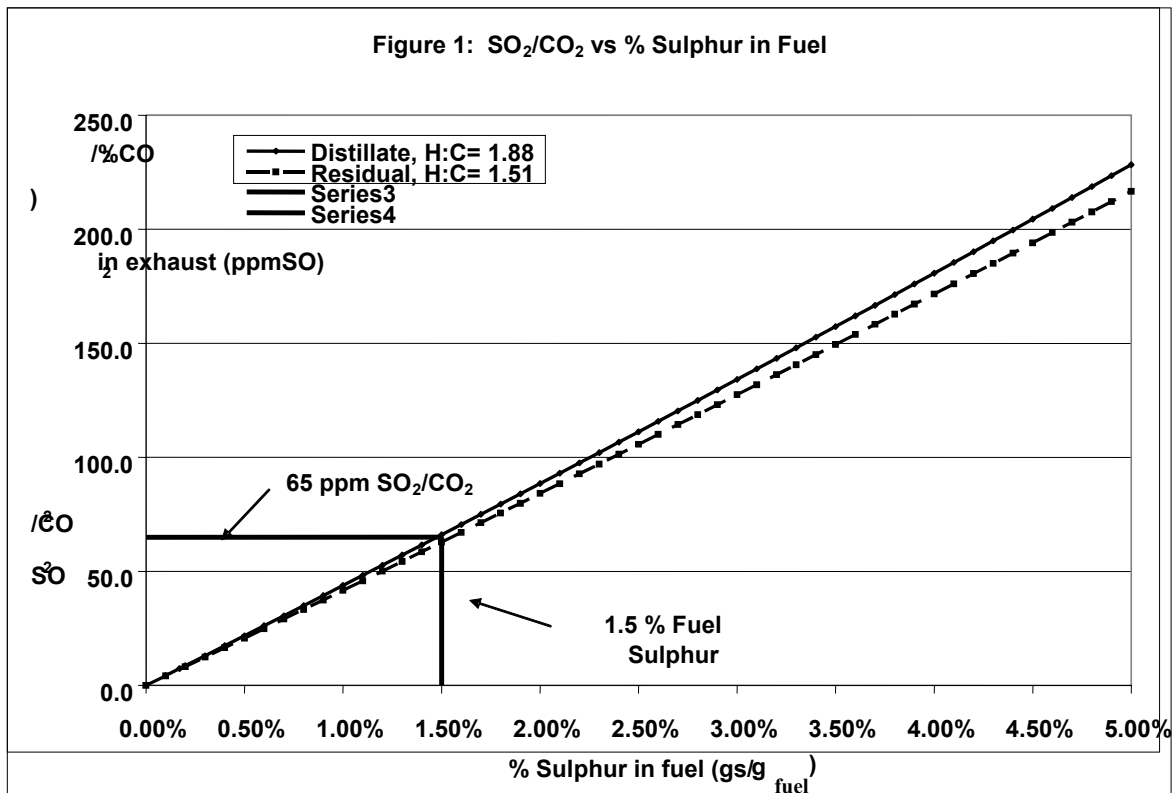
Table 1: Fuel properties for marine distillate and residual fuel

	Carbon	Hydrogen	Sulphur	Other	H:C	Fuel S/C
	g/g	g/g	g/g	g/g	mol/mol	g/g
Distillate*	86.20%	13.60%	0.17%	0.03%	1.880	0.00197
Residual*	86.10%	10.90%	2.70%	0.30%	1.509	0.03136
Distillate 1.5% S	85.05%	13.42%	1.50%	0.03%	1.880	0.01764
Residual 1.5% S	87.17%	11.03%	1.50%	0.30%	1.509	0.01721

*Based on properties in the IMO NO_x Monitoring Guidelines, MEPC.103(49)

Table 2: Emissions calculations corresponding to 1.5 % fuel sulphur

	CO ₂	SO ₂	Exh SO ₂ /CO ₂	Exh S/C
	%	¹ ppm	¹ ppm/%	g/g
Distillate 0.17% S	8	59.1	7.4	0.00197
Residual 2.70% S	8	939.7	117.5	0.03136
Distillate 1.5% S	8	528.5	66.1	0.01764
Residual 1.5% S	8	515.7	64.5	0.01721
Distillate 1.5% S	0.5	33.0	66.1	0.01764
Residual 1.5% S	0.5	32.2	64.5	0.01721



