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SUB-COMMITTEE ON POLLUTION PREVENTION AND RESPONSE
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Agenda item 18

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REPORT TO THE MARINE ENVIRONMENT PROTECTION COMMITTEE

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1 GENERAL

1.1 The Sub-Committee on Pollution Prevention and Response (PPR) held its tenth session from 24 to 28 April 2023. The session was chaired by Dr. Flavio da Costa Fernandes (Brazil). The Vice-Chair, Dr. Anita Mäkinen (Finland), was also present.

1.2 The session was attended by delegations from Member Governments and Associate Members of IMO; representatives from United Nations Programmes, specialized agencies and other entities; observers from intergovernmental organizations with agreements of cooperation; and observers from non-governmental organizations in consultative status, as listed in document PPR 10/INF.1.

Opening address

1.3 The Director of the Marine Environment Division, Mr. Arsenio Dominguez, welcomed participants on behalf of the Secretary-General and delivered the Secretary-General's opening address. The full text of the opening address can be downloaded from the IMO website at the following link: https://www.imo.org/en/MediaCentre/SecretaryGeneral/Pages/Secretary-GeneralsSpeechesToMeetings.aspx

Chair's remarks

1.4 In responding, the Chair, through the Director of the Marine Environment Division, thanked the Secretary-General for his words of guidance and encouragement and provided the assurance that the advice and requests conveyed through the opening address would be given every consideration in the deliberations of the Sub-Committee.

Use of hybrid meeting capabilities

1.5 The Sub-Committee noted that the plenary sessions would be conducted in hybrid mode, i.e. remote participation enabled, taking into account the relevant decisions of C 127 (C 127/D, paragraph 17.3).

1.6 In this regard, the Sub-Committee noted that C 127 had:

.1 agreed to the use of hybrid facilities to complement in-person meetings from September 2022, for a trial period of one year;

.2 agreed that the Rules of Procedure and the *Interim guidance to facilitate remote sessions of the Committees during the COVID-19 pandemic* (MSC-LEG-MEPC-TCC-FAL.1/Circ.1), as appropriate, should be applied; and

.3 invited other organs of the Organization to follow the above decisions and to report to a future session of the Council on their experience with hybrid meetings.

1.7 The Sub-Committee also noted that C 128 had encouraged the IMO bodies to:

.1 hold working group sessions in the hybrid mode as far as practicable; and;

.2 use the trial period and gain more experience in the Main Hall as well as committee rooms 9 and 10 when hybrid capabilities were available.

Update on the revised Organization and method of work (MSC-MEPC.1/Circ.5/Rev.4)

1.8 The Sub-Committee noted that MSC 106 and MEPC 79 had concurrently approved the fourth revision of the *Organization and method of work of the Maritime Safety Committee and the Marine Environment Protection Committee and their subsidiary bodies* (MSC-MEPC.1/Circ.5/Rev.4), which specifies a five working day commenting period for delegations from the day of the publication of the final draft report, limited to editorial corrections and improvements, including finalizing individual statements, and that such comments should not reopen discussion on decisions taken during the session. Additionally, the Chair, supported by the Secretariat, will facilitate resolution of any comments received, as necessary, and the Secretariat, in consultation with the Chair, will then publish a document on IMODOCS containing the comments received, together with an explanation of how they have been addressed. After the above document has been published, the final report will be prepared in due course for publication on IMODOCS.

1.9 In addition to the above, a revised paragraph 6.3 was included in MSC-MEPC.1/Circ.5/Rev.4, stating that documents should not be introduced in plenary unless the Chair decides that this is essential for the proper consideration of the matter concerned. However, submitters of documents may indicate if they have additional information or context required for the discussions, in order for the Chair to prioritize interventions.

Translation of annexes to working papers

1.10 Further to the Sub-Committee being informed that annexes to working, technical and drafting group reports which did not require final decisions at this session would be presented to the plenary in English only, the delegation of Argentina, supported by the delegation of Chile:

.1 emphasized that not having annexes to working, technical and drafting group reports translated into Spanish and French had been accepted strictly as an exception to the requirement for documents to be published in the Organization's three working languages, and yet this had become a frequent occurrence at sub-committee meetings;

.2 sought feedback from the Secretariat as to why this had become the case; and

.3 stressed that whether or not an annex required a final decision by the Sub-Committee was irrelevant, as having annexes to working papers available for consideration in plenary in English only placed delegations whose working language was Spanish or French in the regrettable situation that not all their technical experts or authorities were able to work on an English base document and in many cases resulted in them providing delayed feedback to their representative(s) at IMO, and was not aligned with the United Nations standards of multilingualism.

1.11 The Secretariat advised that the lack of translation of certain annexes to working papers from English to Spanish and French normally was reserved for annexes that required further development, either in a correspondence group or in a group at a subsequent session of the Sub-Committee where the work would be conducted in English only. However, annexes that required a final decision by the Sub-Committee were typically presented to plenary in the Organization's three working languages.

1.12 Subsequently, having noted the concerns regarding deviations from making all sub-committee documents available in the Organization's three working languages, eroding the principle of multilingualism that was intrinsic to IMO as a specialized agency of the United Nations, the Sub-Committee agreed that this should be addressed by Member States at the Council.

Adoption of the agenda and related matters

1.13 The Sub-Committee adopted the agenda (PPR 10/1) and agreed to be guided in its work, in general, by the information and proposed arrangements for the session contained in documents PPR 10/1/1 (Secretariat) and PPR 10/1/2 (Chair).

2 DECISIONS OF OTHER IMO BODIES

2.1 The Sub-Committee noted the outcomes of the following IMO bodies that were relevant to its work:

.1 MSC 105 and MEPC 78, as reported in document PPR 10/2 (Secretariat); and

.2 NSCR 9, C 127, CCC 8, MSC 106, C 128 and MEPC 79, as reported in document PPR 10/2/1.

2.2 Subsequently, the Sub-Committee took action under the relevant agenda items.

3 SAFETY AND POLLUTION HAZARDS OF CHEMICALS AND PREPARATION OF CONSEQUENTIAL AMENDMENTS TO THE IBC CODE

3.1 The Sub-Committee agreed to refer documents PPR 10/3/1 (Kingdom of the Netherlands), PPR 10/3/3 (France), PPR 10/3/4 (France) and PPR 10/3/5 (France) directly to the ESPH Technical Group, having noted that they pertained to ongoing tasks of the Group.

Report of ESPH 28 and related documents

3.2 Having recalled that ESPH 28 had taken place from 10 to 14 October 2022, the Sub-Committee considered the report of ESPH 28 (PPR 10/3) and took action as outlined in paragraphs 3.2 to 3.13.

Outcome of GESAMP/EHS 59

3.3 The Sub-Committee noted the outcome of GESAMP/EHS 59 and that the full report from the meeting, together with the revised GESAMP Composite List, had been disseminated as PPR.1/Circ.12. In this context, the Sub-Committee noted in particular:

.1 the development of GESAMP Hazard Profiles for 10 new substances (PPR.1/Circ.12, section 3); and

.2 the review and revision of GESAMP Hazard Profile ratings for three existing substances, namely "Sorbitan sesquioleate" (EHS 2532), "Glycerol/sorbitol blend, propoxylated and ethoxylated" (EHS 2372) and "Creosote (coal tar)" (EHS 524) (PPR.1/Circ.12, paragraphs 4.3 to 4.17).

Evaluation of products and cleaning additives

3.4 With regard to the provisional categorization of liquid substances carried out by ESPH 28, the Sub-Committee:

.1 concurred with the evaluation of pure or technically pure products and mixtures as a whole, and their respective inclusion in list 1 of MEPC.2/Circ.28 (published on 1 December 2022), with validity for all countries and with no expiry date;

.2 concurred with the evaluation of trade-named mixtures and their respective inclusion in list 3 of MEPC.2/Circ.28, with validity for all countries and with no expiry date, along with the consequential addition to list 5 of MEPC.2/Circ.28;

.3 noted the deliberations of the Group regarding "Fatty acid methyl esters (m)" and the potential inclusion of special requirement 16.2.7 in column o (PPR 10/3, paragraphs 3.46 to 3.49);

.4 having considered the recommendation of the Group, based on expert judgement, that the assignment of ship type 2 (in combination with pollution category X) would be appropriate for "Creosote (coal tar)" (PPR 10/3, paragraphs 3.63):

.1 concurred with the recommendation;

.2 agreed for the expiry date associated with "Creosote (coal tar) (amended)" to be changed to "none" in the next edition of the MEPC.2 circular on *Provisional categorization of liquid substances in accordance with MARPOL Annex II and the IBC Code* (MEPC.2/Circular) (due to be issued on 1 December 2023 as MEPC.2/Circ.29);

.3 confirmed that the carriage requirements for "Creosote (coal tar) (amended)" would replace the carriage requirements for "Creosote (coal tar)" in the next revision of chapter 17 of the IBC Code; and

.4 noted that the justification prepared by ESPH 28 in this regard, as set out in paragraph 3.64.3 of document PPR 10/3, should be included in a draft consequential revision of the *Decisions with regard to the categorization and classification of products* (PPR.1/Circ.7), and instructed the ESPH Technical Group at this session to prepare the draft revision;

.5 concurred with the evaluation of cleaning additives and noted their inclusion in annex 10 to MEPC.2/Circ.28;

.6 noted the review undertaken of the draft of MEPC.2/Circ.28 and the amendments and deletion of products from the lists that had reached their expiry dates or were no longer shipped or had been re-evaluated and met the criteria for complex mixtures in paragraph 9.2 of MEPC.1/Circ.512/Rev.1; and

.7 urged reporting countries that had products listed in list 2 or list 3 of the MEPC.2/Circular to contact the respective manufacturers and request them to review their products for the purpose of assessing whether any changes in the carriage requirements would be necessary, taking into account the revised chapter 21 of the IBC Code, the latest GESAMP Hazard Profiles for the components, MEPC.2/Circ.512/Rev.1, and PPR.1/Circ.10.

3.5 With regard to the review undertaken by ESPH 28 of the draft of MEPC.2/Circ.28 and the amendments and deletion of products from the lists, one delegation expressed appreciation for the decision by ESPH 28 to record on the IMO website the list of products that had been removed from the MEPC.2/Circular following reassessment in accordance with PPR.1/Circ.10 or because they had been deemed to be MARPOL Annex I cargoes. This delegation also proposed a new circular specifically to record cargoes to be carried under MARPOL Annex I rather than MARPOL Annex II.

3.6 Subsequently, the Sub-Committee noted that this should be further considered by the ESPH Technical Group at ESPH 29.

Revision of MEPC.1/Circ.590 on Revised tank cleaning additives guidance note and reporting form

3.7 The Sub-Committee noted the progress made by ESPH 28 with regard to the revision of MEPC.1/Circ.590 on *Revised tank cleaning additives guidance note and reporting form* (PPR 10/3, paragraphs 7.4 to 7.20). Subsequently, the Sub-Committee instructed the ESPH Technical Group to continue work on the revision of MEPC.1/Circ.590 with a view to finalization.

Implications of the lack of toxic vapour detection equipment on the daily operation of chemical tankers

3.8 The Sub-Committee noted the discussion of ESPH 28 regarding toxic vapour detection equipment and the work undertaken by industry regarding the development of ventilation procedures (PPR 10/3, paragraphs 8.3 to 8.11). In this regard, the Sub-Committee had for its consideration document PPR 10/3/2 (INTERTANKO), proposing an amendment to the IBC Code to include using ventilation as an alternate means to determine that a tank atmosphere was safe for entry on chemical tankers following the discharge of certain toxic products where no means of testing for toxicity existed.

3.9 The Sub-Committee recalled that, when PPR 7 had agreed to include in the provisional agenda of ESPH 26 the item regarding consideration of the implications that the lack of toxic vapour detection equipment would have on the daily operation of chemical tankers, it was on the premise that the ESPH Technical Group would discuss the topic substantively and advise the Sub-Committee on the outcome. The Sub-Committee also recalled that this ESPH agenda item was not linked to any approved output, and that the work of the ESPH Group under the standing output on "Safety and pollution hazards of chemicals and preparation of consequential amendments to the IBC Code" was understood as being limited to the evaluation of chemicals and consequential amendments to chapters 17, 18 and 19 of the IBC Code. Consequently, proposals to amend other parts of the IBC Code, particularly if they involved changes as fundamental as those proposed in document PPR 10/3/2, should be preceded by a proposal for a new output to MEPC.

3.10 In the ensuing discussion, all delegations that spoke stressed the need for ensuring crew safety. In this regard, many delegations expressed concerns for the safety of crews if the proposed procedure in document PPR 10/3/2 were to be introduced. Additionally, several delegations highlighted that the proposal in document PPR 10/3/2 could not be further considered in the absence of a corresponding output.

3.11 Some delegations expressed the view that the upcoming comprehensive review approved by the Maritime Safety Committee of Assembly resolution A.1050(27) on *Revised recommendations for entering enclosed spaces aboard ships*, which was applicable to all ships, should not be pre-empted by consideration of changes to tank entry requirements specific to chemical tankers.

3.12 Having noted the lack of support for the proposal in document PPR 10/3/2, the Sub-Committee agreed not to consider this specific proposal further. Nevertheless, the Sub-Committee noted that many delegations supported the need to further consider other potential means of addressing the operational challenges faced by crews on ships carrying IBC Code products with newly assigned "Toxic" ratings for which no toxic vapour detection equipment existed. Subsequently, the Sub-Committee instructed the ESPH Technical Group to review the draft agenda for ESPH 29 and revise as appropriate, based on progress made during this session, and advise the Sub-Committee whether the agenda item relating to toxic vapour detection equipment should be retained on the provisional agenda for ESPH 29.

Provisional agenda for ESPH 29

3.13 Having recalled that MEPC 78 had approved the holding of an intersessional meeting of the ESPH Technical Group in 2023, which was subsequently endorsed by C 127, the Sub-Committee approved the proposed provisional agenda for ESPH 29, as set out in annex 6 to document PPR 10/3, subject to any possible revisions/additions made by the ESPH Technical Group at this session.

Establishment of the ESPH Technical Group

3.14 Having considered the above-mentioned matters, the Sub-Committee established the Technical Group on Evaluation of Safety and Pollution Hazards of Chemicals (ESPH) and instructed it, taking into account the report of ESPH 28 (PPR 10/3) and the comments and decisions made in plenary, to:

.1 conduct an evaluation of products based on the information contained in documents PPR 10/3/1, PPR 10/3/3, PPR 10/3/4 and PPR 10/3/5;

.2 conduct an evaluation of cleaning additives;

.3 prepare a draft revision to PPR.1/Circ.7 on *Decisions with regard to the categorization and classification of products* to include decisions at this session as well as any other recent decisions by the Technical Group, to be issued subject to endorsement by MEPC;

.4 further develop the draft revised MEPC.1/Circ.590, taking into account the discussions and progress made during ESPH 28, with a view to finalization; and

.5 review the draft agenda for ESPH 29 and revise as appropriate, based on progress made during this session.

Report of the ESPH Technical Group

3.15 Having considered the report of the ESPH Technical Group (PPR 10/WP.3), the Sub-Committee approved it in general and took action as outlined in paragraphs 3.17 to 3.22.

3.16 The Sub-Committee noted that the delegation of Hong Kong, China, had not participated in the ESPH Technical Group, despite being listed as a participant in paragraph 1.2 of document PPR 10/WP.3.

Evaluation of products and cleaning additives

3.17 With regard to the provisional categorization of liquid substances, the Sub-Committee concurred with the evaluation of:

.1 "fast pyrolysis bio-oil", as set out in annex 1 to document PPR 10/WP.3, and its inclusion in list 1 of the next edition of the MEPC.2/Circular (MEPC.2/Circ.29, due to be issued in December 2023), with validity for all countries and with no expiry date;

.2 trade-named mixtures, as set out in annex 2 to document PPR 10/WP.3, and their inclusion in list 3 of the next edition of the MEPC.2/Circular (i.e. MEPC.2/Circ.29), with validity for all countries and with no expiry date; and

.3 cleaning additives, as set out in annex 3 to document PPR 10/WP.3, and their inclusion in annex 10 of the next edition of the MEPC.2/Circular (i.e. MEPC.2/Circ.29).

Review of the MEPC.2/Circular

3.18 The Sub-Committee noted that tripartite agreements for 19 products would reach their expiry dates in December 2023 and would be deleted from next edition of the MEPC.2/Circular (i.e. MEPC.2/Circ.29), and invited Member Governments to take action as appropriate to avoid any delay in the carriage of these products beyond their expiry dates.

Review of products in lists 2, 3 and 4 of the MEPC.2/Circular

3.19 The Sub-Committee noted that the trade-named product "RBHC (Exxon Mobil)" had been re-evaluated by the ESPH Technical Group and found to meet the criteria for complex mixtures in paragraph 9.2 of MEPC.1/Circ.512/Rev.1 and consequently would be deleted from the next edition of the MEPC.2/Circular (i.e. MEPC.2/Circ.29).

Draft amendments to the Decisions with regard to the categorization and classification of products (PPR.1/Circ.7)

3.20 The Sub-Committee agreed to the draft amendments to the *Decisions with regard to the categorization and classification of products* (PPR.1/Circ.7), as set out in annex 1, for approval by MEPC 80.

Revision of MEPC.1/Circ.590 on Revised tank cleaning additives guidance note and reporting form

3.21 The Sub-Committee noted the progress made by the Group with regard to the revision of MEPC.1/Circ.590 on *Revised tank cleaning additives guidance note and reporting form*, as set out in annex 6 to document PPR 10/WP.3.

Provisional agenda for ESPH 29

3.22 Taking into account the Group's progress during the session, the Sub-Committee approved the provisional agenda for ESPH 29, as set out in annex 2, and agreed to request MEPC 80 to approve the scheduling of an intersessional meeting of the ESPH Technical Group in the second half of 2024 (see also paragraph 15.12).

4 DEVELOPMENT OF AN OPERATIONAL GUIDE ON THE RESPONSE TO SPILLS OF HAZARDOUS AND NOXIOUS SUBSTANCES (HNS)

4.1 The Sub-Committee recalled that MEPC 74 had agreed to include a new output to develop an operational guide on preparedness and response to spills of hazardous and noxious substances on the post-biennial agenda of the Committee and had assigned the PPR Sub-Committee as the associated organ, with two sessions needed to complete the work (MEPC 74/18, paragraph 14.20).

4.2 The Sub-Committee also recalled that MEPC 76 had subsequently approved the provisional agenda for PPR 9 (MEPC 76/15/Add.2, annex 16), which included the output on "Development of an operational guide on the response to spills of hazardous and noxious substances (HNS)".

4.3 The Sub-Committee further recalled that PPR 9, having considered document PPR 9/4 (REMPEC), containing the multi-regional Marine HNS Response Manual (the Manual) developed by the Bonn Agreement, HELCOM and REMPEC, had invited interested delegations to work intersessionally to progress on the development of an IMO Operational Guide on the Response to Spills of Hazardous and Noxious Substances (HNS) (the Guide), using document PPR 9/4 as the base document, and to submit a draft to PPR 10.

4.4 The Sub-Committee had for its consideration document PPR 10/4 (REMPEC), containing the Manual and proposing potential changes that could be made to the Manual for it to be used as the basis for the development of an IMO guide on the response to HNS.

4.5 Some delegations expressed the view that in order for the Guide to be a practical tool for use by responders during an incident, it needed significant modifications and recommended continuing the work intersessionally through a correspondence group rather than trying to finalize at the current session. However, most of the delegations who took the floor noted that the development of the draft Guide could be finalized at this session as the Manual was very well developed.

4.6 Most delegations also supported the proposal in paragraph 6 of document PPR 10/4 to have two separate volumes covering preparedness and response respectively.

4.7 In light of the above, the Sub-Committee agreed that a drafting group should be established to finalize the draft Guide as two separate volumes.

Establishment of the Drafting Group on Pollution Response

4.8 Subsequently, the Sub-Committee established the Drafting Group on Pollution Response and instructed it, taking into consideration the comments and decisions made in plenary, to:

.1 develop, with a view to finalization of a draft "Operational Guide on the Response to Spills of Hazardous and Noxious Substances (HNS)", using the annex to document PPR10/4 as a basis, ensuring all regional-specific references were removed and making any required modifications to the document to ensure international applicability and scope; and

.2 should finalization not be possible within the available time, prepare draft terms of reference for a correspondence group on pollution response to develop the draft Operational Guide on the Response to Spills of Hazardous and Noxious Substances (HNS), using the annex to document PPR 10/4, as modified during this session, as the basis.

Report of the Drafting Group

4.9 Having considered the relevant part of the report of the Drafting Group (PPR 10/WP.4, paragraphs 4 to 10 and annex), the Sub-Committee agreed to the draft Guide, as set out in annex 3, for approval by MEPC 80 and subsequent publication.

4.10 In this connection, the Sub-Committee requested the Committee to authorize the Secretariat, when preparing the final text of the Guide (volumes 1 and 2) to effect any editorial corrections that might be identified, as appropriate, including additional reference sources deemed appropriate.

5 REVIEW OF THE 2011 GUIDELINES FOR THE CONTROL AND MANAGEMENT OF SHIPS' BIOFOULING TO MINIMIZE THE TRANSFER OF INVASIVE AQUATIC SPECIES (RESOLUTION MEPC.207(62))

5.1 The Sub-Committee recalled that MEPC 72 had included this output in the post-biennial agenda of the Committee, assigning the PPR Sub-Committee as the associated organ, with two sessions needed to complete the work; PPR 6 had included the output in its biennial agenda for the 2020-2021 biennium; and following a request by PPR 8, MEPC 76 had agreed to extend the target completion year of this output to 2023.

5.2 The Sub-Committee recalled also that PPR 7 had agreed to the key elements of the Biofouling Guidelines that required further attention and discussion and the corresponding areas for potential revision of the Guidelines, and had established the Correspondence Group on Review of the Biofouling Guidelines, under the coordination of Norway, which was subsequently re-established by PPR 8 and PPR 9.

5.3 The Sub-Committee had for its consideration the following documents:

.1 PPR 10/5 (ICES), proposing guidelines for the testing of ship biofouling in-water cleaning system safety and efficacy which would be feasible and produce the data needed to inform in-water cleaning system approvals and ship biofouling management decisions intended to improve and standardize the process of independently verifying the performance of all types and components of in-water cleaning systems and support the revision of the Biofouling Guidelines;

.2 PPR 10/5/1 (Norway), containing the report of the Correspondence Group on Review of the Biofouling Guidelines, including the final draft of the revised Guidelines, and highlighting a number of issues requiring further consideration by the Sub-Committee with a view to their conclusion;

.3 PPR 10/5/2 (Brazil), presenting a critical analysis of methodologies for invasion risk assessment via biofouling with the aim of informing the development of a new risk assessment methodology with the incorporation of new parameters, which were currently in the testing and validation stage expected to be published in the second half of 2023 and could be incorporated in the future into the Biofouling Guidelines, to improve the chapter on biofouling risk profile and monitoring of risk parameters;

.4 PPR 10/5/3 (China et al.), proposing to initiate development of guidelines for verification of in-water cleaning systems, containing a discussion on methods to test, evaluate and validate performance of removal and capture, effluent, limitations, damage to anti-fouling coating and paint of such systems, and proposing the extension of the target completion year of output 1.21 to 2025 and amendment of the output as "Development of guidelines for verification of in-water cleaning systems";

.5 PPR 10/5/4 (Norway), proposing the development of forms of the Biofouling Management Plan (BFMP) and the Biofouling Record Book (BFRB), and the use of example forms for the BFMP and the BFRB contained in document PPR 10/INF.21 as a basis in that regard;

.6 PPR 10/5/5 (ICES), providing comments on the report of the Correspondence Group on Review of the Biofouling Guidelines (PPR 10/5/1) and proposing changes to the draft revised Guidelines, with the aim of providing clarity and additional technical insights to ensure the effective implementation of the Guidelines;

.7 PPR 10/5/6 (Brazil), providing comments on the report of the Correspondence Group on Review of the Biofouling Guidelines (PPR 10/5/1) and presenting suggestions related to operational issues to be discussed regarding the viability of the Guidelines' implementation in terms of logistics, cost-effectiveness and technology availability;

.8 PPR 10/5/7 (Australia et al.), providing comments on the report of the Correspondence Group on Review of the Biofouling Guidelines (PPR 10/5/1), highlighting key concerns with the draft revised Guidelines and proposing amendments including alternate texts to increase the uptake and effectiveness of the Guidelines;

.9 PPR 10/5/8 (Australia et al.), commenting on the proposal for the development of guidelines for verification of in-water cleaning systems (PPR 10/5/3) and recommending that concrete proposals related to in-water cleaning be invited to future sessions of the Sub-Committee, to allow PPR 10 to focus on the finalization of the revision of the Biofouling Guidelines;

.10 PPR 10/5/9 (ICS and BIMCO), providing comments on the report of the Correspondence Group on Review of the Biofouling Guidelines (PPR 10/5/1) and highlighting some industry concerns with the draft revised Guidelines which might affect uptake and effectiveness;

.11 PPR 10/5/10 (India and Japan), providing comments on the report of the Correspondence Group on Review of the Biofouling Guidelines (PPR 10/5/1) and concerns on various matters relating to biofouling inspections;

.12 PPR 10/5/11 (RINA), providing comments on the report of the Correspondence Group on Review of the Biofouling Guidelines (PPR 10/5/1) related to recommendations with potential consequences that might lead to complex implementation, significant administrative burden, just-in-time arrivals and prohibitive cost of compliance;

.13 PPR 10/5/12 (RINA), commenting on the proposal for the development of guidelines for verification of in-water cleaning systems (PPR 10/5/3) and recommending that in-water cleaning--related processes, such as inspection and cleaning report requirements, also be considered under the proposed amended output 1.21;

.14 PPR 10/5/13 (IMarEST), providing comments on the report of the Correspondence Group on Review of the Biofouling Guidelines (PPR 10/5/1) and presenting some key concerns about the proposals included in the draft revised Guidelines;

.15 PPR 10/5/14 (CSC), providing comments on the report of the Correspondence Group on Review of the Biofouling Guidelines (PPR 10/5/1), whilst pointing to the importance of defining concepts more clearly to ensure the uptake of the Guidelines, and to articulate base requirements more consistently to ensure that the most environmentally sound options were chosen;

.16 PPR 10/5/15 (CLIA), providing comments on the report of the Correspondence Group on Review of the Biofouling Guidelines (PPR 10/5/1) and proposing improvements to make the Guidelines more reflective of real-world conditions and internally consistent;

.17 PPR 10/INF.16 (Republic of Korea), providing information on an underwater navigation system for multiple hull cleaning robots using ultrashort baseline (USBL) acoustic positioning;

.18 PPR 10/INF.17 (Republic of Korea), providing information on a new safe reactive cleaning technology for niche areas in order to ensure the safety of divers and remove biofouling efficiently;

.19 PPR 10/INF.18 (Republic of Korea), introducing research on the biological risk assessment of biofouling organisms related to in-water cleaning to help scientific management of biofouling;

.20 PPR 10/INF.21 (Norway), providing example forms for the Biofouling Management Plan (BFMP) and the Biofouling Record Book (BFRB), in order the assist the Sub-Committee in its work in support of the proposal in document PPR 10/5/4 to develop forms for the BFMP and the BFRB; and

.21 PPR 10/INF.24 (ICOMIA et al.), presenting a report, developed in cooperation with the GloFouling Partnerships project, containing practical advice and recommendations for biofouling prevention and management applicable to all types of recreational craft.

5.4 Recalling that the target completion year of this output, which had already been extended, was 2023, and noting that there was overwhelming support in the submitted documents for completing the revision of the Biofouling Guidelines at this session, the Sub-Committee agreed that the discussions should be framed under this overarching objective, namely to finalize and approve revised Biofouling Guidelines at this session for adoption by MEPC 80.

5.5 In order to achieve this objective in the most effective manner, noting the large number and broad range of issues addressed in the report of the Correspondence Group and the commenting documents, the discussion in plenary focused on some fundamental points that should be resolved in order to provide clear direction to the Working Group on Marine Biosafety while the remaining points were considered directly in the Working Group.

5.6 In this regard, the Sub-Committee did not have any general discussion on the report of the Correspondence Group on Review of the Biofouling Guidelines, but instead proceeded directly to targeted discussions on the fundamental matters that required further consideration and decision by the Sub-Committee in order to provide clear direction to the Working Group, followed by a very brief discussion to note other matters that did not directly affect the revision of the Biofouling Guidelines.

5.7 In this connection, having noted the extensive work and progress achieved by the Correspondence Group on a number of issues, which resulted in an updated draft of the revised Biofouling Guidelines allowing the finalization of the revised Guidelines at this session, the Sub-Committee expressed its appreciation for the work of the Correspondence Group.

5.8 The matters requiring direction or decision by plenary, as set out in the following paragraphs 5.9 to 5.38, were as follows:

.1 fundamental approach to biofouling risk assessment and inspection frequencies, focusing on proposals for substantial reduction or deletion of chapter 7 and part of chapter 9 of the draft revised Biofouling Guidelines;

.2 inclusion of a new chapter on contingency measures (chapter 8);

.3 fouling ratings and corresponding actions (in chapter 9), including proposals for substantial amendments or deletions in the fouling ratings table;

.4 requirements for in-water cleaning and capture rates (in chapter 10), including proposals for the development of separate guidance on matters relating to in-water cleaning;

.5 development of forms for the Biofouling Management Plan and Biofouling Record Book (relating to appendices 3 and 4); and

.6 time permitting, currently missing content on best practices for biofouling inspections and cleaning actions (in appendices 5 and 6).

Biofouling risk assessment and inspection frequencies

5.9 In considering the issue of biofouling risk assessment and inspection frequencies, as set out in chapter 7, part of chapter 9 and appendix 1 of the draft revised Biofouling Guidelines, the Sub-Committee noted that some documents proposed very fundamental modifications including substantial reductions or even deletions of these parts of the Guidelines; specifically, document PPR 10/5/7 (Australia et al.) proposed the deletion of chapter 7 and paragraph 9.4 and their replacement with proposed new text, while document PPR 10/5/13 (IMarEST) proposed the deletion of chapter 9. In this regard, the discussion addressed the matter at this high level, namely whether any of these parts should be deleted or replaced, and not detailed issues such as specific inspection intervals or details of the risk assessment, which could be considered by the Working Group depending on the outcome of this high-level discussion.

5.10 First, the Sub-Committee considered the proposal in document PPR 10/5/7 (Australia et al.) to delete chapter 7 and replace it with proposed new text as set out in paragraph 12 of that document.

5.11 In the ensuing discussion, a large number of delegations who spoke supported this proposal, as they were of the view that the provisions contained in the report of the Correspondence Group were overly complex and would be difficult to implement in practice, which would limit the uptake and implementation of the Guidelines. In this context, the

Sub-Committee noted that the proposal did not entail losing the entirety of chapter 7, as some of its content would be moved to other parts of the Guidelines.

5.12 Following extensive discussion, the Sub-Committee agreed that chapter 7 would be removed from the revised Biofouling Guidelines and instead the text proposed in paragraph 12 of document PPR 10/5/7 would be included, and any necessary adjustments would be made by the Working Group on Marine Biosafety taking into account the comments made in plenary, as part of the finalization of the revised Biofouling Guidelines.

5.13 Subsequently, the Sub-Committee considered the proposals in documents PPR 10/5/7 (Australia et al.) and PPR 10/5/13 (IMarEST) to delete paragraph 9.4 or the entire chapter 9, respectively.

5.14 In the ensuing discussion, many delegations who spoke, while agreeing that chapter 9 should be simplified, did not support the deletion of this chapter in its entirety as it would be important to maintain provisions for inspections in the Guidelines, and instead supported the deletion of paragraph 9.4 of the draft revised Guidelines.

5.15 In conclusion, the Sub-Committee agreed that paragraph 9.4 would be removed from the revised Biofouling Guidelines, and the Working Group on Marine Biosafety might consider any consequential adjustments to other parts of the Guidelines, taking into account the comments made in plenary, as part of the finalization of the revised Biofouling Guidelines.

Contingency measures

5.16 The Sub-Committee considered the proposed inclusion of a new chapter on contingency measures in the draft revised Biofouling Guidelines (chapter 8), which had been prepared by the Correspondence Group. The discussion addressed whether this additional chapter should be retained or only fundamental aspects of it, noting that, if the inclusion of this chapter were agreed, the details would be considered by the Working Group.

5.17 In the ensuing discussion, several delegations did not support the inclusion of such a chapter in the Guidelines, expressing the view that the provisions in chapter 9 would be sufficient and the additional chapter would add complexity. However, many other delegations supported the inclusion of such a separate chapter as, in their view, it would add value, while any specific concerns about its content could be addressed by the Working Group.

5.18 In conclusion, the Sub-Committee agreed that chapter 8 would be retained in the revised Biofouling Guidelines, with adjustments made by the Working Group on Marine Biosafety as part of the finalization of the revised Biofouling Guidelines taking into account the comments made in plenary.

Fouling ratings and corresponding actions

5.19 With regard to the determination of fouling ratings and corresponding actions, which was a part of chapter 9 of the draft revised Biofouling Guidelines, the Sub-Committee noted that some documents addressed substantial elements of this matter, including the proposal in document PPR 10/5/7 (Australia et al.) to delete fouling rating 2, as well as various comments and proposals regarding whether proactive or reactive cleaning with or without capture should be recommended for each fouling rating. In this regard, the discussion addressed only the proposal to delete fouling rating 2 and not detailed issues such as specifics of the fouling rating definitions or the resulting actions, which could be considered by the Working Group.

5.20 In the ensuing discussion, a large number of delegations who spoke supported the deletion of fouling rating 2, as the distinction between light and heavy microfouling could be difficult and confusing and it would be better to simplify the relevant table 2 and combine ratings 1 and 2 into one rating covering microfouling.

5.21 Following discussion, the Sub-Committee agreed that fouling rating 2 would be removed from table 2 in the revised Biofouling Guidelines and the Working Group on Marine Biosafety should make any consequential adjustments as part of the finalization of the revised Biofouling Guidelines taking into account the comments made in plenary.

Matters relating to in-water cleaning

5.22 Noting that there were several matters relating to in-water cleaning to be resolved, as highlighted both in the report of the Correspondence Group and in various other submissions and commenting documents, the Sub-Committee first considered the development of potential separate guidance relating to in-water cleaning, the outcome of which discussion might affect the consideration of other related matters within the draft revised Biofouling Guidelines; for example, any elements agreed to be included in stand-alone guidance on in-water cleaning might not be included in the revised Biofouling Guidelines.

Development of guidance relating to in-water cleaning

5.23 The Sub-Committee noted that documents PPR 10/5 (ICES) and PPR 10/5/3 (China et al.) contained proposals on guidelines for testing and verification of in-water cleaning systems, respectively, while documents PPR 10/5/8 (Australia et al.) and PPR 10/5/12 (RINA) provided comments on document PPR 10/5/3, and documents PPR 10/INF.16, PPR 10/INF.17 and PPR 10/INF.18 (Republic of Korea) provided information on various methodologies relating to in-water cleaning. In this connection, the Sub-Committee also noted that some of these proposals entailed an extension and renaming of this output.

5.24 The Sub-Committee noted the information contained in documents PPR 10/INF.16, PPR 10/INF.17 and PPR 10/INF.18 (Republic of Korea), providing information on ongoing technology developments and research in the Republic of Korea relating to in-water cleaning, and took it into account, as appropriate, in the context of further work relating to in-water cleaning.

5.25 In the interest of the finalization of the revision of the Biofouling Guidelines at this session, and taking into account the relevant submissions, the Sub-Committee recognized that the main point to consider was whether guidance relating to in-water cleaning might be addressed separately at a future session.

5.26 In the ensuing discussion, there was overwhelming support for the consideration of guidance on in-water cleaning separately at a future session, which would allow relevant matters to be addressed more effectively while facilitating the finalization of the revised Biofouling Guidelines at this session. In this connection, the Sub-Committee also agreed that the development of such separate guidance should take into account relevant submissions to this and previous sessions as well as the revised Biofouling Guidelines as agreed at this session.

5.27 In conclusion, the Sub-Committee:

.1 recommended to the Committee that the target completion year of output 1.21 be extended to 2025 and the output renamed as "Development of guidance on matters relating to in-water cleaning"; and

.2 invited interested Member States and international organizations to work intersessionally and submit concrete proposals on guidance on matters relating to in-water cleaning to the next session of the Sub-Committee.

In-water cleaning requirements and capture rates

5.28 Subsequently, the Sub-Committee turned its attention to the requirements for in-water cleaning and capture rates, as set out in chapter 10 of the draft revised Biofouling Guidelines. In this regard, the Sub-Committee recalled that the outcome of its discussion on the development of guidance relating to in-water cleaning should inform the consideration of other matters relating to in-water cleaning that were being addressed within the Biofouling Guidelines, as might be appropriate; for example, any elements agreed to be included in stand-alone guidance on in-water cleaning might not be included in the revised Biofouling Guidelines.

5.29 Recalling also that there were several relevant matters to be resolved, the discussion aimed at specific decisions on some fundamental proposals and not at detailed issues, which could be considered by the Working Group taking into account the outcome of this high-level discussion. In this regard, the Sub-Committee recognized that, while specific topics such as precise capture rates or other technical details and definitions were addressed in the report of the Correspondence Group and various commenting documents, such topics required detailed consideration in the Working Group.

5.30 In light of this, the discussion focused on making clear decisions on the options regarding paragraph 10.16 of the draft revised Biofouling Guidelines, which addressed the subject of measurable capture rates for in-water reactive cleaning, noting that there were two alternative versions in the draft revised Biofouling Guidelines as well as proposals to delete this paragraph altogether, and the proposals to delete paragraphs 10.5 and 10.7.2 of the draft revised Biofouling Guidelines, which were explicitly linked to paragraph 10.16 and were in square brackets.

5.31 In this connection, the Sub-Committee noted that documents PPR 10/5/6 (Brazil), PPR 10/5/9 (ICS and BIMCO) and PPR 10/5/14 (CSC), inter alia, expressed various views on the options for paragraph 10.16, while documents PPR 10/5/7 (Australia et al.) and PPR 10/5/15 (CLIA) proposed to remove this paragraph from the revised Biofouling Guidelines. The Sub-Committee also noted that documents PPR 10/5/7 (Australia et al.) and PPR 10/5/14 (CSC) proposed to remove paragraphs 10.5 and 10.7.2 from the revised Biofouling Guidelines.

5.32 In the ensuing discussion, several delegations supported alternative 2 for paragraph 10.16 of the draft revised Guidelines, whereas many other delegations supported the deletion of this paragraph along with paragraphs 10.5 and 10.7.2, which could all be replaced by high-level text on principles for in-water cleaning while the details would be addressed in the separate guidance on in-water cleaning agreed to be developed; one delegation supported retaining paragraph 10.7.2.

5.33 Following discussion, the Sub-Committee agreed that paragraphs 10.16 and 10.5 would be removed from the revised Biofouling Guidelines, and the Working Group on Marine Biosafety should make consequential adjustments, including further consideration of the deletion of paragraph 10.7.2, as part of the finalization of the revised Biofouling Guidelines taking into account the comments made in plenary.

Development of forms for the Biofouling Management Plan and Biofouling Record Book

5.34 The Sub-Committee considered the proposals in documents PPR 10/5/4 and PPR 10/INF.21 (Norway) on developing standardized forms for the Biofouling Management Plan (BFMP) and Biofouling Record Book (BFRB), noting that, while there were no submissions commenting on these documents, this matter was also addressed in other documents commenting more broadly on the Correspondence Group report, including documents PPR 10/5/7 (Australia et al.) and PPR 10/5/11 (RINA).

5.35 Recognizing that guidance on developing BFMPs and BFRBs was an essential part of the Biofouling Guidelines, the Sub-Committee noted that it should provide clear direction to the Working Group for its further consideration of this matter, including whether specific forms should be included in the revised Guidelines to be approved at this session and, if so, whether the examples included in document PPR 10/INF.21 or other examples should be used as a basis for such work.

5.36 In the ensuing discussion, there was general support for the inclusion of forms for the BFMP and BFRB in the Biofouling Guidelines, as well as broad support for using the examples proposed in document PPR 10/INF.21 as a basis, while some delegations expressed the view that those examples might be too complex and the examples referenced in document PPR 10/5/7 might be more effective.

5.37 In conclusion, the Sub-Committee agreed that forms for the BFMP and BFRB should be included in the revised Biofouling Guidelines, as part of the finalization of the revised Guidelines at this session by the Working Group on Marine Biosafety, using the examples included in document PPR 10/INF.21 as the basis and taking into account the forms referenced in document PPR 10/5/7 as well as comments made in plenary.

Best practices for biofouling inspections and cleaning actions

5.38 Owing to time constraints, the Sub-Committee was not able to have an initial discussion in plenary on appendices 5 and 6 of the draft revised Biofouling Guidelines, relating to best practices for biofouling inspections and cleaning actions, respectively, which entailed missing content "to be developed"; therefore, this matter was considered directly in the Working Group.

Recommendations on how to increase uptake and effectiveness of the Guidelines

5.39 The Sub-Committee recalled that one of the main objectives of the revision of the Biofouling Guidelines was to increase their uptake and effectiveness, and in this regard the Correspondence Group had been considering and submitting various recommendations on how this could be achieved (PPR 9/7, paragraphs 35 to 41 and 49; PPR 10/5/1, paragraph 50).

5.40 In this regard, the Sub-Committee recognized that this did not affect the finalization of the revision of the Guidelines itself as these recommendations did not form part of the Guidelines but were for Member States and other stakeholders to consider, and as such these recommendations would not be considered by the Working Group.

5.41 In light of this, the Sub-Committee noted the recommendations on how to increase the uptake and effectiveness of the revised Biofouling Guidelines, set out in documents PPR 9/7, paragraphs 35 to 41 and 49, and PPR 10/5/1, paragraph 50, and encouraged Member States and other stakeholders to implement these recommendations.

Other matters and information relating to biofouling management

5.42 The Sub-Committee had for its consideration document PPR 10/5/2 (Brazil), presenting ongoing work on methodologies of invasion risk assessment that could be incorporated in the future into the Biofouling Guidelines. Noting that the information contained in this document did not affect the finalization of the revision of the Biofouling Guidelines at this session, the Sub-Committee invited Brazil to submit further information on its work on risk assessment methodologies in the context of any future relevant work by the Organization following the revision of the Biofouling Guidelines.

5.43 In addition, the Sub-Committee noted the information contained in document PPR 10/INF.24 (ICOMIA et al.) on recommendations for biofouling management for recreational boating developed under the GloFouling Partnerships project.

Establishment of the Working Group on Marine Biosafety

5.44 The Sub-Committee established the Working Group on Marine Biosafety, chaired by Ms. Sarah Bailey (Canada), and instructed it, taking into account comments and decisions made in plenary, to finalize the text of the draft revised Biofouling Guidelines, using the annex to document PPR 10/5/1 as the basis and taking into account documents PPR 10/5/4, PPR 10/5/5, PPR 10/5/6, PPR 10/5/7, PPR 10/5/9, PPR 10/5/10, PPR 10/5/11, PPR 10/5/13, PPR 10/5/14, PPR 10/5/15 and PPR 10/INF.21.

Report of the Working Group

5.45 Having considered the relevant parts of the report of the Working Group (PPR 10/WP.5, paragraphs 4 to 39 and annex 1), the Sub-Committee took action as outlined in paragraph 5.46 to 5.48.

5.46 The Sub-Committee approved the draft *2023 Guidelines for the control and management of ships' biofouling to minimize the transfer of invasive aquatic species* and the associated draft MEPC resolution, set out in annex 4, with a view to their adoption by MEPC 80, and requested the Secretariat to conduct an editorial review of the text prior to its submission for adoption.

5.47 The Sub-Committee also invited Member States and international organizations to submit any relevant information on best practices for biofouling inspections and cleaning actions to the Organization as it became available in the future.

5.48 With its work to revise the Biofouling Guidelines having been completed, the Sub-Committee:

.1 recalled that, after noting the recommendations on how to increase the uptake and effectiveness of the revised Biofouling Guidelines, set out in paragraphs 35 to 41 and 49 of document PPR 9/7 and paragraph 50 of document PPR 10/5/1, it had encouraged Member States and other stakeholders to implement the recommendations (see paragraph 5.41); and

.2 confirmed its recommendation to the Committee for the title of output 1.21 to be changed from "Review of the *2011 Guidelines for the control and management of ships' biofouling to minimize the transfer of invasive aquatic species* (resolution MEPC.207(62))" to "Development of guidance on matters relating to in-water cleaning" and for the target completion year of the renamed output to be set to 2025 (see paragraph 5.27.1).

6 REDUCTION OF THE IMPACT ON THE ARCTIC OF BLACK CARBON EMISSIONS FROM INTERNATIONAL SHIPPING

6.1 The Sub-Committee recalled that:

.1 MEPC 77 had endorsed the terms of reference set out in paragraph 5.23 of document PPR 8/13 for the output on "Reduction of the impact on the Arctic of Black Carbon emissions from international shipping" and had agreed to extend the target completion year of the output to 2023; and

.2 PPR 9 had established the Correspondence Group on Prevention of Air Pollution from Ships to progress the work relating to the reduction of the impact on the Arctic of Black Carbon emissions from international shipping intersessionally, with the terms of reference set out in paragraph 19.23.1 of document PPR 9/21.

6.2 The Sub-Committee noted that document MEPC 79/5/5 (FOEI et al.), which, inter alia, outlined an approach to amend MARPOL Annex VI to incorporate a requirement for ships to only use marine distillate fuel or other cleaner alternative fuels or methods of propulsion that were safe for ships when operating in or near to the Arctic, had been forwarded by the Committee to this session of the Sub-Committee for further consideration with a view to advising the Committee.

6.3 The Sub-Committee also had for its consideration the following documents submitted to this session:

.1 PPR 10/6 (Denmark), containing the Report of the Correspondence Group on Prevention of Air Pollution from Ships with the relevant sections on the impact on the Artic of Black Carbon in paragraphs 7 to 27, paragraph 51.1, and annex 1;

.2 PPR 10/6/1 (Russian Federation), providing comments on document MEPC 79/5/5 (FOEI et al.), expressing, inter alia, the view that an integrated approach was needed when dealing with matters concerning the protection of the marine environment from international shipping which took into account the work carried out in MEPC and the PPR Sub-Committee in terms of various aspects of emissions from international shipping and also took into account the effectiveness of measures already taken; and concluding that the proposals in document MEPC 79/5/5 were not based on the aforementioned compressive approach and therefore were not sufficiently developed;

.3 PPR 10/6/2 (Finland), discussing the performance of a wet electrostatic precipitator (WESP) in marine diesel engine applications; highlighting that electrostatic precipitation was a widely used method for particle removal in onshore applications but was currently not used in the exhaust after the treatment of marine diesel engines; and summarizing the results of a study on particle filtration characteristics of an emission reduction system designed for marine applications and consisting of an exhaust gas cleaning system (EGCS) and WESP in series;

.4 PPR 10/6/3 (FOEI et al.), summarizing over a decade of work on the impact on the Arctic of Black Carbon emissions from international shipping; setting out a possible pathway for the regulation of Black Carbon emissions from shipping impacting the Arctic; focusing on near-term measures which in the co-sponsors' view could be agreed to and implemented now and would lead to reductions in Black Carbon emissions that would be effective in the short term;

.5 PPR 10/6/4 (Canada), commenting on document PPR 10/6 and setting out some potential next steps for the further development of the draft guidelines on recommendatory goal-based control measures to reduce the impact on the Arctic of Black Carbon emissions from international shipping;

.6 PPR 10/6/5 (Inuit Circumpolar Council), emphasizing the areas of particular interest to the Inuit Circumpolar Council and the need to develop mandatory and concrete measures to urgently reduce Black Carbon emissions from shipping in the Arctic and Inuit Nunaat, further supporting the development of a mandatory fuel measure, an Emission Control Areas (ECA) in and near the Arctic and speed reduction measure;

.7 PPR 10/6/6 (FOEI et al.), responding to unresolved discussions during the Correspondence Group on Prevention of Air Pollution from Ships on the geographical scope of measures (recommendatory or mandatory) aimed at reducing emissions of Black Carbon impacting the Arctic from international shipping;

.8 PPR 10/INF.4 (China), providing the Black Carbon emission test results of a low-speed two-stroke marine diesel engine, and highlighting the results that the change of engine load, injection timing, injection pressure and exhaust valve closing timing had obvious influences on Black Carbon emissions, and that, compared with the use of marine gas oil, using biodiesel B50 and B100 could greatly reduce Black Carbon emissions under the same working conditions;

.9 PPR 10/INF.10 (Denmark), providing a collation of the comments received by the coordinator of the Correspondence Group on Prevention of Air Pollution from Ships during the rounds of the Correspondence Group regarding the reduction of the impact on the Arctic of Black Carbon emissions from international shipping;

.10 PPR 10/INF.20 (Finland), presenting an article based on a study on particle filtration characteristics of an emission reduction system designed for marine applications and consisting of an EGCS and a WESP in series, and highlighting that electrostatic precipitation was a widely used method for particle removal in onshore applications but was not being currently used in the exhaust after treatment of marine diesel engines; and

.11 PPR 10/INF.22 (Canada and the Republic of Korea), providing an update on the work of the international Technical Working Group established by Canada to develop a Standardized Sampling, Conditioning and Measurement Protocol for Black Carbon Emissions from Marine Engines.

6.4 Following a suggestion by the Chair, the Sub-Committee agreed to structure its discussion around the following matters:

.1 how to advance the further development of draft guidelines on goal-based control measures to reduce the impact on the Arctic of Black Carbon emissions from international shipping;

.2 general comments on Black Carbon measurement methods and results; and

.3 how to advance the further consideration of Black Carbon control measures.

General comments on the conduct of the work under this output

6.5 In the ensuing discussion, several delegations recalled that the Sub-Committee had been working on the reduction of the impact on the Arctic of Black emissions from international shipping for many years and stressed the need for the Sub-Committee to make tangible progress at this session.

6.6 Several delegations, in referring in particular to document PPR 10/6/3, summarizing over a decade of work, stressed the need to better structure the work under this agenda item in order to make progress on the various tasks, and that this might necessitate distinguishing between short-term and long-term action and between measures applicable to existing ships and measures applicable to new ships.

6.7 Several delegations highlighted the importance of taking into account the socio-economic impact of any measures on the Arctic population and Indigenous communities as the Sub-Committee progressed its work under this output.

6.8 Several delegations, in recalling the agreement in the Correspondence Group that further work should first focus on measures that could be agreed and implemented now (PPR 10/6, paragraphs 15 to 17), supported starting with the development of recommendatory guidelines, then building on the experience from their application to inform the consideration of mandatory control measures. Some delegations supported this step-by-step approach which in their view was in line with the terms of reference approved by MEPC 77.

Further development of draft guidelines on goal-based control measures to reduce the impact on the Arctic of Black Carbon emissions from international shipping

6.9 The Sub-Committee recalled that as per the terms of reference for this output approved by MEPC 77, the priority should be to develop, as a starting point, guidelines on recommendatory goal-based control measures to reduce the impact on the Arctic of Black Carbon emissions from international shipping. In this regard, several delegations expressed the view that the draft guidelines should focus on immediate action levers and could be framed as a voluntary "Black Carbon management plan" addressing best practices as well as awareness-raising activities that could help reduce Black Carbon emissions, e.g. engine maintenance, ship operations and fuel use, and actions by Administrations, port authorities and other stakeholders in the maritime value chain, like engine manufacturers or fuel producers. One delegation suggested exploring the inclusion of voluntary Black Carbon reduction goal-setting in the draft guidelines.

6.10 Several delegations expressed the view that the Sub-Committee should prioritize the finalization of draft guidelines on Black Carbon data collection at this session using annex 1 of document PPR 10/6 as a basis.

6.11 Several delegations supported the continued work on recommendatory guidelines, including refinement of their scope, using annex 1 of document PPR 10/6 as a starting point.

6.12 Several delegations, in stressing that Black Carbon emissions were responsible for around 20% of shipping's climate impact on a 20-year Global Warming Potential timescale, expressed the view that at this session the Sub-Committee should at a minimum finalize voluntary guidelines and advance the work on the development of mandatory measures as a matter of urgency.

General comments on Black Carbon measurement methods and results

6.13 Several delegations, in recalling that PPR 5 had identified the most appropriate Black Carbon measurement methods for data collection as Filter Smoke Number (FSN), Photo Acoustic Spectroscopy (PAS) and Laser Induced Incandescence (LII), were of the view that this agreement was still valid but that FSN was the most suitable method for in-service measurement on existing ships as it was robust, easy to install and use, cost-effective and there was no need for dilution. Some delegations also stressed that FSN was already used by the shipping sector and research institutions, as well as covered by ISO standards. Some delegations, in stressing that the suitability of LII and PAS still needed to be further proved, expressed the view that FSN should be recognized as the reference in-service measurement method.

6.14 Several delegations mentioned that if, in the long term, the Organization developed Black Carbon standards for engine manufacturers, FSN would probably remain the most suitable method for establishing thresholds for new engines, and the draft guidelines on Black Carbon emission data collection and reporting as set out in annex 1 to document PPR 10/6 could represent a good basis for future emission measurement in this context.

6.15 One delegation stated that since it was still unclear what the measurement methods could be used for in the context of goal-based measures, acceptable measurement methods should not be limited to FSN but all three methods already approved by the Organization (i.e. FSN, PAS and LII) should be maintained as work progresses.

6.16 One delegation, in highlighting the difference between a measurement technique and a measurement standard, called for the urgent development of Black Carbon measurement standards.

General comments on how to advance the further consideration of Black Carbon control measures

6.17 Several delegations stated that considering the limited available data and analysis, it was premature to develop mandatory Black Carbon control measures at this stage, and that the Organization should therefore focus its efforts on the further development of guidelines on recommendatory measures as a starting point on a pathway of development of mandatory measures.

6.18 Several delegations supported the further detailed consideration of the six candidate control measures identified by the Correspondence Group with a view to agreeing on a way forward, also noting that global warming required urgent action to reduce the impact on the Arctic of Black Carbon emissions of international shipping.

6.19 Several delegations, in referring in particular to document PPR 10/6/3, supported the urgent adoption of a mandatory switch to distillate fuels or other cleaner alternative fuels as an appropriate and immediate measure with the potential to reduce Black Carbon emissions in and near the Inuit Nunaat and the global Arctic, alongside speed reductions and the establishment by Arctic States of Black Carbon Emission Control Areas.

6.20 Several other delegations recalled that the prohibition on the use and carriage for use as fuel of heavy fuel oil (HFO) by ships in Arctic waters on and after 1 July 2024 adopted by MEPC 76 would already significantly reduce the use of HFO in the Arctic region. Several delegations expressed caution regarding the possible mandatory switch to distillate fuels and recalled that many factors influenced Black Carbon emissions, such as engine type, fuel type, engine load and other parameters like the aromatic or paraffinic content of fuels. One delegation mentioned that although sufficient distillates would be available for ships operating in the Arctic, for ships operating near the Arctic the availability of distillate fuels would need to be further assessed.

6.21 Several delegations expressed a preference for a goal-based, fuel and technology-neutral approach instead of a fuel or technology-prescriptive approach in further developing possible control measures recalling the wide range of parameters affecting Black Carbon emissions from ships.

6.22 One delegation suggested that the consideration of control measures should comprise the following successive tasks: 1) definition of the geographical scope for the Arctic region, where mandatory Black Carbon reduction measures would apply; 2) development of short-term measures that could be implemented immediately and be mandatory for all ships (e.g. mandatory switch to distillates); and 3) development of midterm measures that could achieve higher Black Carbon emission reductions beyond the short-term measures.

6.23 Several delegations, in seeing merit in the development of potential Black Carbon emission thresholds for engines, stressed that these would need to be based on real-world measurement using FSN and not only on Black Carbon emission factors as developed in the Fourth IMO GHG Study 2020.

Geographical scope of this output

6.24 Several delegations, in referring in particular to document PPR 10/6/6, supported the further consideration of the geographical scope of measures developed to reduce the impact on the Arctic of Black Carbon emissions from international shipping, and that it should at a minimum cover the maritime waters of the Arctic Human Development Report area or the Arctic Monitoring and Assessment Programme area or alternatively all waters north of 60° North.

6.25 Several other delegations referred to the definition of Arctic waters in MARPOL.

6.26 One delegation, in referring to the geographical range already identified in resolution MEPC.342(77) on *Protecting the Arctic from shipping Black Carbon emissions*, stressed that, in the event that the geographical scope were changed, the time, impact and total ratio of Black Carbon in that area should be strictly assessed.

6.27 The observer from IBIA pointed out that extending the geographical scope for Black Carbon reduction measures to areas near the Arctic would have an impact on the amount of distillate fuels being required to meet demand, thus requiring careful consideration.

6.28 The Sub-Committee acknowledged that at this stage the only relevant definition in IMO instruments was that for "Arctic waters" in MARPOL and SOLAS and that the geographical scope of Black Carbon measures was outside the remit of the Sub-Committee; therefore, any further discussion on defining the geographical scope beyond Arctic waters should not be undertaken at the Sub-Committee and should be addressed at the Committee.

Statement from the observer from ISO on relevant ongoing work regarding the characterization of marine fuels

6.29 The observer from ISO provided an update on the work undertaken to provide the maritime industry with an indicator to characterize whether a marine fuel tended to be more paraffinic or aromatic in nature (ISO/TC 28/SC 4/WG6). The Sub-Committee noted that the revised ISO 8217 standard and a technical report on the characterization of marine fuels were expected to be published in the first quarter of 2024.

6.30 The statement by the observer from ISO is set out in annex 19.

6.31 The delegation of Germany, in responding to the ISO statement and supported by the delegation of Canada, expressed the view that the inclusion of the viscosity gravity constant in the ISO 8217 marine fuels standard would not be sufficient to characterize whether a marine fuel could be more paraffinic or aromatic in nature, and instead invited ISO to reconsider the inclusion of the hydrogen to carbon (H/C) ratio in ISO 8217. The full statement is set out in annex 19.

Instructions to the Working Group on Prevention of Air Pollution from Ships

6.32 Following the discussion, the Sub-Committee noted all documents considered under this agenda item and instructed the Working Group on Prevention of Air Pollution from ships, taking into account comments and decisions made in plenary, as well as all documents submitted to this session, or forwarded by MEPC to this session concerning Black Carbon emissions, as appropriate, to:

.1 further develop, with a view to finalization, draft guidelines on goal-based control measures to reduce the impact on the Arctic of Black Carbon emissions from international shipping using annex 1 to document PPR 10/6 as a basis;

.2 further consider the list of potential Black Carbon control measures set out in paragraph 15.5 of document PPR 10/6, with a view to advising the Sub-Committee on how best to advance the work under this output; and

.3 consider whether a correspondence group needed to be established and develop draft terms of reference, as appropriate.

Report of the Working Group on Prevention of Air Pollution from Ships

6.33 Having considered the relevant parts of the report of the Working Group (PPR 10/WP.6, paragraphs 4 to 38 and annexes 1 and 2), the Sub-Committee approved the report in general and:

.1 noted the progress made by the Group in developing draft guidelines on recommendatory goal-based control measures to reduce the impact on the Arctic of Black Carbon emissions from international shipping as set out annexes 1 and 2 to the Working Group report;

.2 noted the Group's discussion on the list of potential Black Carbon control measures and invited interested Member States and international organizations to work intersessionally on further developing proposals on potential Black Carbon control measures and to submit them to the next session of the Sub-Committee; and

.3 established the Correspondence Group on Prevention of Air Pollution from Ships under the coordination of the United States,[1] with the following terms of reference:

".1 further develop, with a view to finalization, draft guidelines on recommendatory goal-based control measures to reduce the impact on the Arctic of Black Carbon emissions from international shipping, using annex 1 and annex 2 of document PPR 10/WP.6 as a basis; and;

.2 submit a written report to PPR 11."

6.34 In considering the action requested of the Sub-Committee with regard to the Working Group's discussions on the list of potential Black Carbon control measures, the observers from FOEI, Pacific Environment, CSC and the Inuit Circumpolar Council expressed disappointment and concerns regarding the lack of progress at this session on the development of mandatory measures to reduce the impact on the Arctic of Black Carbon emissions from ships after more than a decade of discussions in the Organization. These observers, in recalling that Black Carbon emissions from shipping in the Arctic had doubled from 2015 to 2021 and that Black Carbon emissions were five times more potent a climate disruptor when emitted in the Arctic, urged Member States to urgently bring forward concrete proposals for mandatory Black Carbon control measures which would result in rapid, deep and sustained emission reductions this decade, such as requiring a switch to distillate or cleaner alternative fuels by ships operating in or near the Arctic and Inuit Nunaat. The full statements of the observers from FOEI, Pacific Environment, CSC and the Inuit Circumpolar Council are set out in annex 19.

6.35 The delegation of Canada expressed its support for developing goal- or standards-based control measure(s) which could accommodate the broad range of fuels and shipboard technologies developed in response to IMO's environmental efforts in other areas, including the reduction of GHG emissions from ships, informed the Sub-Committee of the planned submission to MEPC 80 notifying Canada's intention to submit a full proposal to MEPC 81 for an Emission Control Area (ECA) in Arctic waters under Canadian jurisdiction, and invited interested Member States and international organizations to contribute to this effort.

Extension of the target completion year

6.36 In light of the above, the Sub-Committee invited the Committee to extend the target completion year for the output to 2025.

7 STANDARDS FOR SHIPBOARD GASIFICATION OF WASTE SYSTEMS AND ASSOCIATED AMENDMENTS TO REGULATION 16 OF MARPOL ANNEX VI

7.1 The Sub-Committee recalled that PPR 9 had instructed the Correspondence Group on Prevention of Air Pollution from Ships to develop draft standard specification/guidelines for thermal waste treatment devices, using the annex to document PPR 9/9 (Panama) as a basis.

7.2 The Sub-Committee noted, in general, the discussion and progress made by the Correspondence Group on the Development of Draft Standard Specification/Guidelines for

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Thermal Waste Treatment Devices, set out in paragraphs 28 to 32, paragraph 51.2 and annex 2 to document PPR 10/6 (Denmark) and the relevant sections of document PPR 10/INF.9 (Denmark).

7.3 In addition to the relevant sections of the report of the Correspondence Group, the Sub-Committee also had for its consideration the following documents related to the draft standard specification/guidelines for thermal waste treatment devices:

.1 PPR 10/7 (India), expressing the view that because the draft guidelines for thermal waste treatment devices contained provisions for record-keeping rather than just monitoring, there might be a need to amend regulation 16 of MARPOL Annex VI to introduce a requirement for record-keeping rather than just having such a provision only as part of guidelines; and

.2 PPR 10/7/1 (Finland), containing proposals to amend the standards for shipboard gasification of waste systems, set out in annex 2 to document PPR 10/6, notably suggesting the inclusion of hydrothermal carbonization in the draft guidelines for thermal waste treatment devices.

7.4 In the ensuing discussion, the observer from IACS raised an issue concerning the proposal in document PPR 10/7/1 to amend the header of the Thermal Waste Treatment Device Certificate to also allow for "other applicable measure of capacity" which, in IACS's view, could introduce a vagueness potentially leading to uncertainty. The Sub-Committee agreed to instruct the Working Group on Prevention of Air Pollution Ships to further consider this issue.

Instructions to the Working Group on Prevention of Air Pollution from Ships

7.5 Following the discussion, and considering the highly technical nature of the work, the Sub-Committee agreed to instruct the Working Group on Prevention of Air Pollution from Ships, established under agenda item 6, taking into consideration the comments and decisions made in plenary, to finalize the draft 2023 guidelines for thermal waste treatment devices using annex 2 to document PPR 10/6 as a basis and taking into account documents PPR 10/7 and PPR 10/7/1 and comments made in plenary.

Report of the Working Group on Prevention of Air Pollution from Ships

7.6 Having considered the relevant parts of the report of the Working Group (PPR 10/WP.6, paragraphs 40 to 45 and annex 3), the Sub-Committee agreed to the draft 2023 guidelines for thermal waste treatment devices, and the associated draft MEPC resolution, as set out in annex 5, with a view to adoption by MEPC 80, and requested the Secretariat to conduct an editorial review of the text prior to its submission for adoption.

Completion of the work on the output

7.7 In view of the above, the Sub-Committee invited MEPC 80 to note that the work on this output had been completed.

8 DEVELOPMENT OF AMENDMENTS TO MARPOL ANNEX VI AND THE NO_X TECHNICAL CODE ON THE USE OF MULTIPLE ENGINE OPERATIONAL PROFILES FOR A MARINE DIESEL ENGINE

8.1 The Sub-Committee recalled that MEPC 73 had agreed to a new output on "Development of amendments to MARPOL Annex VI and the NO_X Technical Code on the use of multiple engine operational profiles for a marine diesel engine" with the scope of work, set out in paragraph 15.18 of document MEPC 73/19, as follows:

> "Taking into account the concept of Not to Exceed (NTE) Zones, as described in documents MEPC 73/11/1 and MEPC 73/INF.15, clarify whether multiple engine operational profiles are allowed, and if so, what regulatory controls should be applied; noting these may also need to include amendments to MARPOL Annex VI and the NO_X Technical Code 2008; and if not allowed, then what amendments would be necessary to MARPOL Annex VI and the NO_X Technical Code 2008 to explicitly prohibit multiple engine operational profiles."

8.2 The Sub-Committee also recalled that, owing to time constraints, PPR 9 had forwarded all relevant documents on multiple engine operational profiles (MEOPs) to the Correspondence Group on Prevention of Air Pollution from Ships established at that session with the following instructions:

".1 further consider how to incorporate, and prepare regulatory controls and/or draft amendments on, the use of MEOPs in MARPOL Annex VI and/or the NO_X Technical Code 2008 (NTC) as appropriate;

.2 clarify the need for definitions of terminology and application related to Engine International Air Pollution Prevention (EIAPP) test cycles and related amendments to the NO_X Technical Code 2008; and

.3 in relation to possible outcomes on these two points, consider whether to extend the scope of the output, and advise the Sub-Committee accordingly."

8.3 The Sub-Committee noted, in general, the discussion and the progress made by the Correspondence Group in its report in relation to MEOPs, set out in paragraphs 33 to 44, paragraph 51.3 and annex 3 to document PPR 10/6 (Denmark) and the relevant sections of document PPR 10/INF.9 (Denmark).

8.4 The Sub-Committee also noted the points on which the Group had reached general agreement, as set out in paragraphs 35 to 37 of document PPR 10/6, which can be summarized as follows:

.1 with regard to MEOPs, there was a general agreement in the Correspondence Group that MEOPs could be allowed under certain circumstances; that amendments regarding MEOPs and not-to-exceed (NTE) zones should be placed in a new chapter 8 of the NO_X Technical Code 2008; and there was a general agreement on a definition of "engine operational profile"; and

.2 with regard to the EIAPP test cycles, the Group identified a need for clear terminology and application related to EIAPP test cycles; and consequently, the Group supported extending the scope of the output to cover definitions of terminology and application related to EIAPP test cycles and related amendments to the NTC 2008.

8.5 The Sub-Committee further noted that the Group had identified a number of outstanding issues to be further discussed, as set out in paragraphs 38 and 39 of document PPR 10/6.

8.6 In the ensuing discussion, several delegations supported deferring the further consideration of draft amendments to MARPOL Annex VI and the NO_X Technical Code concerning MEOPs to PPR 11 in order to allow sufficient time for interested delegations to prepare concrete proposals intersessionally.

8.7 In supporting the general agreement of the Correspondence Group, several delegations supported the extension of the scope of the output to cover definitions of terminology and application related to EIAPP test cycles and related amendments to the NO_X Technical Code 2008 and requested that comments and proposals made in documents PPR 7/13/2 and PPR 9/11/4 (Finland), PPR 7/18 and PPR 9/11/1 (IACS) as well as any new documents submitted to the next session should be taken into account in the further consideration of this important issue during PPR 11.

8.8 The observer from IMarEST stressed that auxiliary control devices, in addition to NTE zones, should also be further considered within the scope of work and that a combination of multiple engine operational profiles, NTE zones and auxiliary control devices might resolve the concerns raised on engine test cycles. The observer also suggested that the invitation to submit draft amendments to the NO_X Technical Code should not be limited to proposing a new chapter 8 since amendments to other chapters might also be required.

8.9 Following consideration, the Sub-Committee endorsed the points on which the Correspondence Group reached general agreement and invited interested Member States and international organizations to submit proposed draft amendments to the NO_X Technical Code regarding MEOPs and EIAPP test cycles to PPR 11, taking into account the points on which there was a general agreement in the Correspondence Group and comments made at this session.

8.10 The Sub-Committee requested the Committee to endorse the expansion of the scope of the output to cover definitions of terminology and application related to EIAPP test cycles and related amendments to the NO_X Technical Code and to change the title of the output to "Development of amendments to MARPOL Annex VI and the NO_X Technical Code on the use of multiple engine operational profiles for a marine diesel engine and on the clarification of test cycles".

8.11 The Sub-Committee further agreed to forward documents PPR 7/13/2 (Finland), PPR 7/18 (IACS), PPR 9/11/1 (IACS) and PPR 9/11/4 (Finland) to PPR 11 for further consideration as appropriate.

Extension of the target completion year

8.12 Consequently, the Sub-Committee invited the Committee to extend the target completion year for output 2.15 to 2025.

9 REVISION OF REGULATION 13.2.2 OF MARPOL ANNEX VI TO CLARIFY THAT A MARINE DIESEL ENGINE REPLACING A BOILER SHALL BE CONSIDERED A REPLACEMENT ENGINE

9.1 The Sub-Committee recalled that MEPC 77 had agreed to a new output on "Revision of regulation 13.2.2 of MARPOL Annex VI to clarify that a marine diesel engine replacing a boiler shall be considered a replacement engine" in the post-biennial agenda of the Committee, assigning the PPR Sub-Committee as the associated organ, with one session needed to complete the work (paragraph 11.7, MEPC 77/16).

9.2 The Sub-Committee noted that the scope of the output also included the development of consequential amendments to the *2013 Guidelines as required by regulation 13.2.2 in* *respect of non-identical replacement engines not required to meet the Tier III limit* (resolution MEPC.230(65)).

9.3 In this regard, the Sub-Committee recalled that the output on "Revision of regulation 13.2.2 of MARPOL Annex VI to clarify that a marine diesel engine replacing a boiler shall be considered a replacement engine" had been included in the provisional agenda of PPR 10, which had been approved by MEPC 78 and subsequently confirmed by MEPC 79.

9.4 The Sub-Committee had for its consideration the following documents:

.1 PPR 10/9 (Norway), proposing amendments to regulation 13.2.2 of MARPOL Annex VI and the *2013 Guidelines as required by regulation 13.2.2 in respect of non-identical replacement engines not required to meet the Tier III limit* (resolution MEPC.230(65)); and noting that, should the proposed amendments to MARPOL Annex VI be agreed, consequential amendments to the corresponding existing unified interpretation of regulation 13.2.2 would have to be developed; and

.2 PPR 10/9/1 (IMarEST), providing comments on document PPR 10/9 and, in particular, proposing amendments to the Guidelines, adopted by resolution MEPC.230(65), to take into account the specific considerations for when a marine diesel engine replaced a boiler; and also proposing that in all cases where a Tier II engine, as opposed to a Tier III engine, was allowed to be installed it should be required that the Organization be informed, and that this functionality be added to the MARPOL Annex VI module in GISIS.

9.5 In order to expedite the work under this agenda item, the Sub-Committee referred all documents under this agenda item directly to the Working Group on Prevention of Air Pollution from Ships without discussion in plenary.

Instructions to the Working Group on Prevention of Air Pollution from Ships

9.6 Following consideration, the Sub-Committee instructed the Working Group on Prevention of Air Pollution from Ships, established under agenda item 6, taking into consideration the comments and decisions made in plenary, to:

.1 finalize draft amendments to regulation 13.2.2 of MARPOL Annex VI using annex 1 to document PPR 10/9 (Norway) as the base document;

.2 develop draft consequential amendments to the unified interpretation of regulation 13.2.2 of MARPOL Annex VI (section 6 of the annex to MEPC.1/Circ.795/Rev.7);

.3 further consider the proposal in document PPR 10/9/1 (IMarEST) to add a reporting requirement in regulation 13.2.2 of MARPOL Annex VI for all instances where a Tier II engine, as opposed to a Tier III engine, was allowed to be installed as a boiler replacement, develop corresponding draft amendments to the regulation if there was agreement in that regard, and advise the Sub-Committee on how to proceed with regard to the proposal for the reported information to be captured under a new tab in the MARPOL Annex VI GISIS module; and

.4 finalize draft amendments to the *2013 Guidelines as required by regulation 13.2.2 in respect of non-identical replacement engines not required to meet the Tier III limit* (resolution MEPC.230(65)), using annex 2 to document PPR 10/9 and the annex to document PPR 10/9/1 as the base documents.

Report of the Working Group on Prevention of Air Pollution from Ships

9.7 Having considered the relevant parts of the report of the Working Group (PPR 10/WP.6, paragraphs 46 to 52 and annexes 4, 5 and 6), the Sub-Committee:

.1 agreed to the draft amendments to regulation 13.2.2 of MARPOL Annex VI on a marine diesel engine replacing a steam system, as set out in annex 6, for submission to MEPC 80 for approval, with a view to adoption at MEPC 81;

.2 agreed to the draft *2023 Guidelines as required by regulation 13.2.2 in respect of non-identical replacement engines not required to meet the Tier III limit* and the associated draft MEPC resolution, as set out in annex 7, with a view to adoption by MEPC; and

.3 agreed to the draft consequential revision of the unified interpretations of regulation 13.2.2 of MARPOL Annex VI, as set out in annex 8, for approval by MEPC 80 and inclusion in a further revision of MEPC.1/Circ.795 (i.e. MEPC.1/Circ.795/Rev.8).

9.8 The delegation of the Marshall Islands, in referring to paragraph 48 of the Working Group's report and to the draft amendments to regulation 13.2.2 of MARPOL Annex VI set out in annex 6, noted that a new requirement had been added for Administrations to notify the Organization in all instances where a Tier II, rather than a Tier III, replacement engine had been installed in accordance with the provisions in this regulation. This delegation, without objecting to forwarding the draft amendments to regulation 13.2.2 of MARPOL Annex VI to MEPC 80 for approval, stated that this amendment could have been beyond the scope of the Group's instructions as this reporting requirement would not be limited to instances where an engine was installed as a boiler replacement, and highlighted that the impacts of this change should be further evaluated; additionally, it was not clear how the new reporting requirement might apply to replacement engines that had already been installed under the provisions of this regulation.

Completion of the work on the output

9.9 In view of the above, the Sub-Committee invited MEPC 80 to note that its work on this output had been completed.

10 DEVELOPMENT OF MEASURES TO REDUCE RISKS OF USE AND CARRIAGE OF HEAVY FUEL OIL AS FUEL BY SHIPS IN ARCTIC WATERS

Draft guidelines on mitigation measures to reduce risks of use and carriage for use of heavy fuel oil as fuel by ships in Arctic waters

10.1 The Sub-Committee recalled that at PPR 8 it had agreed, in principle, to the version of the draft guidelines on mitigation measures to reduce risks of use and carriage for use of HFO as fuel by ships in Arctic waters set out in annex 2 to document PPR 8/6 (Russian Federation) being advanced and eventually finalized.

10.2 The Sub-Committee also recalled that at PPR 8 it had agreed to request:

.1 the NCSR Sub-Committee to review section 2 (Navigational measures) and section 5 (Communication) of the draft guidelines;

.2 the SDC Sub-Committee to review paragraph 4.4 concerning the location of fuel tanks; and

.3 the HTW Sub-Committee to review section 7 (Familiarization, training and drills),

with view to being advised subsequently of the outcome of their consideration.

10.3 The Sub-Committee further recalled that, at PPR 9 (PPR 9/21, paragraphs 12.3 to 12.9):

.1 it had noted the input provided by SDC 8 and HTW 8, along with the comments made during that session, and had agreed to take them into account when finalizing the draft guidelines;

.2 the delegation of the Russian Federation had expressed its intention to prepare and submit a document to PPR 10 addressing some of the comments made during SDC 8 and PPR 9; and

.3 owing to NCSR 9 having been scheduled to take place after PPR 9, it had agreed to keep this agenda item in abeyance until PPR 10, at which point the relevant outcome of NCSR 9 would be available for consideration.

10.4 In this connection, the Sub-Committee had for its consideration document PPR 10/10 (Russian Federation), providing clarifications regarding comments made at SDC 8 on the draft guidelines on measures to reduce risks of use and carriage of heavy fuel oil as fuel by ships in Arctic waters, as well as a graphic illustration for paragraph 4.4 of the draft guidelines.

10.5 Furthermore, the Sub-Committee noted that NCSR 9 had invited the Sub-Committee to consider limiting the scope of the draft guidelines on mitigation measures to reduce risks of use and carriage for use of HFO as fuel by ships in Arctic waters only to ships using HFO as fuel, or carrying HFO for use, in Arctic waters, which were not currently covered by the Polar Code or other IMO instruments (PPR 10/2/1, paragraph 2.5).

10.6 The Sub-Committee also noted that, due to the proximity in time between HTW 9 and PPR 10, the relevant outcome of HTW 9 had not been reported in writing to this session of the Sub-Committee. That notwithstanding, the Sub-Committee was informed that HTW 9:

.1 after noting the recommendations of the Working Group on the Implementation of the STCW Convention (HTW 9/WP.11, paragraph 6) that the term "Ship operators" in the titles of section I be replaced by "Companies" and the term "Maritime Administrations" in the title of section II be replaced by "Administrations", respectively, had referred the matter to PPR 10 accordingly for consideration, as necessary; and

.2 had agreed to the proposed amendments to the provisions for familiarization, training and drills in sections I and II of the draft guidelines, as set out in annex 15 of document HTW 9/15, and had referred them to PPR 10 also for consideration.

10.7 Having noted that no further groups could be established at this session in accordance with the Committees' method of work (MSC-MEPC.1/Circ.5/Rev.4, paragraph 5.24), the Sub-Committee confirmed that, since the effective date of regulation 43A of MARPOL Annex I was 1 July 2024, the draft guidelines could yet be finalized at PPR 11 and submitted for approval to MEPC 81 (i.e. prior to 1 July 2024). Consequently, the Sub-Committee considered deferring further consideration of the draft guidelines, document PPR 10/10 and the related outcomes of NCSR 9 and HTW 9 to its next session with a view to the draft guidelines being finalized at PPR 11.

10.8 In this regard, the delegation of the United States expressed support for the draft guidelines generally, welcomed the review by NCSR 9 and other sub-committees, and made the following additional comments:

.1 the draft guidelines did not take into account issues raised at the previous session of the Sub-Committee regarding language in multiple paragraphs related to national requirements;

.2 guidelines should be implemented in a manner consistent with international law, and IMO guidelines, in particular, should not give an appearance of accepting national requirements that were not consistent with international law; and

.3 technical legal fixes could be made to the draft guidelines at PPR 11 to address national requirements and resolve any outstanding issues.

10.9 Subsequently, the Sub-Committee agreed to defer further consideration of the draft guidelines to PPR 11 and requested the Secretariat to submit a document to PPR 11 containing the draft guidelines, as set out on annex 2 to document PPR 8/6, incorporating the proposals in document PPR 10/10 and any suggested modifications originating from NCSR 9 and HTW 9 to aid the Sub-Committee's work in this regard.

Extension of the target completion year

10.10 Consequently, the Sub-Committee invited the Committee to extend the target completion year for output 7.11 to 2024.

Proposal to amend the special requirements for the use and carriage of oils as fuel in Arctic waters

10.11 The Sub-Committee noted that MEPC 78 had considered document MEPC 78/14/1 (Iceland and Norway), proposing to expand the scope of the existing output 7.11 on Development of measures to reduce risks of use and carriage of heavy fuel oil (HFO) as fuel by ships in Arctic waters, to include an upper pour point limit for HFO in regulation 43.1.2 in MARPOL Annex I.