2 Correspondence between 65 (ppm/%) / CO₂ and 6.0 g/kWh is demonstrated by showing that their S/C ratios are similar. This requires the additional assumption of a brake-specific fuel consumption value of 200 g/kWh. This is an appropriate average for marine diesel engines. The calculation is as follows:

$$S/C_{fuel} = \frac{\text{brake-specific SO}_2 * (MW_s / MW_{SO_2})}{\text{BSFC} * (\% \text{ carbon in fuel} / 100)}$$

$$\text{brake-specific SO}_2 = 6.0 \text{ g/kW-hr}$$

$$MW_s = 32.065 \text{ g/mol}$$

$$MW_{SO_2} = 64.064 \text{ g/mol}$$

$$\text{BSFC} = 200 \text{ g/kW-hr}$$

$$\% \text{ carbon in 1.5\% S fuel (from Table 1)} = 85.05\% \text{ (distillate) \& } 87.17\% \text{ residual}$$

$$S/C_{\text{residual fuel}} = \frac{6.0 * (32.065 / 64.064)}{200 * (87.17\% / 100)}$$

$$S/C_{\text{residual fuel}} = 0.01723$$

$$S/C_{\text{distillate fuel}} = \frac{6.0 * (32.065 / 64.064)}{200 * (85.05\% / 100)}$$

$$S/C_{\text{distillate fuel}} = 0.01765$$

Note that the S/C mass ratios calculated above, based on 6.0 g/kWh and 200 g/kWh BSFC, are both within 0.10% of the S/C mass ratios in the emissions table (Table 2). Therefore, 65 ¹ppm/CO₂ corresponds well to 6.0 g/kWh in regulation 14(4)(b).

3 Thus, the working formulas are as follows:

$$\text{For complete combustion} = \frac{\text{SO}_2 \text{ (ppm*)}}{\text{CO}_2 \text{ (%*)}} \leq 65$$

$$\text{For incomplete combustion} = \frac{\text{SO}_2 \text{ (ppm*)}}{\text{CO}_2 \text{ (%*)} + (\text{CO (ppm*)}/10000) + (\text{THC (ppm*)}/10000)} \leq 65$$

* Note: gas concentrations must be sampled or converted to the same residual water content (e.g., fully wet, fully dry).

4 The following is the basis of using the 65 (¹ppm/%) SO₂/CO₂ as the limit for determining compliance with regulation 14:

- (a) This limit can be used to determine compliance from fuel oil burners that do not produce mechanical power.
- (b) This limit can be used to determine compliance at any power output, including idle.
- (c) This limit only requires two gas concentration measurements at one sampling location.
- (d) There is no need to measure any engine parameters such as engine speed, engine torque, engine exhaust flow, or engine fuel flow.
- (e) If both gas concentration measurements are made at the same residual water content in the sample (e.g. fully wet, fully dry), no dry-to-wet conversion factors are required in the calculation.
- (f) This limit completely decouples the thermal efficiency of the fuel oil combustion unit from the EGCS-SO_x unit.
- (g) No fuel properties need to be known.
- (h) Because only two measurements are made at a single location, transient engine or EGCS-SO_x unit effects can be minimized by aligning signals from just these two analysers. (Note that the most appropriate points to align are the points where each analyser responds to a step change in emissions at the sample probe by 50% of the steady-state value).
- (i) This limit is independent of the amount of exhaust gas dilution. Dilution may occur due to evaporation of water in an EGCS-SO_x unit, and as part of an exhaust sampler's preconditioning system.

¹ppm means "parts per million". It is assumed that ppm is measured by gas analysers on a molar basis, assuming ideal gas behaviour. The technically correct units are actually micro-moles of substance per mole of total amount (μmol/mol), but ppm is used in order to be consistent with units in the NO_x Technical Code.