10.12 The Sub-Committee also noted that, in this context, at MEPC 78:

.1 some delegations had expressed support for the proposal to expand the scope of the existing output 7.11 to amend regulation 43.1.2 of MARPOL Annex I to include an upper pour point limit of $0^{o}C$;

.2 some other delegations had been of the view that the proposal required further detailed technical consideration that would take into account more data and studies, as the introduction of a pour point limit might affect, inter alia, the availability of distillate fuels, and Black Carbon emissions, and might increase leakage of fuel oil in the event of a ship sinking or sustaining damage to its hull; and

.3 the observers from ISO, IBIA and IPIECA made statements, as set out in annex 28 to document MEPC 78/17/Add.1.

10.13 The Sub-Committee further noted that MEPC 78, having agreed subsequently that detailed technical consideration of the proposal in document MEPC 78/14/1 was necessary, had forwarded it to PPR 10 and had instructed the Sub-Committee to consider the document further, with a view to advising the Committee on how best to proceed.

10.14 In addition to document MEPC 78/14/1, the Sub-Committee had for its consideration document PPR 10/10/1 (Norway), providing input to the technical considerations of document MEPC 78/14/1 and responding to some of the comments made during the discussions at MEPC 78 with information highlighting the challenges created by the generally high pour point in low sulphur fuel; comments regarding the suitability of the term "heavy fuel oil" in the context of discussions on fuels that were prohibited for use in polar waters; comments regarding the retention of solidified oil in hull structures following collision or grounding incidents; comments on the availability of fuel oil compliant with a potential upper pour point requirement of $0^{o}C$; suggestions to include pour point and kinematic viscosity in appendix V of MARPOL Annex VI; information on the behaviour of marine gas oils with high paraffinic content when spilled in cold waters; information on oil spillage retrieval equipment; and the view that a better alternative to defining oils that were prohibited for use or for carriage for use as fuels in Arctic waters would be for regulation 43A of MARPOL Annex I to be amended to define "polar fuel oils" that were acceptable for use or for carriage for use as fuels in Arctic waters in a similar manner to the requirements in the Svalbard Environmental Act.

10.15 In the ensuing discussion, many delegations stressed, inter alia:

.1 that the characteristics of low sulphur fuel oils and their behaviour when spilled in cold water conditions were of major concern, as they could significantly reduce the effectiveness of oil spill response equipment, which in turn posed a threat to the Arctic marine environment as well as food security for populations and communities in the Arctic;

.2 the importance of ensuring that the composition of residual fuel oils could not be adjusted to fall outside the criteria referenced in regulation 43A of MARPOL Annex I, and that this was an urgent matter that needed to be addressed prior to the prohibition stipulated in regulation 43A of MARPOL Annex I took effect on 1 July 2024; and

.3 supported the proposals on the way forward in documents MEPC 78/14/1 and PPR 10/10/1, namely to amend regulation 43.1.2 of MARPOL Annex I to include an upper pour point limit of $0^{o}C$ or to define "polar fuel oils" that would be acceptable for use, or for carriage for use, as fuels by ships operating in Arctic waters in a similar manner to the requirements in the Svalbard Environmental Act.

10.16 Many other delegations, while noting with appreciation the proposals in document MEPC 78/14/1 and the additional technical information and proposals in document PPR 10/10/1, could not support amending the criteria in regulation 43 of MARPOL Annex I at this stage and were of the view that it was important to see the actual effects of regulation 43A of MARPOL Annex I before introducing any additional elements in those two carefully crafted regulations. Some of these delegations were of the view that consideration should be given to the impacts on the marine environment as a whole rather than focusing solely on oil spill response. Many delegations also expressed the view that proposals in document PPR 10/10/1, in particular the option of defining polar petroleum-based fuel oils that would be acceptable for use as fuel by ships operating in Arctic waters, would require a new output.

10.17 Having noted that there was no general consensus to move forward at this stage with the proposals in documents MEPC 78/14/1 and PPR 10/10/1, the Sub-Committee:

.1 agreed to revisit this matter in 2025 and to review documents MEPC 78/14/1 and PPR 10/10/1 again at PPR 12 following the effective date (1 July 2024) of the prohibition in regulation 43A of MARPOL Annex I; and

.2 invited Member States and international organizations to submit information to future sessions of the Sub-Committee on bunker fuel properties available for Arctic shipping, including any trends in viscosity, density and pour point in the lead-up to 1 July 2024 and after that date.

10.18 The Sub-Committee also noted that, should Member States in the meantime wish to pursue an alternative approach to the current structure of regulation 43A, for example the development of a polar fuel standard, they could submit proposals for a new output to the Committee.

11 REVIEW OF THE IBTS GUIDELINES AND AMENDMENTS TO THE IOPP CERTIFICATE AND OIL RECORD BOOK

11.1 The Sub-Committee recalled that, at PPR 7, it had prepared the draft MEPC circular on the *2020 Guidelines for systems for handling oily wastes in machinery spaces of ships incorporating guidance notes for an integrated bilge water treatment system* (IBTS), as set out in annex 13 to document PPR 7/22/Add.1, the draft amendments to appendix II (Form of the IOPP certificate and Supplements) and appendix III (Form of Oil Record Book) of MARPOL Annex I, as set out in annex 14 to document PPR 7/22/Add.1, and the draft revised MEPC circular on *Guidance for the recording of operations in the Oil Record Book Part I – machinery space operations (all ships)*, as set out in annex 15 to document PPR 7/22/Add.1, and had requested MEPC to consider them as a package and decide on whether they could be approved.

11.2 In this regard, the Sub-Committee noted that MEPC 78, following consideration of the outcome of PPR 7, the relevant documents that had been submitted to MEPC 75, MEPC 76 and MEPC 78, and the comments made during the discussion at that session of the Committee, had agreed, in principle, that forced evaporation was acceptable as a means for disposing of oily bilge water and had invited proposals to PPR 10 to add an appropriate regulation in MARPOL Annex I accordingly.

11.3 The Sub-Committee also noted that MEPC 78 had forwarded the following documents to this session of the Sub-Committee for further consideration:

.1 MEPC 78/9 (IACS), supporting the proposed deletion of example 10-1 in the draft ORB guidance and a change in figure 2 of appendix 1 to the draft revised IBTS guidelines, as proposed by INTERTANKO in document MEPC 76/9/5;

.2 MEPC 76/9/5 (INTERTANKO) (paragraphs 12 to 19), proposing the deletion of new example 10-1 in the draft ORB guidance and a change in figure 2 of appendix 1 to the draft 2020 IBTS guidelines; and

.3 MEPC 75/10/4 (IACS) (paragraphs 5 to 7), proposing modifications to the draft revised IBTS guidelines, specifically changes to paragraph 6.3 to clarify to which system the integral pump is connected to, if fitted; amendments to paragraph 4.3.2 of appendix 1 to align it with figure 2; and moving sections 4.5 and 4.6 of appendix 1 to the end of section 7.

11.4 In addition to the documents forwarded by MEPC, the Sub-Committee had for its consideration document PPR 10/11 (India), providing comments and proposals concerning the automatic stopping device and clean bilge water pump mentioned in the draft revised IBTS guidelines, as well as comments regarding the requirement for clean bilge water to be discharged overboard only when a ship was proceeding en route, certain safety aspects associated with forced evaporation, condensate drains of steam heating systems, and the changes to the IBTS flow diagram proposed in document MEPC 75/10/4.

11.5 In the absence of proposals to amend MARPOL Annex I to introduce requirements under which forced evaporation of oily bilge water would be considered an appropriate means of disposal, and without the option of establishing any additional groups at this session in accordance with the Committees' method of work (MSC-MEPC.1/Circ.5/Rev.4, paragraph 5.24), the Sub-Committee agreed to defer further consideration of this agenda item and all remaining documents to its next session, with a view to completing this output at PPR 11 subject to interested Member States and international organizations developing and submitting to PPR 11 relevant proposals for amendments to MARPOL Annex I.

11.6 The observer from INTERTANKO recalled the significant progress that had been achieved at PPR 7 within a working group setting and stressed the need for a working group to be established at PPR 11 to facilitate constructive discussions on the technical details that remained unresolved and to ensure completion of the work under this output. In this regard, the Chair noted this comment and informed the Sub-Committee that he would take it into account along with all documents submitted to PPR 11 when preparing his proposal for working, technical and drafting groups to be established at the Sub-Committee's next session (see also paragraph 15.10).

Extension of the target completion year

11.7 Consequently, the Sub-Committee invited the Committee to extend the target completion year for output to 2025.

12 REVISION OF MARPOL ANNEX IV AND ASSOCIATED GUIDELINES

12.1 The Sub-Committee recalled that MEPC 74 had considered document MEPC 74/14 (Norway), proposing to expand the scope of output 1.26 to include a revision of MARPOL Annex IV and associated guidelines, and had agreed to amend the title of the output to "Revision of MARPOL Annex IV and associated guidelines to introduce provisions for record-keeping and measures to confirm the lifetime performance of sewage treatment plants".

12.2 With regard to the renamed output, the Sub-Committee also recalled that MEPC 74 had instructed it to:

.1 seek the input of the III and HTW Sub-Committees in relation to issues of port State control and human element, as appropriate;

.2 give due consideration to the application of draft amendments to MARPOL Annex IV, taking into account the general principle that ships should not be unduly penalized; and

.3 further consider the comment by the observer from IACS, as noted by MEPC 74, seeking clarification on whether the scope of the work (MEPC 74/14, paragraph 16) should include not only amendments to regulations of MARPOL Annex IV but also development of associated templates or guidelines in relation to sewage record-keeping and sewage management plan.

12.3 The Sub-Committee further recalled that:

.1 PPR 7 had established the Correspondence Group on Amendments to MARPOL Annex IV and Associated Guidelines to progress the work intersessionally, with the terms of reference set out in paragraph 16.9 of document PPR 7/22 (Secretariat);

.2 PPR 8, having noted the progress made by the Correspondence Group and the Group's summaries of areas that required further work, had re-established the Correspondence Group on Amendments to MARPOL Annex IV and Associated Guidelines to progress the work intersessionally, with the terms of reference set out in paragraph 7.11 of document PPR 8/13 (Secretariat).

.3 PPR 9 had recommended to the Committee to amend the title of output 1.26 to "Revision of MARPOL Annex IV and associated guidelines to introduce provisions for record-keeping and measures to confirm the lifetime performance of sewage treatment plants; and further, on new ships, a prohibition of fitting comminuting and disinfecting systems (CDS)";

.4 PPR 9, having established the Working Group on Sewage Treatment Plants and Marine Plastic Litter from Ships, had instructed the Group to submit part 2 of its report in relation to sewage treatment plants to PPR 10;

.5 PPR 9 also had re-established the Correspondence Group on Amendments to MARPOL Annex IV and Associated Guidelines to progress the work intersessionally, with the terms of reference set out in paragraph 14.9 of document PPR 9/21 (Secretariat); and

.6 subsequently, MEPC 78 had agreed to amend the title of the existing output 1.26 to "Revision of MARPOL Annex IV and associated guidelines", with the specific work to be carried out being captured in the scope of work as follows:

.1 introduce provisions for record-keeping and measures to confirm the lifetime performance of sewage treatment plants;

.2 consider amending the definition of "person" as provided in regulation 1 of MARPOL Annex IV, taking into account persons other than crew and passengers; and

.3 prohibit fitting comminuting and disinfecting systems (CDS) on new ships.

Report of the Correspondence Group and related documents

12.4 The Sub-Committee had for its consideration the following documents:

.1 PPR 10/12 and PPR 10/INF.8 (Norway), containing the report of the Correspondence Group on Amendments to MARPOL Annex IV and Associated Guidelines, including draft amendments to MARPOL Annex IV; draft amendments to the *2012 Guidelines on implementation of effluent standards and performance tests for sewage treatment plants* (resolution MEPC.227(64), as amended by MEPC.284(70)) (2012 Guidelines); proposed draft guidelines on the implementation of MARPOL Annex IV for sewage treatment plants; summaries of the comments and work of the Correspondence Group; and reports of the four virtual meetings organized as a complement to the work of the Correspondence Group;

.2 PPR 10/12/1 (China), proposing to amend MARPOL Annex IV to introduce the definition of zero discharge system, and include the use of such a zero-discharge system as an exemption from MARPOL Annex IV;

.3 PPR 10/12/2 (Japan), providing comments on independent testing facilities to conduct the type approval test for STP (PPR 10/12, paragraph 11) and proposing that the option of the Government or the Administration directly confirming the type approval test should not be ruled out;

.4 PPR 10/12/3 (India et al.), providing comments on document PPR 10/12, in particular on the implementation of performance tests on existing ships, proposing that performance tests and indicative monitoring should not be mandatory for existing ships and recommending maintenance and operational measures instead;

.5 PPR 10/12/4 (FOEI et al.), providing comments on document PPR 10/12, supporting regular performance and indicative testing of STPs on existing ships, and stressing the importance of sewage effluent limits for existing ships in order to best protect the marine environment and coastal populations; and

.6 PPR 9/WP.5/Add.1 (Chair of the Working Group), providing part 2 of the report of the Working Group on Sewage Treatment Plants and Marine Plastic Litter from Ships that was established at PPR 9 in relation to STP concerning modalities for intersessional work, draft amendments to MARPOL Annex IV, sampling points, discharge requirements for effluent and screenings.

12.5 The Sub-Committee noted the progress reported in document PPR 9/WP.5/Add.1 on part 2 of the report of the Working Group established at PPR 9, which had been taken into account by the Correspondence Group on Amendments to MARPOL Annex IV and Associated Guidelines. In this regard, the Sub-Committee also noted the progress made by the Correspondence Group, as reported in documents PPR 10/12 and PPR 10/INF.8.

12.6 In welcoming the progress made by the Correspondence Group, the observer from IACS drew the attention of the Sub-Committee to potential issues that might arise if the surveys were implemented as outlined in section 4.1.1 of the draft amendments to MARPOL Annex IV and the associated draft guidelines as set out in annex 3 to document PPR 10/12. The full text of the Statement made by the observer from IACS containing detailed technical comments is set out in annex 19.

12.7 The observer from CLIA, in supporting the report of the Correspondence Group, expressed concern over the lack of requirements or guidance for sewage sludge, including parameters related to discharge, offloading to facilities or onboard treatment; suggested that further guidance should be developed on limits for discharging or transferring residual food waste to the sewage system; expressed the view that the inclusion of the recommendation to install devices to check turbidity parameters was premature; and supported non-applicability to existing ships. In this connection, the observer from CESA informed the Sub-Committee that CESA was looking forward to the review of additional information showing that turbidity sensors could be applied beyond just being indicators, potentially as limit detection sensors, in the future as more experience was gained.

12.8 The observer from CSC in referring to the previous submissions to the Sub-Committee and the Committee regarding poor performance or failure of sewage treatment plants installed on board, stressed the importance of requiring regular maintenance and performance testing of STP, monitoring of STP effluents and establishing effluent limits for both new and existing ships.

12.9 Having noted the Correspondence Group's recommendation that a sewage record book and sewage management plan be required for all ships, the Sub-Committee concurred with the recommendation and subsequently requested of the Committee a consequential expansion of the scope of work of output 1.26 to include the introduction of provisions for a sewage management plan and record-keeping on all ships (i.e. not only ships with an STP) under MARPOL Annex IV.

12.10 In considering document PPR 10/12/1, several delegations supported the proposal contained in this document regarding amendments to MARPOL Annex IV to introduce the concept of a zero discharge system, highlighted the benefits of using innovative technologies and suggested it be referred to the Correspondence Group for further consideration. However, several other delegations were of the view that, while they saw the merit of the zero discharge concept, more information such as information on handling microorganism residues from such systems would be needed to allow detailed consideration. In addition, those delegations considered that the proposal went beyond the scope of work for this output and hence did not support the document being referred to the Correspondence Group.

12.11 Following discussion, the Sub-Committee agreed not to refer document PPR 10/12/1 to the Correspondence Group. In addition, the Sub-Committee agreed that should interested Member States wish to pursue this proposal further, a proposal for a new output should be submitted to the Committee.

12.12 The Sub-Committee noted that the Correspondence Group had agreed that fitting of CDS should not be allowed as a replacement of an existing STP or of a holding tank on existing ships.

Re-establishment of the Correspondence Group

12.13 Having agreed that the proposals and comments contained in documents PPR 10/12/2, PPR 10/12/3 and PPR 10/12/4 required detailed technical consideration, the Sub-Committee re-established the Correspondence Group on Amendments to MARPOL

Annex IV and Associated Guidelines, under the coordination of Norway,[2] with the following terms of reference:

"By using the annexes to document PPR 10/12 as a basis and document PPR 9/14/2 and the matters described in paragraphs 10.1 and 10.2 of document PPR 8/7/8, as relevant, and taking into account documents PPR 10/12/2, PPR 10/12/3 and PPR 10/12/4, as relevant, the Correspondence Group is instructed to:

.1 further develop draft amendments to the *2012 Guidelines on implementation of effluent standards and performance tests for sewage treatment plants*;

.2 further develop the draft guidelines on implementation of MARPOL Annex IV for sewage treatment plants;

.3 further develop the draft amendments to MARPOL Annex IV, including consideration of the consequential need to provide adequate port reception facilities;

.4 consider the completion status of terms of reference .1 to .3 and, based on that, further:

.1 review the scope of application of the draft amendments to MARPOL Annex IV to new and existing ships, taking into account the general principle that ships should not be unduly penalized; and, in parallel

.2 consider other guidelines that may need to be amended as a result of the new draft requirements concerning STPs and advise the Sub-Committee accordingly; and

.5 submit a written report to PPR 11."

12.14 Having noted the recommendation set out in paragraph 40 of document PPR 10/12 regarding an option of virtual meetings as an equal alternative to the work by correspondence, the Sub-Committee agreed that the coordinator of the Correspondence Group could have the flexibility to convene virtual meetings, but only as a complement to the work by correspondence.

Extension of the target completion year

12.15 Consequently, the Sub-Committee invited the Committee to extend the target completion year for the output to 2025.

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13 FOLLOW-UP WORK EMANATING FROM THE ACTION PLAN TO ADDRESS MARINE PLASTIC LITTER FROM SHIPS

Reduction of the environmental risk associated with the maritime transport of plastic pellets

13.1 The Sub-Committee recalled that MEPC 77:

.1 had considered document MEPC 77/8/3 (Sri Lanka), commenting on document MEPC 75/8/3 and discussing the impacts of the **MV X-Press Pearl** spill of 11,000 tonnes of plastic pellets off the shore of Colombo, Sri Lanka in May 2021, and highlighting the hazardous nature of plastic pellets and the need to establish, inter alia, international guidelines and requirements for loading, unloading and packaging, and emergency response protocols, with clear labelling of containers carrying pellets, and improved stowage instructions; and

.2 had referred document MEPC 77/8/3 to PPR 9 for the Sub-Committee to further consider the proposals, requesting the input of the CCC Sub-Committee as appropriate, with a view to advising the Committee on how best to proceed.

13.2 The Sub-Committee also recalled that, at PPR 9, it had established the Correspondence Group on Marine Plastic Litter from Ships, under the coordination of Norway and Spain, and had instructed it, in this context, to take into consideration documents MEPC 77/8/3, PPR 9/15/1 (Cook Islands, et al.), PPR 9/15/4 (FOEI, Pacific Environment and CSC), PPR 9/15/8 (CEFIC) and PPR 9/15/9 (DGAC), as well as the comments and decisions made by PPR 9, and further consider the options for reducing the environmental risk associated with the maritime transport of plastic pellets and advise the Sub-Committee on the way forward.

13.3 In this regard, the Sub-Committee had for its consideration the following documents:

.1 PPR 10/13 (Norway and Spain) (paragraphs 1 to 51, paragraphs 97.1 to 97.7 and annex 1), containing the report of the Correspondence Group on Marine Plastic Litter from Ships, established by PPR 9, in particular the outcome of the Group's consideration of the options for reducing the environmental risk associated with the maritime transport of plastic pellets;

.2 PPR 10/13/5 (FOEI and CSC), commenting on document PPR 10/13 calls for coordination on international governance of plastic pellets with particular reference to the current negotiations for a new legally binding instrument to end plastic pollution initiated at the resumed fifth session of the United Nations Environment Assembly (UNEA 5.2), inviting action to support the circular for plastic pellets, and introducing the findings of a new study analysing the feasibility of the different regulatory options for tackling pellet loss at sea;

.3 PPR 10/13/7 (CEFIC and DGAC), recommending that a detailed evaluation of the individual measures suggested by the participants of the Correspondence Group now be performed and that the evaluation also include consideration of suitable instruments to be used for implementing potential primary measures; encouraging the consideration of other legal instruments as alternatives to the IMDG Code for mandatory provisions governing the maritime transport of plastic pellets, including potentially MARPOL Annex V, and proposing that the review of potential primary measures and a suitable instrument be undertaken by the CCC Sub-Committee, which possessed expertise in both operations and dangerous goods transport;

.4 PPR 10/INF.5 (Norway), providing the comments regarding transport of plastic pellets, as received by the Coordinator of the Correspondence Group on that subject during the first round of correspondence, as well as a summary of the first round of correspondence;

.5 PPR 10/INF.6 (Norway), providing the comments regarding transport of plastic pellets, as received by the Coordinator of the Correspondence Group on that subject during the second round of correspondence, as well as a summary of the second round of correspondence;

.6 PPR 10/INF.7 (Norway), providing the comments regarding transport of plastic pellets, as received by the Coordinator of the Correspondence Group on that subject during the third round of correspondence; and

.7 PPR 10/INF.23 (CEFIC), presenting information on the Operation Clean Sweep® programme (content, implementation, etc.) and highlighting how it could contribute to the reduction of the environmental risk associated with the maritime transport of plastic pellets.

13.4 The Sub-Committee noted the Correspondence Group's conclusion that a two-stage approach could be adopted to reduce the environmental risk of the maritime transport of plastic pellets in freight containers, as follows:

.1 at an initial stage, through developing a circular containing recommendations for the carriage of plastic pellets by sea in freight containers, addressing in particular packaging, notification and stowage; and

.2 at a second stage, through developing amendments to appropriate mandatory instruments, which could be informed by the experience gained from implementing the voluntary measures.

13.5 The Sub-Committee also noted that the Correspondence Group had developed a draft circular on recommendations for the carriage of plastic pellets by sea in freight containers, as set out in annex 1 to document PPR 10/13, and was of the view that the CCC Sub-Committee should provide substantive input to the circular, given the nature of the Guidance, which focused on cargo-related matters.

13.6 With regard to the Correspondence Group's consideration of the different instruments that could be used as a legal basis for mandatory provisions applicable to the maritime transport of plastic pellets, the Sub-Committee noted that the Correspondence Group had considered the following options/instruments in detail, without, however, being in a position to conclude on the most appropriate instrument:

.1 an assignment of an individual UN Number (class 9) for plastic pellets transported at sea in freight containers (UN Number);

.2 an amendment to appendix I of MARPOL Annex III that would recognize plastic pellets as a "harmful substance"; and

.3 a new chapter in MARPOL Annex III that would prescribe requirements for the transport of plastic pellets in freight containers without classifying the cargo as a harmful substance/dangerous goods.

13.7 Furthermore, the Sub-Committee noted that the Correspondence Group, in addition to the proposed request for input by the CCC Sub-Committee on the draft circular on recommendations for the carriage of plastic pellets by sea in freight containers, had also proposed that the CCC Sub-Committee be requested to consider the different instruments that could be used as a legal basis for mandatory regulations for the transport of plastic pellets and to also consider matters concerning the shipment of plastic pellets in bulk under the IMSBC Code, as identified in paragraph 48 of document PPR 10/13, with a view to advising the PPR Sub-Committee and MEPC as appropriate.

13.8 Having noted the progress made by the Correspondence Group in relation to the instruction by PPR 9 to provide advice on the options for reducing the environmental risk associated with the maritime transport of plastic pellets, the Sub-Committee proceeded to discuss the outcome of the Correspondence Group in conjunction with all other relevant documents that had been submitted to this session.

13.9 The Sub-Committee noted widespread support for developing a circular containing recommendations for packing, notification and stowage provisions as a short-term measure for reducing the environmental risk associated with the maritime transport of plastic pellets in freight containers. In this regard, many delegations stressed the need for this circular to be developed and finalized as soon as possible given the significant environmental risks posed by plastic pellet loss at sea. Several delegations also highlighted the need for input by the CCC Sub-Committee prior to finalization.

13.10 Additionally, some delegations emphasized that the circular should not seek to determine in advance or prejudge which legal instrument should be used in the future for mandatory measures.

13.11 The Sub-Committee noted mixed views with regard to whether the definition of plastic pellets set out in the proposed draft circular (PPR 10/13, annex 1) should include pellet size and agreed that this should be further considered in a working group.

13.12 In this context, one delegation proposed that, in addition to notification, stowage and packaging provisions, consideration should be given to developing a transportation standard that would require plastic resin feedstock to be transported as plastic resin bricks or ingots, in order to simplify containment and recovery operations in the event of loss at sea.

13.13 In relation to developing mandatory measures, there was general support for developing mandatory measures for the maritime transport of plastic pellets in freight containers to reduce the risk of pellet loss into the marine environment. Having recognized the importance of taking action on this issue, however, the Sub-Committee noted divergent views on how to proceed with the development of mandatory measures.

13.14 Many delegations supported the development of mandatory measures only after gaining experience with the effectiveness of the short-term voluntary measures, though some delegations expressed the view that the Sub-Committee should develop mandatory measures on the basis of submissions made to this session in order to take action as quickly as possible.

13.15 In addition to the question of when mandatory measures should be developed, the Sub-Committee noted a range of views on potential instruments that could be used as a legal basis, and in particular on the three options/instruments considered by the Correspondence Group:

.1 an assignment of an individual UN Number (class 9) for plastic pellets transported at sea in freight containers (UN Number);

.2 an amendment to appendix I of MARPOL Annex III that would recognize plastic pellets as a "harmful substance"; and

.3 a new chapter in MARPOL Annex III that would prescribe requirements for the transport of plastic pellets in freight containers without classifying the cargo as a harmful substance/dangerous goods.

13.16 With regard to the first option, namely the assignment of an individual UN Number to plastic pellets, some delegations noted that this proposal would first need to be discussed and agreed in the UN Sub-Committee of Experts on the Transport of Dangerous Goods and in the UN Sub-Committee of Experts on the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) considering the multimodal nature of the transport of dangerous goods. Some delegations also noted that amending MARPOL Annex III to classify plastic pellets as a harmful substance would represent a departure from the GHS and could lead to unintended consequences and result in disruption to the multimodal global transport chain.

13.17 Some delegations expressed the view that addressing plastic pellet loss through the classification of plastic pellets as dangerous goods or harmful substances would not address the root causes of the entry of plastic pellets into the marine environment when carried by sea, as associated provisions for dangerous goods or harmful substances did not address container loss. In this context, some delegations proposed pursuing root cause analyses while the short-term voluntary measures were enacted in order to ensure that long-term mandatory measures would be both effective and feasible.

13.18 Some delegations made alternative suggestions for developing a framework specifically dedicated to the carriage of plastic pellets at sea outside of the scope of existing dangerous goods requirements. These suggestions included possible amendments to MARPOL Annex V or amendments to MARPOL Annex III that would classify pellets as a new class of harmful substances not subject to the IMDG Code.

13.19 Many delegations expressed the view that careful consideration of all possible instruments was necessary and that the Sub-Committee should proceed with caution to ensure that long-term mandatory measures would be both effective and practical.

13.20 Some delegations highlighted the need to duly take into account the development of international legally binding instrument on plastic pollution, including in the marine environment, to be finalized by the United Nations Environment Assembly in 2024.

13.21 During discussion, the Sub-Committee also noted concerns relating to the carriage of plastic pellets in bulk and the need to seek clarification from the CCC Sub-Committee on shipments of plastic pellets under the IMSBC Code.

13.22 Having considered all of the views expressed, the Sub-Committee agreed that there was a need for measures to be adopted to address the environmental risk associated with the maritime transport of plastic pellets. In light of the variety of views expressed with regard to the different instruments that could be used as a legal basis for mandatory measures for the maritime transport of plastic pellets in freight containers, and the time that it would take for any mandatory measures to be developed and enter into force, the Sub-Committee agreed to a two-stage approach, entailing the following:

.1 firstly, the development of a circular containing recommendations for the carriage of plastic pellets by sea in freight containers, addressing in particular packaging, notification and stowage; and

.2 at a later stage, the development of amendments to appropriate mandatory instruments, subject to proposals by Member States and international organizations to MEPC, as appropriate, which could be informed by the experience gained from the implementation of the voluntary measures.

13.23 With regard to the draft circular, the Sub-Committee agreed that it should be developed as an MEPC circular so that the Committee could consider the final draft prior to the circular being issued. The Sub-Committee noted that, following the work at this session and subsequent input by the CCC Sub-Committee, the draft circular could be finalized at PPR 11 (subject to the CCC Sub-Committee being in a position to initiate and complete its consideration of the matter at CCC 9), with a view to approval by MEPC 81 in 2024.

13.24 In relation to the different instruments that could be used as a legal basis for mandatory provisions for the maritime transport of plastic pellets in freight containers, some delegations expressed the view that the report of the Correspondence Group had identified possible options and that there was no need to task a working group with considering this matter further, taking also into account the need to make progress at this session on the short-term voluntary measures and matters relating to fishing gear under this agenda item.

13.25 In this context, the Sub-Committee recognized the need to ensure that all suggestions or comments regarding instruments that could be used as a legal basis for mandatory provisions were captured for use in any future work on this subject. Subsequently, the Sub-Committee agreed that this should be limited to preparing a list of potential instruments that could form a legal basis and identifying the paragraphs in the Correspondence Group's report where relevant comments had been reported, as well as any documents that had been submitted to this session providing comments on potential mandatory instruments.

13.26 The Sub-Committee confirmed that such a list or table was not intended to pre-empt any decisions but simply to ensure that all documents and comments were appropriately recorded for consideration in future sessions of the Sub-Committee. In addition, the Sub-Committee noted that interested Member States and international organizations could submit concrete proposals on potential mandatory measures to a future session of the Sub-Committee, taking into account discussions to date, the list to be prepared at this session, and experience from implementing any non-mandatory measures.

13.27 Subsequently, the Sub-Committee agreed that the relevant part of the Correspondence Group's report (PPR 10/13), together with documents PPR 10/13/5 and PPR 10/13/7, and the information in documents PPR 10/INF.5, PPR 10/INF.6, PPR 10/INF.7 and PPR 10/INF.23 should be further considered in a working group (see also paragraph 13.50) with instructions to:

.1 review and further develop the draft circular on recommendations for the carriage of plastic pellets by sea in freight containers set out in annex 1 to document PPR 10/13 (Report of the Correspondence Group on Marine Plastic Litter from Ships) and prepare a draft request for input by the CCC Sub-Committee;

.2 time permitting, further consider the different instruments that could be used as a legal basis for mandatory provisions for the maritime transport of plastic pellets in freight containers, and advise the Sub-Committee on how consideration of potential mandatory provisions should be progressed including whether input by the CCC Sub-Committee was required in this regard; and

.3 prepare a draft request to the CCC Sub-Committee for input on shipments of plastic pellets in bulk under the IMSBC Code taking into account paragraphs 48 to 50 of document PPR 10/13.

Proposed guidelines on clean-up of plastic pellets from ship-source spills

13.28 The Sub-Committee recalled that at PPR 9, having noted the information contained in document PPR 9/INF.20 (Norway), as well as widespread support for guidelines with best practices related to cleaning up plastic pellets, it had invited interested Member States and international organizations to submit documents with draft guidelines on best practices related to response to and the clean-up of plastic pellet spills to a future session of the Sub-Committee, using the draft outline set out in the annex to document PPR 9/15/2 (Norway) as a starting point.

13.29 In this connection, the Sub-Committee noted that MEPC 79 had referred document MEPC 79/INF.20 (South Africa), containing a report on the South African Maritime Safety Authority's experience from the clean-up operation following the **MSC Susanna** plastic pellet spill incident, to this session of the Sub-Committee for information.

13.30 In addition to document MEPC 79/INF.20, the Sub-Committee had for its consideration the following documents:

.1 PPR 10/13/3 (Norway, South Africa, ITOPF and P & I Clubs) describing the structure and content of guidelines on best practices related to clean-up of plastic pellets from ship-source spills, which had been developed subsequent to the consideration of document PPR 9/15/2 (Norway) by PPR 9; and

.2 PPR 10/INF.13 (Norway, South Africa, ITOPF and P & I Clubs) containing examples of guidelines on the clean-up of plastic pellets from ship-source spills.

13.31 Following a brief consideration, the Sub-Committee instructed the Drafting Group on Pollution Response, established under agenda item 4 (see paragraph 4.8), to prepare draft terms of reference for a correspondence group to develop draft guidelines on clean-up of plastic pellets from ship-source spills, taking into account document PPR 10/13/3 and the information in documents PPR 10/INF.13 and MEPC 79/INF.20.

Reporting of fishing gear that has been lost or discharged from a ship as provided for in regulation 7.1.3 and 7.1.4 of MARPOL Annex V, and marking of fishing gear

13.32 With regard to reporting of fishing gear that has been lost or discharged from a ship as provided for in regulation 7.1.3 and 7.1.4 of MARPOL Annex V, the Sub-Committee recalled that, at PPR 7, it had established the Correspondence Group on Marine Plastic Litter from Ships, under the coordination of France, and had instructed it to:

.1 consider how to amend MARPOL Annex V and the *2017 Guidelines for the implementation of MARPOL Annex V* (resolution MEPC.295(71)) to facilitate and enhance reporting of the accidental loss or discharge of fishing gear, as currently provided in regulation 10.6 of MARPOL Annex V; and

.2 also consider the information to be reported to Administrations and IMO, the reporting mechanisms and the modalities, taking into account the comments and decisions made at PPR 7, document PPR 7/17 and any relevant documents submitted to MEPC and the PPR Sub-Committee associated with the *Action Plan to Address Marine Plastic Litter from Ships*;

13.33 The Sub-Committee also recalled that at PPR 8:

.1 it had noted the progress made by the Correspondence Group, but due to time constraints had been unable to consider the report of the Group (PPR 8/8) and document PPR 8/8/1 (Palau, United Arab Emirates and Vanuatu) in detail; and

.2 having recognized that further deliberations would be facilitated by in-person discussions in a working group and by additional written proposals, either containing draft text building on the framework for proposed amendments developed by the Correspondence Group or elaborating on the matters that required further consideration (e.g. on the frequency of reporting, data management, information-sharing and harmonization of reporting formats), as well as by additional consultations with the fishing industry and FAO, it had forwarded documents PPR 8/8 and PPR 8/8/1 to PPR 9 for detailed consideration and had invited interested Member States and international organizations to submit additional proposals or commenting documents to PPR 9 to build on the work of the Correspondence Group.

13.34 The Sub-Committee further recalled that at PPR 9 it had established the Correspondence Group on Marine Plastic Litter from Ships, under the coordination of Norway and Spain, and had instructed it, in this context, using document PPR 8/8 as a basis, taking into consideration documents PPR 8/8/1, MEPC 75/8/1 (FAO), PPR 9/15/3 (Norway), PPR 9/15/5 (FOEI, Pacific Environment, and CSC), PPR 9/15/7 (Austria et al.) and PPR 9/INF.23 (Kingdom of the Netherlands), as well as the comments and decisions made during PPR 9 to:

.1 further consider the draft amendments to MARPOL Annex V to provide for the reporting mechanisms, the modalities and the information to be reported to Administrations and IMO to facilitate and enhance reporting of the loss or discharge of fishing gear; and

.2 develop appropriate draft amendments to the *2017 Guidelines for the implementation of MARPOL Annex V* (resolution MEPC.295(71)) to support the implementation of the contemplated draft amendments to MARPOL Annex V.

13.35 In addition, the Sub-Committee noted that MEPC 79 had referred document MEPC 79/INF.13 (Republic of Korea) to PPR 10 for information.

13.36 With regard to fishing gear marking, the Sub-Committee noted that MEPC 78:

.1 had agreed with the approach proposed in document MEPC 75/8/4 (Vanuatu), namely that a goal-based requirement under MARPOL Annex V for the mandatory marking of fishing gear should be developed. Subsequently, the Committee instructed the PPR Sub-Committee to develop draft amendments to MARPOL Annex V and associated guidelines accordingly;

.2 had invited Member States to submit information on the implementation of fishing gear marking systems, including how the diversity of fisheries and fishing gear had been accommodated, specific technical or legal considerations that had been taken into account, and other relevant experience regarding fishing gear marking to help inform the process of developing a mandatory goal-based requirement;

.3 recognizing the importance of also taking action in the near-term with regard to ALDFG, it had also instructed the Sub-Committee to develop an MEPC circular to promote the implementation of fishing gear marking systems and the FAO Voluntary Guidelines for the Marking of Fishing Gear, taking into account additional work by FAO, such as the technical manual on marking of fishing gear being developed by FAO; and

.4 had further invited the Secretariats of FAO and IMO to continue to cooperate closely, with a view to keeping the Committee informed of relevant joint capacity-building activities and work being carried out by FAO.

13.37 In the context of the above two topics, the Sub-Committee had for its consideration the following documents:

.1 PPR 10/13 (Norway and Spain) (paragraphs 1 to 6, paragraphs 52 to 96, paragraphs 97.8 to 97.10, and annexes 2 to 5), containing the report of the Correspondence Group on Marine Plastic Litter from Ships, established by PPR 9, in particular the outcome of its consideration of the draft amendments to MARPOL Annex V to provide for the reporting mechanisms, the modalities and the information to be reported to Administrations and IMO to facilitate and enhance reporting of the loss or discharge of fishing gear; and the outcome of its work to develop appropriate draft amendments to the *2017 Guidelines for the implementation of MARPOL Annex V* (resolution MEPC.295(71)) to support the implementation of the contemplated draft amendments to MARPOL Annex V;

.2 PPR 10/13/1 (United States), detailing key considerations that should be taken into account in developing any goal-based gear marking scheme, building upon experiences from the United States, and offering recommendations to help inform the work of PPR 10, and, inter alia, concluding that a goal-based approach should not be overly prescriptive and should allow Member States to develop the specific parameters of any gear marking requirements;

.3 PPR 10/13/2 (Norway), providing information on Norwegian legislation to be used in the discussions regarding the marking of fishing gear, and, inter alia, concluding that to ensure a successful implementation of a globally applicable goal-based requirement for the marking of fishing gear, it was crucial that Member States be given the flexibility to adjust the requirement to take into account the differences and needs of fisheries in all regions;

.4 PPR 10/13/4 (FAO), providing an update on the work conducted by the Food and Agriculture Organization of the United Nations (FAO) to support implementation of the FAO Voluntary Guidelines on the Marking of Fishing Gear;

.5 PPR 10/13/6 (FOEI and CSC), commenting on document PPR 10/13 and calling for a working group at PPR 10 to consider effective mandatory measures towards addressing abandoned, lost and otherwise discarded fishing gear (ALDFG) through the reporting of lost fishing gear, with a broadened scope to advance discussions on the marking of fishing gear in parallel; and highlighting the need for a recommendation to MEPC to ensure coordination between efforts on fishing gear at IMO and negotiations towards a new legally binding instrument to end plastic pollution;

.6 PPR 10/13/8 (Kingdom of the Netherlands), proposing additional discussions and research into the sources and causes of marine plastic litter, specifically for (floating) fishing net litter, and drawing attention to the research findings reported in document PPR 9/INF.23;

.7 PPR 10/INF.11 (Canada), providing information on the Canadian mandatory fishing gear marking and reporting requirements for commercial fisheries and how they are implemented; and

.8 MEPC 79/INF.13 (Republic of Korea), describing a method for predicting the sources and amount of marine debris based on big data technology, developed as part of the "Development of Smart Technology to Support the Collection and Management of Marine Debris", a national research and development project of the Government of the Republic of Korea.

13.38 The Sub-Committee proceeded to consider the report of the Correspondence Group in conjunction with all other documents listed in paragraph 13.36.

13.39 In this context, the representative of the FAO Secretariat made a statement:

.1 highlighting the information provided in document PPR 10/13/4;

.2 calling upon IMO Member Governments to seek input from their fisheries authorities on the development of gear marking and reporting systems, and existing management capacities, and possible needs, to handle these, as this would be important information to feed into the process, facilitating development of a measure that could be implemented successfully;

.3 advising the Sub-Committee that the physical design of gear marks was important for certain fishing gear, urging delegations to consider the potential safety risks that might result from attaching a physical mark to some fishing gear during the course of fishing operations; and

.4 reiterating that FAO was available to assist IMO and Member Governments by providing relevant input, and sharing information on activities related to the marking of fishing gear.

13.40 The full text of the statement by FAO is set out in annex 19.

13.41 Some delegations expressed a preference for a voluntary approach at this stage both with regard to reporting and with regard to marking, rather than opting for mandatory measures through developing amendments to MARPOL Annex V, as many countries, particularly developing countries, were at the initial stages of developing and implementing relevant activities and actions, including through technical support by IMO. In this regard, the support of the GloLitter Partnerships Project was highlighted.

13.42 The need for active consultations and coordination between IMO and FAO was also emphasized in order to avoid duplication of efforts and minimize the risk of conflicting regulatory developments.

13.43 Some delegations stressed the need for flexibility with regard to fishing gear marking and gear reporting systems, due to different national circumstances and the wide variety of fisheries, which utilized many different types of fishing gear and also varied in their degree of sophistication and modernization, and on whether recreational fishing vessels should be included as a reporting target. In this connection, some delegations supported the establishment of thresholds for reporting which were science-based and practicable, and would account for cumulative impacts, and also to ensure that reporting provisions could feasibly be fulfilled and implemented. A variety of views were expressed as to the options for collecting data and what data should be sent to IMO.

13.44 Some delegations expressed the view that marking and reporting of fishing gear should be considered in tandem and that reporting requirements related to fishing gear marking should be revisited after consideration of a goal-based approach for requiring fishing gear markings had concluded. Conversely, other delegations were of the view that work to develop fishing gear marking provisions should not delay the work on fishing gear reporting mechanisms, as fishing gear reporting mechanisms were a key tool to support global efforts addressing plastic pollution.

13.45 Some delegations reminded the Sub-Committee that work to amend MARPOL Annex V had been ongoing since PPR 7 and that concrete next steps should be agreed at this session in line with the purpose of this agenda item, in order to create a comprehensive package of measures to significantly reduce sea-based sources of marine plastic pollution in line with SDG 14.1.

13.46 In light of the views expressed and having noted the progress made by the Correspondence Group on Marine Plastic Litter from Ships in respect of enhancing the reporting of fishing gear that had been lost or discharged from a ship as provided for in regulations 7.1.3, 7.1.4 and 10.6 of MARPOL Annex V, the Sub-Committee agreed that the topics identified in paragraphs 96 and 97.8 of document PPR 10/13 as requiring a decision should be further considered in a working group. The working group would take into account the comments made in plenary and the parts of documents PPR 10/13/1, PPR 10/13/2, PPR 10/13/4 and PPR 10/13/8 that related to reporting along with the information in documents PPR 10/INF.11 and MEPC 79/INF.13 and provide recommendations to the Sub-Committee on how to proceed. Additionally, the Sub-Committee agreed that the working group should also consider whether a correspondence group needed to be established (see paragraph 13.50).

13.47 Mindful of the decision of MEPC 78, as noted in paragraph 13.36, the Sub-Committee invited interested Member States and international organizations to submit proposals to PPR 11 for:

.1 a draft MEPC circular to promote the implementation of fishing gear marking systems and the FAO Voluntary Guidelines for the Marking of Fishing Gear, taking into account additional work by FAO reported in document PPR 10/13/4; and

.2 draft amendments to MARPOL Annex V and associated guidelines for a goal-based fishing gear marking requirement, taking into consideration the work undertaken by the Sub-Committee on the reporting of fishing gear.

13.48 In this connection, the Sub-Committee forwarded documents PPR 10/13/1, PPR 10/13/2, PPR 10/13/4, PPR 10/13/8, PPR 10/INF.11 and MEPC 79/INF.13 to PPR 11, to be further considered, as appropriate, together with any new documents on marking of fishing gear submitted at that session.

13.49 Some delegations expressed concern with regard to the Sub-Committee's decision to invite proposals to PPR 11 for draft amendments to MARPOL Annex V and associated guidelines for a goal-based fishing gear marking requirement at the same time as proposals for a draft MEPC circular to promote the implementation of fishing gear marking systems and the FAO Voluntary Guidelines for the Marking of Fishing Gear. These delegations were of the view that, at this stage, the Sub-Committee should have invited proposals to PPR 11 only on guidelines for fishing gear marking rather than also inviting proposals for draft amendments to MARPOL Annex V, as, in the view of these delegations, there had been general support for a phased approach entailing the development of guidelines initially, to be followed by consideration of potential mandatory fishing gear marking requirements at a later stage taking into account experience gained from the implementation of non-mandatory measures (see also paragraph 13.41). These delegations emphasized that such a phased approach was important due to the challenges that many countries, in particular developing countries, would face should mandatory requirements be developed and adopted without allowing sufficient time for capacity-building and for experience to be gathered.

Establishment of the Working Group on Marine Plastic Litter from Ships

13.50 Subsequently, the Sub-Committee established the Working Group Marine Plastic Litter from Ships and instructed it to:

with regard to the environmental risk associated with maritime transport of plastic pellets

.1 taking into account the comments and decisions made in plenary and documents PPR 10/13 (Norway and Spain), PPR 10/13/5 (FOEI and CSC), PPR 10/13/7 (CEFIC and DGAC), as well as the information in documents PPR 10/INF.5, PPR 10/INF.6, PPR 10/INF.7 (Norway) and PPR 10/INF.23 (CEFIC):

.1 review and further develop the draft circular on recommendations for the carriage of plastic pellets by sea in freight containers set out in annex 1 to document PPR 10/13 (Report of the Correspondence Group on Marine Plastic Litter from Ships) and prepare a draft request for input by the CCC Sub-Committee;

.2 time permitting, further consider the different instruments that could be used as a legal basis for mandatory provisions for the maritime transport of plastic pellets in freight containers, and advise the Sub-Committee on how consideration of potential mandatory provisions should be progressed, including whether input by the CCC Sub-Committee was required in this regard; and

.3 prepare a draft request to the CCC Sub-Committee for input on shipments of plastic pellets in bulk under the IMSBC Code taking into account paragraphs 48 to 50 of document PPR 10/13;

with regard to reporting the loss or discharge of fishing gear as provided for in regulations 7.1.3 and 7.1.4 of MARPOL Annex V

.2 taking into account the comments and decisions made in plenary:

.1 further consider the topics that had been identified in paragraphs 96 and 97.8 of document PPR 10/13 as requiring a decision, taking into account the parts of documents PPR 10/13/1 (United States), PPR 10/13/2 (Norway), PPR 10/13/4 (FAO) and PPR 10/13/8 (Kingdom of the Netherlands) that related to reporting, as well as the information in documents PPR 10/INF.11 and MEPC 79/INF.13, and provide recommendations to the Sub-Committee on how to proceed; and

.2 consider the need for the establishment of a correspondence group and develop draft terms of reference, as appropriate.

Report of the Working Group on Marine Plastic Litter from Ships

13.51 Having considered the report of the Working Group on Marine Plastic Litter from Ships (PPR 9/WP.7), the Sub-Committee took action as described in paragraphs 13.52 to 13.61. Regarding the report of the Working Group, the delegation of Argentina made a general statement on premises for future work on transport of plastic pellets by freight containers and on lost and discarded fishing gear. The full statement by the delegation of Argentina is set out in annex 19.

Reduction of the environmental risk associated with maritime transport of plastic pellets

Maritime transport of plastic pellets in freight containers

13.52 The Sub-Committee noted the Working Group's discussion with regard to packaging measures related to the carriage of plastic pellets by sea in freight containers, in particular that:

.1 several delegations had supported reference to the IMDG Code for providing information on what packaging measures should be referred to when implementing the circular, since this would provide more specific guidance on how to deal with packaging until mandatory measures could be developed;

.2 several other delegations had indicated concerns with referencing the IMDG Code, including only applying one section of the IMDG Code (i.e. part 6), which could not be applied in isolation from other related sections of the Code, and also that the inclusion of the IMDG Code would prejudge future consideration of the most appropriate legal instrument to address this issue;

.3 the Chair of the Working Group had proposed that further consideration could be given to the inclusion of the IMDG Code in the draft circular by providing the following text in a possible footnote for further consideration by the CCC Sub-Committee: "It is recommended that packaging used could meet the performance level of packing group III of the IMDG Code, to the extent possible"; but the majority of the Working Group participants who spoke did not agree to pursue alternative text being placed in a footnote; and

.4 the Working Group, subsequently, had agreed to delete the last sentence from paragraph 1.1 of the draft circular that had been prepared by the Correspondence Group, i.e. "the use of packaging which is type-approved in accordance with part 6 of the IMDG Code is recommended";

13.53 In addition, the Sub-Committee noted the Group's discussion on the definition of plastic pellets, including the Group's agreement to retain the definition within the footnote of the draft circular but keep the reference to the size limit in square brackets for further consideration at PPR 11.

13.54 Subsequently, the Sub-Committee:

.1 agreed to the draft MEPC circular on recommendations for the carriage of plastic pellets by sea in freight containers, as set out in annex 9, for submission to the CCC Sub-Committee for input;

.2 invited interested Member States and international organizations to submit proposals on the definition of plastic pellets, in particular the size limit, to PPR 11;

.3 requested the input of the CCC Sub-Committee on the draft circular, in particular with regard to the most appropriate text on packaging to be included in the circular, and invited Member States and international organizations to submit any relevant information on packaging to the CCC Sub-Committee for consideration when it considered the most appropriate text for inclusion in paragraph 1.1 of the draft circular;

.4 invited interested Member States and international organizations to submit documents on the existing or possible parameters for packaging to PPR 11 for further consideration in conjunction with any input provided by the CCC Sub-Committee.

13.55 Specifically, the request for input by the CCC Sub-Committee, as agreed at this session, was the following:

"Noting that the PPR Sub-Committee is currently considering the reduction of the environmental risk associated with maritime transport of plastic pellets in freight containers, the CCC Sub-Committee is requested to provide relevant input to the PPR Sub-Committee on the matter as follows:

1 note the text of the draft circular on the recommendations for the carriage of plastic pellets by ships in freight containers; and

2 provide advice on what further recommendation on packaging measures, if any, would be appropriate for inclusion in paragraph 1.1 of the circular, considering the discussion by the Working Group in this regard (paragraph 13.52 of document PPR 10/WP.1/Rev.1), including whether reference should be made to the IMDG Code and, if any, what reference would be most appropriate, without prejudging future discussions on potential mandatory instruments which may be used to regulate the carriage

of plastic pellets by ships in freight containers; and what existing or possible other parameters for packaging, if any, should be taken into consideration, taking into account any submissions made to the CCC Sub-Committee on this issue."

13.56 In this context, the Chair of the CCC-Sub-Committee stressed the importance of Member States and international organizations submitting documents to the CCC Sub-Committee in connection with the request for input to facilitate discussions.

13.57 Having noted the table on "Potential instruments that could form a legal basis for mandatory provisions for the maritime transport of plastic pellets in freight containers", as prepared by the Working Group and set out in annex 10, the Sub-Committee invited interested Member States and international organizations to submit concrete proposals on potential mandatory measures to a future session of the Sub-Committee – rather than MEPC as had previously been agreed prior to the establishment of the Working Group (see paragraph 13.22) – taking into account discussions to date, the table prepared at this session, and experience from the implementation of any non-mandatory measures.

Maritime transport of plastic pellets in bulk

13.58 The Sub-Committee noted the Working Group's discussion in relation to the need for requesting the CCC Sub-Committee to provide input on shipments of plastic pellets in bulk, in particular that the Working Group had:

.1 considered the Correspondence Group's discussion on shipments of plastic pellets in bulk and noted the request that had been drafted to seek advice from the CCC Sub-Committee (PPR 10/13, paragraph 50);

.2 discussed whether the CCC Sub-Committee should be consulted on this matter, noting that the request needed to be clear on what this Sub-Committee was requesting to ensure any consideration of this issue could not be misconstrued as promoting the transport of plastic pellets in bulk;

.3 agreed that plastic pellets should not be carried in bulk; and

.4 agreed that further consideration could be given to how the existing regulatory framework might need to be amended.

13.59 Having agreed that plastic pellets should not be carried in bulk, the Sub-Committee invited interested Member States and international organizations to submit relevant proposals to a future session of the Sub-Committee on potential regulatory changes that might be needed to prevent the shipment of plastic pellets in bulk.

Reporting the loss or discharge of fishing gear as provided for in regulations 7.1.3 and 7.1.4 of MARPOL Annex V and re-establishment of the Correspondence Group on Marine Plastic Litter from Ships

13.60 The Sub-Committee noted the Working Group's discussion on the reporting of the loss or discharge of fishing gear, in particular, general agreement:

.1 that globally consistent thresholds to report lost or discharged fishing gear should be developed, taking into account the wide variety of fisheries and fishing gear;

.2 that recreational vessels should be exempted from mandatory reporting requirements without any prejudice to any other MARPOL requirements; and

.3 on the purpose and objectives of the database (PPR 10/WP.7, paragraphs 32 to 39).

13.61 In this context, the Sub-Committee re-established the Correspondence Group on Marine Plastic Litter from Ships, under the coordination of Spain,[3] with the following terms of reference:

"Using document PPR 10/13 relating to fishing gear reporting as a basis, and taking into account documents PPR 10/13/4, PPR 10/13/6, PPR 10/13/8 and MEPC 79/INF.13, as well as comments and decisions made at PPR 10, the Correspondence Group, with the option of meeting virtually as a complement to the work by correspondence and taking into account relevant decisions by the Council and MEPC if members of the Group agree to do so, is instructed to:

.1 consider and provide final advice on which data, if any, should be mandatory to report, taking into consideration appendix III of annex 3 to document PPR 10/13, based on discussion of the Correspondence Group established at PPR 9, and provide advice on whether to amend MARPOL Annex V fishing gear reporting requirements, or to allow Member States to collect the data using their own resources and legislation, taking into consideration paragraphs 58 and 59 of document PPR 10/13;

.2 further consider and advise on what methods of data reporting should be used and who will be responsible for reporting based on options presented in paragraphs 69 to 72 of document PPR 10/13; and

.3 consider and advise on if coastal States should have access to the IMO database and, if so, what level of access they should have (i.e. access to aggregated data, or access to reports of individual losses/discharges), taking into consideration paragraphs 83, 84 and 96.3.4 of document PPR 10/13; and

based on the outcome of discussions of terms of reference .1 to .3 above, as necessary:

.4 further develop functionalities for the templates and discuss whether any other functionalities need to be added to the database in addition to those of annex 2 to document PPR 8/8;

.5 further consider the draft amendments to MARPOL Annex V to provide for the reporting mechanisms, the modalities and the information to be reported to the Administrations and IMO to

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facilitate and enhance reporting of the accidental loss or discharge of fishing gear, based on annex 3 to document PPR 10/13;

.6 further consider guidelines for the development and management of the lost or discharged fishing gear IMO database based on annex 4 to document PPR 10/13;

.7 further develop appropriate draft amendments to the *2017 Guidelines for the implementation of MARPOL Annex V* (resolution MEPC.295(71)) to support the implementation of the contemplated draft amendments to MARPOL Annex V based on annex 5 to document PPR 10/13; and

.8 submit a written report to PPR 11."

Report of the Drafting Group on Pollution Response

Clean-up of plastic pellets from ship-source spills and establishment of the Correspondence Group on Pollution Response

13:62 Having considered the relevant part of the report of the Drafting Group (PPR 10/WP.4, paragraph 11), the Sub-Committee established the Correspondence Group on Pollution Response, under the coordination of France, [4] and instructed it to:

.1 develop a draft guide on clean-up of plastic pellets from ship-source spills, taking into account document PPR 10/13/3 and the information contained in documents PPR 10/INF.13 and MEPC 79/INF.20; and

.2 submit a written report, including a draft guide, to PPR 11.

Extension of the target completion year

13.63 In light of the above and in line with the time frame of the *Action Plan to Address Marine Plastic Litter from Ships* (resolution MEPC.310(73)), the Sub-Committee requested MEPC 80 to extend the target completion year for the work assigned to it under output 4.3 (Follow-up work emanating from the Action Plan to address marine plastic litter from ships) to 2025.

14 UNIFIED INTERPRETATION OF PROVISIONS OF IMO ENVIRONMENT-RELATED CONVENTIONS

Unified interpretations of provisions of the BWM Convention

14.1 The Sub-Committee recalled that MEPC 72, through resolution MEPC.297(72), had adopted amendments to regulation B-3 of the BWM Convention regarding the implementation schedule of ballast water management for ships, and, through resolution MEPC.298(72), had further determined that the renewal survey referred to in the amended regulation B-3.10 of the

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BWM Convention was the renewal survey for the ship associated with the International Oil Pollution Prevention Certificate pursuant to MARPOL Annex I.

14.2 The Sub-Committee recalled also that MEPC 75, through resolution MEPC.325(75), had adopted amendments to the BWM Convention regarding, inter alia, the form of the International Ballast Water Management Certificate (IBWMC) set out in appendix I of the BWM Convention.

14.3 The Sub-Committee had for its consideration document PPR 10/14/1 (China), seeking clarification on the item "Date of construction" in the form of the IBWMC for a ship which had undergone a major conversion, and proposing draft unified interpretations for "Date of construction" in the form of the IBWMC and regulations B-3.5 and B-3.10 of the BWM Convention.

14.4 In its consideration of this matter, the Sub-Committee recalled that the established practice was that unified interpretations were only agreed if there was effectively unanimous support for them. In the ensuing discussion, there was support in general for the proposed unified interpretation, with different views expressed, in particular with regard to the proposed alternative options for the second part of the unified interpretation.

14.5 In light of this, the Sub-Committee referred the proposed unified interpretation to the Working Group on Marine Biosafety for finalization in accordance with the relevant term of reference.

Instructions to the Working Group on Marine Biosafety

14.6 The Sub-Committee instructed the Working Group on Marine Biosafety, taking into account comments and decisions made in plenary, to finalize the draft unified interpretation for the form of the IBWMC and regulations B-3.5 and B-3.10 of the BWM Convention, regarding the "date of construction" for a ship which had undergone a major conversion in order to implement the BWM Convention, using the annex to document PPR 10/14/1 as the basis.

Report of the Working Group

14.7 Having considered the relevant parts of the report of the Working Group (PPR 10/WP.5, paragraphs 40 to 43 and annex 2), the Sub-Committee agreed to the draft unified interpretation for the form of the International Ballast Water Management Certificate and regulations B-3.5 and B-3.10 of the BWM Convention, set out in annex 11, and invited the Committee to approve it for inclusion in a further revision of BWM.2/Circ.66 (i.e. BWM.2/Circ.66/Rev.5), consolidating all unified interpretations to provisions of the BWM Convention.

Unified interpretations of provisions of MARPOL Annex VI and the NO_x Technical Code 2008

14.8 The Sub-Committee had for its consideration the following documents submitted to this session:

.1 PPR 10/14 (United Kingdom et al.), proposing a draft unified interpretation for the form of the Bunker Delivery Note (BDN) referred to in regulation 18 (Fuel oil availability and quality) of MARPOL Annex VI to confirm that BDNs were acceptable in either hard copy or digital form providing they met the relevant requirements of MARPOL Annex VI;

.2 PPR 10/14/2 (BIMCO), commenting on document PPR 10/14 and supporting the use and acceptance of electronic BDNs; and proposing the deletion of the reference to the *Guidelines for the use of electronic certificates* (FAL.5/Circ.39/Rev.2) from the draft unified interpretation set out in paragraph 9 of document PPR 10/14, based on the view that a BDN was a declaration which did not carry the same statutory force as a statutory certificate; and

.3 PPR 10/14/3 (India), commenting on document PPR 10/14, which proposed a unified interpretation for the issuance of BDNs in electronic format, and highlighting the challenges and practical solutions in the issuance of electronic BDNs considering the current practices followed in shipping.

14.9 In the ensuing discussion, many delegations supported in general the proposal in document PPR 10/14 to develop a unified interpretation of regulations 18.5 and 18.6 of MARPOL Annex VI confirming that BDNs should be acceptable in either hard copy or in electronic format providing they met the relevant requirements of MARPOL Annex VI.

14.10 Several delegations, noting that electronic BDNs were already used in the shipping industry and could bring significant benefits in terms of flexibility, sustainability and transparency, acknowledged the challenges raised in document PPR 10/14 regarding the recognition of electronic BDNs by port State control officers and other stakeholders, and concurred with the urgent need to clarify the status of e-BDNs. In this regard, many delegations supported in general the proposal set out in document PPR 10/14, for further consideration in the Working Group on Prevention of Air Pollution from Ships.

14.11 Several delegations concurred with the concerns raised in document PPR 10/14/2 and suggested deleting the reference to FAL.5/Circ.39/Rev.2 from the draft unified interpretation, with the understanding that a BDN was a declaration which did not carry the same statutory force as a statutory certificate. Some other delegations preferred to keep the reference to FAL.5/Circ.39/Rev.2 or otherwise include text directly in the unified interpretation ensuring equivalent features. One delegation stressed that any potential proposal to amend FAL.5/Circ.39/Rev.2 in order to cover e-BDNs should be submitted to the FAL Committee. Some delegations suggested considering including in the unified interpretations a reference to the *Guidelines for the use of electronic record books under MARPOL* (resolution MEPC.312(74)).

14.12 Several delegations saw merit in taking into account comments and proposals set out in document PPR 10/14/3 regarding challenges and practical solutions in the issuance of e-BDNs, such as establishing a global repository for e-BDNs to ensure verification, as well as the need to ensure full compliance with requirements under MARPOL Annex VI, in particular ensuring that both signatures from the fuel provider and the recipient were reflected in e-BDNs. One delegation, in recalling that the proposed unified interpretation was related to regulation 18 of MARPOL Annex VI, suggested that the discussion should focus only on how the e-BDN was retained on board and not on how it was delivered to the ship.

14.13 Several delegations stressed that BDNs in both hard copy and electronic format should comply with relevant requirements of MARPOL Annex VI, and that any IMO instrument on the use of BDNs should provide sufficient security and accountability requirements to ensure that these were tamper-proofed.

14.14 Several delegations indicated that BDNs were an important legal documentation supporting current decarbonization efforts such as the IMO ship fuel oil consumption data-collection system (IMO DCS), and were likely to become even more important in the future when alternative fuels with higher prices were used by the shipping sector and a possible IMO economic instrument to reduce GHG emissions from ships, potentially based on fuel consumption, was established. Some delegations expressed concerns that developing a unified interpretation might not provide sufficient security and accountability guarantees, and suggested that a dedicated IMO guidance might need to be developed to provide the necessary information. In this regard, several delegations recalled that a unified interpretation should be considered as a provisional measure until a more appropriate approach was taken forward.

Instructions to the Working Group on Prevention of Air Pollution from Ships

14.15 The Sub-Committee instructed the Working Group on Prevention of Air Pollution from Ships, established under agenda item 6, to further consider documents PPR 10/14, PPR 10/14/2 and PPR 10/14/3, and advise the Sub-Committee on how best to proceed taking into account the comments made in plenary, noting that any long-term solutions other than a unified interpretation would require a proposal for a new output.

Report of the Working Group on Prevention of Air Pollution from Ships

14.16 Having considered the relevant parts of the report of the Working Group (PPR 10/WP.6, paragraphs 53 to 61 and annex 6), the Sub-Committee agreed to the draft new unified interpretation to regulations 18.5 and 18.6 of MARPOL Annex VI concerning electronic bunker delivery notes, as set out in annex 12, for approval by MEPC 80 and inclusion in a further revision of MEPC.1/Circ.795 (i.e. MEPC.1/Circ.795/Rev.8).

15 BIENNIAL AGENDA AND PROVISIONAL AGENDA FOR PPR 11

Biennial status report

15.1 The Sub-Committee recalled that MEPC 78 and subsequently MEPC 79 had confirmed the Sub-Committee's biennial status report for 2022-2023.

15.2 Taking into account the progress made at this session, the Sub-Committee updated the biennial status report for the 2022-2023 biennium, as set out in annex 13, for approval by MEPC 80.

Proposed biennial agenda for the 2024-2025 biennium and provisional agenda for PPR 11

15.3 The Sub-Committee noted that MEPC 78 had agreed to include in the post-biennial agenda of the Committee an output on "Development of a guide compiling best practices to develop local-level marine spill contingency plans to aid States, particularly local governments and key institutions, in implementing the OPRC Convention and OPRC-HNS Protocol", with two sessions needed to complete the item, assigning the PPR Sub-Committee as the associated organ.

15.4 In relation to output 1.23 (Evaluation and harmonization of rules and guidance on the discharge of discharge water from EGCS into the aquatic environment, including conditions and areas), the Sub-Committee noted that MEPC 79 had referred documents MEPC 79/5/1 (CESA), MEPC 79/5/4 (CESA) and MEPC 79/INF.4 (Kingdom of the Netherlands) to PPR 11 and had instructed the Sub-Committee to consider them further in conjunction with document MEPC 78/9/3 (Germany), with a view to advising the Committee accordingly.

15.5 The Sub-Committee also noted that MEPC 79 had agreed to include in the Committee's post-biennial agenda:

.1 an output on "Amendments to MARPOL Annex II in order to improve the effectiveness of cargo tank stripping, tank washing operations and prewash procedures for products with a high melting point and/or high viscosity", assigning the PPR Sub-Committee as the associated organ, with two sessions needed to complete the output and with the understanding that the comments and concerns expressed at MEPC 79, as listed in paragraph 12.2 of document MEPC 79/15, would be taken into account by the Sub-Committee; and

.2 an output on "Revision of the *Revised guidelines and specifications for pollution prevention equipment for machinery space bilges of ships* (resolution MEPC.107(49))", with two sessions needed to complete the output, and assigning the PPR Sub-Committee as the associated organ.

15.6 The Sub-Committee agreed to include the output on "Development of a guide compiling best practices to develop local-level marine spill contingency plans to aid States, particularly local governments and key institutions, in implementing the OPRC Convention and OPRC-HNS Protocol" and the output on "Amendments to MARPOL Annex II in order to improve the effectiveness of cargo tank stripping, tank washing operations and prewash procedures for products with a high melting point and/or high viscosity" in the provisional agenda for PPR 11. Consequently, the Sub-Committee invited MEPC 80 to endorse the transfer of the two above-mentioned outputs to the Committee's 2024-2025 biennial agenda from its post-biennial agenda.

15.7 In addition, in accordance with the outcome of MEPC 79 concerning output 1.23, the Sub-Committee included the agenda item on "Evaluation and harmonization of rules and guidance on the discharge of discharge water from EGCS into the aquatic environment, including conditions and areas" in the provisional agenda for PPR 11.

15.8 Having taken into account the progress made at this session and the relevant decisions of MEPC 78 and MEPC 79, the Sub-Committee prepared its proposed biennial agenda for the 2024-2025 biennium, and the provisional agenda for PPR 11, as set out in annexes 14 and 15, respectively, for consideration by MEPC 80.

Correspondence Groups established at this session

15.9 The Sub-Committee established the following Correspondence Groups, due to report to PPR 11:

.1 Correspondence Group on Pollution Response;

.2 Correspondence Group on Prevention of Air Pollution from Ships;

.3 Correspondence Group on Amendments to MARPOL Annex IV and Associated Guidelines; and

.4 Correspondence Group on Marine Plastic Litter from Ships.

Arrangements for the next session

15.10 The Sub-Committee, taking into account the decisions made under the respective agenda items, anticipated that working, technical and drafting groups may be established at PPR 11 on the following subjects:

.1 evaluation of safety and pollution hazards of chemicals (agenda items 3 and 4 of the proposed provisional agenda for PPR 11);

.2 prevention of air pollution from ships (agenda items 6, 7, 8, 17 (part) of the proposed provisional agenda for PPR 11)

.3 pollution response (agenda items 9 and 13 (part) of the proposed provisional agenda for PPR 11)

.4 revision of MARPOL Annex IV and associated guidelines (agenda item 12 of the proposed provisional agenda for PPR 11);

.5 follow-up work emanating from the Action Plan to Address Marine Plastic Litter from Ships (agenda item 13 of the proposed provisional agenda for PPR 11);

.6 development of measures to reduce risks of use and carriage of heavy fuel oil as fuel by ships in Arctic waters (agenda item 10 of the proposed provisional agenda for PPR 11); and

.7 review of the IBTS Guidelines and amendments to the IOPP Certificate and Oil Record Book (agenda item 11 of the proposed provisional agenda for PPR 11),

whereby the Chair, taking into account the submissions received on the respective subjects and all other agenda items, would advise the Sub-Committee well before PPR 11 on the final selection of such groups.

15.11 In this regard, the Sub-Committee also noted that due consideration would be given with regard to the principle established under paragraph 5.18 of the Committee's Method of work (MSC-MEPC.1/Circ.5/Rev.4) when the final recommendation was made.

Intersessional meetings

15.12 The Sub-Committee noted that MEPC 78 had approved the holding of an intersessional meeting of the ESPH Technical Group in 2023, which had been subsequently endorsed by C 127 and scheduled to be held from 30 October to 3 November 2023. The Sub-Committee invited MEPC 80 to approve the holding of an intersessional meeting of the ESPH Technical Group in 2024.

Date for the next session

15.13 The Sub-Committee noted that the eleventh session of the Sub-Committee had tentatively been scheduled to take place from 19 to 23 February 2024.

16 ELECTION OF CHAIR AND VICE-CHAIR FOR 2024

16.1 In accordance with the Rules of Procedure of the Marine Environment Protection Committee, the Sub-Committee unanimously elected Dr. Flavio da Costa Fernandes (Brazil) as Chair and Dr. Anita Mäkinen (Finland) as Vice-Chair, both for 2024.

16.2 The Sub-Committee recalled rule 18(1) of the Rules of Procedure of the Marine Environment Protection Committee, which provides that the Chair and Vice-Chair shall both be eligible for re-election for up to four further consecutive terms of office, while in exceptional circumstances they may be elected for an additional consecutive term.

16.3 The Sub-Committee also recalled that Dr. Flavio Da Costa Fernandes and Dr. Anita Mäkinen had been first elected by PPR 6 for 2020 and noted that they would serve their fifth consecutive term of office at PPR 11. Consequently, they would not be standing for re-election to their respective posts of Chair and Vice-Chair for 2025.

16.4 In this context, the Sub-Committee was informed that the Secretariat would prepare a document for PPR 11 to formally invite nominations of candidates for the positions of the Chair and Vice-Chair for the Sub-Committee for the year of 2025.

17 ANY OTHER BUSINESS

Development of a protocol for verification of ballast water compliance monitoring devices

17.1 The Sub-Committee recalled that MEPC 74, having considered a proposal, initially submitted to PPR 6, for the development of a standard for the verification of ballast water compliance monitoring systems, had invited interested delegations to submit concrete proposals to PPR 7, and that PPR 7, PPR 8 and PPR 9 had considered consecutive proposed drafts of a protocol for verification of ballast water compliance monitoring devices.

17.2 The Sub-Committee recalled also that PPR 8 had established the Correspondence Group on Development of a Protocol for Verification of Ballast Water Compliance Monitoring Devices, under the coordination of the United Kingdom, which was subsequently re-established by PPR 9.

17.3 The Sub-Committee had for its consideration the following documents:

.1 PPR 10/17 (United Kingdom), containing the report of the Correspondence Group on Development of a Protocol for Verification of Ballast Water Compliance Monitoring Devices, which included the final draft of the protocol;

.2 PPR 10/INF.14 (ISO), providing an update on the development of the ISO Standard that outlined methods for evaluating the performance of compliance monitoring devices for ballast water discharges, describing key elements of the methods, and setting out the timeline for the completion of the Standard; and

.3 PPR 9/WP.3/Add.1, containing the second part of the report of the Working Group on Marine Biosafety established during PPR 9, corresponding to the development of a protocol for verification of ballast water compliance monitoring devices.

17.4 The Sub-Committee recalled that the Working Group on Marine Biosafety established during PPR 9 had been instructed to submit its report on its consideration of this matter to PPR 10. In this regard, since the report of that Working Group, which had been submitted as document PPR 9/WP.3/Add.1, had been taken into account by the Correspondence Group on Development of a Protocol for Verification of Ballast Water Compliance Monitoring Devices, the Sub-Committee noted the progress reported in document PPR 9/WP.3/Add.1.

17.5 The Sub-Committee also noted the information contained in document PPR 10/INF.14 (ISO) and took it into account, as appropriate, in the context of the finalization of the protocol for verification of ballast water compliance monitoring devices.

17.6 With regard to the report of the Correspondence Group on Development of a Protocol for Verification of Ballast Water Compliance Monitoring Devices (PPR 10/17), some delegations supported the further consideration of the draft protocol contained therein in the

Working Group with a view to finalization; however, a majority of delegations expressed the view that the draft protocol was developed to a sufficient level and could be agreed as submitted.

17.7 In conclusion, the Sub-Committee agreed to the draft protocol for verification of ballast water compliance monitoring devices as set out in annex 2 to document PPR 10/17 and, having considered the draft circular set out in the annex to document PPR 10/WP.8, agreed to the draft BWM.2 circular set out in annex 16 with a view to its approval by MEPC 80.

Detailed analysis for 10-50 µm plankton in ballast water

17.8 The Sub-Committee had for its consideration the following documents:

.1 PPR 10/17/3 (China), proposing the use of neutral red staining microscopy as a detailed laboratory assay method for the detection of 10-50 µm plankton in ballast water, and inviting interested Member States and international organizations to conduct additional experiments on this method; and

.2 PPR 10/INF.19 (China), providing information on the neutral red staining microscopy method for the survival count of 10-50 µm plankton in ballast water.

17.9 Following brief discussion, the Sub-Committee invited interested Member States and international organizations to carry out further experiments and research on neutral red staining microscopy for the detection of 10-50 µm plankton in ballast water.

Revision of the 2015 Guidelines for the development of the Inventory of Hazardous Materials

17.10 The Sub-Committee recalled that MEPC 76, through resolution MEPC.331(76), had adopted amendments to the AFS Convention, concerning controls on cybutryne, which had entered into force on 1 January 2023.

17.11 The Sub-Committee recalled also that MEPC 78 had agreed that there was no need for an update to the list of materials for the Inventory of Hazardous Materials under the Hong Kong Convention to include cybutryne, as the existing relevant text in appendix I to the Hong Kong Convention was generic enough, but there might be a need to consider amending the *2015 Guidelines for the development of the Inventory of Hazardous Materials* (resolution MEPC.269(68)), which contained more specific guidance that was so far limited to organotin compounds.

17.12 In this context, the Sub-Committee had for its consideration document PPR 10/17/1 (China), proposing modifications to the *2015 Guidelines for the development of the Inventory of Hazardous Materials* (resolution MEPC.269(68)) to include cybutryne following the entry into force of the respective controls in the AFS Convention.

17.13 In this connection, the Sub-Committee noted that, in contrast to organotin compounds, the controls on cybutryne that entered into force on 1 January 2023 did not contain any caveat about this substance acting as a biocide, as there was no other use for this substance in anti-fouling systems and therefore the prohibition of its use was total.

17.14 In the ensuing discussion, there was overwhelming support for the proposal in document PPR 10/17/1 with the necessary amendments to remove all references to the use of cybutryne as a biocide. There was also a proposal to further consider the relevant threshold values and clarify the references to the appropriate resolutions on guidelines under the AFS Convention.

17.15 In conclusion, the Sub-Committee referred the proposed amendments to the *2015 Guidelines for the development of the Inventory of Hazardous Materials* (resolution MEPC.269(68)) to the Working Group on Marine Biosafety for further consideration in accordance with the relevant term of reference, taking into account the decision to delete all references to the use of cybutryne as a biocide.

Instructions to the Working Group on Marine Biosafety

17.16 The Sub-Committee instructed the Working Group on Marine Biosafety, taking into account comments and decisions made in plenary, to consider the amendments to the *2015 Guidelines for the development of the Inventory of Hazardous Materials* (resolution MEPC.269(68)) proposed in document PPR 10/17/1, and advise the Sub-Committee accordingly.

Report of the Working Group

17.17 Having considered the relevant parts of the report of the Working Group (PPR 10/WP.5, paragraphs 44 to 48 and annex 3), the Sub-Committee approved the draft *2023 Guidelines for the development of the Inventory of Hazardous Materials* and the associated draft MEPC resolution, set out in annex 17, and invited the Committee to adopt them.

Draft amendments to the *2019 Guidelines for onboard sampling for the verification of the sulphur content of the fuel oil used on board ships* (MEPC.1/Circ.864/Rev.1)

17.18 The Sub-Committee recalled that:

.1 MEPC 74 had approved the *2019 Guidelines for onboard sampling for the verification of the sulphur content of the fuel oil used on board ships* (MEPC.1/Circ.864/Rev.1); and

.2 MEPC 75 had adopted amendments to MARPOL Annex VI by resolution MEPC.324(75), which mandated the retrofitting of in-use fuel oil sampling points.

17.19 The Sub-Committee considered document MEPC 78/5/1 (China), proposing draft amendments to MEPC.1/Circ.864/Rev.1 addressing sampling of fuel oil with poor fluidity in low-temperature environments, sampling in the event that unstable/incompatible fuel oil was mixed, and the amounts of fuel sampled, which had been referred by the Committee to this session for further consideration with a view to advising the Committee accordingly (MEPC 78/17, paragraph 5.3).

17.20 The delegation of China further commented on experienced issues with fuel oil accumulation leading to clogging at fuel sampling points in ships operating in low-temperature environments.

17.21 Several delegations expressed the view that the arguments raised in document MEPC 78/5/1 lacked sufficient technical justification, referring, inter alia, to the absence of information on recurrent difficulties with fuels sampling under cold weather conditions and expressing a preference for not overly prescribing the sampling procedure but leaving that to the professional discretion of the fuel sampler and involved laboratories, and therefore could not support the proposed amendments to the *2019 Guidelines for onboard sampling for the verification of the sulphur content of the fuel oil used on board ships* (MEPC.1/Circ.864/Rev.1).

17.22 Several delegations, in noting the highly technical nature of the proposal, suggested instructing the Working Group on Prevention of Air Pollution to further consider document MEPC 78/5/1 and the proposed amendments to MEPC.1/Circ.864/Rev.1 therein and advise the Sub-Committee on how to proceed.

17.23 The Sub-Committee also had for its consideration document PPR 10/17/2 (IACS), highlighting specific difficulties with complying with the sample point location requirements in MEPC.1/Circ.864/Rev.1 for the fuel oil lines serving the emergency generator and inviting the Sub-Committee to consider the need to revise MEPC.1/Circ.864/Rev.1 to define alternative fuel oil sample point location arrangements for the tank serving the emergency generator.

17.24 In the ensuing discussion, several delegations questioned whether the difficulties described in document PPR 10/17/2 for ships to fulfil all of the sampling conditions set in paragraph 2 of MEPC.1/Circ.864/Rev.1 due to the lack of space between the tank and the emergency generator would pose serious concerns affecting compliance with the relevant sampling requirements. Several of these delegations indicated that there existed multiple locations where fuel oil samples could be taken without difficulty in accordance with MEPC.1/Circ.864/Rev.1. One delegation expressed concern that the proposal in document PPR 10/17/2 to take fuel samples from the drain line of the tank might cause deviation in the analysis regarding water content and sediment.

17.25 Several delegations, in noting that the observer from IACS had offered to propose detailed technical explanations on the document, suggested further considering document PPR 10/17/2 in the Working Group on Prevention of Air Pollution from Ships.

17.26 Following discussion, the Sub-Committee instructed the Working Group on Prevention of Air Pollution from Ships, established under agenda item 6, to consider documents PPR 10/17/2 and MEPC 78/5/1, with a view to preparing draft amendments to the *2019 Guidelines for onboard sampling for the verification of the sulphur content of the fuel oil used on board ships*.

Request for new output on MARPOL Annex VI and the NO_X Technical Code 2008 to allow for technologies that reduce CO_2 emissions

17.27 The Sub-Committee noted the information in document PPR 10/17/4 (Denmark and Germany), highlighting the challenges with NO_X certification of existing engines when retrofitted with modern technologies to reduce their GHG emissions, stressing the urgent need to find a solution. In this context, the delegation of Germany brought to the Sub-Committee's attention document MEPC 80/14/2 (Denmark and Germany), containing a proposal for a new output to revise the NO_X Technical Code 2008 regarding re-certification procedures of existing marine diesel engines on board ships, with a view to starting work on this aspect during PPR 11, and further stressing the importance of addressing NO_X emissions potentially resulting from measures taken with the aim of reducing GHG emissions.