ANNEX 13**UNIFIED INTERPRETATIONS TO MARPOL ANNEX VI
AND THE NO_x TECHNICAL CODE****MARPOL Annex VI****Regulation 1***Application*

Regulation 1 reads as follows:

The provisions of this Annex shall apply to all ships, except where expressly provided otherwise in regulations 3, 5, 6, 13, 15, 18 and 19 of this Annex.

Interpretation:

For application of this regulation the term “all ships” should be interpreted as applicable to all ships (as defined by MARPOL 73, Article 2(4)).

Regulation 2(4)*Ozone depleting substances*

Regulation 2(4) reads as follows:

New installations, in relation to regulation 12 of this Annex, means the installation of systems, equipment, including new portable fire-extinguishing units, insulation, or other material on a ship after the date on which this Annex enters into force, but excludes repair or recharge of previously installed systems, equipment, insulation, or other material, or recharge of portable fire-extinguishing units.

Interpretation:

For application of this regulation the term “new installations” should be interpreted as follows:

- (a) For new ships, installations on board ships the keels of which are laid or which are at a similar stage of construction on or after 19 May 2005.
- (b) For existing ships, new installations with a contractual delivery date to the ship on or after 19 May 2005 or, in the absence of a contractual delivery date, the actual delivery of the equipment to the ship on or after 19 May 2005.

The same interpretation should apply with regard to new HCFC installations but with the substitution of ‘1 January 2020’ in place of 19 May 2005.

Regulation 13(1)(b)(i)*Nitrogen oxides (NO_x)*

Regulation 13(1)(b)(i) reads as follows:

This regulation does not apply to emergency diesel engines, engines installed in lifeboats and any device or equipment intended to be used solely in case of emergency.

Interpretation:

Regulation 13 does not apply to an engine which is used solely in response to emergencies on the ship on which the engine is installed.

Regulation 13(1)(c)

Nitrogen oxides (NO_x)

Regulation 13(1)(c) reads as follows:

Notwithstanding the provisions of subparagraph (a) of this paragraph, the Administration may allow exclusion from the application of this regulation to any diesel engine which is installed on a ship constructed, or on a ship which undergoes a major conversion, before the entry into force of the present Protocol, provided that the ship is solely engaged in voyages to ports or offshore terminals within the State of the flag of which the ship is entitled to fly.

Interpretation:

For application of this regulation the term “on a ship which undergoes a major conversion,” should be interpreted as an error inserting the concept of “ship” in place of “engine”, ship conversion is not given elsewhere within the Annex. In order to be consistent with regulation 13(1)(a)(i) and (ii) this should be read as “or engine which undergoes a major conversion”.

Regulation 13(2)(a)(iii)

Nitrogen oxides (NO_x)

Regulation 13(2)(a)(iii) reads as follows:

For the purpose of this regulation, *major conversion* means a modification of an engine where the maximum continuous rating of the engine is increased by more than 10%.

Interpretation:

For application of this regulation in the case of ships built before 1 January 2000 the term “by more than 10%” should be interpreted as applicable to the pre 1 January 2000 maximum continuous rating.

Regulation 16(2)(a)

Shipboard incineration

Regulation 16(2)(a) reads as follows:

Except as provided in subparagraph (b) of this paragraph, each incinerator installed on board a ship on or after 1 January 2000 shall meet the requirements contained in appendix IV to this annex. Each incinerator shall be approved by the Administration taking into account the standard specifications for shipboard incinerators developed by the Organization*.

* Refer to resolution MEPC.76(40), Standard specification for shipboard incinerators.

Interpretation:

For application of this regulation the term “installed on board a ship on or after 1 January 2000” should be interpreted as follows:

- (a) For new ships, installations on board ships the keels of which are laid or which are at a similar stage of construction on or after 1 January 2000.
- (b) For existing ships, new installations with a contractual delivery date to the ship on or after 1 January 2000 or, in the absence of a contractual delivery date, the actual delivery of the equipment to the ship on or after 1 January 2000.

Regulation 16(6)

Shipboard incineration

Regulation 16(6) reads as follows:

Shipboard incineration of polyvinyl chlorides (PVCs) shall be prohibited, except in shipboard incinerators for which IMO Type Approval Certificates have been issued.

Interpretation:

For application of this regulation it should be interpreted as applicable to incinerators meeting either resolution MEPC.59(33) or resolution MEPC.76(40) specifications.

Regulation 16(7)

Shipboard incineration

Regulation 16(7) reads as follows:

All ships with incinerators subject to this regulation shall possess a manufacturer’s operating manual which shall specify how to operate the incinerator within the limits described in paragraph 2 of appendix IV to this Annex.

Interpretation:

For application of this regulation it should be interpreted that possession of an operating manual is applicable only to resolution MEPC.76(40) incinerators installed on or after 1 January 2000.

Regulation 16(8)

Shipboard incineration

Regulation 16(8) reads as follows:

Personnel responsible for operation of any incinerator shall be trained and capable of implementing the guidance provided in the manufacturer’s operating manual.

Interpretation:

For application of this regulation it should be interpreted that any incinerator refers to those specified in regulation 16(2).

Regulation 16(9)

Shipboard incineration

Regulation 16(9) reads as follows:

Monitoring of combustion flue gas outlet temperature shall be required at all times and waste shall not be fed into a continuous-feed shipboard incinerator when the temperature is below the minimum allowed temperature of 850°C. For batch-loaded shipboard incinerators, the unit shall be designed so that the temperature in the combustion chamber shall reach 600°C within five minutes after start-up.

Interpretation:

For application of the regulation it should be interpreted that the temperature restrictions as given are only applicable to resolution MEPC.76(40) Incinerators installed on or after 1 January 2000.

Regulation 18(1)

Fuel Oil Quality

Regulation 18(1) reads as follows:

Fuel oil for combustion purposes delivered to and used on board ships to which this Annex applies shall meet the following requirements:

.....

Interpretation:

Fuel oil means any oil used in connection with the propulsion and operation of the ship.

**TECHNICAL CODE ON CONTROL OF EMISSION OF NITROGEN OXIDES FROM
MARINE DIESEL ENGINES (NO_x TECHNICAL CODE)**

Table 3 – Symbols and subscripts for terms and variables used in the formulae for the test-bed measurement methods

Table 3 gives:

Symbol	Term	Dimension
p_a	Saturation vapour pressure of the engine intake air (in ISO 3046-1, 1995: $p_{sy} = PSY$, test ambient vapour pressure)	kPa
p_B	Total barometric pressure (in ISO 3046-1, 1995: $p_x = PX$, site ambient total pressure; $p_y = PY$, test ambient total pressure)	kPa
p_s	Dry atmospheric pressure	kPa
R_a	Relative humidity of the intake air	%
T_a	Absolute temperature of the intake air	K

Interpretation:

For application of the term “ p_s ” it should be interpreted that the dry atmospheric pressure is determined in accordance with the following formula:

$$p_s = p_B - \frac{R_a \bullet p_a}{100}$$

It should also be interpreted that the p_a term be determined using a temperature value for the intake air determined at the same physical location as the measurements for p_B and R_a .

Interpretation:

For application of the term “ T_a ” it should be interpreted that the temperature of the intake air temperature is that determined at the engine/turbocharger intake suction filter.

Chapter 1.3 Definitions

Chapter 1.3.10

Chapter 1.3.10 reads as follows:

Marine diesel engine means any reciprocating internal-combustion engine operating on liquid or dual fuel, to which regulations 5, 6 and 13 of Annex VI apply, including booster/compound systems if applied.

Interpretation:

Regulation 13 does apply to dual-fuel engines. For the application of this section it should be interpreted that if the engine is intended to be operated normally in the gas mode i.e. with the main fuel gas and only a small amount of liquid pilot fuel, the requirements of regulation 13 have to be met only for this operation mode. Operation on pure liquid fuel resulting from restricted gas supply in cases of failures should be exempted for the voyage to the next appropriate port for the repair of the failure.

Chapter 2.2 Procedures for pre-certification of an Engine Group

Chapter 2.2.4

Chapter 2.2.4 reads as follows:

There are engines which, due to their size, construction and delivery schedule, cannot be pre-certified on a test-bed. In such cases, the engine manufacturer, shipowner or ship builder shall make application to the Administration requesting an on-board test (see 2.1.2.2). The applicant must demonstrate to the Administration that the on-board test fully meets all of the requirements of a test-bed procedure as specified in chapter 5 of this Code. Such a survey may be accepted for one engine or for an engine group represented by the parent engine only, but it shall not be accepted for an engine family certification. In no case shall an allowance be granted for possible deviations of measurements if an initial survey is carried on board a ship without any valid pre-certification test.