Volatile organic compound emissions

17.28 The Sub-Committee recalled that MEPC 77 had instructed the PPR Sub-Committee to investigate how the reduction of volatile organic compound (VOC) emissions could be further addressed and that PPR 9 had instructed the Correspondence Group on Prevention of Air Pollution from Ships to identify the outline of a scope of work on the reduction of VOC emissions, and to submit a written report to this session.

17.29 In this context, the Sub-Committee considered the relevant sections of the report of the Correspondence Group (paragraphs 45 to 50, paragraph 51.4 and annex 4 to document PPR 10/6) and noted that the Correspondence Group had agreed, in general, that:

.1 the scope of work on reduction of VOC emissions should be based on the further examination of the existing regulatory framework;

.2 OCIMF should be invited to contribute to the work in reducing the emissions of VOC from tankers in their interface with terminals; and

.3 the following outstanding issues needed to be further considered:

  .1 method to estimate VOC emissions;

  .2 possible amendments to MARPOL Annex VI; and

  .3 finalization of the scope of work based on annex 4 to the Correspondence Group report.

17.30 The Sub-Committee also had for its consideration document PPR 10/17/5 (INTERTANKO), containing comments on the draft scope of work set out in annex 4 to the Correspondence Group report notably with regard to the role of shore terminals in VOC reduction, the relevance of cargo temperatures and loading level of cargo tanks in VOC emissions, and on the proposed VOC measurement system.

17.31 In the ensuing discussion, several delegations expressed their support for the points on which the Correspondence Group had agreed and suggested forwarding the draft scope of work for the reduction of VOC emissions set out in annex 4 of document PPR 10/6 to the Working Group on Prevention of Air Pollution from Ships for finalization, also taking into account comments made in document PPR 10/17/5.

17.32 In further elaborating on document PPR 10/17/5, the observer from INTERTANKO highlighted that the majority of VOC emissions from shipping occured during cargo loading operations and that the main obstacle to the further reduction of VOC emissions from tankers was the lack of available reception facilities in oil terminals, thus stressing the importance of involving terminals in the work envisaged on reducing VOC emissions. Several delegations, in supporting this intervention, were of the view that it would be difficult to justify imposing additional measures on ships that would have little to no effect on VOC emissions unless there were corresponding mandatory obligations on shore facilities to enable the delivery of retained VOCs ashore.

17.33 The observer from OCIMF, in noting the concerns expressed by INTERTANKO and expressing its commitment to support the work under the proposed scope, stressed that the burden of managing VOC emissions should be shared by all stakeholders in the value chain to the extent possible and that this aspect should be duly addressed in the scope of work.

17.34 The delegation of Norway, in noting that the draft scope of work set out in annex 4 to document PPR 10/6 was too detailed and therefore unfit as scope of work, offered to present a proposal for a simplified scope of work on the reduction of VOC emissions to the Working Group. Several delegations supported the consideration of this proposal in the Working Group.

17.35 The delegation of the Kingdom of the Netherlands recalled that in 2011 and 2014 it had reported specific information on delivery of VOCs to terminals in six of its ports to the MARPOL Annex VI GISIS module. This delegation further highlighted that reducing VOC emissions from ships was a relevant means to improve local air quality and odour, and port authorities in the Kingdom of the Netherlands therefore actively regulated VOC emissions, along with specification for each port of the size of tankers controlled, the cargoes requiring vapour emission control systems and other regulatory requirements.

17.36 Following discussion, the Sub-Committee instructed the Working Group on Prevention of Air Pollution from Ships, established under agenda item 6, to finalize the draft scope of work on reduction of VOC emissions, taking into account the concerns raised in document PPR 10/17/5, and advise the Sub-Committee on how best to advance the work.

Studies concerning discharge water from exhaust gas cleaning systems

17.37 The Sub-Committee noted that, with regard to output 1.23 (Evaluation and harmonization of rules and guidance on the discharge of discharge water from EGCS into the aquatic environment, including conditions and areas), MEPC 78 had agreed:

.1 to extend the target completion year of the output to 2025;

.2 not to include the output in the provisional agenda for PPR 10; and

.3 that it would consider reinstating the output in the provisional agenda of a future session of the Sub-Committee subject to further proposals to the Committee.

17.38 The Sub-Committee also noted that, in the context of output 1.23, MEPC 79 had referred documents MEPC 79/5/1 (CESA), MEPC 79/5/4 (CESA) and MEPC 79/INF.4 (Kingdom of the Netherlands) to PPR 11 and had instructed the Sub-Committee to consider them further in conjunction with document MEPC 78/9/3 (Germany), with a view to advising the Committee accordingly. As a result of this outcome by MEPC 79, the Sub-Committee confirmed that the item on "Evaluation and harmonization of rules and guidance on the discharge of discharge water from EGCS into the aquatic environment, including conditions and areas" would be included in the provisional agenda of PPR 11

17.39 In this connection, the Sub-Committee noted the information in document PPR 10/INF.3 (OSPAR Commission), in relation to the OSPAR Commission's activities and the findings from a recent assessment of discharges from EGCS into marine waters, and the information in document PPR 10/INF.15 (Germany), concerning the final report of the German project ImpEx, which analysed discharge water from EGCS to assess the ecotoxicological effects of EGCS discharge water. Additionally, the Sub-Committee forwarded both documents to its next session, for the information to be taken into account as appropriate.

Study concerning spills of very low sulphur fuel oils

17.40 The Committee noted the information in document PPR 10/INF.12 (Australia) on a study concerning the properties and potential spill behaviour of very low sulphur fuel oils and associated pollution response.

Instructions to the Working Group on Prevention of Air Pollution from Ships

17.41 Following the discussion, the Sub-Committee instructed the Working Group on Prevention of Air Pollution from Ships, established under agenda item 6, taking into consideration the comments and decisions made in plenary, to:

.1 consider documents PPR 10/17/2 and MEPC 78/5/1, with a view to preparing draft amendments to the *2019 Guidelines for onboard sampling for the verification of the sulphur content of the fuel oil used on board ships*; and

.2 finalize the draft scope of work on reduction of VOC emissions, taking into account the concerns raised in document PPR 10/17/5, and advise the Sub-Committee on how best to advance the work.

Report of the Working Group on Prevention of Air Pollution from Ships

17.42 Having considered the relevant parts of the report of the Working Group (PPR 10/WP.6, paragraphs 62 to 80 and annex 7), the Sub-Committee:

.1 noted the Group's discussion on proposed draft amendments to the *2019 Guidelines for onboard sampling for the verification of the sulphur content of the fuel oil used on board ships* (MEPC.1/Circ.864/Rev.1) and that the Group had agreed to keep the Guidelines unchanged; and

.2 agreed to the draft scope of work on reduction of volatile organic compound (VOC) emissions, as set out in annex 18, and requested that the Committee concur.

Local level marine spill contingency plans

17.43 The Sub-Committee noted the information in document PPR 10/INF.2 (Norway) regarding the status of development of a guide compiling best practices to develop local level spill contingency plans to aid States, particularly local government and key institutions, to implement the OPRC Convention and OPRC-HNS Protocol, and the invitation to interested Member States and international organizations to work together with Norway in order to prepare a document with a more developed guide to be submitted to PPR 11.

Experience gained with using the hybrid system

17.44 The Sub-Committee, in recounting its experience on the use of the hybrid system during the session, noted the following comments by the delegation of Germany:

.1 the option to participate remotely was highly appreciated, as it allowed for the input by experts, who, for various reasons, had been unable to travel to IMO Headquarters, to be taken into account;

.2 while the need to limit the number of remote-active slots for plenary was understandable and justified, sharing 10 remote-active slots between plenary (Main Hall) and the working groups in committee rooms 9 and 10 resulted in some delegations not having enough remote-active slots for all their experts to participate remotely in those working groups at this session; and

.3 consideration should be given to decoupling remote-active slots reserved for plenary from the remote-active slots associated with the working groups in committee rooms 9 and 10 in order to provide more remote-active slots than was currently possible for remote participation in working groups.

17.45 In this regard, the Sub-Committee invited MEPC 80 to note the above comments with respect to the experience gained with using the hybrid system and forward them to the appropriate session of the Council to take action, as appropriate.

Expressions of condolence

17.46 The Sub-Committee noted with great sadness the recent passing of Mr. Verner Wilson, who frequently had attended sessions of the PPR Sub-Committee and MEPC as an observer with FOEI. The Sub-Committee expressed its appreciation for Mr. Wilson's contribution to the work of the Organization, particularly regarding safety of navigation and environmental protections in the Arctic, and the importance of having an Arctic Indigenous voice at the Organization and also expressed its condolences and sincere sympathy to the Wilson family for their loss.

Expression of appreciation

17.47 The Sub-Committee expressed its appreciation to the following delegates who had recently retired or relinquished their duties for their invaluable contribution to its work:

- Mr. Jorma Kämäräinen (Finland) (on retirement)
- Mr. Dick Brus (Kingdom of the Netherlands) (on retirement)
- Rear Admiral José Luis Gavidia Arrascue (Peru) (on transfer)

18 ACTION REQUESTED OF THE COMMITTEE

Consideration of the report of the Sub-Committee

18.1 The draft report of the session (PPR 10/WP.1) was prepared by the Secretariat for consideration by the Sub-Committee.

18.2 During the meeting held on Friday, 28 April 2023, delegations were given an opportunity to provide comments on the draft report (PPR 10/WP.1), and the Secretariat then prepared the revised draft report (PPR 10/WP.1/Rev.1), incorporating the comments made. Member States and international organizations wishing to provide further editorial corrections and improvements, including finalizing individual statements, were given a deadline of Wednesday, 17 May 2023, 23.59 (UTC+1) to do so by correspondence, in accordance with paragraphs 4.37 and 4.38 of the Committees' method of work (MSC-MEPC.1/Circ.5/Rev.4) (see also paragraph 1.8). By the above-mentioned deadline, no comments had been received, and the report of the Sub-Committee was finalized by the Secretariat in consultation with the Chair

Action requested of the Committee

18.3 The Marine Environment Protection Committee, at its eightieth session, is invited to:

.1 note that the report of GESAMP/EHS 59, together with the revised GESAMP Composite List, had been disseminated as PPR.1/Circ.12, and that the outcome of GESAMP/EHS 59 had been noted by the Sub-Committee (paragraph 3.3);

.2 concur with the evaluation of products and their respective inclusion in lists 1, 2, 3 and 5 of MEPC.2/Circ.28 (published on 1 December 2022), with validity for all countries and with no expiry date where appropriate (paragraphs 3.4.1 and 3.4.2);

.3 with regard to the carriage requirements for "Creosote (coal tar)":

.1 concur with the recommendation of ESPH 28 and of the Sub-Committee that the assignment of ship type 2 (in combination with pollution category X) is appropriate for "Creosote (coal tar)" based on expert judgement (paragraph 3.4.4.1);

.2 agree for the expiry date associated with "Creosote (coal tar) (amended)" to be changed to "none" in the next edition of the MEPC.2 circular on *Provisional categorization of liquid substances in accordance with MARPOL Annex II and the IBC Code* (MEPC.2/Circular) (due to be issued on 1 December 2023 as MEPC.2/Circ.29) (paragraph 3.4.4.2); and

.3 note the consequential amendments to the *Decisions with regard to the categorization and classification of products* (PPR.1/Circ.7) and to the entry for "Creosote (coal tar)" in the next revision of chapter 17 of the IBC Code (paragraphs 3.4.4.3 and 3.4.4.4);

.4 concur with the evaluation of cleaning additives and their inclusion in annex 10 to MEPC.2/Circ.28 (paragraph 3.4.5);

.5 note that prior to MEPC.2/Circ.28 being published, a review was undertaken by ESPH 28 and amendments were made, including the deletion of products that had reached their expiry dates, or were no longer shipped, or had been re-evaluated and met the criteria for complex mixtures in paragraph 9.2 of the *Guidelines for the provisional assessment of liquid substances transported in bulk* (MEPC.1/Circ.512/Rev.1) (paragraph 3.4.6);

.6 urge reporting countries that have products listed in list 2 or list 3 of the MEPC.2/Circular to contact the respective manufacturers and request them to review their products for the purpose of assessing whether any changes in the carriage requirements would be necessary, taking into account the revised chapter 21 of the IBC Code, the latest GESAMP Hazard Profiles for the components, MEPC.1/Circ.512/Rev.1 and PPR.1/Circ.10 (paragraph 3.4.7);

.7 concur with the evaluation products and their inclusion in lists 1 and 3 of the next edition of the MEPC.2/Circular (i.e. MEPC.2/Circ.29), with validity for all countries and with no expiry date (paragraphs 3.17.1 and 3.17.2);

.8 concur with the evaluation of cleaning additives and their inclusion in annex 10 to the next edition of the MEPC.2/Circular (i.e. MEPC.2/Circ.29) (paragraph 3.17.3);

.9 note that the trade-named product "RBHC (Exxon Mobil)" had been re-evaluated and found to meet the criteria for complex mixtures in paragraph 9.2 of MEPC.1/Circ.512/Rev.1 and consequently would be deleted from the next edition of the MEPC.2/Circular (i.e. MEPC.2/Circ.29) (paragraph 3.19);

.10 approve the draft amendments to the *Decisions with regard to the categorization and classification of products* (PPR.1/Circ.7) (paragraph 3.20 and annex 1);

.11 approve the draft operational guide on the response to spills of hazardous and noxious substances (HNS), for subsequent publication (paragraph 4.9 and annex 3);

.12 authorize the Secretariat, when preparing the final text of the operational guide on the response to spills of hazardous and noxious substances (HNS) (volumes 1 and 2), to effect any editorial corrections that may be identified, as appropriate, including additional reference sources deemed appropriate (paragraph 4.10);

.13 consider the draft 2023 guidelines for the control and management of ships' biofouling to minimize the transfer of invasive aquatic species and the associated draft MEPC resolution, with a view to adoption (paragraph 5.46 and annex 4);

.14 note that the Sub-Committee:

.1 invited Member States and international organizations to submit relevant information on best practices for biofouling inspections and cleaning actions to the Organization as it may become available in the future (paragraph 5.47); and

.2 after noting the recommendations on how to increase the uptake and effectiveness of the revised Biofouling Guidelines, set out in paragraphs 35 to 41 and 49 of document PPR 9/7 (Norway) and in paragraph 50 of document PPR 10/5/1 (Norway), encouraged Member States and other stakeholders to implement the recommendations (paragraph 5.48.1)

.15 agree to change the title of output 1.21 from "Review of the *2011 Guidelines for the control and management of ships' biofouling to minimize the transfer of invasive aquatic species* (resolution MEPC.207(62))" to "Development of guidance on matters relating to in-water cleaning" and to set the target completion year of the renamed output to 2025 (paragraph 5.48.2);

.16 with regard to the reduction of the impact on the Arctic of Black Carbon emissions from international shipping, note that the Sub-Committee, having considered document MEPC 79/5/5 (FOEI et al.) and other relevant documents that had been submitted to PPR 10:

.1 in relation to the geographical scope of Black Carbon measures, acknowledged that, at this stage, the only relevant definition in IMO instruments was that for "Arctic waters" in MARPOL and SOLAS and that the geographical scope of Black Carbon measures was outside the remit of the Sub-Committee; therefore, any further discussion on defining the geographical scope beyond Arctic waters should not be undertaken at the Sub-Committee and should be addressed at the Committee (paragraph 6.28);

.2 established the Correspondence Group on Prevention of Air Pollution to further develop, with a view to finalization, draft guidelines on recommendatory goal-based control measures to reduce the impact on the Arctic of Black Carbon emissions from international shipping (paragraph 6.33.3); and

.3 invited interested Member States and international organizations to work intersessionally on further developing proposals on potential Black Carbon control measures and to submit them to the next session of the Sub-Committee (paragraph 6.33.2);

.17 consider the draft 2023 guidelines for thermal waste treatment devices and the associated draft MEPC resolution, with a view to adoption (paragraph 7.6 and annex 5);

.18 endorse the expansion of the scope of output 2.15 (Development of amendments to MARPOL Annex VI and the NO_X Technical Code on the use of multiple engine operational profiles for a marine diesel engine) to cover definitions of terminology and application related to Engine International Air Pollution Prevention (EIAPP) test cycles and related amendments to the NO_X Technical Code (paragraph 8.10);

.19 agree to change the title of output 2.15 to "Development of amendments to MARPOL Annex VI and the NO_X Technical Code on the use of multiple engine operational profiles for a marine diesel engine and on the clarification of test cycles" (paragraph 8.10);

.20 approve the draft amendments to regulation 13.2.2 of MARPOL Annex VI on a marine diesel engine replacing a steam system, with a view to subsequent adoption (paragraph 9.7.1 and annex 6);

.21 consider the draft 2023 guidelines as required by regulation 13.2.2 in respect of non-identical replacement engines not required to meet the Tier III limit and the associated draft MEPC resolution, with a view to adoption (paragraph 9.7.2 and annex 7);

.22 approve the draft revised unified interpretations for regulation 13.2.2 of MARPOL Annex VI, for inclusion in a further revision of MEPC.1/Circ.795 (i.e. MEPC.1/Circ.795/rev.8) (paragraph 9.7.3 and annex 8);

.23 note the outcome of the Sub-Committee's consideration of document MEPC 78/14/1 (Iceland and Norway), which proposed that the scope of the existing output 7.11 on Development of measures to reduce risks of use and carriage of heavy fuel oil (HFO) as fuel by ships in Arctic waters be expanded to include an upper pour point limit in regulation 43.1.2 in MARPOL Annex I (paragraphs 10.17 and 10.18);

.24 endorse the expansion of the scope of output 1.26 (Revision of MARPOL Annex IV and associated guidelines) to include the introduction of provisions for a sewage management plan and record-keeping on all ships (i.e. not only ships with an STP) under MARPOL Annex IV (paragraph 12.9);

.25 note the outcome of the Sub-Committee's consideration of how to proceed in relation to reducing the environmental risk associated with the maritime transport of plastic pellets, subsequent to document MEPC 77/8/3 (Sri Lanka) being referred to the Sub-Committee and, in particular, note:

.1 the two-stage approach agreed by the Sub-Committee in relation to reducing the environmental risk associated with the maritime transport of plastic pellets in freight containers (paragraphs 13.22 and 13.57);

.2 the draft MEPC circular on recommendations for the carriage of plastic pellets by sea in freight containers and the request to the CCC Sub-Committee for input in that regard (paragraphs 13.54 to 13.56 and annex 9);

.3 the invitation to interested Member States and international organizations to submit concrete proposals on potential mandatory measures to a future session of the Sub-Committee (paragraph 13.57 and annex 10);

.4 the agreement of the Sub-Committee that plastic pellets should not be carried in bulk, and the invitation to interested Member States and international organizations to submit relevant proposals to a future session of the Sub-Committee on potential regulatory changes that may be needed to prevent the shipment of plastic pellets in bulk (paragraph 13.59); and

.5 the establishment of the Correspondence Group on Pollution Response to develop a draft guide on clean-up of plastic pellets from ship-source spills (paragraph 13.62);

.26 note the progress made by the Sub-Committee in relation to marking fishing gear and with regard to facilitating and enhancing reporting of the loss or discharge of fishing gear as provided for in regulations 7.1.3 and 7.1.4 of MARPOL Annex V (paragraphs 13.39 to 13.49, 13.60 and 13.61);

.27 approve the draft unified interpretation for the form of the International Ballast Water Management Certificate and regulations B-3.5 and B-3.10 of the BWM Convention for inclusion in a further revision of BWM.2/Circ.66 (i.e. BWM.2/Circ.66/Rev.5) (paragraph 14.7 and annex 11);

.28 approve the draft unified interpretation for regulations 18.5 and 18.6 of MARPOL Annex VI, concerning electronic bunker delivery notes, for inclusion in a further revision of MEPC.1/Circ.795 (i.e. MEPC.1/Circ.795/rev.8) (paragraph 14.16 and annex 12);

.29 note the biennial status report of the Sub-Committee for the current biennium (paragraph 15.2 and annex 13);

.30 approve the proposed biennial agenda of the Sub-Committee for the 2024-2025 biennium and the provisional agenda for PPR 11 (paragraphs 15.6 to 15.8 and annexes 14 and 15);

.31 approve the holding of an intersessional meeting of the ESPH Technical Group in 2024 (paragraph 15.12);

.32 approve the draft BWM.2 circular on the protocol for verification of ballast water compliance monitoring devices (paragraph 17.7 and annex 16);

.33 consider the draft 2023 guidelines for the development of the Inventory of Hazardous Materials and the associated draft MEPC resolution, with a view to adoption (paragraph 17.17 and annex 17);

.34 note that the Sub-Committee, having considered document MEPC 78/5/1 (China), agreed to keep the *2019 Guidelines for onboard sampling for the verification of the sulphur content of the fuel oil used on board ships* (MEPC.1/Circ.864/Rev.1) unchanged (paragraphs 17.19 to 17.22, 17.26, 17.41.1 and 17.42.1)

.35 concur with the draft scope of work on the Reduction of Volatile Organic Compound (VOC) emissions (paragraph 17.42.2 and annex 18);

.36 note the comments made with respect to the experience gained with using the hybrid system and forward them to the appropriate session of the Council to take action, as appropriate (paragraphs 17.44 and 17.45); and

.37 approve the report in general.

(The annexes to this report have been issued as documents PPR 10/18/Add.1 and PPR 10/18/Add.2)

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SUB-COMMITTEE ON POLLUTION PREVENTION AND RESPONSE
10th session
Agenda item 18

PPR 10/18/Add.1
26 May 2023
Original: ENGLISH

REPORT TO THE MARINE ENVIRONMENT PROTECTION COMMITTEE

Attached are annexes 1, 2, and 4 to 19 to the report of the Sub-Committee on Pollution Prevention and Response on its tenth session (PPR 10/18).

(See document PPR 10/18/Add.2 for annex 3)

LIST OF ANNEXES

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ANNEX 1

DRAFT AMENDMENTS TO THE DECISIONS WITH REGARD TO THE CATEGORIZATION AND CLASSIFICATION OF PRODUCTS (PPR.1/CIRC.7)

1 Paragraph 1.7 is replaced by the following:

".7 When a material has floater characteristics but this is combined with dissolution or evaporation properties (having an SD, FD, FE or FED rating for column E2 in the GESAMP Hazard Profile), consideration of this combined rating should not trigger a Pollution Category Y on the basis of the S or F reference presented in column E2 of the hazard profile in view of the substance's associated properties and behaviour."

2 Paragraph 1.11 is replaced by the following:

".11 Substances only used as components in trade named mixtures need to have a full GESAMP Hazard Profile. The Ship Type, component factor and Pollution Category of these products can be established based on the GESAMP Composite List. If the component is used in the contains name of the mixture, it should be included in annex 5 to the MEPC.2/Circular. If the component presents a safety hazard this should be taken into account when assigning carriage requirements to the mixture. The contains name used in the trade name mixture needs not be listed in chapter 17 or 18 of the IBC Code or in List 1 of the MEPC.2/Circular."

3 A new paragraph 1.11bis is inserted after existing paragraph 1.11 as follows:

".11*bis* Notwithstanding sub-paragraph 11 above, for a mixture which contains one or more MARPOL Annex I components forming more than 1% by weight of the mixture, the resulting Pollution Category of the mixture should always be Pollution Category X. A component factor of 100 should be used for the assignment of ship type. The MARPOL Annex I component(s) should also be indicated in the contains name as follows: contains oil.* The MARPOL Annex I component(s) should not be included in annex 5 to the MEPC.2/Circular."

4 New paragraphs 1.18 and 1.19 are inserted after existing paragraph 1.17 as follows:

".18 In cases where products included in list 1 of the MEPC.2/Circular have amended carriage requirements subsequent to the latest set of amendments to the IBC Code, a qualifier to the product name may be assigned by the ESPH Technical Group. The product name will be the IBC Code product name followed by "(amended)", e.g. Ethyl tert-butyl ether (amended), which will be the new provisional product name. The addition of a qualifier to the product name means that the reassessed product with the new provisional product name will be a separate product in respect of the IBC Code, even if the chemical composition of the product is the same. Where a product with a qualifier is to be shipped, the product should be included in the addendum to the Certificate.

* See list of oils in appendix I to MARPOL Annex I, excluding "Mineral oil" as a component in Lube Oil Additive mixtures.

.19 With regard to chapter 21 of the IBC Code (resolutions MEPC.318(74) and MSC.460(101)), note the corrected carriage requirements for methyl acrylate and methyl methacrylate set out in PPR.1/Circ.9 on *Revised carriage requirements for methyl acrylate and methyl methacrylate*."

5 Paragraph 2 is replaced by the following:

"2 Background information and rationale for the decisions set out above can be found in the following documents: BLG/Circ.15, BLG 11/3/2, BLG 12/3, BLG 14/3, BLG 15/3, BLG 16/3, PPR 3/WP.3, PPR 5/3, PPR 5/WP.4, PPR 6/3, PPR 7/3, PPR 7/WP.3, PPR 8/3 and PPR 10/3."

6 The appendix is replaced as follows:

"**RATIONALE FOR DEVIATING FROM THE CARRIAGE REQUIREMENTS SET OUT IN CHAPTER 21 OF THE IBC CODE (RESOLUTIONS MEPC.318(74) and MSC.460(101))**

The information set out below provides the rationale for deviating from the carriage requirements based on the criteria set out in chapter 21 of the IBC Code for the following products, as agreed by the ESPH Technical Group.

.1 **Ammonium nitrate solution (93% or less):** it was agreed that this product would require 1G tanks owing to the carriage temperature and the thermal stress placed on the structure, if shipped in 2G tanks. It was further agreed that Special Requirement 15.2 should be amended to make this clear.

.2 **Ammonium sulphide solution (45% or less)**: it was agreed that, owing to the Temperature Class being rated as T4, i.e. auto-ignition temperature <200°C due to H_2S, a ship type 2 would be required for this product.

.3 **Coal tar pitch (molten):** it was agreed that, owing to the high carriage temperature and the stress levels on the structure, 1G tanks should be retained.

.4 **Creosote (coal tar):** taking into account the considerations on safety and environmental protection aspects (see PPR 10/3, paragraphs 3.56 to 3.58 and 3.60), it was agreed that a ship type 2 would be appropriate for carrying this product based on expert judgement.

.5 **Diethyl ether:** it was noted that this product had a high vapour pressure and was also listed in chapter 19 of the IGC Code. It was therefore agreed that the appropriate section of chapter 15 of the IBC Code should be amended to identify that 1G tanks would be appropriate for carrying this product.

.6 **Ethylamine**: it was noted that this product was also included in chapter 19 of the IGC Code. Given its high vapour pressure, it was agreed that carriage in 1G tanks should be retained for this product.

.7 **Hydrochloric acid:** it was agreed that the product should be retained in 1G tanks owing to its corrosivity and that a new special requirement be added following 15.8 to indicate that hydrochloric acid should only be carried in 1G tanks.

.8 **Methyl alcohol:** during the review of chapters 17 and 18 of the IBC Code, it was agreed that the requirements in paragraph 15.12.3.1 of the IBC Code would not to be applied to the revised carriage requirements, on the basis of experience and expert judgement. All other requirements of 15.12 would apply in addition to all other applicable carriage requirements.

.9 **Phosphoric acid:** the Group could not agree on the proposed deviation to the carriage requirements, based on the information presented. The Group therefore requested industry to submit data on the C1 and C2 ratings to GESAMP to reassess the GESAMP Hazard Rating, as the current C1 and C2 ratings were not based on actual data, but by analogy with the D1 and D2 ratings.

.10 **Phosphorus, yellow or white:** it was agreed that the existing tank type should be retained as the special requirements in 15.7 implied independent tanks. It was also agreed that the wording in chapter 15.7 would need to be amended to emphasize this point.

.11 **Sodium hydrosulphide/Ammonium sulphide solution**: it was agreed that, owing to the temperature class being rated as T4, i.e. auto-ignition temperature <200ºC, a ship type 2 would be required.

.12 **Sulphur (molten):** owing to its carriage at high temperature and corresponding stress on the tank, it was agreed to retain its carriage in 1G tanks. It was also agreed that special requirement 15.10 would need to be amended and a new entry under 15.10.7 be added to require the carriage of this product in 1G tanks only."

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ANNEX 2*

PROVISIONAL AGENDA FOR ESPH 29

Opening of the session

1 Adoption of the agenda

2 Decisions of other bodies

3 Evaluation of products

4 Evaluation of cleaning additives

5 Review of MEPC.2/Circular – Provisional classification of liquid substances transported in bulk and other related matters

6 Review of products in lists 2, 3 and 4 of the MEPC.2/Circular

7 Revision of MEPC.1/Circ.590 – expanded guidance on what can be considered as a cleaning additive for the cleaning of NLS cargo residues

8 Consider the implications that the lack of toxic vapour detection equipment will have on the daily operation of chemical tankers

9 Proposed provisional agenda for ESPH 30

10 Report to the Sub-Committee

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* Available in English only.

ANNEX 4

DRAFT MEPC RESOLUTION

2023 GUIDELINES FOR THE CONTROL AND MANAGEMENT OF SHIPS' BIOFOULING TO MINIMIZE THE TRANSFER OF INVASIVE AQUATIC SPECIES

THE MARINE ENVIRONMENT PROTECTION COMMITTEE,

RECALLING Article 38 of the Convention on the International Maritime Organization concerning the functions of the Marine Environment Protection Committee relating to any matter within the scope of the Organization concerned with the prevention and control of marine pollution from ships,

RECALLING ALSO that Member States of the International Maritime Organization made a clear commitment to minimizing the transfer of invasive aquatic species by shipping in adopting the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004,

RECALLING FURTHER that studies have shown biofouling on ships to be an important means of transferring invasive aquatic species which, if established in new ecosystems, may pose threats to the environment, human health, property and resources,

NOTING the objectives of the Convention on Biological Diversity, 1992, and that the Kunming-Montreal Global Biodiversity Framework includes a target to eliminate, minimize, reduce and/or mitigate the impacts of invasive alien species on biodiversity and ecosystem services by identifying and managing pathways of the introduction of alien species,

NOTING ALSO that the transfer and introduction of aquatic invasive species through ships' biofouling threatens the conservation and sustainable use of biological diversity, and implementing practices to control and manage ships' biofouling can greatly assist in reducing the risk of the transfer of invasive aquatic species,

NOTING FURTHER that this issue, being of worldwide concern, demands a globally consistent approach to the management of biofouling,

RECALLING that, at its sixty-second session, it had adopted, by resolution MEPC.207(62), the *2011 Guidelines for the control and management of ships' biofouling to minimize the transfer of invasive aquatic species* (Biofouling Guidelines), developed by the Sub-Committee on Bulk Liquids and Gases,

RECALLING ALSO that, at its seventy-second session, it had agreed to review the Biofouling Guidelines, with a view to amending the Guidelines, if required,

HAVING CONSIDERED, at its eightieth session, the draft revised *Guidelines for the control and management of ships' biofouling to minimize the transfer of invasive aquatic species*, developed by the Sub-Committee on Pollution Prevention and Response,

1 ADOPTS the *2023 Guidelines for the control and management of ships' biofouling to minimize the transfer of invasive aquatic species*, as set out in the annex to the present resolution;

2 REQUESTS Member States to take urgent action in applying these Guidelines, including the dissemination thereof to the shipping industry and other interested parties, taking these Guidelines into account when adopting measures to minimize the risk of introducing invasive aquatic species via biofouling, and reporting to MEPC on any experience gained in their implementation;

3 AGREES to keep these Guidelines under review in light of the experience gained;

4 REVOKES resolution MEPC.207(62).

REVISED GUIDELINES FOR THE CONTROL AND MANAGEMENT OF SHIPS' BIOFOULING TO MINIMIZE THE TRANSFER OF INVASIVE AQUATIC SPECIES

TABLE OF CONTENTS

1 INTRODUCTION

1.1 MEPC 62 adopted the 2011 *Guidelines for the control and management of ships' biofouling to minimize the transfer of invasive aquatic species* (the Guidelines) through resolution MEPC.207(62). The aim of the Guidelines was to provide a globally consistent approach to managing biofouling by providing useful recommendations of general measures to reduce the risk associated with biofouling for all types of ships.

1.2 Member States of the International Maritime Organization (IMO) decided at MEPC 72 to review the Guidelines in order to assess the uptake and effectiveness of the Guidelines and identify any required action.

1.3 Studies have shown that biofouling can be a significant vector for the transfer of invasive aquatic species. Biofouling on ships entering the waters of States may result in the establishment of invasive aquatic species, which may pose threats to human, animal and plant life, economic and cultural activities, and the aquatic environment.

1.4 Invasive aquatic species have been recognized as one of the major threats for the well-being of the oceans by, inter alia, the Convention on Biological Diversity, several UNEP Regional Seas Conventions, the Asia Pacific Economic Cooperation forum and the Secretariat of the Pacific Region Environmental Programme.

1.5 Prediction of risk of introducing invasive species is complex, hence these Guidelines have the intention to minimize the accumulation of biofouling on ships. Biofouling may include invasive species while a clean hull and niche areas significantly reduce this risk. Studies have shown that the biofouling process begins within the first few hours of a ship's immersion in water. The biofouling pressure on a specific ship is influenced by a range of factors, starting with design and construction of the ship hull and niche areas, followed by operating profile of the ship and maintenance history.

1.6 These Guidelines describe recommended biofouling management practices, as illustrated in figure 1. Attention during initial ship design and construction may provide effective and sustainable means to reduce ship biofouling risks, supplemented by anti-fouling systems (AFS) for all types of ships' submerged or otherwise wetted surface areas, including hull and niche areas. Although these Guidelines focus on ships using AFS, these biofouling management practices are equally recommended for ships using coatings or surfaces that are not used to control or prevent attachment of organisms, as may be applicable.

1.7 The need for inspection and biofouling management may depend on the use of AFS, cleaning regime, and the overall risk of biofouling on the hull and in niche areas. By conducting ship-specific monitoring of risk parameters, identifying potential higher risk for biofouling, an optimized regime for biofouling management can be determined. Cleaning is an important measure to remove biofouling from the hull and niche areas but, when conducted in-water, it poses a risk of releasing invasive aquatic species into the water. Waste substances which are dislodged from the ship during the cleaning operation should therefore be collected. The Guidelines provide guidance for cleaning actions based on a fouling rating number with an overall aim to minimize the risk of transfer of invasive aquatic species. Maintenance and ship recycling should also be conducted with sufficient preventative measures to avoid release of any invasive aquatic species into the water. When conducting biofouling management, potential release of harmful waste substances should also be considered.

1.8 In addition to the Biofouling Guidelines, the following frameworks are relevant for minimizing the transfer of invasive aquatic species:

.1 the *International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004* (BWM Convention), which aims to minimize the transfer of invasive aquatic species through ships' ballast water and sediments; and

.2 the *International Convention on the Control of Harmful Anti-fouling Systems on Ships, 2001* (AFS Convention), which addresses anti-fouling systems on ships and focuses on the prevention of adverse impacts from the use of anti-fouling systems and the biocides they may contain.

1.9 Biofouling management practices may also improve a ship's hydrodynamic performance and can be effective at enhancing energy efficiency and reducing air emissions from ships. This concept has been identified by IMO in the 2022 *Guidelines for the development of a ship energy efficiency management* plan *(SEEMP)* (resolution MEPC.346(78)). These Guidelines further support the *Initial IMO Strategy on Reduction of GHG Emissions from Ships* (resolution MEPC.304(72)) [Comment: To be replaced by the revised strategy to be adopted at MEPC 80)].

1.10 A GEF-UNDP-IMO GloFouling Partnerships Project was conducted as part of wider efforts by IMO, in collaboration with the United Nations Development Programme (UNDP) and the Global Environment Facility (GEF), to protect marine ecosystems from the negative effects of invasive aquatic species. The aim of the GloFouling Partnerships Project was to build capacity in developing countries for implementing the IMO Biofouling Guidelines and other relevant guidelines to minimize the transboundary introduction of invasive aquatic species, with additional benefits in the reduction of greenhouse gas emissions from global shipping.

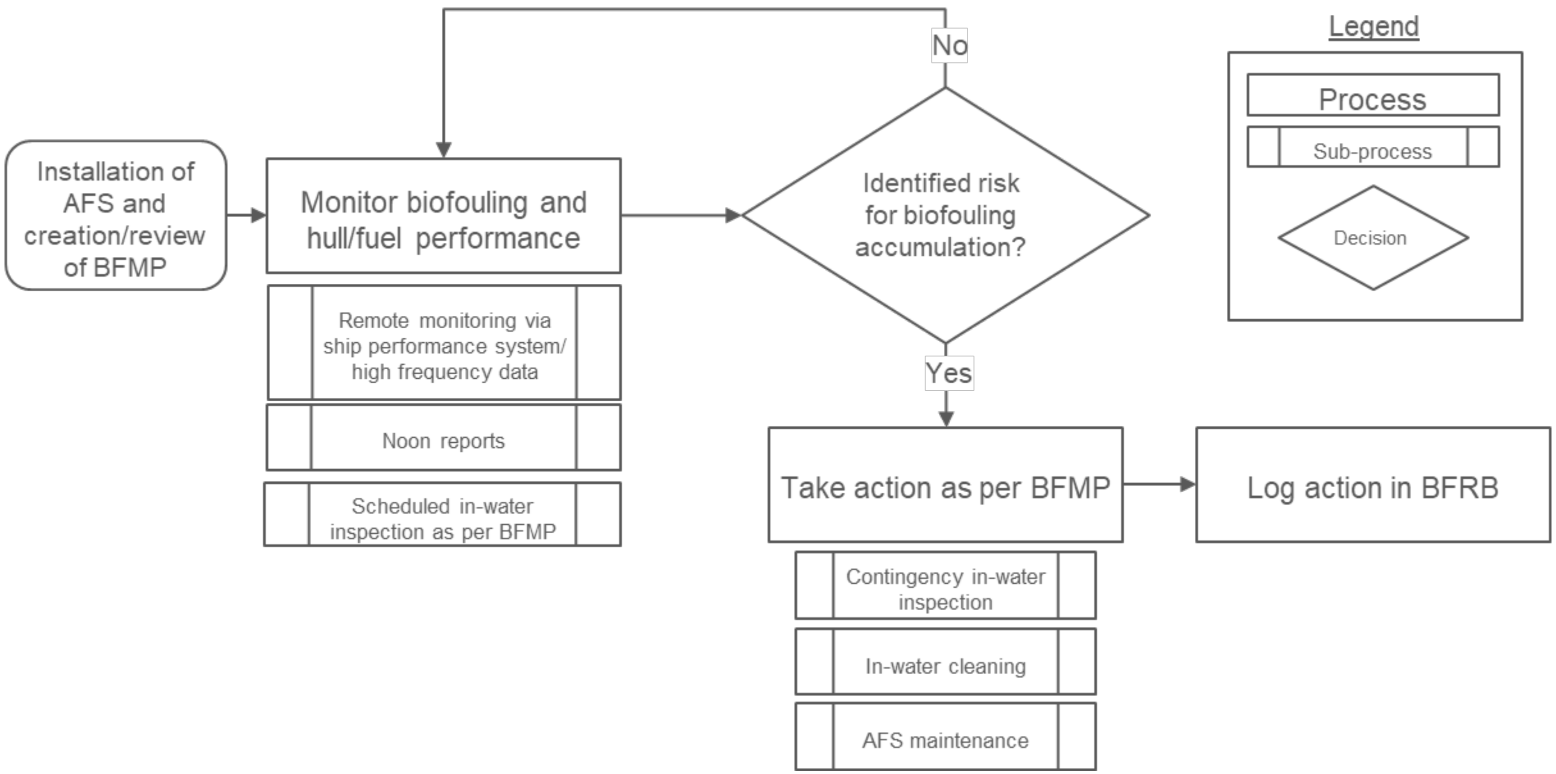

Figure 1: Simplified flow chart visualizing the biofouling management activities of a ship

2 DEFINITIONS

2.1 For the purposes of these Guidelines, the following definitions apply:

Anti-fouling system (AFS) means a coating, paint, surface treatment, surface or device that is used on a ship to control or prevent attachment of organisms.