Interpretation:

For engines undergoing an on-board certification test, to be issued with an EIAPP Certificate, the same procedures apply as if the engine had been pre-certified on a test-bed:

- (a) the survey on-board meets the pre-certification survey requirements; and
- (b) the on-board test fully meets all of the requirements of a test-bed procedure as specified in chapter 5 of the NO_x Technical Code; and
- (c) the application average weighted NO_x emission value meets the requirements of regulation 13 of Annex VI; and
- (d) the engine has an approved Technical File.

Chapter 2.2.8

Chapter 2.2.8 reads as follows:

A flow chart providing guidance for compliance with the requirements of a pre-certification survey for marine diesel engines intended for installation on board of ships is provided in figure 1 of Appendix 2 of this Code.

Interpretation:

The text in chapter 2 gives the certification procedures which should be followed. Where discrepancies exist with figure 1, the text of chapter 2 takes precedence.

Chapter 2.3 Procedures for certification of an engine

Chapter 2.3.4

Chapter 2.3.4 reads as follows:

The shipowner shall have the option of direct measurement of NO_x emissions during engine operation. Such data may take the form of spot checks logged with other engine operating data on a regular basis and over the full range of engine operation or may result from continuous monitoring and data storage. Data must be current (taken within the last 30 days) and must have been acquired using the test procedures cited in this NO_x Technical Code. These monitoring records shall be kept on board for three months for verification purposes by the Parties to the Protocol of 1997. Data shall also be corrected for ambient conditions and fuel specification, and measuring equipment must be checked for correct calibration and operation, in accordance with the procedures specified by the measurement equipment manufacturer in the engine's technical file. Where exhaust gas after-treatment devices are fitted which influence the NO_x emissions, the measuring point(s) must be located downstream of such devices.

Interpretation:

For application of this section it should be interpreted that any system or procedure utilized to monitor engine NO_x emissions by the direct measurement method shall meet the requirements of MEPC Resolution 103(49) "Guidelines for On-board NO_x Verification Procedure – Direct Measurement and Monitoring Method".

Chapter 2.3.5

Chapter 2.3.5 reads as follows:

To demonstrate compliance by the direct measurement method, sufficient data shall be collected to calculate the weighted average NO_x emissions in accordance with this Code.

Interpretation:

For application of this section it should be interpreted that sufficient data shall be collected by the direct measurement method to enable the weighted average NO_x emissions to be determined in accordance with resolution MEPC.103(49) "Guidelines for On-board NO_x Verification Procedure – Direct Measurement and Monitoring Method".

Chapter 2.3.6

Chapter 2.3.6 reads as follows:

Every marine diesel engine installed on board a ship shall be provided with a technical file. The technical file shall be prepared by the engine manufacturer and approved by the Administration,

and required to accompany an engine throughout its life on board ships. The technical file shall contain information as specified in 2.4.1.

Interpretation:

For application of this section it should be interpreted that the term “engine manufacturer” is the entity which applied for the engine certification.

Chapter 2.3.13

Chapter 2.3.13 reads as follows:

Flow charts providing guidance for compliance with the requirements of an initial, periodical and intermediate surveys for certification of marine diesel engines installed on board ships are provided in figures 2 and 3 of Appendix 2 of this Code.

Interpretation:

This section should be interpreted as follows:

The text in chapter 2 gives the certification procedures which should be followed. Where discrepancies exist with figures 2 and 3, the text of chapter 2 takes precedence.

Chapter 2.4 Technical file and on-board NO_x verification procedures

Chapter 2.4.1.1

Chapter 2.4.1.1 reads as follows:

To enable an Administration to perform the engine surveys described in 2.1, the technical file required by 2.3.6 shall, at a minimum, contain the identification of those components, settings and operating values of the engine which influences its NO_x emissions.