Anti-fouling coating (AFC) means a surface coating or paint designed to prevent, repel or facilitate the detachment of biofouling from hull and niche areas that are typically or occasionally submerged.

Biofouling is the accumulation of aquatic organisms such as microorganisms, plants and animals on surfaces and structures immersed in or exposed to the aquatic environment. Biofouling can include pathogens. For microfouling and macrofouling, see definitions below.

Biofouling pressure means the biofouling accumulation rate, which differs regionally and seasonally. High biofouling pressure means the development of dense biofouling within a short period of time.

Capture is the process of containment, collection and removal of biofouling material and waste substances surfaces during cleaning in water or in dry dock.

Cleaning system is the equipment used for, or the process of, removal of biofouling from the ship surface, with or without capture.

Dry-dock cleaning refers to the cleaning of the submerged areas when the ship is out of water.

Fouling rating is the allocation of a number for a defined inspection area of the ship surface based on a visual assessment, including description of biofouling present and percentage of macrofouling coverage.

In-water cleaning is the removal of biofouling from a ship's hull and niche areas while in the water.

Invasive aquatic species are non-native species to a particular ecosystem which may pose threats to human, animal and plant life, economic and cultural activities and the aquatic environment.

Macrofouling is biofouling caused by the attachment and subsequent growth of visible plants and animals on structures and ships exposed to water. Macrofouling is large, distinct multicellular individual or colonial organisms visible to the human eye such as barnacles, tubeworms, mussels, fronds/filaments of algae, bryozoans, sea squirts and other large attached, encrusting or mobile organisms.

Marine growth prevention system (MGPS) is an AFS used for the prevention of biofouling accumulation in niche areas or other surface areas but may also include methods which apply surface treatments.

Member States means States that are Members of the International Maritime Organization.

Microfouling is biofouling caused by bacteria, fungi, microalgae, protozoans and other microscopic organisms that creates a biofilm also called a slime layer.

Niche areas are a subset of the submerged surface areas on a ship that may be more susceptible to biofouling than the main hull owing to structural complexity, different or variable hydrodynamic forces, susceptibility to AFC wear or damage, or inadequate or no protection by AFS.

Organization means the International Maritime Organization.

Port State authority means any official or organization authorized by the Government of a port State to verify the compliance and enforcement of standards and regulations relevant to the implementation of national and international shipping control measures.

Proactive cleaning is the periodic removal of microfouling on ships' hulls to prevent or minimize attachment of macrofouling.

Reactive cleaning is a corrective action during which biofouling is removed from a ship's hull and niche areas either in water with capture or in dry dock.

Ship means a vessel of any type whatsoever operating in the aquatic environment and includes hydrofoil boats, air-cushion vehicles, submersibles, floating craft, fixed or floating platforms, floating storage units and floating production storage and off-loading units.

States means coastal, port, flag or Member States, as appropriate.

Waste substances are dissolved and particulate materials that may be released or produced during cleaning or maintenance, and may include biocides, metals, organic substances, removed biofouling, pigments, microplastics or other contaminants that could have a negative impact on the environment.

3 APPLICATION

3.1 The Guidelines are intended to provide useful recommendations for measures to minimize biofouling for all types of ships. The Guidelines are directed at various stakeholders, such as ship designers, shipbuilders, anti-fouling paint manufacturers and suppliers, States, including environmental and regulatory agencies, classification societies, shipowners, ship operators, charterers, shipmasters, port authorities, ship cleaning and maintenance operators, inspection organizations, ship repair, dry-docking and recycling facilities, and any other interested parties.

3.2 Alternative procedures, methods or actions taken to meet the objectives of these Guidelines which are not described should be reported to the Organization by Members of the Organization and their representatives and be taken into account in future reviews of the Guidelines as appropriate.

3.3 A separate guidance document, based on these Guidelines, provides advice relevant to owners and/or operators of recreational craft less than 24 metres in length, using terminology appropriate for that sector (*Guidance for minimizing the transfer of invasive aquatic species as biofouling (hull fouling) for recreational craft* (MEPC.1/Circ.792)).

3.4 The Guidelines may not be relevant to ships which operate only in the same waters in which the biofouling was accumulated. Although operation in the same waters leads to no risk of introducing invasive aquatic species, measures to avoid discharge of harmful waste substances during cleaning may still be relevant.

3.5 An inspection regime as defined in paragraphs 8.4 to 8.6 may not be relevant to a ship when idle for a longer period. To maintain the anti-fouling effect of an AFS, inspection and reactive cleaning may be needed before the ship is reactivated to reduce the risk of biofouling.

4 OBJECTIVES

4.1 The objective of these Guidelines is to minimize the transfer of invasive aquatic species through biofouling on ships.

4.2 Procedures, methods and actions taken in line with these Guidelines should safeguard the obligation under the United Nations Convention on the Law of the Sea (UNCLOS), article 194, to prevent, reduce and control pollution of the marine environment. This includes ensuring not to transfer, directly or indirectly, damage or hazards from one area to another, or transform one type of pollution into another (ref. UNCLOS article 195), as well as preventing the intentional or accidental introduction of species, alien or new, to a particular part of the marine environment (ref. UNCLOS article 196).

4.3 The objective of these Guidelines is pursued by providing a globally consistent approach to stakeholders on the control and management of biofouling, which will contribute to minimizing the risk of transferring invasive aquatic species from biofouling on ships. An additional effect of good biofouling management can be a reduction in emissions to air from ships, due to lower fuel demand in operation as a result of a clean hull.

5 DESIGN AND CONSTRUCTION

5.1 Initial ship design and construction offers the most comprehensive, effective and long-lasting means to minimize ship biofouling risks. In the design and construction of a ship, or when a ship is being significantly modified, the following items, not exhaustive, should be taken into consideration:

.1 small niches and sheltered areas should be avoided as far as practical, e.g. flush mounting pipes in sea chests (where not practical, these should be designed so that they may be easily accessed for inspection, cleaning and application of AFS like marine growth prevention systems (MGPS));

.2 rounding and/or bevelling of corners, gratings and protrusions to promote more effective coverage of AFC and hinging of gratings to enable diver access;

.3 providing the capacity to block off the sea chest and other areas, such as moon pools, floodable docks and other free-flood spaces, for cleaning and treatment, if applicable and appropriate; and

.4 internal seawater cooling systems should be designed with a minimum number of bends and flanges. The design should be made of appropriate material to minimize biofouling, and be compatible with MGPS, if any. Dead ends, as can be found between different systems like cross-over piping between cooling and general service systems, should be avoided. Standby pumps and piping should be fully integrated into the systems to avoid stagnant water.

6 ANTI-FOULING SYSTEM INSTALLATION AND MAINTENANCE

6.1 AFS are effective means to minimize biofouling on ships' submerged surfaces, including the hull and niche areas.

6.2 Restrictions on the use of certain substances in the AFC are regulated by the AFS Convention.

Choosing an AFS

6.3 It is recommended to install AFS in all submerged surfaces on a ship where biofouling may attach. Various AFS are designed for different ship operating profiles, some suitable for hull and some for niche areas and therefore will require different maintenance activities. Thus, it is essential that shipowners, ship operators and shipbuilders obtain appropriate technical advice. AFS manufacturers are best suited to provide advice to ensure a suitable system is applied, reapplied, installed or renewed. As biofouling may typically be found at higher abundance in niche areas, where flow characteristics change as the ship moves through the water, it is recommended to choose a combination of AFC and MGPS, suitable for different submerged areas. If an appropriate AFS is not applied, biofouling accumulation may increase, and more frequent inspections may be necessary. Some factors to consider when choosing an AFS include the following:

.1 **Ship design and construction:** Where possible and appropriate upon the recommendation of AFS manufacturers, targeted installation of AFS may be employed for different areas of the ship. AFS for the hull may include specific AFC, paint and/or surface treatment. Installation of any proactive cleaning measures should be in accordance with the recommendations from the AFC provider and should not damage the AFC. Different AFS are designed to optimize their performance for specific ship speeds. For niche areas, the selected AFS should be optimized for conditions of the niche area, e.g. an AFC may be recommended for use in combination with effective MGPS to minimize biofouling. AFC selection should be based on expected wear, abrasion and water flow rates.

.2 **Active ingredients of AFC:** Environmental impact assessment of the selected AFC with respect to the release of harmful substances should be considered. The limitations of an AFC to minimize biofouling should be known and may include operating profile, aquatic environment, ship design and life cycle of AFC. Decision makers should be aware of the limitations of each AFC and the recommended in-water cleaning methods in order to minimize potential environmental impacts and damage to the system. Depending on the type of AFC, various types of waste substances may be released when cleaning. Some waste substances may easily be captured but others are fine particles or dissolved substances that may be released into the water. Therefore, not all AFC types are designed for frequent cleaning. The AFC manufacturers should provide key information on any biocides used and coating types on publicly available safety and technical datasheets. Frequent cleaning may impact the effectiveness of a specific AFC, and it is therefore recommended that the AFC manufacturers provide relevant guidance. In-water cleaning service providers and manufacturers of cleaning methods/equipment should provide guidance considering compatibility with AFC type.

.3 **Operating profile:** Patterns of use, operating routes, ship activity levels and periods of inactivity may influence the rate of biofouling accumulation and thus the effectiveness of the AFS. Inactivity may cause higher accumulation of biofouling. Biofouling may attach more easily on slow-moving ships.

.4 **Aquatic environment:** Biofouling pressure differs between areas, depending on temperature, salinity and nutrient conditions. Biofouling grows more slowly, but is not prevented, in low temperature waters. Ships operating in ice conditions should consider special AFC. Different organisms grow in different salinity waters and, if a ship operates in all salinity ranges, the anti-fouling system should target a wide range of organisms causing fouling. The benthic (seabed) environment should also be considered. Increasing depth of water and distance from shore may decrease susceptibility for biofouling. Additionally, higher content of nutrients in the water may increase algal blooms and susceptibility to biofouling.

.5 **Cleaning method:** Although cleaning system manufacturers are encouraged to find technological solutions that allow them to clean a wide variety of AFC, not all AFC can be cleaned by every cleaning system. When selecting the AFC, the available cleaning technologies and techniques and their suitability for the specific AFC should be considered. Therefore, AFC manufacturers should provide key information on any biocides used and coating types. The choice of AFC should be compatible with the cleaning technologies available to ensure both minimum biofouling growth as well as reducing the risk of damage to the AFC and the potential release of harmful waste substances to the environment.

.6 **Maintenance:** The lifespan of an AFS should be considered in combination with dry-docking schedules. AFC lifespan and lifetime of MGPS (e.g. anodes) should exceed the period between dry-dockings.

.7 **Legal requirements:** In addition to the AFS Convention, any national or regional regulatory requirements, if relevant, should be considered in the selection of AFS. This may apply to release of chemicals from MGPS and the AFS.

Installing the AFS

6.4 Installing an AFS in hull and niche areas should be in accordance with the manufacturer's guidance.

6.5 Niche areas are particularly susceptible to biofouling growth. Care should be taken in surface preparation and application of any AFC to ensure adequate adhesion and coating thickness. Particular attention should be paid to corners, edges, pipes, holding brackets and bars of gratings. Corners, edges and welded joints should be smooth and coated with adequate coating thickness to optimize system effectiveness. Additionally, for such areas, it is recommended to apply a touch up to ensure film thickness or a higher-grade AFC.

6.6 A non-exhaustive list of recommended measures for installation of an AFS in niche areas is as follows:

.1 **Sea chest:** Internal surfaces and inlet gratings of sea chests should be protected by an AFS that is suitable for the flow conditions of the area over the gratings and through the sea chest.

.2 **Bow and stern thrusters:** Free-flooding spaces which may exist around the thruster tunnel require special attention. The housings/recesses and retractable fittings such as stabilizers and thruster bodies should have an AFC of adequate thickness for optimal effectiveness.

.3 **Rudder hinges and stabilizer fin apertures:** Rudders and stabilizer fins should be moved through their full range of motion during the coating process to ensure that all surfaces are correctly coated to the specification of the AFC. Rudders, rudder fittings and the hull areas around them should also be adequately coated to withstand the increased wear rates experienced in these areas.

.4 **Propeller and shaft:** Propellers and immersed propeller shafts are generally not coated but polished. Fouling release coatings or other suitable coatings may be applied where possible and appropriate to maintain efficiency.

.5 **Stern tube seal assemblies and the internal surfaces of rope guards:** Exposed sections of stern tube seal assemblies and the internal surfaces of rope guards should be carefully painted with AFC appropriate to the degree of water movement over and around these surfaces.

.6 **Cathodic protection anodes:** Biofouling can be minimized in niche areas if anodes are flush-fitted to the hull, a rubber backing pad is inserted between the anode and the hull or the gap is caulked. Caulking the gap will make the seam or joint watertight. If not flush-fitted, the hull surface under the anode and the anode strap should be coated with an AFC suitable for low water flow to prevent biofouling accumulation. If anodes are attached by bolts recessed into the anode surface, the recess should be caulked to remove a potential niche.

.7 **Pitot tubes:** Where retractable pitot tubes are fitted, the housing should be internally coated with an AFC suitable for static conditions.

.8 **Sea inlet pipes and overboard discharges:** Pipe openings and accessible internal areas should be protected by an AFS as far as practicable. Any anti-corrosive or primer coating used should be appropriate for the specific pipe material and area requirements. Care should be taken in surface preparation and coating application to ensure good adhesion and coating thickness.

6.7 Details for performance monitoring of the AFS should be included in the ship-specific Biofouling Management Plan (BFMP) and be based on recommendations from the manufacturer of the AFS. Necessary measures to ensure that the AFS remains effective over the specified docking interval, plus any recommendations on how to return the AFS to optimal performance, should be included.

6.8 Manufacturers of AFS are also encouraged to provide information on appropriate cleaning methods, details of maintenance or upgrade protocols specific to the AFS and details on inspection and repair to ensure the effectiveness of their products. Such details are encouraged to be included in the ship-specific BFMP.

Reinstalling, reapplying or repairing the AFS

6.9 Reinstalling, reapplying or repairing the AFS should be in accordance with manufacturer's guidance that includes measures for surface preparation to facilitate good adhesion and durability.

6.10 Positions of dry-docking blocks and supports should be varied at each dry-docking, or alternative arrangements made to ensure that areas under blocks are painted with an AFC, at least at alternate dry-dockings. Where it is not possible to alternate the position of dry-docking support strips, these areas should be specially considered and managed by other means, e.g. the application of specialized coatings or procedures or measures for such areas based on the past arrangement of dry-docking support strips to shift their position step by step for each docking.

6.11 Reinstalling or repairing the MGPS in niche areas should be in accordance with manufacturer's guidance.

6.12 When reinstalling, reapplying or repairing AFS in niche areas, the list of recommended items in paragraph 6.6 should be considered. A non-exhaustive list of some additional recommended measures for reinstallation or reapplication of an AFS in niche areas is as follows:

.1 bow and stern thrusters – the body and area around bow, stern and any other thrusters prone to coating damage should be routinely maintained during dry-dockings;

.2 recesses within rudder hinges and behind stabilizer fins need to be carefully and effectively cleaned and recoated during maintenance dry-dockings; and

.3 gratings located in sea chests may require a major-refurbishment type of surface preparation at each dry-docking to ensure coating durability.

7 CONTINGENCY ACTION PLANS

7.1 A ship-specific contingency action plan based on specific triggers from monitoring of biofouling parameters should be described in the BFMP.

7.2 As presented in figure 1, monitoring of hull/fuel performance during ship operation should identify whether there may be an increased risk of biofouling accumulation. When monitoring identifies a possible increase in biofouling accumulation, the ship is at a higher risk level which should lead to contingency actions. A contingency action plan may involve inspection of submerged surfaces in line with chapter 8.

7.3 A contingency action plan may include measures which are ship-specific and relevant for the monitoring parameters. In general, a contingency action plan could include the following aspects:

.1 proactive actions can be implemented to lower the risk of biofouling accumulation if a higher biofouling risk may be predicted owing to planned operational changes;

.2 corrective actions to operating profile, maintenance or other repair plans, if the monitoring identifies an early indication of elevated risk; and

.3 inspection may be necessary to determine biofouling accumulation if the monitoring of biofouling parameters identifies an indication of prolonged elevated risk. The inspection should be in line with chapter 8.

7.4 Depending on the relevant biofouling risk parameters, the contingency action plan should trigger a reaction to be conducted in line with the BFMP.

7.5 If an inspection is conducted and biofouling is identified, cleaning actions should be conducted as described in table 1.

7.6 Monitoring of risk parameters may also identify and trigger a need for maintenance of MGPS or AFC.

8 INSPECTION

8.1 Inspections should be carried out:

.1 by organizations, crew or personnel competent to undertake inspections following these guidelines and competent to use relevant inspection methods or equipment to determine the level of biofouling and the condition of the AFS;

.2 for the purpose of fixed schedule inspections by inspection organizations or personnel able to provide impartial inspection; and

.3 for the purpose of inspections as part of contingency actions, by organizations, crew or personnel competent for such inspections.

8.2 The fixed schedule of inspections should be carried out in line with the minimum frequencies as described in paragraphs 8.4 to 8.6.

8.3 Inspection frequency or inspection dates (or date ranges) for in-water inspections during the in-service period of the ship should be based on the ship-specific biofouling risk profile (see appendix 1), including inspection as a contingency action, and specified in the BFMP. The BFMP should also specify management actions to be taken when biofouling is identified during inspections (e.g. cleaning), including changes to inspection frequency.

8.4 For ships not undertaking performance monitoring, the first inspection date should be within 12 months of application, reapplication, installation or renewal of AFS to confirm their effective operation.

8.5 Where monitoring indicates that the AFS is not performing effectively soon after application, reapplication, installation or renewal (e.g. increased fuel consumption), an inspection should be carried out to confirm the condition of the AFS and level of biofouling as soon as practical or possible, in line with the BFMP and contingency action plan. If adequate performance of the AFS is observed through monitoring, the inspection could be conducted up to 18 months after application, reapplication, installation or renewal, noting that such monitoring may not reflect the level of biofouling in all niche areas.

8.6 Subsequent inspections should occur at least every 12 to 18 months and may need to increase to confirm the continued effectiveness of ageing or damaged AFS. In-water inspections should seek to coincide with existing subsea operations (e.g. underwater inspections in lieu of dry-dock or any other in-water inspections), including any unscheduled subsea operations. If no AFS are installed in areas of a ship and no other measures are undertaken such as in-water cleaning or propeller polishing, then inspections should occur more frequently (<12 months) to manage the risk of biofouling accumulation.

8.7 In-water inspections should assess biofouling across the entirety of a ship's hull and niche areas. If high levels of biofouling are identified during an inspection and there are reasons to suspect issues with the AFS's effectiveness, actions should be taken to manage the biofouling and subsequent inspections should occur more frequently, for example biannually until dry-docking and recoating of AFC.

8.8 In-water inspections should determine the level of biofouling of the hull and niche areas and the condition of the AFS. The inspection areas should be subdivided into appropriate sections as listed in tables 4 and 5 of appendix 2. The fouling rating for each area on the ship should be the highest rating identified in the inspected areas.

8.9 The following should be investigated during the inspection:

.1 rating of the type and approximate extent of biofouling in line with the definitions in table 1 below;

.2 condition of the AFC on the hull and in niche areas as described in paragraph 8.7 using definitions in table 4; and

.3 functionality of the MGPS in niche areas.

Extent of biofouling and recommended actions

8.10 During an inspection, niche areas in the ship-specific BFMP should be inspected as a priority. All inspected areas should be allocated a fouling rating number in line with the extent of fouling as defined in table 1 below.

Table 1: Rating scale to assess the extent of fouling on inspection areas

<table>
<tr><th>Rating</th><th>Description</th><th>Macrofouling cover of area inspected (visual estimate)</th><th>Recommended cleaning</th></tr>
<tr><td>0</td><td>No fouling
Surface entirely clean. No visible biofouling on surfaces.</td><td>-</td><td>-</td></tr>
<tr><td>1</td><td>Microfouling
Submerged areas partially or entirely covered in microfouling. Metal and painted surface may be visible beneath the fouling.</td><td>-</td><td>Proactive cleaning may be recommended as further specified in paragraph 9.4.</td></tr>
<tr><td>2</td><td>Light macrofouling
Presence of microfouling and multiple macrofouling patches. Fouling species cannot be easily wiped off by hand.</td><td>1-15% of surface</td><td rowspan="3">Cleaning with capture is recommended as further specified in paragraph 9.9.

It is recommended to shorten the interval until the next inspection. If the AFS is significantly deteriorated, dry-docking with maintenance and reapplication of the AFS is recommended.</td></tr>
<tr><td>3</td><td>Medium macrofouling
Presence of microfouling and multiple macrofouling patches.</td><td>16-40% of surface</td></tr>
<tr><td>4</td><td>Heavy macrofouling
Large patches or submerged areas entirely covered in macrofouling.</td><td>41-100% of surface</td></tr>
</table>

Condition of the AFS

8.11 The condition of the AFS on the hull and in niche areas should be observed during the inspection and reported. Recommended action and relevant procedures for inspection of the AFS are described in tables 4 and 5.

Inspection report

8.12 An inspection report should be prepared and a copy should be available on board and listed/linked in the Biofouling Record Book (BFRB). For details on reporting on biofouling levels and AFS condition inspections, see appendix 2, tables 4 to 6.

9 CLEANING AND MAINTENANCE

9.1 Cleaning is an important measure to remove biofouling from the hull and niche areas, but may physically damage the AFC, shorten coating service lifetime and release harmful waste substances and invasive aquatic species into the environment.

9.2 Comprehensive testing of cleaning systems or processes is necessary to understand the cleaning performance, capture efficiency or any release of harmful waste substances as well as improve knowledge concerning the prevention of release of viable fragments, spores and other parts of biofouling organisms that have the potential to be invasive.

9.3 In-water cleaning is a complex activity to manage appropriately and international standards for the management of in-water cleaning may continue to be developed and published in a stand-alone document to the Guidelines.

Procedures for proactive cleaning

9.4 Proactive cleaning is the periodic removal of microfouling on ships' hull and niche areas or other submerged surfaces as relevant prior to macrofouling growth and can be conducted with or without capture. Proactive cleaning without capture should:

.1 not be conducted on biofouling with rating ≥2 in line with table 1; and

.2 be performed in an area accepted by the relevant authority for this activity.

9.5 Operators undertaking proactive cleaning should be aware of any local regulations or requirements. Regulations regarding the discharge of biofouling and waste substances into the marine environment and the location of sensitive areas (such as marine protected areas) may be relevant.

9.6 Procedures for proactive cleaning and frequency should be described in the BFMP. All proactive cleaning, and any determination of biofouling level prior to the cleaning, should be entered in the BFRB.

Procedures for reactive cleaning

9.7 Reactive cleaning systems physically remove micro- and macrofouling from the hull and niche areas. There are various reactive cleaning methods available and more under development.

9.8 Reactive cleaning should be conducted based on the inspection results and contingency actions as outlined in table 1, though cleaning with capture may be used to manage any rating level.

9.9 The reactive cleaning should:

.1 use a reactive cleaning system that is compatible with the AFC in order to minimize damage of the AFC;

.2 be conducted with the aim of achieving a fouling rating ≤1 for the cleaned area in line with table 1;

.3 strive for effective collection and safe disposal of all biofouling material and waste substances when reactive cleaning is performed in water or at dry dock; and

.4 be performed in an area accepted by the relevant authority for this activity.

9.10 Biofouling management in niche areas should include the following or similar adequate measures:

.1 maintenance of any MGPS installed to ensure they operate effectively to prevent accumulation of biofouling in relevant niche areas;

.2 regular polishing (with capture of debris) of uncoated propellers to maintain operational efficiency and minimize macrofouling accumulation;

.3 appropriate treatment of internal seawater cooling systems and discharge of any treated water in accordance with applicable regulations; and

.4 minimizing the use of any soap, cleaner or detergent used on surfaces and ensuring they are toxic- and phosphate-free, biodegradable and non-hazardous to the marine environment.

9.11 Operators undertaking in-water reactive cleaning should be aware of any regulations or requirements. Regulations regarding the discharge of biofouling and waste substances into the marine environment and the location of sensitive areas (such as marine protected areas) may be relevant.

9.12 Captured biological waste and waste substances should be disposed of and treated in a safe and environmentally sound manner, in accordance with local requirements.

9.13 A report on the cleaning should be prepared by the operators undertaking reactive cleaning. The report should have the content as described in appendix 2 and describe the cleaning outcome.

9.14 A copy of the cleaning report or similar outcome in a digital tool should be available on board and the activity entered in the BFRB.

Procedures for recycling facilities

9.15 Ship recycling facilities should adopt measures (consistent with applicable national and local laws and regulations) to ensure that biofouling organisms or waste substances are not released into the local aquatic environment.

9.16 Ship recycling facilities should develop a plan to minimize release of biofouling organisms and/or waste substances. If relevant, it is recommended that hull and niche areas be cleaned prior to recycling to avoid release of viable biofouling organisms or waste substances.

10 BIOFOULING MANAGEMENT PLAN

10.1 It is recommended that every ship have a ship-specific BFMP under the responsibility of shipowners, ship operators and shipmasters. A BFMP may require information from ship designers, shipbuilders, shipowners, AFC and MGPS manufacturers, recognized organizations and suppliers.

10.2 An effective BFMP should contribute to the aim of maintaining a recommended fouling rating ≤1, as described in chapter 8.

10.3 The ship-specific BFMP should include, but not necessarily be limited to, the following:

.1 identification of the officer, or the position (e.g. chief engineer), responsible for the BFMP, ensuring that the plan is properly implemented;

.2 details of the AFS installed and where it is installed;

.3 details of the recommended operating conditions which are suitable for the selected AFS to avoid deterioration of AFC, including recommended conditions such as temperature, salinity, speed;

.4 details of expected AFC efficacy throughout AFC lifetime including the need for inspection or maintenance, if relevant;

.5 description of monitoring on biofouling risk parameters;

.6 regime for cleaning, if any;

.7 details of hull and niche areas where biofouling may accumulate;

.8 schedule for fixed inspections of areas;

.9 procedures for reactive cleaning actions that should be performed if triggered by inspection results;

.10 contingency action plan based on specific triggers from monitoring of biofouling risk parameters;

.11 regime for repairs, maintenance and renewal of AFS, when relevant, in accordance with the manufacturer's instructions;

.12 process for monitoring and maintenance of MGPS as per the manufacturer's instructions to ensure their effectiveness in minimizing biofouling; and

.13 details of the documentation/reports required to document biofouling activities.

Continuous improvements

10.4 Information should be gathered to plan and facilitate efficient and sustainable biofouling management, allowing the evaluation and comparison of the cost-effectiveness of alternative strategies. The optimal solution is case-specific and should be considered in the light of several aspects.

10.5 Monitoring of the hull and the biofouling risk parameters may determine a risk of biofouling to be higher than predicted in the BFMP and therefore trigger more frequent inspections.

10.6 Inspection results may be shared in agreement with stakeholders involved if they are relevant for improvement purposes. To increase the efficiency of biofouling management and inspections, inspection organizations are encouraged to share inspection results with AFS manufacturers.

10.7 The effectiveness of the management actions in place should be reviewed following inspections and cleaning. The BFMP should be updated if the management actions in place are ineffective or deficient. Efficacy of the following items should be evaluated:

.1 ability to minimize biofouling by use of proactive cleaning methods;

.2 biofouling inspections schedule;

.3 ability to minimize biofouling by MGPS;

.4 AFS performance; and

.5 outcome of reactive biofouling management procedures:

.1 efficacy of the biofouling removal (i.e. no areas are missed); and

.2 accessibility for reactive cleaning in niche areas.

10.8 A form of a BFMP is set out in appendix 3 to these Guidelines.

11 BIOFOULING RECORD BOOK

11.1 The overall record-keeping of ship-specific biofouling management activities in a BFRB is the responsibility of shipowners, ship operators and/or shipmasters. The ship-specific BFRB should include information on biofouling management actions with input from AFS manufacturers and suppliers, ship cleaning and maintenance operators, inspection organizations, and ship repair and dry-docking facilities when relevant.

11.2 It is recommended that the BFRB be retained on board for the life of the ship. The book should record details and reports of all inspection and maintenance activities to be undertaken for all hull and niche areas. The BFRB may be maintained physically or electronically, and could be a stand-alone document, or integrated in part or fully into the existing ships' operational and procedural manuals and/or planned maintenance systems.

11.3 The BFRB should assist the shipowner and operator to evaluate the efficacy of the specific AFS and biofouling management measures on the ship.

11.4 All biofouling management activities should be recorded in a BFRB, including the following:

.1 details of repair and maintenance to the AFS including date, location and areas of the ship affected, including the percentage of the ship that was recoated with AFC – this is in addition to recordings in the International Anti-fouling System Certificate;

.2 details of repair and maintenance to the MGPS, including date, location and areas of the ship affected;

.3 the initial date, final date, duration in hours/days and location of in-water inspections, including the inspection report;

.4 the initial date, final date, duration in hours/days and location of cleaning (in water or in dry dock), including a cleaning report;

.5 details of when the ship has been operating outside its normal operating profile including any details of when the ship was laid up or inactive for extended periods of time;

.6 details of relevant performance monitoring parameters used to determine inspection intervals;

.7 a copy of the cleaning report including the information set out in appendix 2, if applicable; and

.8 description of contingency actions taken, including date, time and location.

11.5 A form of a BFRB is set out in appendix 4 to these Guidelines.

12 DOCUMENTATION AND DISSEMINATION OF INFORMATION

12.1 Documentation which is recommended in these Guidelines, such as relevant plans and reports, can be developed, maintained and kept in an electronic format.

12.2 States are encouraged to provide information on the location and the terms of use of proactive cleaning, inspection, reactive cleaning services and facilities to comply with these Guidelines. States requiring inspection or cleaning prior to arrival in their territory should inform the Organization. Member States or other relevant stakeholders are encouraged to communicate the outcome of testing of cleaning systems and applicable test standards to relevant stakeholders via https://bwema.org.

12.3 States are also encouraged to provide technical and research information to the Organization, including any studies on the impact and control of invasive aquatic species in ships' biofouling, information on local biofouling pressure, databases on regional biofouling management options, tools for the choice of AFS, and on the efficacy and practicality of in-water cleaning technologies, risk assessment tools and inspection reporting tools.

12.4 State authorities should provide ships with timely, clear and concise information on biofouling management measures and cleaning requirements that are being applied to shipping and ensure these are widely distributed. Shipowners and operators should endeavour to become familiar with all requirements related to biofouling by requesting such information from their port or shipping agents or competent authorities (i.e. State authorities).

12.5 Organizations or shipping agents representing shipowners and operators should be familiar with the requirements of State authorities with respect to biofouling cleaning and management procedures, including information that will be needed to obtain entry clearance. Verification and detailed information concerning State requirements should be obtained by the ship prior to arrival.

12.6 To monitor the effectiveness of these Guidelines as part of the evaluation process, States are encouraged to provide the Organization with records describing reasons why ships could not apply these Guidelines, e.g. design, construction or operation of a ship, particularly from the viewpoint of ships' safety, or lack of information concerning the Guidelines.

13 TRAINING AND EDUCATION

13.1 Training for ships' masters and crew, in-water cleaning or maintenance facility operators and those surveying or inspecting ships as appropriate should include instructions on the application of biofouling cleaning and management procedures, based upon the information contained in these Guidelines. Instruction should also be provided on the following:

.1 maintenance of appropriate records and logs;

.2 impacts of invasive aquatic species from ships' biofouling;

.3 benefits to the ship of managing biofouling and the threats posed by not applying management procedures;

.4 biofouling management measures and associated safety procedures; and

.5 relevant health and safety issues.

13.2 States and industry organizations should ensure that relevant marine training organizations are aware of these Guidelines and include them in their syllabuses as appropriate.

14 OTHER MEASURES

14.1 To the extent practical, States and port authorities should aim to ensure a smooth flow of ships going in and out of their ports to avoid ships waiting offshore, so that AFS can operate as effectively as possible.

14.2 States may apply other measures to ships within their jurisdiction for the purpose of providing additional protection for their marine environment, or in emergency situations. When managing emergency situations for biofouling, States may find the guidance document for ballast water emergency situations (BWM.2/Circ.17, as may be amended) also relevant to biofouling management.

14.3 States should consider these Guidelines when developing other measures and/or restrictions for managing ships' biofouling.

14.4 Where other measures are being applied, States should notify the Organization of the specific requirements, with supporting documentation, for dissemination to other States and non-governmental agencies where appropriate.

14.5 The application of other measures by States should not place the safety of the ship and crew at risk.

LIST OF APPENDICES

ABBREVIATIONS

AFS	Anti-fouling system
AFC	Anti-fouling coating
BFMP	Biofouling Management Plan
BFRB	Biofouling Record Book
IMO	International Maritime Organization
MGPS	Marine growth prevention system

APPENDIX 1

ASSESSMENT OF BIOFOULING RISK

1 Introduction

The Guidelines recommend taking a proactive approach to biofouling through assessment of biofouling risk profiles for hull and niche areas and by monitoring various risk parameters during operation. An assigned risk profile is dependent on AFS type and protection and should be ship-specific. Definition of risk monitoring parameters and trigger points for actions should also be ship-specific.

Monitoring various risk parameters during operation will lead to a holistic approach to biofouling management in line with a risk-based approach.

2 Identification of risk areas

Typical niche areas and other areas susceptible to biofouling on the hull are indicated in figure 2, but other niche areas may be relevant.

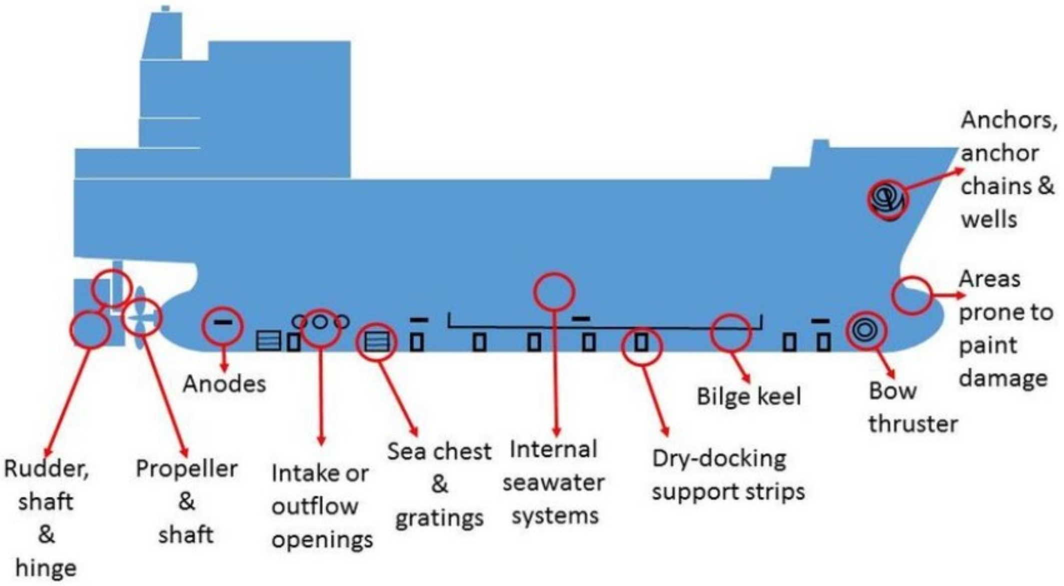

Figure 2: Hull with typical niche areas susceptible to biofouling (source: *Eugene, Conduct of land-based biofouling surveys for domestic vessels)*

3 Relevant parameters to be considered in the risk assessment

A ship-specific assessment should be established based on the possibility for biofouling accumulation. If any ship areas have no AFS installed, there is typically a higher risk of biofouling accumulation. If all ship areas have an AFS installed which is compatible with the ship's operating profile, the ship has an overall lower risk profile.

Based on the risk profile, an inspection regime should be determined and described in the BFMP. If the assessment determines that an area has a high risk for biofouling accumulation, an inspection regime with short intervals between inspections is recommended. Further, the areas with a low risk profile may follow the inspection regime with longer fixed intervals as specified in chapter 8 of the Guidelines.

The risk profile indicates the possibility of accumulating biofouling and increases as a function of biofouling pressure versus biofouling protection over time. The biofouling risk parameters given in table 2 should be monitored as the risk of biofouling accumulation may increase over time. When higher risk is identified, recommended actions in the form of inspection, reactive cleaning and/or maintenance of AFS should be performed as described in the BFMP. Inspection as a contingency action, if completed by an inspection organization in line with chapter 8, can be treated as a starting point to define the interval for the next inspection.

A hull performance monitoring system can be used to assess the changes in the propulsion power and fuel consumption of the ship. Such changes may indicate a degradation of hull or propeller condition due to biofouling.

The results from the hull performance monitoring may indicate biofouling growth on the hull and propeller; however, growth in niche areas will not necessarily be detected with this monitoring method.

Digital tools may be applied for monitoring of biofouling risk parameters. Monitoring of parameters should be as thorough as practicable.

In table 2 below, various biofouling risk parameters are presented with a description of possible risk impact.

Table 2: Biofouling risk parameters

	Examples of biofouling risk parameters	Description and evaluation guidance
1	**Deviation from AFS specifications (e.g. speed, salinity, temperature)**	An AFS/AFC can typically work well within a specific range of operating parameters. The relevant parameters and acceptable ranges for each parameter should be described in the manufacturer's specification and included in the BFMP. Specifications typically include operation routes, ship activity level, speed, water salinity and temperature and cleaning requirements. Specifications may vary depending on the technology of the AFS used. Ship operations should be in accordance with the recommendations from the AFC manufacturer. Deviation from the specification of the ship's AFC may increase the deterioration of the AFC or reduce its efficacy and change the biofouling risk. Incidental deviations should be evaluated for potential biofouling impact. Continuous or regular deviations, or deviations not rectified, would lead to an elevated risk profile and more frequent inspection should be part of the contingency plan.
2	**Deviation from AFS maintenance/service regime**	Regular maintenance and service (e.g. calibration or adjustment of treatment dosages for an MGPS) may be necessary actions for proper protection by the AFS. If the maintenance and service time is exceeded, as specified by the manufacturer, the risk profile is elevated. For maintenance of AFC, see item 7. Missing maintenance and/or service should be evaluated as part of the contingency plan for potential biofouling impact.
3	**Deviation from regular proactive cleaning or necessary reactive cleaning**	When proactive cleaning is part of the ship-specific BFMP, deviation from regular use as specified in the BFMP may lead to increased risk of biofouling growth onto relevant areas. The impact should be evaluated as part of the contingency action plan for potential biofouling impact until the missing proactive cleaning is back in regular operation. Ships should be aware of possible macrofouling accumulation and, if fouling rating is >1, cleaning with capture is the recommended cleaning action. If reactive cleaning is not conducted when inspection has determined cleaning is necessary, it will increase the risk of spreading organisms to new locations. This risk should be evaluated as part of the contingency plan until the next cleaning event is undertaken.
4	**Extended ship idle time**	Biofouling accumulation starts immediately when a ship is idle, but the rate depends on AFS type and biofouling pressure (temperature, distance to coast). To avoid risk of biofouling, the operating profile should only allow short periods in port or at anchorage or at least not exceed the recommendation by the AFS manufacturer. Acceptable idle time should be specified in the ship's BFMP. Idle time is often defined in charter party contracts and typically ranges between 18 to 30 days. If the idle time is longer than specified in the BFMP, the risk profile changes. If the number of consecutive idle days is still within what is specified as acceptable as per AFS supplier's guarantee and/or idling takes place in an area far from shore (>200 nm and >200 m depth), the risk may still be considered low. If the number of consecutive idle days is beyond what is specified as acceptable as per AFS supplier's guarantee, the risk may be considered very high if the ship is subject to biofouling pressure. For these cases, the contingency action plan should include immediate actions before the next voyage.

	Examples of biofouling risk parameters	Description and evaluation guidance
5	**Performance loss as per PMS**	Performance monitoring of fuel consumption may give indication on possible biofouling accumulation on the hull. Performance monitoring is mainly for hull monitoring (not niche areas) and may include the following methods: .1 Sensors and collecting high frequency data. .2 Semi-automatic or manual calculations using data collected by ship's crew (e.g. noon reports). .3 Speed trials and comparing the performance data with previous speed trial reports. Note that PMS is often a lagging indicator and may depend on many factors, therefore additional measures may be necessary before it can be used to determine biofouling accumulation. For some ships, a speed loss between 1% and 3% or increased fuel consumption of 3-9% may indicate light biofouling while a speed loss >3% or fuel consumption increase by >9% may indicate higher biofouling risk (examples taken from ISO 19030-2:2016).
6	**AFS damage**	Failure caused by mechanical damage to the AFS may result in higher risk of biofouling in the areas affected, if not rectified within reasonable time. Failures and damage should be recorded in the BFRB. As part of the contingency action plan, the impact from the damage should be evaluated for potential biofouling accumulation and relevant actions should be implemented until a repair is undertaken.
7	**Downtime/malfunction of MGPS, proactive cleaning or other AFS**	Observed downtime of an MGPS, proactive cleaning or other AFS have a direct impact on risk of biofouling accumulation. The impact on the area impacted will be affected depending on the duration of malfunction. The impact should be evaluated as part of the contingency plan for potential biofouling impact until the missing MGPS/proactive cleaning/other AFS is back in operation. Reduced operation time of proactive cleaning, i.e. longer intervals between cleaning than specified in the BFMP, is defined as downtime and may increase biofouling accumulation particularly in those areas where it is not applied as specified in the BFMP. The impact on the area affected depends on the duration of malfunction and the trading conditions during that time. The evaluation of impact and potential reactions should be part of the contingency plan. If proactive cleaning without capture is irregular, ships should be aware of possible macrofouling accumulation and take actions to avoid spread of macrofouling. If fouling growth exceeds fouling rating 1, cleaning with capture is recommended.
8	**Exceeding expected lifetime of AFS**	Once an AFS has exceeded its lifetime, as specified by the manufacturer, the biofouling risk profile is elevated. Inspection and cleaning should be performed more often and 1-2 months interval between inspections is recommended. Additionally, the efficacy of the AFS may be reduced as it approaches the end of its lifetime. If macrofouling has been removed in a previous cleaning event, the strong forces needed for removing the fouling can have compromised the lifetime of the AFC. The performance of the AFS, and any necessary change in maintenance or inspection schedule, as given by the AFS manufacturer, should be part of the contingency action plan specified in the BFMP.

4 Flow chart visualizing biofouling management

An example of a flow chart for visualizing biofouling management risk profile and monitoring of parameters is shown in figure 3.

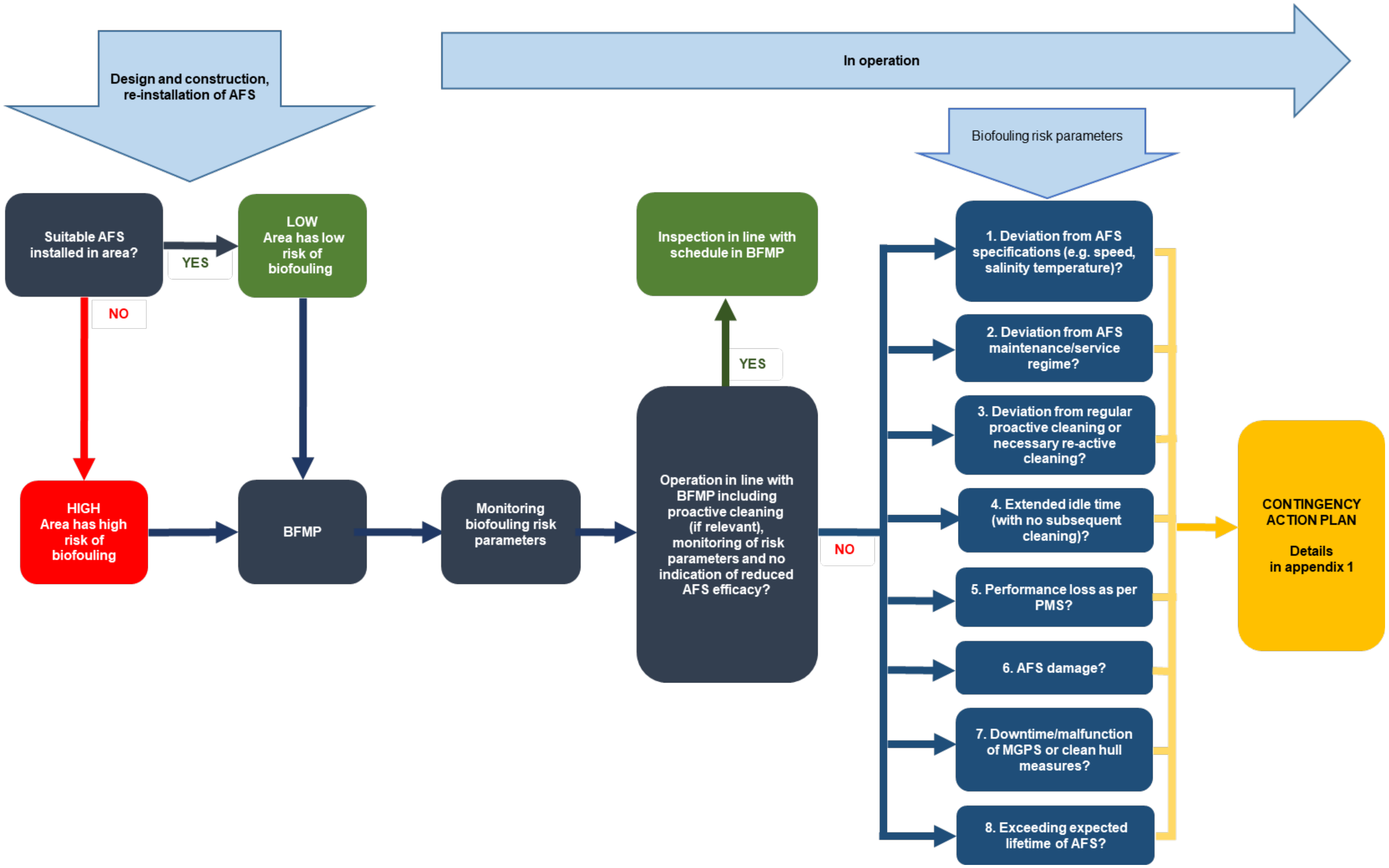

Figure 3: Flow chart visualizing the biofouling management risk profile and monitoring parameters

APPENDIX 2 INSPECTION AND CLEANING REPORTS

1 Introduction

The Guidelines recommend that a report should be prepared after an inspection and/or cleaning operation. The report should record the details of the biofouling management actions undertaken on the ship. The inspection report should be prepared by the inspection provider. It may also be relevant to prepare a report after an inspection carried out by ship's crew as part of contingency actions.

The cleaning report should be prepared by either the cleaning operators or the inspection provider as part of a combined cleaning and inspection report.

Digital tools may be applied for the reporting and/or assessment of results. The conclusions from the reports should be recorded in the BFRB including reference to the detailed report/assessment.

2 Entries in the report after a biofouling inspection

The following information should be recorded in the inspection report:

- Ship particulars:
  - ship name
  - IMO number
- Date and place of inspection
- Name of inspection/cleaning company
- List of all inspected hull and niche areas
- Inspection equipment used (including list of divers/ROV operators participating in the operation)
- Inspection conditions (i.e. duration, estimated visibility underwater)
- Signature of authorized person of the inspection/cleaning company
- Inspection start and end times
- Results:
  - Type of biofouling as per the rating in table 1
  - Quantitative assessments of biofouling cover of area inspected (i.e. estimates of per cent cover) as per table 1
- AFC condition
  - The condition of the AFC should be observed during the inspection and reported. The condition is recommended to be categorized in line with table 4
- MGPS condition
  - The condition of the MGPS should be observed during the inspection and reported. The condition is recommended to be categorized in line with table 5
- Photos/videos
  - Photos and videos submitted or used in a digital assessment tool as evidence of hull fouling

SAMPLE OF INSPECTION REPORT

Name of ship: ....

IMO number: ....

Date: ....

Location/port: ……………………………………………………………….

Inspection organization/responsible officer: ……………………………………………….

Inspection conditions: ……………………………………………………………………..

Inspection equipment used: ……………………………………………..……………….

Divers/ROV operators participating: ……………………………………………………….

Quantitative assessment of biofouling cover is summarized in table 3 (in line with the ratings in table 1)

Table 3: Quantitative assessment of biofouling cover

For each transect and niche area surveyed, the mode of the fouling rating (most frequent rating) and the range (lowest and highest rating) should be recorded. An average should not be used. If more than one of the same type of area is assessed, these should be recorded separately and each be given their own fouling rating.

Areas	**Fouling rating** (0-4)			**Macrofouling cover** (%)
	Lowest rating	Highest rating	Most frequent rating	
Hull below the waterline				
Port vertical side				
1 m wide belt				
1 m wide belt of subsection X				
1 m wide belt of subsection X				
Starboard vertical side				
1 m wide belt				
1 m wide belt of subsection X				
1 m wide belt of subsection X				
Flat bottom front				
1 m wide belt				
1 m wide belt of subsection X				
Flat bottom mid				
1 m wide belt				

Areas	**Fouling rating** (0-4)			**Macrofouling cover** (%)
	Lowest rating	Highest rating	Most frequent rating	
Hull below the waterline				
1 m wide belt of subsection X				
Flat bottom aft				
1 m wide belt				
1 m wide belt of subsection X				
Niche areas				
Bow subsection X				
Bow subsection X				
Bow thruster				
Bilge keels				
Sea chest gratings				
Location 1				
Location 2				
Stern				
Propeller and its shaft				
Rudder and rudder shaft				
Discharge pipes				
Rope guards				
Sounders/instruments				
Sacrificial anodes				
Internal seawater systems				
…..				
…..				

An area should be assigned a fouling rating equal to the highest rated 1 m^2 identified along the subdivided areas.

The inspection should be as comprehensive as practicable. The more subdivided areas that are inspected, the greater the certainty that the biofouling for the area is realistic. It is recommended that the identified niche areas should be in line with the BFMP.

The condition of the AFC and MGPS should be observed during the inspection and reported. The condition is recommended to be categorized in line with tables 4 and 5, respectively. If the condition of the AFC could only be thoroughly assessed after reactive cleaning, table 4 should be part of the cleaning report.

Table 4: The condition of the AFC

AFC condition								
Areas	**Intact and effective in preventing biofouling**	**Failure of adhesion between a coating and a metallic surface**	**Blistering in coating**	**Cracks in the coatings**	**Cold flow resulting in irregular coating thickness**	**Delamination / peeling / detachment between coatings**	**Polishing off coating during the ship's operation (beyond specifications)**	**Grounding / general damage to coating**
Hull below the waterline								
Port vertical side								
subsection X								
Starboard vertical side								
subsection X								
Flat bottom front								
subsection X								
Flat bottom mid								
subsection X								
Flat bottom aft								
subsection X								
Bow								
Bow thruster								
Bilge keels								
Sea chest gratings								
Location X								
Location X								
Stern								
Propeller and its shaft								
Rudder and rudder shaft								
Discharge pipes								
Rope guards								
Sounders/instruments								
Sacrificial anodes								
…								
…								

Table 5: The condition of the MGPS

Areas examples (typical niche areas)	Condition of MGPS		
	Intact and effective in preventing biofouling	Calibration/maintenance required	Non-effective to prevent biofouling
Bow			
Bow thruster			
Bilge keels			
Sea chest gratings			
Location 1			
Location 2			
Stern			
Propeller and its shaft			
Rudder and rudder shaft			
Discharge pipes			
Rope guards			
Sounders/instruments			

Comments: …………………………..………………………………………………………………………………………………

Reference to supporting photos/videos for fouling inspection and assessment of AFC/MGPS: …………………………………

Signature of inspection organization or competent ship's crew: ……………………..………………………...……………………

3 Entries in the report after biofouling management (reactive cleaning)

The following information should be recorded in the cleaning report:

- Ship particulars:
  - ship name
  - IMO number
- Date and place of inspection
- Name of cleaning company
- All hull and niche areas cleaned/treated specified and documented in the report, including also areas not cleaned/treated
- Cleaning equipment used for hull
- Cleaning equipment used for niche areas
- Inspection equipment used (including list of divers/ROV operators participating in the operation)
- Conditions during cleaning inspection (i.e. duration, estimated visibility underwater)
- Signature of authorized person of the cleaning company
- Cleaning start and end times
- Results:
  - Type of biofouling after reactive cleaning (as per the ratings in table 1)
  - Quantitative assessments of biofouling cover after cleaning (as per table 1)
- AFC condition (unless assessed during inspection)
  - The condition of the AFC should be observed during the cleaning activity and reported using the conditions as categorized in table 4
- Photos/videos
  - Photos and videos submitted or used in a digital assessment tool as evidence of hull cleaning
- Capture
  - Description of capture method
  - Supporting evidence that dislodged material (by mass) has been captured as described in chapter 9

  (Reference to equipment specification and validation test report may be sufficient)
- Treatment* and/or disposal of waste material captured during cleaning should be described in the report. Evidence of delivery to waste management facility(ies) should be attached to the cleaning report. The biofouling waste should be disposed of and/or treated in a safe and environmentally sound manner, in accordance with local regulations, and ensure that the main objective of the Guidelines, to minimize the spread of invasive aquatic species, is safeguarded.

* Treatment is any process designed to remove or deactivate any biofouling material and particulate or dissolved waste substances captured or produced during any stages of cleaning.

SAMPLE OF A BIOFOULING CLEANING REPORT

Name of ship: ....

IMO number: ....

Date: ....

Location/port: ……………………………………………………………

Cleaning company: …………………………………………………...

In-water conditions: ………………………………………………………..

Technologies used for reactive cleaning of hull and niche areas:
………
………

Table 6: Summary of the operations

Areas examples	**New fouling rating after performed cleaning**		
	Lowest rating	Highest rating	Most frequent rating
Hull below the waterline			
Port vertical side			
subsection X			
subsection X			
subsection X			
Starboard vertical side			
subsection X			
subsection X			
subsection X			
Flat bottom front			
subsection X			
subsection X			
Flat bottom mid			
subsection X			
subsection X			
Flat bottom aft			
subsection X			
subsection X			
Niche areas			
Bow			
Bow thruster			
Bilge keels			
Sea chest gratings			
Location 1			
Location 2			
Stern			
Propeller and its shaft			
Rudder and rudder shaft			
Discharge pipes			
Rope guards			
Sounders/instruments			
Sacrificial anodes			
Internal seawater systems			
….			
….			

Description of activity and reference to supporting evidence (photos/videos):

Description of capture and reference to supporting evidence:

Description of treatment and/or biofouling waste disposal with supporting evidence (e.g. receipts):

Description of any problems encountered during cleaning including details of any damage to the AFS that may have occurred:

Comments:

Signature of cleaning organization: …………………………………………………..……

APPENDIX 3

EXAMPLE FORM OF BIOFOULING MANAGEMENT PLAN

INTRODUCTION

Biofouling on ships can be a significant vector for the transfer of invasive aquatic species. Biofouling management practices may also improve a ship's hydrodynamic performance and can be effective at enhancing energy efficiency, hence reducing air emissions from ships as well as fuel costs.

This Biofouling Management Plan (BFMP) should assist the ship crew in conducting biofouling management and is specific to this ship.

SHIP PARTICULARS

Name of ship	
IMO number	
Date of construction	
Ship type	
Gross tonnage	
Beam or ship's breadth	
Length overall	
Maximum and minimum draughts	

RECORD OF REVISION OF THE BFMP

This plan describes the biofouling management for the period between two scheduled dry-dockings which include application, reapplication, installation or renewal of the AFS. The plan should be re-evaluated and, if necessary, updated after a dry-docking and/or if any changes are made that have an impact on the anticipated biofouling.

	Date:
Most recent scheduled dry-docking	
The next scheduled dry-docking	

The following revisions have been made:

Date/timeline	**Developed by**	**Implemented by/ responsible person**	**Updated parts**

INDEX

<A table of contents should be included.>

PURPOSE

The purpose of the BFMP is to outline measures for the control and management of the ship's biofouling to minimize the spread of invasive aquatic species.

DESCRIPTION OF OPERATING PROFILE

The ship's operating profile is described below and is the basis for the selection of the ship's anti-fouling systems (AFS) and operational practices.

Typical operating speed	
Typical trading areas	<EXAMPLE> <Domestic, great coasting, North Sea and Baltic trade, European trade, short international voyage, international voyage, overseas voyage or unrestricted voyages>
Typical operating areas, including climate zones in which the ship will operate	<EXAMPLE> <Temperate, semi-temperate, tropical and/or arctic>
Typical salinities of operating areas in which the ship will operate	<EXAMPLE> <Fresh water, brackish water and/or marine water>
AFS installed are suitable for typical operating profile (Y/N)	

DESCRIPTION OF HULL AND NICHE AREAS WHERE BIOFOULING MAY ACCUMULATE

The hull and niche areas where biofouling may accumulate are described below.

Areas on hull	<EXAMPLE> <flat-bottom- front flat-bottom- mid flat-bottom- aft bow dome boot top vertical sides – port side vertical sides – starboard side vertical side – aft transom or others>
Niche areas (including quantity where relevant)	<EXAMPLE> <Sea chests bow dome bow thruster tunnel tunnel grates cathodic protection anodes bilge keels anchor chain chain locker stabilizer fins rudder dock block positions A-brackets/stern tube cathodic protection anodes and systems draft internal pipework ballast uptake system inlet gratings sea inlet pipes stern thruster thruster body velocity probes propeller propeller shaft stern tube seal echo sounders rope guards box coolers moon pools free-flood spaces/voids engine cooling system fire-fighting system auxiliary service system or others>

LOCATION OF AREAS WHERE BIOFOULING MAY ACCUMULATE ON THE SHIP

<A diagram of both side and bottom of the ship identifying the location of each area that may accumulate biofouling should be included.>

DESCRIPTION OF APPLIED ANTI-FOULING SYSTEM

The selected AFS that are applied, reapplied, installed or renewed on the ship are described below. When more than one type of anti-fouling coating (AFC) or marine growth prevention system (MGPS) are applied, reapplied, installed or renewed, each AFS should be described individually and in accordance with each manufacturer's instructions.

Prior to a scheduled dry-docking, an evaluation of qualitative observations regarding the ship's biofouling should be made with the purpose of a potential improvement of the AFS selection. Previous reports on the performance of the ship's AFS should be part of the evaluation.

Manufacturer(s) and type(s) of AFC	<EXAMPLE> <Hard coating, self-polishing or fouling release, etc.>
Biocides in AFC	<EXAMPLE> <Copper oxide, zineb, etc.>
Dry film thickness	
Expected lifetime and, if any, expected reduction of efficiency of AFC	
Operating profiles which are suitable for the AFC including temperature, salinity, speed, periods of inactivity	
Recommended regime for repairs, maintenance and/or renewal to receive the AFC optimal performance	<EXAMPLE> <Regime for repairs> <Regime for maintenance> <Regime for renewal> <N/A>
Cleaning methods recommended for AFC	
Cleaning methods not appropriate for AFC, if any	
IAFS Certificate	

Manufacturer(s), models and type(s) of MGPS	<EXAMPLE> <Anode, ultrasound, electrode, electrolysis, ultraviolet radiation or other>
Type(s) of harmful discharge from MGPS	<EXAMPLE> <Chlorine, noise or other>

Operating conditions/frequency of use	<EXAMPLE> <dosing frequency temperature, salinity, speed>
Required maintenance and frequency	
Service life of MGPS	

Manufacturer(s), models and type(s) of other AFS	
Type(s) of harmful discharge from other AFS	
Operating conditions/frequency	
Required maintenance and frequency	
Service life and expiry date of AFS	

INSTALLATION OF ANTI-FOULING SYSTEM

The areas on the ship which are protected with the selected AFS are described below. If necessary, the individual AFS could be identified as A and B, respectively. Areas with no protection are also described.

AFS applied	Areas on ship where AFS is applied	Date of application	Recommended cleaning technique
<EXAMPLE> <AFC (A)>	<EXAMPLE> <flat-bottom- front, flat-bottom- mid, flat-bottom- aft, bow dome, boot top, vertical sides – port side, vertical sides – starboard side, vertical side – aft, transom, or others>		<EXAMPLE> <soft brush, blades, metal brushes or water jet>
<EXAMPLE> <MGPS (A)>	<EXAMPLE> <Sea chests, internal pipework, ballast uptake system, inlet gratings>		<EXAMPLE> <Steaming>
<EXAMPLE> <Other AFS>			
<EXAMPLE> <No AFS>			

INSPECTION SCHEDULE OF HULL AND NICHE AREAS

An inspection will be carried out by organizations or personnel competent to undertake inspections in line with the fixed intervals described below:

Inspection areas	Initial inspection	Subsequent inspections
<EXAMPLE> <Areas installed with AFS and operating within the profile>	<EXAMPLE> <Inspection within 12 months> <When utilizing a performance monitoring system that indicates adequate performance of the AFS, an inspection will be conducted within 18 months. If the monitoring indicates that the AFS is not performing effectively, an inspection should be carried out as soon as possible.>	<EXAMPLE> <If rating 0-1 in previous inspection, then inspection every 12-18 months If rating 2, 3 or 4 in previous inspection, then more frequent inspections>
<EXAMPLE> <Areas with no AFS and no other measures>	<EXAMPLE> <Inspection within 12 months>	<EXAMPLE> <Inspection more frequent>

CLEANING

Reactive cleaning should be performed as a result of any inspection with a fouling rating ≥2. It should be performed in line with procedures of the ship cleaning operator or the dry-dock facilities used, and the cleaning practices should be conducted in accordance with the jurisdiction's policies or regulations of the relevant authority. Preferred cleaning methods and procedures that can be used are described below. The methods and cleaning operator used in each cleaning occasion should be recorded in the BFRB.

Reactive cleaning method(s)	Areas where cleaning method will be applied	Operating condition when cleaning method will be applied	Cleaning schedule
<EXAMPLE> <Water jet and suction with capture in line	<EXAMPLE> <flat-bottom-front, flat-bottom-mid, flat-bottom-aft, bow dome,	<EXAMPLE> <moored in harbour, drifting in open sea, on anchorage	<EXAMPLE> <When recommended based on monitoring of biofouling parameters and/or

Reactive cleaning method(s)	**Areas where cleaning method will be applied**	**Operating condition when cleaning method will be applied**	**Cleaning schedule**
with <name of the standard>>	boot top, vertical sides – port side, vertical sides – starboard side, vertical side – aft, transom, or others>	in coastal waters, on voyage>	in case unforeseen biofouling levels are detected on hull or in niche areas>
<EXAMPLE> <Steaming with capture performed in line with <name of the standard>>	<EXAMPLE> <Sea chests, internal pipework, ballast uptake system, inlet gratings>	<EXAMPLE> <in dry dock>	<EXAMPLE> <When recommended based on monitoring of biofouling parameters and/or in case unforeseen biofouling levels are detected in niche areas>
Possible harmful discharge from cleaning with reactive cleaning method			
Manufacturer and model of ship-specific reactive cleaning device, if applicable			
Reactive cleaning method suitable for AFC			

Reactive cleaning method(s)	Areas where cleaning method will be applied	Operating condition when cleaning method will be applied	Cleaning schedule
Required maintenance and frequency, as applicable			
Reactive cleaning suitable for typical operating profile, i.e. is the ship expected to stay enough time in locations where reactive cleaning can be carried out			
Reactive cleaning device tested in line with <name of the standard> (Y/N), if applicable			

Proactive cleaning should take into account recommendations from the AFS manufacturer listed in this BFMP. Description of proactive cleaning activities which are planned on a regular basis, if any, are listed below.

Proactive cleaning method(s)	Areas where cleaning method will be applied	Operating condition when cleaning method will be applied	Cleaning schedule
<EXAMPLE> <ROV with water jet, ROV with soft brush,	<EXAMPLE> <flat-bottom-front, flat-bottom-mid, flat-bottom-	<EXAMPLE> <moored in harbour, drifting in open	<EXAMPLE> <every <XX> days when operating in temperate waters;

<table>
<tr><th>Proactive cleaning method(s)</th><th>Areas where cleaning method will be applied</th><th>Operating condition when cleaning method will be applied</th><th>Cleaning schedule</th></tr>
<tr><td>manual device with soft brush or other></td><td>aft, bow dome, boot top, vertical sides – port side, vertical sides – starboard side, vertical side – aft, transom, or others></td><td>sea, on anchorage in coastal waters, on voyage></td><td>every <XX> days when operating in tropical/semi-tropical waters;
when recommended based on monitoring of biofouling parameters; and
in case of unforeseen biofouling levels defined as rating 1 are detected on hull or in niche areas></td></tr>
<tr><td colspan="2">Possible harmful discharge from cleaning with proactive cleaning method</td><td colspan="2"><EXAMPLE>
<AFC biocides, biofouling, particles or other></td></tr>
<tr><td colspan="2">Manufacturer and model of ship-specific proactive cleaning device, if applicable</td><td colspan="2"></td></tr>
<tr><td colspan="2">Proactive cleaning method suitable for AFC</td><td colspan="2"></td></tr>
<tr><td colspan="2">Required maintenance and frequency, as applicable</td><td colspan="2"></td></tr>
<tr><td colspan="2">Proactive cleaning suitable for typical operating profile, i.e. is the ship expected to stay enough time in locations where proactive cleaning can be carried out</td><td colspan="2"></td></tr>
<tr><td colspan="2">Description of how to avoid biofouling cleaning and discharge of macrofouling, if possible</td><td colspan="2"></td></tr>
<tr><td colspan="2">Proactive cleaning device tested in line with <name of the standard> (Y/N), if applicable</td><td colspan="2"></td></tr>
</table>

MONITORING OF BIOFOULING RISK PARAMETERS AND CONTINGENCY ACTIONS

Relevant digital tools applied for monitoring of biofouling risk parameters and/or digitalized real-data input are <describe the tools and data used for this ship>.

The biofouling risk parameters given below should be monitored when the ship is in operation. When a parameter goes beyond the deviation limit, the risk of biofouling is increased, and the recommended contingency actions should be used as described.

Biofouling risk parameters to monitor	**Evaluation of a deviation including deviation limit of the risk parameter**	**Contingency actions**	**Long-term actions**
<EXAMPLE> <Deviation from speed specifications acceptable for the AFS>	<EXAMPLE> <Incidental deviations should be evaluated for potential biofouling impact. Continuous or regular deviations, or deviations not rectified, should lead to contingency actions>.	<EXAMPLE> <Shorter inspection interval with inspection every 4 months. When recommended by the AFS manufacturer, more frequent proactive cleaning activities could be implemented between inspections.>	<EXAMPLE> <Evaluate the need for a potential improvement of the AFS selection prior to the next dry-docking.>
<EXAMPLE> <Deviation from salinity specifications acceptable for the AFS>	<EXAMPLE> <Incidental deviations should be evaluated for potential biofouling impact. Continuous or regular deviations, or deviations not rectified, should lead to contingency actions.>	<EXAMPLE> <Shorter inspection interval with inspection every 4 months. When recommended by the AFS manufacturer, more frequent proactive cleaning activities could be implemented between inspections.>	<EXAMPLE> <Evaluate the need for a potential improvement of the AFS selection prior to the next dry-docking.>
<EXAMPLE> <Deviation from temperature range specifications acceptable for the AFS>	<EXAMPLE> <Incidental deviations should be evaluated for potential biofouling impact. Continuous or regular deviations, or deviations not rectified, should lead to contingency actions.>	<EXAMPLE> <Shorter inspection interval with inspection every 4 months. When recommended by the AFS manufacturer, more frequent proactive cleaning activities could be implemented between inspections.>	<EXAMPLE> <Evaluate the need for a potential improvement of the AFS selection prior to the next dry-docking.>

Biofouling risk parameters to monitor	**Evaluation of a deviation including deviation limit of the risk parameter**	**Contingency actions**	**Long-term actions**
<EXAMPLE> <Deviation from the maintenance/service regime of the AFC>	<EXAMPLE> <If the maintenance and service time, specified by the manufacturer, is exceeded, the risk of biofouling is elevated, and contingency actions should be implemented>.	<EXAMPLE> <An inspection should be carried out for the relevant area. Maintenance or repair should be performed at earliest possible opportunity.>	<EXAMPLE> <Regular maintenance and repair (e.g.) may be necessary actions for proper protection by the AFC. Evaluate the need to update maintenance programme.>
<EXAMPLE> <AFC damage>	<EXAMPLE> <Failure caused by mechanical damage to the AFC may result in higher risk of biofouling in the areas affected, if not rectified within reasonable time. The damage should be evaluated for potential biofouling accumulation.>	<EXAMPLE> <An inspection should be carried out for the relevant area. Repair should be performed at earliest opportunity. More frequent inspections of damaged area should be implemented until a repair is undertaken.>	
<EXAMPLE> <Deviation from the maintenance/service regime of the MGPS>	<EXAMPLE> <If the maintenance and service time, specified by the manufacturer, is exceeded, the risk of biofouling is elevated, and contingency actions should be implemented.>	<EXAMPLE> <An inspection should be carried out for the relevant niche area where MGPS is installed. Maintenance, calibration, or adjustment of treatment dosages for a MGPS should be performed at earliest possible opportunity.>	<EXAMPLE> <Regular maintenance and service (e.g.) may be necessary actions for proper protection by the AFS. Evaluate the need to update maintenance programme>

Biofouling risk parameters to monitor	**Evaluation of a deviation including deviation limit of the risk parameter**	**Contingency actions**	**Long-term actions**
<EXAMPLE> <Downtime/malfunction of MGPS>	<EXAMPLE> <Observed downtime of an MGPS could have a direct impact on risk of biofouling accumulation. The impact will depend on the duration of malfunction and operating areas (coastal area).>	<EXAMPLE> <More frequent inspections of relevant area should be implemented until the MGPS is back in operation.>	
<EXAMPLE> <Downtime/malfunction of other AFS>	<EXAMPLE> <Reduced operation time of other AFS may increase biofouling accumulation in areas where it is usually applied.>	<EXAMPLE> <More frequent inspections of relevant area should be implemented until the AFS is back in operation.>	
<EXAMPLE> <Exceeding expected lifetime of AFS>	<EXAMPLE> <Once an AFS has exceeded its lifetime, as specified by the manufacturer, the biofouling risk is increased.>	<EXAMPLE> <More frequent inspections should be implemented until the AFS is back in operation.>	<EXAMPLE> <The performance of the AFS, and any necessary change in maintenance or inspection schedule, based on experience, should be included in the next update of this BWMP.>
<EXAMPLE> <Deviation from regular proactive cleaning>	<EXAMPLE> <When proactive cleaning is implemented as part of the AFS, deviation from regular use could lead to increased risk of biofouling growth onto relevant submerged areas.>	<EXAMPLE> <An inspection should be carried out. If there is macrofouling (fouling rating≥2) in the relevant area, reactive cleaning with capture should be performed before	<EXAMPLE> <Regular maintenance and repair (e.g.) may be necessary actions for proper protection by the proactive cleaning.

Biofouling risk parameters to monitor	Evaluation of a deviation including deviation limit of the risk parameter	Contingency actions	Long-term actions
		proactive cleaning is used again. Maintenance or repair should be performed at earliest possible opportunity. More frequent inspections should be implemented until the missing proactive cleaning is in regular use.>	Evaluate the need to update maintenance programme.>
<EXAMPLE> <Deviation from necessary reactive cleaning>	<EXAMPLE> <If reactive cleaning is not conducted as scheduled or after an inspection has determined that reactive cleaning is necessary, it will increase the risk of spreading organisms to new locations.>	<EXAMPLE> <Prior to departure reactive cleaning should be performed, to avoid risk of spreading invasive aquatic species. If no reactive cleaning is performed prior to departure, a reactive cleaning activity should be scheduled at earliest possible opportunity. If no reactive cleaning is performed, an acceptance could be required to arrive in the next port. Contact next port for further advice.>	<EXAMPLE> <More frequent reactive cleaning may be necessary actions for proper biofouling management. Evaluate the need to update the cleaning schedule.>
<EXAMPLE> <Extended ship idle time (berthed, anchored, moored)>	<EXAMPLE> <If the idle time is longer than estimated in the ship's operating profile, it could lead to	<EXAMPLE> <If the idle time is within the guarantee of the AFS supplier, a short voyage with speed as specified for AFS could be	EXAMPLE> <Evaluate the need for a potential improvement of the AFS selection prior

Biofouling risk parameters to monitor	**Evaluation of a deviation including deviation limit of the risk parameter**	**Contingency actions**	**Long-term actions**
	an elevated risk of biofouling. If the idle time is beyond the guarantee of the AFS supplier, the risk of biofouling accumulation increases. The risk also depends on biofouling pressure, e.g. temperature and distance to the coastline. If ship is idle in an area far from shore (>200 nm and >200 m depth) and far from other installations, the risk may still be considered low.>	conducted, sea chests could be blanked off or, when recommended by the AFS manufacturer, more frequent proactive cleaning activities could be implemented. If the idle time is beyond the guarantee of the AFS supplier, an inspection should be carried out.>	to the next dry-docking.>
<EXAMPLE> <Performance loss as per Performance Monitoring System>	<EXAMPLE> <Performance monitoring may detect biofouling growth on hull, but not necessarily in niche areas. Performance monitoring of fuel consumption may give indication on possible biofouling accumulation on the hull and may include the following methods: .1 Sensors and collecting high-frequency data. .2 Semi-automatic or manual	<EXAMPLE> <When the data show a trend in performance loss over time, the time since last cleaning activity in combination with operating profile should be evaluated to determine if an inspection should be carried out.>	<EXAMPLE> <Experience from fuel consumption and cleaning activity over time may lead to optimization and changes to the cleaning schedule.>

Biofouling risk parameters to monitor	**Evaluation of a deviation including deviation limit of the risk parameter**	**Contingency actions**	**Long-term actions**
	calculations using data collected from ship's crew (e.g. noon reports). .3 Speed trials and comparing the performance data with previous speed trial reports. <Percentage of the speed loss and percentage of increased fuel consumption, that may indicate light biofouling on the ship>.>		
<EXAMPLE> <Downtime/malfunction of proactive cleaning >	<EXAMPLE> <When proactive cleaning is implemented as part of the AFS, long periods of downtime could lead to increased risk of biofouling growth.>	<EXAMPLE> <More frequent inspections of relevant area should be implemented until the proactive cleaning is back in operation. Maintenance or repair should be performed at earliest possible. If macrofouling accumulation is found (fouling rating ≥2), reactive cleaning with capture should be conducted before the proactive cleaning is put into service again.>	<EXAMPLE> <Regular maintenance and repair (e.g.) may be necessary actions for proper protection by the proactive cleaning. Evaluate the need to update maintenance programme.>

CAPTURE AND DISPOSAL OF WASTE

In-water reactive cleaning companies should arrange for capture of debris during cleaning. The biofouling waste should be disposed of and/or treated in a safe and environmentally sound manner, in accordance with local regulations, to ensure that the main objective of the Guidelines, to minimize the transfer of invasive aquatic species, is safeguarded.

Documenting evidence of collection/delivery of the wastes (a receipt) will be appended to the BFRB.

SAFETY PROCEDURES FOR THE SHIP AND THE CREW

<Details of specific operational or safety restrictions associated with the AFC or MGPS systems that affect the ship and/or the crew.

Details of specific safety procedures to be followed during ship inspections and cleaning operations.>

CREW TRAINING AND FAMILIARIZATION

<Information on the provision of crew training and familiarization on biofouling management.

Detailed description of how inspections are to be carried out by ship crew as part of contingency actions.>

APPENDIX 4

EXAMPLE FORM OF BIOFOULING RECORD BOOK

PART I – Biofouling management activities

Name of ship: ....

IMO number, distinctive numbers or letters:..

Gross tonnage: ....

Period from:...................... to: ....

Note:

Biofouling Record Book Part I should be provided to every ship with a Biofouling Management Plan (BFMP), to record relevant biofouling activities such as inspections, maintenance and cleaning activities. Biofouling Record Book Part II should also be provided to record when the ship has a higher risk of biofouling accumulation and related contingency actions.

1 Introduction

The following pages of this section show a comprehensive list of items of biofouling management activities which are, when appropriate, to be recorded in Biofouling Record Book Part I. Management of biofouling should be in line with an approved Biofouling Management Plan (BFMP) and take into account guidelines developed by the Organization. The items have been grouped into operational sections, each of which is denoted by a letter code.

When making entries in Biofouling Record Book Part I, the date, operational code and item number should be inserted in the appropriate columns and the required particulars should be recorded chronologically in the blank spaces. Each completed operation should be signed for and dated by the officer or officers in charge. The master of the ship should sign each completed page.

The use of an electronic record book to record activities is an alternative method to a hard copy record book. Electronic recording and reporting should be encouraged as it may have many benefits and may allow ships to utilize their technology to reduce administrative burdens and contribute to onboard environmental initiatives, e.g. reduction of paper use. In case electronic recording is to be used, resolution MEPC.312(74) may be used for guidance.

Biofouling Record Book Part I contains many references to observations regarding fouling rating. These observations may be included in separate reports including observations of subsections and corresponding photos/video. The entries in Biofouling Record Book Part I may be a summary only including a conclusion on whether the activity is in line with the BFMP. Biofouling Record Book Part I should be kept on board the ship in a place where it is readily available for inspection at all reasonable times and for the life of the ship.

Any inspection of Biofouling Record Book Part I should be performed as expeditiously as possible without causing the ship to be unduly delayed.

LIST OF ITEMS TO BE RECORDED

(A) Proactive cleaning

1 Date and location of ship when proactive cleaning occurred.

2 General observations with regard to biofouling prior to cleaning, if any (i.e. extent of microfouling and macrofouling in line with the defined ratings).

3 Records of permits required to undertake in-water proactive cleaning, if applicable.

4 Details of hull and niche areas cleaned.

5 General observations with regard to biofouling after the cleaning, if any (i.e. extent of microfouling and macrofouling in line with the defined ratings).

6 Reference to any supporting evidence/reports of the cleaning (e.g. report from supplier, photographs/videos and/or receipts), if any.

7 Method, manufacturer and model of proactive cleaning method used, if not given in BFMP.

8 Reference to test standard for which the method has been tested, if not given in BFMP.

9 Name, position and signature of the person in charge of the activity.

(B) Inspection

1 Date and location of inspection.

2 Methods used for inspection (including inspection tools/devices).

3 Areas inspected of the ship.

4 Observations with regard to biofouling (extent of microfouling and macrofouling in line with the defined fouling rates).

5 Observations with regard to anti-fouling system (AFS) condition.

6 Reference to any supporting evidence/reports of the inspection.

7 Name, position and signature of the person in charge of the activity.

(C) Reactive cleaning

1 Date and location of ship when cleaning occurred.

2 Records of permits required to undertake in-water cleaning, if applicable.

3 Description of hull and niche areas cleaned.

4 Methods of reactive cleaning used.

5 Estimation of overall biofouling after cleaning in line with the defined fouling rates.

6 Reference to any supporting evidence/reports of the activity.

7 Receipt or other documenting evidence of collection/delivery of the wastes.

8 Name, position and signature of the person in charge of the activity.

9 Manufacturer and model of cleaning and capture device as well as cleaning company executing the cleaning.

10 Reference to test standard for which the method has been tested, if relevant.

(D) Additional operational procedures and general remarks

Name of ship ....

IMO number, distinctive numbers or letters ....

BIOFOULING MANAGEMENT ACTIVITIES

Date	Code (letter)	Item (number)	Record of activity / signature of officer in charge

Signature of master ....

PART II – Monitoring of biofouling risk parameters

Name of ship: ....

IMO number, distinctive numbers or letters:...

Gross tonnage: ....

Period from:.................. to: ....

Note:

Biofouling Record Book Part II should be provided to every ship with a Biofouling Management Plan, to record when the ship is at higher risk of biofouling accumulation given by monitoring of biofouling risk parameters. Relevant contingency actions should also be recorded.

1 Introduction

The following pages of this section show a comprehensive list of risk parameters to be monitored and recorded in Biofouling Record Book Part II whenever the risk is increased according to the BFMP. The items have been grouped into sections, each of which is denoted by a letter code.

When making entries in Biofouling Record Book Part II, the date, code and item number should be inserted in the appropriate columns and the required particulars should be recorded chronologically in the blank spaces. Each completed operation should be signed for and dated by the officer or officers in charge. The master of the ship should sign each completed page.