Interpretation:

This section should be interpreted as follows:

Where a NO_x reducing device or system is fitted in order to achieve compliance with regulation 13 (in accordance with paragraph 2.2.5), these should be identified in the Technical File.

Chapter 2.4.4.3

Chapter 2.4.4.3 reads as follows:

On-board NO_x verification procedures shall be determined by using the direct measurement and monitoring method in accordance with 2.3.4, 2.3.5, 2.3.7, 2.3.8, 2.3.11, and 5.5.

Interpretation:

For application of this section it should be interpreted that the on-board NO_x verification procedures have been approved by the Administration taking into account resolution MEPC.103(49) the “Guidelines for On-board NO_x Verification Procedure – Direct Measurement and Monitoring Method”.

Chapter 2.4.5

Chapter 2.4.5 reads as follows:

When a NO_x monitoring and recording device is specified as on-board NO_x verification procedures, such device shall be approved by the Administration based on guidelines to be developed by the Organization. These guidelines shall include, but are not limited to, the following items:

- .1 a definition of continuous NO_x monitoring, taking into account both steady-state and transitional operations of the engine;
- .2 data recording, processing and retention;
- .3 a specification for the equipment to ensure that its reliability is maintained during service;
- .4 a specification for environmental testing of the device;
- .5 a specification for the testing of the equipment to demonstrate that it has a suitable accuracy, repeatability and cross sensitivity compared with the applicable sections of this Code; and
- .6 the form of the approval certificate to be issued by the Administration.

Interpretation:

For application of this section it should be interpreted that resolution MEPC.103(49) “Guidelines for On-board NO_x Verification Procedure – Direct Measurement and Monitoring Method” defines the guidelines as developed by the Organization.

Chapter 4.4 Application of the engine group concept

Chapter 4.4.4

Chapter 4.4.4 reads as follows:

The application for the engine group concept, if requested by the engine manufacturer or another party, shall be considered for certification approval by the Administration. If the engine owner, with or without technical support from the engine manufacture, decides to perform modifications on a number of similar engines in the owner’s fleet, the owner may apply for an engine group certification. The engine’s group may include a test engine on the test bench. Typical applications are similar modifications of similar engines in service or similar engines in similar operational conditions.

Interpretation:

For application of this section it should be interpreted that the applicant for the engine certification takes on the responsibilities of the “engine manufacturer” as elsewhere given within the NO_x Technical Code.

Chapter 5.2 Test conditions

Chapter 5.2.2.2

Chapter 5.2.2.2 reads as follows:

All engines when equipped as intended for installation on board ships must be capable of operating within the allowable NO_x emission levels of regulation 13(3) of Annex VI at an ambient seawater temperature of 25°C.*

* 25°C seawater temperature is the reference ambient condition to comply with the NO_x limits. An additional temperature increase due to heat exchangers installed on board, e.g. for the low-temperature cooling water system, shall be taken into consideration.

Interpretation:

For application of this section it should be interpreted that the 25°C seawater temperature defines an ambient reference value for which compliance with the NO_x emission limits as defined by regulation 13(3) must be demonstrated (tested or calculated with T_{SC Ref} specified by the manufacturer).

The application of this reference primary coolant value should be considered in accordance with the charge air cooling arrangement applicable to the individual installation as follows:

- (a) Direct seawater cooling to engine charge air coolers. Compliance with the NO_x limits should be demonstrated (or otherwise justified) with a charge air/scavenge air cooler coolant inlet temperature of 25°C.
- (b) Intermediate “freshwater” cooling to engine charge air coolers. Compliance with the NO_x limits should be demonstrated (or otherwise justified) with the charge air/scavenge air cooling system operating with the highest allowable in service coolant inlet temperature regime comparable with an ambient seawater temperature of 25°C.

Demonstration of compliance at a Parent Engine test for a direct seawater cooled system, as given by (a) above, does not demonstrate compliance in accordance with the higher charge air temperature regime inherent with an intermediate ‘freshwater’ cooling arrangement as given under (b).

- (c) For those installations incorporating no seawater cooling, either direct or indirect, to the charge air coolers e.g. radiator cooled ‘freshwater’ systems, air/air charge air coolers, then it should be interpreted that compliance with the NO_x limits should be demonstrated with the engine and charge air cooling systems operating “as intended for installation on board”.

Chapter 5.4 Measurement equipment

Chapter 5.4.2

Chapter 5.4.2 reads as follows:

Other systems or analysers may, subject to the approval of the Administration, be accepted if they yield equivalent results to that of the equipment referenced in 5.4.1.

Interpretation:

For application of the term “equivalent” it should be interpreted that alternative systems or analysers would, as quantified by using recognized national or international standards (such as ISO 8178, Part 1:1996, section 7), yield equivalent results when used to measure diesel engine exhaust emission concentrations in terms of the requirements referenced in 5.4.1 of Appendix 3.

Chapter 5.5 Determination of exhaust gas flow

Chapter 5.5.3 *Carbon-balance method*

Chapter 5.5.3 reads as follows:

This method involves exhaust gas mass flow calculation from fuel consumption and exhaust gas concentrations using the carbon and oxygen balance method as specified in Appendix 6 of this Code.

Interpretation:

For calculation of the exhaust gas mass flow in accordance with “Method 2, universal, carbon/oxygen-balance” detailed under appendix 6 the “CW (soot)” term should be taken as zero.

Chapter 5.6 Permissible deviations of instruments for engine-related parameters and other essential parameters

Chapter 5.6 reads as follows:

The calibration of all measuring instruments shall be traceable to recognized international standards and shall comply with the requirements as set out in 1.3.1 of appendix 4 of this Code.

Interpretation:

For application of this section it should be interpreted that the measuring instruments as detailed under appendix 4 is not to be considered a definitive listing. Where additional measuring instruments are required in order to define an engine’s NO_x emission performance, for example the measurement of peak cylinder or charge air pressures, then those measuring instruments should also be calibrated. As given by 1.3.1 of appendix 4 the recognized standards may be national or international.

Chapter 5.9 Test Run

Chapter 5.9.2 *Main exhaust components to be analysed*

Chapter 5.9.2.1 reads as follows:

An analytical system for the determination of the gaseous emissions (CO, CO₂, HC, NO_x, O₂) in the raw exhaust gas shall be based on the use of the following analysers:

- .1 HFID analyser for the measurement of hydrocarbons;
- .2 NDIR analyser for the measurement of carbon monoxide and carbon dioxide;
- .3 HCLD or equivalent analyser for the measurement of nitrogen oxides; and
- .4 PMD, ECS or ZRDO for the measurement of oxygen.

Interpretation:

For application of 5.9.2.1.3 the term “equivalent” in this instance should be interpreted as referring to the use of CLD analysers for the dry basis measurement of nitrogen oxides.

Chapter 5.9.7 *Analyser response*

Chapter 5.9.7 reads as follows:

The output of the analysers shall be recorded, both during the test and during all response checks (zero and span), on a strip chart recorder or measured with an equivalent data acquisition system with the exhaust gas flowing through the analysers at least during the last ten minutes of each mode.

Interpretation:

For application of this section it should be interpreted that the response must be of sufficient accuracy and resolution to enable verification of the zero and span response of the analysers in accordance with 5.9.9.

Chapter 5.12 Calculation of the gaseous emissions

Chapter 5.12.4 *Calculation of the emission mass flow rates*

Chapter 5.12.4.1 reads as follows:

The emission mass flow rates for each mode shall be calculated as follows (for the raw exhaust gas):

$$\text{Gas mass} = u \cdot \text{conc} \cdot G_{\text{EXHW}} \quad (15)$$

or

$$\text{Gas mass} = v \cdot \text{conc} \cdot V_{\text{EXHD}} \quad (16)$$

or

$$\text{Gas mass} = w \cdot \text{conc} \cdot V_{\text{EXHW}} \quad (17)$$

Interpretation:

For application of this section it should be interpreted that for equations (15) and (17) the term “conc” applies to the averaged gas concentrations, as determined in accordance with 5.11, measured or corrected in accordance with 5.12.2 (conc, dry/ $K_{w,r}$) to a wet basis and (in the case of NO_x) multiplied by the K_{HDIES} correction factor for humidity and temperature in accordance with 5.12.3.

For equation (16) the term “conc” applies to the averaged gas concentrations, as determined in accordance with 5.11, measured or corrected in accordance with 5.12.2 (conc, wet • $K_{w,r}$) to a dry basis and (in the case of NO_x) multiplied by the K_{HDIES} correction factor for humidity and temperature in accordance with 5.12.3.

Chapter 6.2 Engine parameter check method

Chapter 6.2.3 Documentation for an engine parameter check method

Chapter 6.2.3.4 List of NO_x – influencing parameters sometimes modified on board

Chapter 6.2.3.4.2 reads as follows:

The actual technical file of an engine may, based on the recommendations of the engine manufacturer and the approval of the Administration, include less components and/or parameters than discussed above depending on the particular engine and the specific design.

Interpretation:

For application of this section it should be interpreted that the term “engine manufacturer” is the entity which applied for the engine certification.

Chapter 6.2.3.5 Checklist for the engine parameter check method

Chapter 6.2.3.5 reads as follows:

For some parameters, different survey possibilities exist. Approved by the Administration, the ship operator, supported by the engine manufacturer, may choose what method is applicable. Any one of, or a combination of, the methods listed in Appendix 7 of this Code may be sufficient to show compliance.

Interpretation:

For application of this section it should be interpreted that the term “engine manufacturer” is the entity which applied for the engine certification.

APPENDIX 4

CALIBRATION OF THE ANALYTICAL INSTRUMENTS (REFER TO CHAPTER 5 OF THE NO_x TECHNICAL CODE)

1 Introduction

Chapter 1.1 reads as follows:

Each analyser used for the measurement of an engine's parameters shall be calibrated as often as necessary in accordance with the requirements of this Appendix.

Tables 1, 2, 3 and 4 right hand column headers read as follows:

Calibration intervals (month).

Interpretation:

For application of this section it should be interpreted that the calibration intervals as defined by Tables 1, 2, 3, and 4 of Appendix 4 represent the duration of calibration validity applicable to the particular measurement instruments listed.

All instruments used for the measurement of an engine's parameters should be verified as being within the defined calibration validity period at the time of the measurement.

8 Interference effects with CO, CO₂, NO_x and O₂ analysers

8.1 CO analyser interference check

8.1 reads as follows:

Water and CO₂ may interfere with the CO analyser performance. Therefore, a CO₂ span gas having a concentration of 80 to 100% of full scale of the maximum operating range used during testing shall be bubbled through water at room temperature and the analyser response recorded. The analyser shall not be more than 1% of full scale for ranges greater than or equal to 300 ppm or more than 3 ppm for ranges below 300 ppm.

Interpretation:

For application of this section the term "The analyser shall not be more than ..." should be interpreted as "The analyser response shall not be more than ..." to correctly reflect the intent of this statement and ISO 8178-1, section 8.9.1.

ANNEX 14**TERMS OF REFERENCE FOR THE BLG SUB-COMMITTEE ON THE REVISION
OF MARPOL ANNEX VI AND THE NO_x TECHNICAL CODE**

- 1 The BLG Sub-Committee is instructed to:
 - .1 examine available and developing techniques for reduction of emission of air pollutants;
 - .2 review the relevant technologies and potential for reduction of NO_x, and recommend future limits of NO_x emission;
 - .3 review technology and the need for reduction of SO_x, justify and recommend future limits of SO_x emission;
 - .4 review the technology and potential for reduction of VOC;
 - .5 with a view to controlling emissions of particulate matter (PM), study current emission levels of PM from marine engines, including their size distribution, quantity, and recommend actions to be taken for the reduction of PM from ships. Since reduction of NO_x and SO_x emission is expected to also reduce PM emission, estimate the level of PM emission reduction through this route;
 - .6 consider reducing NO_x and PM limits for existing engines;
 - .7 consider whether Annex VI emission reductions or limitations should be expanded to include diesel engines that use alternative fuels and engine systems/power plants other than diesel engines;
 - .8 review the texts of Annex VI, NO_x Technical Code and related guidelines and recommend necessary amendments.
 - 2 The BLG Sub-Committee should complete its work on the above by 2007.
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