The use of an electronic record book to record when the ship is subject to higher risk of biofouling accumulation is an alternative method to a hard copy record book. Electronic recording and reporting should be encouraged as it may have many benefits and may allow ships to utilize technology to monitor the risk parameters as defined in the BFMP. This may reduce administrative burdens and contribute to better surveillance of potential risk. In case electronic recording is to be used whenever the ship has higher risk, resolution MEPC.312(74) may be used for guidance.

Biofouling Record Book Part II may contain many references to contingency actions. When actions include inspection, maintenance and/or cleaning, these may be recorded in Biofouling Record Book Part I.

Biofouling Record Book Part II should be kept on board the ship in a place where it is readily available for inspection at all reasonable times and for the life of the ship.

Any inspection of Biofouling Record Book Part II should be performed as expeditiously as possible without causing the ship to be unduly delayed.

LIST OF ITEMS TO BE RECORDED

(A) When the ship operates outside the expected operating profile specified in the BFMP (e.g. speed, temperature or salinity)

1 Duration and dates when ship is not operating in line with its BFMP.

2 Reason for departure from normal operation.

3 Contingency actions taken to minimize biofouling accumulation (e.g. more frequent inspections) taken in the period when the ship is operating outside the expected operating profile.

4 Time and location (port name or latitude/longitude) when the ship operates again as specified in the BFMP.

(B) Maintenance/service or damage to AFC

1 Date/period and description of any observed reduction of the efficacy, damage or deviation from maintenance/service to anti-fouling coating (AFC) during its lifetime.

2 Date/period and description of any operation beyond expected lifetime.

3 Contingency actions taken to minimize biofouling accumulation (e.g. more frequent inspections).

4 Date/period and location where any AFC maintenance or repair was performed (e.g. in dry dock).

5 Description of any AFC, including patch repairs, that was applied during maintenance. Detail the type of AFC, the area and locations it was applied to (including the location of dry-dock support blocks if relevant), an estimated percentage cover of reapplication of the AFC, the coating thickness achieved and any surface preparation work undertaken (e.g. complete removal of underlying AFC or application of new AFC over the top of existing AFC).

6 Reference to any supporting data for AFC maintenance (e.g. AFC technical file).

7 Name, position and signature of the person in charge of the activity.

(C) Maintenance/service or downtime/malfunction of MGPS

1 Date/period and description of any observed reduction of the efficacy, downtime, malfunction or deviation from maintenance/service of marine growth prevention system (MGPS) during its lifetime.

2 Date/period and description of operation beyond the expected lifetime.

3 Date and location of any instances when the system was not operating in line with the BFMP.

4 Records of maintenance (including regularly monitoring the electrical and mechanical functions of the systems, calibration, or adjustment of treatment dosages).

5 Contingency actions taken to minimize biofouling accumulation (e.g. more frequent inspections).

6 Name, position and signature of the person in charge of the activity.

(D) Maintenance/service or downtime/malfunction of other AFS

1 Date/period and description of any observed reduction of the efficacy, downtime, malfunction or deviation from maintenance/service of other AFS during its lifetime.

2 Date/period and description of operation beyond expected lifetime.

3 Date and location of any instances when the system was not operating in line with the Biofouling Management Plan.

4 Records of maintenance.

5 Contingency actions taken to minimize biofouling accumulation (e.g. more frequent inspections).

(E) Deviation from regular use of expected proactive cleaning as specified in the BFMP

1 Date and location where ship did not conduct proactive cleaning as specified.

2 Contingency actions taken to minimize biofouling accumulation (e.g. inspections of biofouling and/or reactive cleaning before return to proactive cleaning activity).

3 Records of maintenance, if any.

4 Date when ship returned to normal activities with proactive cleaning.

(F) Deviation from necessary reactive cleaning as specified in the BFMP

1 Date and location where ship was inspected and reactive cleaning found necessary.

2 Contingency actions taken until reactive cleaning, including scheduling of reactive cleaning activity.

3 Date when ship completed the reactive cleaning and reference to relevant recording in Part I.

(G) When the ship is idle (berthed, anchored, moored) for a longer period

1 Date and location where ship was laid up, including general description of biofouling pressure, e.g. temperature and distance to the coastline.

2 Contingency actions taken to minimize biofouling accumulation (e.g. inspections, sea chests blanked off or short voyages taken prior to and following the period laid up).

3 Precautions taken to minimize biofouling accumulation (e.g. short voyage).

4 Date when ship returned to normal operations.

(H) When the ship has performance loss as per Performance Monitoring System for a period beyond the expected period as specified in the BFMP

1 Date and location where ship started with performance loss beyond the expectations.

2 Inspections or biofouling management actions taken prior to and following the period with performance loss.

3 Contingency actions taken to minimize biofouling accumulation.

4 Date when ship returned to normal performance.

(I) Other deviations

Name of ship ....

IMO number, distinctive number or letters ....

BIOFOULING MANAGEMENT ACTIVITIES

Date	Code (letter)	Item (number)	Record of risk / signature of officer in charge

Signature of master ....

***

ANNEX 5

DRAFT MEPC RESOLUTION

2023 GUIDELINES FOR THERMAL WASTE TREATMENT DEVICES

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 from ships,

RECALLING ALSO that, at its fifty-eighth session, the Committee adopted, by resolution MEPC.176(58), a revised MARPOL Annex VI, which mentions in paragraph 5.2 of regulation 16 that this regulation should not preclude the development, installation and operation of alternative design shipboard thermal waste treatment devices that meet or exceed the requirements of this regulation,

NOTING that regulation 4 of MARPOL Annex VI allows the use of alternative compliance methods at least as effective in terms of emissions reductions as those required by the Annex,

RECOGNIZING the need to develop guidelines for the use of thermal waste treatment devices as alternative methods to comply with the standards set forth in regulation 16 on shipboard incineration,

HAVING CONSIDERED, at its eightieth session, *2023 Guidelines for Thermal Waste Treatment Devices* (hereinafter referred to as the "2023 TWTD Guidelines"), prepared by the Sub-Committee on Pollution Prevention and Response at its tenth session,

1 ADOPTS the 2023 TWTD Guidelines, as set out in the annex to the present resolution;

2 INVITES Administrations to take the annexed Guidelines into account in developing provisions for regulating the use of thermal waste treatment devices as equivalent means of compliance in accordance with regulation 4 of MARPOL Annex VI;

3 REQUESTS Parties to MARPOL Annex VI and other Member Governments to bring the 2023 TWTD Guidelines to the attention of shipowners, ship operators, shipbuilders, marine equipment manufacturers and any other interested groups;

4 AGREES to keep these Guidelines under review in light of experience gained with their application.

ANNEX

2023 GUIDELINES FOR THERMAL WASTE TREATMENT DEVICES

Contents:

1 Introduction

1.1 These Guidelines cover the approval, certification and in-service controls applicable to thermal waste treatment devices (TWTD) as equivalent means, under regulation 4 of MARPOL Annex VI, to incinerators as covered by regulation 16 of that annex and as specifically provided for by paragraphs 1 and 5.2 of that regulation.

1.2 These Guidelines, as directed by PPR 6, are written on the basis of a technology-neutral, goal-based approach that can be applied to any thermal waste treatment device using, for example, gasification, hydrothermal carbonization, pyrolysis, plasma or other thermal means for the disposal of permitted garbage and other shipboard wastes generated during a ship's normal service.

1.3 As an alternative to conventional incinerators, as a means of disposal of garbage and other shipboard wastes, these thermal waste treatment devices remain subject to the same prohibitions as to those materials which are not to be so disposed of as given in regulation 16.2 of MARPOL Annex VI.

1.4 A TWTD certified in accordance with these Guidelines should meet Performance Level 1 in terms of emissions to air which is comparable to the emission limit requirements given in the *2014 Standard specification for shipboard incinerators* (resolution MEPC.244(66), as amended) – this Performance Level should be demonstrated by in-service emission measurements. Where there is a related water discharge to sea, that also should be controlled as given in these Guidelines.

1.5 Additionally, an applicant may request certification to Performance Level 2. In that case not only should the Performance Level 1 requirements be met but there are detailed additional testing requirements which should be met prior to approval as an equivalent means together with tighter in-service emission limits.

2 General – Basis of these Guidelines

2.1 In order to be "technology-neutral" these Guidelines follow a goal-based approach, the basis of which is:

.1 the in-service monitoring and recording of specified emissions;

.2 the identification of relevant Functional Objectives; and

.3 the applicant-proposed/demonstrated resolution of each Functional Objective by means of an applicant-compiled Thermal Waste Treatment Device Technical Report. The aspects which should be covered as part of that TWTD Technical Report may include, but are not limited to, the items listed in table 2 as given in these Guidelines.

2.2 The TWTD Technical Report should be assessed for completeness in respect of the Functional Objectives by the reviewing Administration and further developed by the applicant as considered necessary by the Administration together with such physical surveys as required of the device in production and, as a unit, as installed and in operation. This TWTD Technical Report should thereafter form the basis of the overall approval package of that thermal waste treatment device as an equivalent means to incineration for permitted onboard garbage and waste disposal. Thereafter individual unit certification should be in accordance with the procedures as agreed in respect of the related Functional Objective – Unit certification resulting in the issue to each unit of a TWTD Certificate, the form of which is given in the annex, and the approval of that unit's TWTD File.

2.3 These Guidelines cover only the MARPOL Annex VI, prevention of air pollution, aspects related to the use of TWTD. The manufacturer, installer, shipowner and others, as applicable, are responsible for ensuring that all other relevant statutory requirements, together with relevant classification requirements, are complied with as and where appropriate.

2.4 These Guidelines may involve hazardous materials, operations and equipment. These Guidelines do not purport to address the safety aspects associated with the use of thermal waste treatment devices. It is the responsibility of the user of these Guidelines to establish appropriate safety and health practices and determine the applicability of regulatory and classification limitations prior to use, including possible port State limitations.

3 Definitions

Table 1: Definitions

Applicant	This may be the device manufacturer or another party – in all cases the applicant is responsible for providing the required information, performance testing (where required) and subsequent required ongoing support of the certification
Carbon monoxide (CO)	Controlled as an indicator of incomplete oxidation of waste material – otherwise as per the NO_x Technical Code 2008
Event Record Points	Events to be recorded for the purpose of reflecting compliant operation of the device as installed
Functional Objectives	These are the objectives which should be met in order that the thermal waste treatment device is designed, manufactured, installed, operated, maintained and serviced such that the required emission performance is achieved and that as an equivalent means other uncontrolled pollution streams are not generated
PAH	Polycyclic Aromatic Hydrocarbons – expressed in terms of phenanthrene equivalent as defined in the *2021 Guidelines for Exhaust Gas Cleaning Systems* (resolution MEPC.340(77))
Performance Level 1	See section 4.1.1 for the requirements for Performance Level 1. This performance level, where limited, is comparable to the existing requirements for incinerators (resolution MEPC.244(66), as amended) but as appropriate to in-service monitoring applied on a continuous basis to a thermal waste treatment device
Performance Level 2	Requirements set out in section 4.1.2. This level has tighter emission to air limits than Performance Level 1. The report from that testing should be included in the TWTD Technical Report
Sewage sludge	Material from the ship's sewage system which would include, but not be limited to, de-watered sewage prior to treatment or the residues from a sewage treatment plant
Supporting information annex	Commercially sensitive material submitted to the approving Administration covering detailed aspects of the TWTD Technical Report, which should not be circulated outside that Administration
Thermal waste treatment device (TWTD)	A device for disposing, by thermal action, of onboard generated garbage other than by use of an incinerator as defined by paragraph 2.2 of the *2014 Standard specification for shipboard incinerators* (resolution MEPC.244(66), as amended). The thermal waste treatment device includes the waste reduction unit itself together with all other necessary support systems and equipment

TWTD File	The document prepared by the applicant for each certified thermal waste treatment device and approved by the Administration. The TWTD File should be retained on board with the device during its service life. The TWTD File details the device and how it is to be surveyed or inspected
TWTD Operating Manual	The document supplied with the thermal waste treatment device describing to the user how the device is to be installed, operated, maintained and serviced
TWTD Technical Report	The document prepared by the applicant detailing how the Functional Objectives are met. The TWTD Technical Report would form part of the information supplied to the Organization by the Administration of a Party approving a thermal waste treatment device as an equivalent means in accordance with the requirements of regulation 4 of MARPOL Annex VI
UTC	Universal Time Coordinated

4 Emission limits

4.1 Discharges to air

This section does not apply to systems which do not generate any emissions to air, such as hydrothermal carbonization (HTC).

4.1.1 Performance Level 1

4.1.1.1 A TWTD certified under these Guidelines should not exceed the following in-service maximum emission limits:

CO 185 ppm (dry basis) at 11.00% O_2 – averaged over each UTC three-hour period

Soot number maximum average: Bacharach 3 or Ringelman 1 (20% opacity) (A higher soot number is acceptable only during very short periods such as starting up)

4.1.1.2 CO should be measured in accordance with section 6.4 of the NO_x Technical Code 2008 (direct measurement and monitoring) and should be monitored at a frequency of not less than 0.05 Hz.

4.1.1.3 Oxygen content, temperature and pressure profiles, as applicable, through the TWTD should be monitored and controlled in accordance with the relevant Functional Objective.

4.1.2 Performance Level 2

4.1.2.1 Where requested by the applicant, the TWTD may additionally be certified as meeting Performance Level 2. This involves a detailed pre-certification test together with in-service emission limits which are tighter than those of Performance Level 1.

4.1.3 Pre-approval Test

4.1.3.1 As part of the initial approval process for Performance Level 2 as an equivalent means, the TWTD model should be subject to a Pre-approval Test.

4.1.3.2 The Pre-approval Test should be of 6 to 8 hours duration with the TWTD in its operating condition.

4.1.3.3 Pre-approval Test emission limit values are given on a dry basis, other than for HC which is measured on a wet basis, at 11.00 % O_2 concentration and at 273 K, 101.3 kPa:

Pre-approval Test

Species	**Limit**	**Test Method**
CO	50 ppm	NTC **
NO_x	100 ppm – as NO_2	NTC **
HC	15 ppmC_1	NTC **
Particulate matter	10 mg/m^3	US EPA Method 5
Hydrogen Chloride (HCl)	10 mg/m^3	US EPA Method 26/26A
Dioxins and Furans*	0.1 ng/m^3	US EPA Method 1613B

In addition oxygen, temperature and pressure profiles, as applicable, through the device should be monitored over the duration of the test period and given in the test report.***

* as listed and with equivalency calculated in accordance with EU Directive 2010/75/EU Annex-VI Part 2

** in accordance with the NO_x Technical Code 2008 chapter 5

*** oxygen content, temperature and pressure, as applicable, should be measured in accordance with NO_x Technical Code 2008 chapter 5

4.1.3.4 Pre-approval Test procedures:

.1 testing should be undertaken while operating with a) sludge oil (if applicable to the TWTD system) and b) solid waste compositions both as given in paragraph 1 of appendix IV to MARPOL Annex VI;

.2 sampling position should be after any exhaust gas treatment components, such as water washing, but prior to any dilution of that exhaust gas;

.3 CO, NO_x and HC should be monitored at a frequency of not less than 0.05 Hz over the duration of each test and those readings averaged to give the result to be compared to the respective limit value;

.4 CO and NO_x limits are given on a dry basis. Consequently, if these are measured on a wet basis, those findings should be converted to dry basis reading using a concurrently measured water vapour content in order to determine the relevant dry/wet correction factor (concentration, dry = concentration, wet/exhaust gas non-water fraction);

.5 correction to reference 11.00% O_2 should be on the basis of:

$C_{reference} = C_{measured}$ x (20.95 - O_2 measured) / (20.95 – 11.00);

.6 oxygen content, temperature and pressure, as applicable, profiles through the TWTD should be monitored over the duration of each test for conformity with the required values as given by the relevant Functional Objective;

.7 not less than three separate HCl and particulate matter readings should be taken over the duration of each test period at approximately equally spaced intervals and those results averaged to give the result to be compared to the limit value. For thermal waste treatment devices with intermittent loading those test procedures should commence no later than 10 minutes after a loading; and

.8 alternative emission species test methods which provide equivalent results to those given above may be used with the agreement of the Administration.

4.1.3.5 A test report detailing the TWTD tested, the test sequence followed, the measurement devices/procedures used, the traces of the CO, NO_x, HC, O_2, temperature and pressure profile readings and the test results of the other emissions measured together with details of the actual sludge oil (if applicable), and solid waste compositions and waste loading quantities and times should be recorded in a test report which should form part of the TWTD Technical Report. If the TWTD is not built for handling sludge oil and testing it is therefore not undertaken with sludge oil, this should be specified in the test report.

4.1.3.6 In service, the emissions from thermal waste treatment devices certified to Performance Level 2 should not exceed the following in-service maximum emission limits:

CO 50 ppm (dry basis) at 11.00% O_2 – averaged over each UTC three-hour period

Opacity 10%

4.1.3.7 CO should be measured in accordance with section 6.4 of the NO_x Technical Code 2008 (direct measurement and monitoring) and should be monitored at a frequency of not less than 0.05 Hz.

4.1.3.8 Oxygen content, temperature and pressure profiles, as applicable, through the TWTD should be monitored and controlled in accordance with the relevant Functional Objective.

4.2 Discharge Water to Sea

4.2.1 This section applies if there is:

.1 a direct water discharge as a by-product of the thermal waste treatment process used; and/or

.2 water used to wash the exhaust gas from the TWTD before discharge to the atmosphere, where that water is then subsequently discharged to sea.

Alternatively, these discharge water streams may be collected in a holding tank for discharge ashore.

4.2.2 If discharged to sea, the discharge water should not be diluted or mixed with water from other sources before monitoring for the turbidity and PAH limit parameters. After monitoring for PAH and turbidity, the discharge water may be diluted as required or chemically treated prior to pH monitoring.

4.2.3 The discharge water to sea should not exceed the following limits at any time when the TWTD is in operation:

.1 pH: minimum 6.5 or a maximum difference of 2 pH units between the inlet water and the discharged water after dilution values – if chemically treated the requirements of 10.1.6.1 of the *2021 Guidelines for Exhaust Gas Cleaning Systems* (resolution MEPC.340(77)) should also be applied;

.2 Turbidity: maximum continuous turbidity in the discharge water should not be greater than 25 FNU (formazine nephelometric units) or 25 NTU (nephelometric turbidity units) or equivalent units, above the inlet water turbidity assessed on the basis of 15-minute average values; and

.3 PAH: phenanthrene equivalent concentration should not exceed that equivalent to 2.2 g/h per nameplate capacity in MW at the discharge water flow rate(s) above the inlet water PAH concentration.

4.2.4 The monitoring methods used for pH, turbidity and PAH should be in accordance with the *2021 Guidelines for exhaust gas cleaning systems* (resolution MEPC.340(77)) and should be monitored at a frequency of not less than 0.05 Hz.

4.2.5 Performance, calibration and permissible deviations of the discharge water monitoring devices should be in accordance with the relevant sections of the *2021 Guidelines for exhaust gas cleaning systems* (resolution MEPC.340(77)).

4.3 Residues from thermal waste treatment devices

4.3.1 Any solid residues or other materials from TWTD, including any washings or other material collected as part of maintenance or servicing activities, should be discharged ashore to appropriate reception facilities.

4.3.2 Any residues from a TWTD discharge water treatment system, either in-service or as collected during maintenance or servicing activities, should be discharged ashore to appropriate reception facilities.

5 Functional Objectives and TWTD Technical Report

5.1 These are the Functional Objectives which should be met in order to achieve the in-service Performance Level 1 emission limit requirements and, if applicable, those of Performance Level 2. The following listing of core Functional Objectives represents a technology-neutral approach to the review of the design, manufacture, installation, use and ongoing management of a TWTD. The applicant is therefore additionally responsible for identifying any other Functional Objectives which may potentially affect the device's performance in terms of emissions to air and, if applicable, water and to duly address those as part of the TWTD Technical Report such that the requirements of regulation 4.4 of MARPOL Annex VI are met. Consequently, the TWTD Technical Report is to cover, but is not limited to, an assessment of the following functional requirements and is to be compiled against the Functional Objective references as listed in table 2. In the case of operational, servicing or maintenance requirements, the TWTD Technical Report may cite the relevant section of the TWTD Operating Manual which is to be supplied with the device rather than reproducing in full the applicable text. Where a particular Functional Objective is not applicable owing to the operating principle applied, the waste streams to be processed or other factors would be given as "not applicable", together with supporting justification, in the TWTD Technical Report.

5.2 It is recognized that the applicant may need to provide commercially sensitive information to the Administration in order to demonstrate that a particular Functional Objective has been met by the design of the TWTD and/or would be met in service. In view of this, such information may instead be included in a supporting information annex to the TWTD Technical Report which would not be circulated outside the approving Administration. Where information is provided in that category, it may be cited rather than being given in full in the TWTD Technical Report itself.

Table 2: Thermal Waste Treatment Device – Functional Objectives

These Guidelines have been developed on a technology-neutral basis. Therefore, particular Functional Objectives as listed below may not be applicable to certain types of TWTD since the point being covered does not exist. The applicant should indicate in the TWTD Technical Report submitted why certain Functional Objectives are not applicable to the TWTD under consideration and provide justification for that assertion.

	Functional Objective	**Content of TWTD Technical Report**
1. Device design and manufacture		
1.1	The device should be designed to meet the Performance Level 1 criteria under all operating conditions with the waste materials it is designed to process To include those in-service controls and measurements used to regulate the device	Description and basis of how the device has been designed and tested to demonstrate the required performance
1.2	Device capacity should be defined	How capacity (i.e. MW, m^3/day, or as applicable) is assessed and defined for the device
1.3	The device should be designed so that when installed it will operate as required 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	Description of how the device has been designed and tested to ensure that it will operate as required under those conditions
1.4	The device should be designed so that there will not be leakage out of the device to the surrounding environment	Description and basis of how the device has been so designed and how is that demonstrated and maintained in service
1.5	The device should be designed to handle the various temperatures to which it will be exposed	Description and basis of how the device has been so designed and how that is demonstrated and maintained in service
1.6	The device should be designed to resist corrosion and erosion that may be result from the process method applied, the waste materials to be handled or the resulting products	Description and basis of how the device has been so designed and how that is demonstrated and maintained in service
1.7	The device should be designed to minimize the amount of by-product, unburnt and partially combusted material in the exhaust gas stream	Description and basis of how the device has been so designed and how that is demonstrated and maintained in service
1.8	The device should be designed to control intake air flow such that the required oxygen content and operating conditions are achieved through the device for it to function as intended	Description and basis of how the device has been so designed and how that is demonstrated and maintained in service together with the required oxygen content profile across the device in operation

	Functional Objective	Content of TWTD Technical Report
1.9	The device should be designed to maintain the required pressure levels through the device for it to function as intended	Description and basis of how the device has been so designed and how that is demonstrated and maintained in service together with the required pressure profile across the device in operation
1.10	The device should be designed to minimize visible smoke and particulate emissions	Description and basis of how the device has been so designed and how that is demonstrated and maintained in service
1.11	The device should be designed to minimize the formation of dioxins in the exhaust gas stream when disposing of garbage containing PVC	Description and basis of how the device has been so designed and how that is demonstrated and maintained in service
1.12	The device should be designed so that if there is an emergency shutdown, either triggered by the device itself or the user, there will not be abnormal levels of emissions	Description and basis of how the device has been so designed and how that is demonstrated and maintained in service
1.13	The device should be designed so that on restart following an emergency shutdown the emission limits will normally not be exceeded	Description and basis of how the device has been so designed and how that is demonstrated and maintained in service
1.14	Unless discharged ashore, the discharge water arrangements of the device should be designed to meet the discharge limits under all operating conditions with the waste materials it is designed to process to include those in-service controls and measurements used to regulate the device together with emergency shutdown and re-starting procedures	Description and basis of how the discharge water arrangements of the device have been designed and tested to demonstrate in service that the required performance will be achieved under all operating conditions
1.15	Where the nature of the device operating principles results in a discharge water stream with pollution aspects additional to those controlled in section 4 of these Guidelines then those should be duly controlled	Identification of additional discharge water criteria applicable to the operating principle applied and how those are controlled in order to meet the requirements of regulation 4.4 of MARPOL Annex VI
1.16	The capacity of the device (minimum and maximum) should be stated and should be such that when operating at any point in that range the emission limits would not be exceeded	How that capacity range has been established and demonstrated
1.17	All different capacity options/models of the device should meet the emission limits	How those capacity ranges have been established and demonstrated
1.18	The design of the device should be defined and there should be an agreed conformity of production arrangement to ensure each unit as delivered will not exceed the emission limits in service	Device definition and proposed conformity of production arrangement and how that is to be audited/inspected to ensure ongoing consistency with that definition

	Functional Objective	Content of TWTD Technical Report
	Each unit should be identified in a manner which provides for its inclusion under the approval given together with its waste handling capacity (MW or as applicable)	
1.19	There should be a means of unit certification	Proposed means by which each unit will be certified and how that is to function between the applicant and the Administration leading to the issue of individual TWT Device Certificates
1.20	Where there are design/manufacturing changes after approval as an equivalent means that affect the emissions performance of the device, those changes should be approved before being applied to devices to be considered for certification under that approval	Proposed change management process and how that will function to ensure that changes are not introduced to certified devices prior to their acceptance by the Administration
1.21	Additional device design and/or manufacture related Functional Objectives as applicable to this type of device which are relevant in terms of meeting the emission limits and the objectives of regulation 4.4 of MARPOL Annex VI should be identified	Resolution of those additional Functional Objectives
2. Installation on board		
2.1	The installation on board should be such that the device performance is as required	The onboard installation requirements, including if applicable discharge water arrangements, to ensure that the performance of the device is not adversely affected by, but not limited to, heat, vibration, ship movement or the functioning of other equipment. How it is demonstrated, by post installation tests or other means, that these requirements have been met
2.2	The exhaust duct arrangements and fittings should be such that the device performance is as required	The design, arrangement and installation requirements of the exhaust duct design from the device to atmosphere to ensure that the performance of the device is not adversely affected. All necessary connections for operating features, monitoring devices and control arrangements to be positioned as necessary. The means by which it is demonstrated these have been met
2.3	The necessary supply services (fuel, air, compressed air, electrical, etc.) for the device to operate as required should be provided	Listing of all the requirements in respect of those support services necessary for the correct operation and performance of the device

	Functional Objective	Content of TWTD Technical Report
		including any associated discharge water arrangements. The means by which it is demonstrated that these have been met
2.4	Installation test demonstrating that the device performance is as required including that of any discharge water arrangements	Installation test procedures which are to be applied and associated acceptance criteria
2.5	Additional device installation related Functional Objectives as applicable to this type of device which are relevant in terms of meeting the emission limits and the objectives of regulation 4.4 of MARPOL Annex VI should be identified	Resolution of those additional Functional Objectives
3. In-service operation		
3.1	When in an idle condition there should not be any significant emissions from the device (these systems can be difficult to quickly shut completely on and off and thus may require an idle status when they do not receive any feedstock)	Means by which this requirement is achieved or basis on which this is not applicable
3.2	The warm-up phase should ensure that on completion the device will operate as required	Means by which this requirement is achieved
3.3	The preparation of solid waste (sorting, size screening etc.) should be such that the device will operate as required	Operating procedures in respect of the preparation of solid waste
3.4	The preparation of liquid wastes/sludge oil should be such that the device will operate as required	Operating procedures in respect of the preparation of liquid wastes
3.5	The preparation of sewage sludge should be such that the device will operate as required	Operating procedures in respect of the preparation of sewage waste
3.6	The procedure for loading solid waste should be such that the device performs as required	Operating procedures in respect of the loading of solid waste into the device
3.7	The procedure for loading liquid waste should be such that the device performs as required	Operating procedures in respect of the loading of liquid waste into the device
3.8	The procedure for loading sewage sludge should be such that the device performs as required	Operating procedures in respect of the loading of sewage waste into the device
3.9	If applicable – the procedure for concurrently loading solid waste, liquid waste or sewage sludge should be such that the device performs as required	Operating procedures in respect of the concurrent loading of solid waste, liquid waste or sewage waste into the device
3.10	When processing solid waste, the emission to air should be controlled to not exceed the emission limits	Operating procedures for the disposal of solid waste

	Functional Objective	Content of TWTD Technical Report
3.11	When processing liquid waste, the emission to air is to be controlled to not exceed the emission limits	Operating procedures for the disposal of liquid waste
3.12	When processing sewage sludge, the emission to air should be controlled to not exceed the emission limits	Operating procedures for the disposal of sewage sludge
3.13	If applicable - when concurrently disposing of solid waste, liquid waste or sewage sludge the emission to air should be controlled to not exceed the emission limits	Operating procedures when operating concurrently on solid waste, liquid waste or sewage sludge
3.14	The loading of further waste material should not result in one or more of the emission limits being exceeded	Operating procedures in respect of loading additional solid waste, liquid waste or sewage sludge while the device is in operation
3.15	The device should demonstrate ongoing compliance with the emission limits to air at all times when in operation, including warm-up and shutdown phases	Means by which ongoing compliance with the emission limits is to be demonstrated
3.16	The means by which ongoing compliance with the emissions to air are monitored should produce reliable measurement data	Means by which monitoring equipment, and any associated equipment, are operated, zero and span checked, maintained and serviced to achieve the required measurement performance
3.17	The device should be shut down in a manner which ensures that all thermal processes are terminated and that the device and associated exhaust system to atmosphere is purged of all residual gases	Operating procedures and procedures relating to the shutdown of the device
3.18	The means and procedures for the removal of solid residues from the device should ensure that these are fully and securely contained for landing ashore	Operating means and procedures in respect of the removal of solid residue material from the device and subsequent onboard storage prior to discharge ashore
3.19	The discharge water arrangements should be prepared, operated and shutdown such that the emission to sea limits are met under all operating conditions including during the device warm-up and shutdown phases	Operating procedures of the discharge water arrangements, including control and monitoring functions, relating to the preparation for use, in-service application and shutdown
3.20	Discharge water PAH limit should be expressed as a concentration (µg/litre) as appropriate to the device across its operating range	PAH limit(s) should be given against discharge water flow rate(s)
3.21	The means by which ongoing compliance with the discharges to sea is monitored should produce reliable measurement data	Means by which monitoring equipment, and any associated equipment, are operated, zero and span checked maintained and serviced to achieve the required measurement performance

	Functional Objective	Content of TWTD Technical Report
3.22	Additional Functional Objectives related to device operations, as applicable to this type of device and relevant in terms of meeting the emission limits and the objectives of regulation 4.4 of MARPOL Annex VI, should be identified	Resolution of those additional Functional Objectives
4. Record-keeping		
4.1	There should be an Events Record for each TWTD device installed. That Events Record is to cover all phases of operation of the device when in service	What the Events Record is to include and the manner of its recording
4.2	There should be retained records in respect of emissions to air	Form of records which are required to be kept demonstrating the performance and self-checking functions against respective limits showing that the device performed as required set against the recorded Event Record points
4.3	There should be records of the oxygen content, temperature and pressure values, as applicable to the principle of operation, through the device showing that it operated within the required profiles	Form and extent of records which should be kept demonstrating that the required oxygen content, temperature and pressure values were achieved set against the recorded Event Record points
4.4	There should be records in respect of emissions to sea	Form of records which are required to be kept demonstrating the performance and self-checking functions against respective limits showing that the device performed as required set against the recorded Event Record points
4.5	There should be records of solid, and any other, residue materials or related liquids discharged ashore	Related record-keeping requirements
4.6	Records should be against date and UTC. These records should be retained on board at least 18 months from date of recording. If the recording device is changed over that period, it should be ensured that the required data is retained on board and available as required. The recording device should be capable of producing reports as required demonstrating past performance	Means by which the required records are to be recorded and retained on board in a tamper-proof manner. The extent and form of the reports that the recording device is capable of producing
4.7	Additional Functional Objectives related to device record-keeping, as applicable to this type of device and relevant in terms of meeting the emission limits and the objectives of regulation 4.4 of MARPOL Annex VI, should be identified	Resolution of those additional Functional Objectives
5. Maintenance and servicing		

	Functional Objective	Content of TWTD Technical Report
5.1	The extent, frequency and details of device maintenance necessary by user is to be specified – including like for like replacements – should be specified	Basis and details of the required onboard maintenance in terms of activities and timings in order to maintain the effectiveness of the device
5.2	Extent, frequency and details of device servicing requirements should be specified	Basis and details of the required servicing in terms of activities and timings in order to maintain the effectiveness of the device to operate with the emission limits
5.3	Extent, frequency and details of maintenance and servicing requirements of emission monitoring devices should be specified	Basis and details of the required maintenance and servicing in terms of activities and timings in order to maintain the effectiveness of the devices to operate as required
5.4	Maintenance and servicing records should be retained on board for a duration at least 18 months from the date of performance	Means by which the recordkeeping requirements related to maintenance and servicing are recorded and retained on board in a tamper-proof manner and will be available as required
5.5	Additional Functional Objectives related to device maintenance and servicing related as applicable to this type of device and relevant in terms of meeting the emission limits and the objectives of regulation 4.4 of MARPOL Annex VI, should be identified	Resolution of those additional Functional Objectives
6. Instructions and training		
6.1	A TWTD Operating Manual should be supplied with the device covering as necessary those Functional Objective sections 2 to 5	The TWTD Operating Manual, which may be divided into a number of separate documents as appropriate, should provide all necessary direction and guidance for the installation, in-service operation and onboard maintenance of the device together with appropriate fault finding and resolution guidance. Also included should be the servicing extent and timing requirements
6.2	A person who is to operate or maintain the device is to be trained to implement the guidance provided by the TWTD Operating Manual – training records are to be retained on board at least 18 months from date of training or while that person is performing those tasks – whichever is the longer	Description and content of the provided training programme, which may include test material, to be provided which would allow the user to train persons to apply the guidance as given in the TWTD Operating Manual and means to record, in a tamper-proof manner, which persons had been successfully trained as appropriate to their assigned tasks

	Functional Objective	Content of TWTD Technical Report
7. TWTD File		
7.1	To enable the device to be surveyed, or inspected, a TWTD File should be provided The TWTD File should include, but is not limited to, the following: 1. Identification of the device to which the File refers, including model, rating and serial number 2. Description of the device and its manner of operation – including any exhaust gas treatment arrangements 3. The means by which the device should be surveyed both initially and in-service to verify that it is conforms to its as certified condition and is operating and performing as required 4. The means by which it would be verified that the guidance given in the TWTD Operating Manual has been applied as required 5. Means of verification that the required maintenance and servicing has been performed as required 6. Description of the emission monitoring arrangements and components and necessary ancillary equipment or requirements. Including details of the respective sampling points relative to the layout of the device including, if fitted, the discharge water handling arrangements 7. Details of monitoring device zero and span check, calibration, maintenance and servicing requirements and timings and the means of verification that those actions have been undertaken as required 8. Description of the monitoring and record-keeping arrangements and the capability of the recording device to produce operating/emission reports for selected parameters as required 9. The means by which recorded emissions values, set against the Events Record, compared to the respective limit values would be reviewed In addition, the TWTD File should include other checkpoints, as appropriate to the particular type of thermal waste treatment device and its manner of operation, that	An example of a TWTD File covering the required topics should be included

	Functional Objective	Content of TWTD Technical Report
	would confirm its correct operation and performance	
7.2	The TWTD File for each TWTD model should be approved by the Administration	Means by which TWTD File for each device will be submitted for approval
7.3	Amendments to the TWTD File which reflect changes that affect aspects covered by these Functional Objectives and the associated TWTD Technical Report or emissions performance, should be approved by the Administration. Where these are to be applied to previously certified devices and reflect necessary changes to the TWTD File as approved, those changes should not be applied prior to their approval by the Administration. Where additions, deletions or amendments to the TWTD File are separate to the TWTD File as initially approved, they should be retained with the TWTD File and should be considered as part of it	Means by which amendments to previously approved TWTD File will be submitted for approval prior to application to in-service devices
8. Performance Level 2		
8.1	Where a device is to be approved and individual units certified to Performance Level 2, and as a result the device requires additional or alternative fittings, settings, operating procedures, documentation or other aspects in order to achieve that performance level, then that should be reflected as relevant in each of the respective Functional Objectives as listed above	Information, procedures, records, restrictions or other as appropriate to achieving and maintaining Performance Level 2

6 Certification process

6.1 The certification process divides into two parts. The first is the approval of the proposed TWTD model as an equivalent means under regulation 4 of MARPOL Annex VI. The second part is the approval of individual units of that TWTD operating on the basis of the equivalent means as approved.

6.2 The approval by the Administration of the TWTD model as an equivalent means should be on the basis of the applicant-submitted TWTD Technical Report together with, if appropriate, any additional information in the supporting information annex. The TWTD Technical Report should specify whether the units are to be certified to Performance Level 1 or Performance Level 2 and, in the latter case, contain the necessary supporting data including the Pre-approval Test report.

6.3 Any subsequent amendments to the information as given in the TWTD Technical Report or which affect emissions performance as controlled by these Guidelines should be approved by the Administration before being applied to individual thermal waste treatment devices in service.

6.4 Following approval of the TWTD unit as an equivalent means then individual units should be certified by the Administration in accordance with the agreed procedures as set out in the TWTD Technical Report as approved.

6.5 An approved TWTD should be issued with a TWTD Certificate, as set out in the annex, by the Administration and have TWTD File as approved by that Administration.

6.6 Following satisfactory completion of installation test procedure as given in the TWTD File, section 2.6 of the Supplement to the International Air Pollution Prevention Certificate should be duly updated.

6.7 Individual thermal waste treatment devices should thereafter be subject to the survey procedures as given in the approved TWTD File at those times the ship on which the device is installed is surveyed in accordance with the applicable MARPOL Annex VI survey regime.

6.8 Amendments to the TWTD as installed, operated or monitored should be duly covered by amendments to the TWTD File as approved by the Administration before they are applied in service.

ANNEX

FORM OF TWTD CERTIFICATE

Name of Administration

Thermal Waste Treatment Device Approval Certificate

Issued under the provisions of the Protocol of 1997, as amended, to amend the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 related thereto under the authority of the Government of:

………………………………………………………………………………………………………
(*full designation of the country*)

by ……………………………………………………………………………………………………...
(*full designation of the competent person or organization authorized under the provisions of the Convention*)

This is to certify that the thermal waste treatment device (TWTD), as an equivalent means under regulation 4 to incineration under regulation 16, as detailed below has been surveyed and related documentation approved in accordance the *2023 Guidelines for thermal waste treatment devices* adopted by resolution MEPC…(..).

Manufacturer	**Model/ Type**	**Serial Number**	**Maximum capacity**	**Equivalent means – approval reference**
[…]	[…]	[…]	[…]	[…]

This TWTD is certified to:
Performance Level 1 ..…………………………………………………...……… ☐
Performance Level 2 ..…………………………………………………...……… ☐

The TWTD does not generate any emissions to air …………………………………… ☐

Title	**Approval reference**
TWTD File	

A copy of this Certificate together with the approved TWTD File should be carried on board the ship fitted with this TWTD at all times and should be available as required.

This Certificate is valid for the life of the TWTD, subject to surveys in accordance with regulation 5 of MARPOL Annex VI, installed in ships under the authority of this Government.

Issued at ……………………………………………………………………………..
(*place of issue of Certificate*)

Date (dd/mm/yyyy) ………………….. ……………………………
(*date of issue*) (*signature of duly authorized official issuing the Certificate*)

(*seal or stamp of the authority, as appropriate*)

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ANNEX 6

DRAFT AMENDMENTS TO MARPOL ANNEX VI

(A marine diesel engine replacing a steam system)

Regulation 13
Nitrogen oxides (NO_x)

Major conversion

1 Paragraph 2.2 is replaced by the following:

"2.2 For a major conversion involving the replacement of a marine diesel engine with a non-identical marine diesel engine, or the installation of an additional marine diesel engine, the standards in this regulation at the time of the replacement or addition of the engine shall apply. For the purpose of this regulation, the installation of a marine diesel engine replacing a steam system shall be considered a replacement engine. In the case of replacement engines only, if it is not possible for such a replacement engine to meet the standards set forth in paragraph 5.1.1 of this regulation (Tier III, as applicable), then that replacement engine shall meet the standards set forth in paragraph 4 of this regulation (Tier II), taking into account the guidelines developed by the Organization. A Party shall notify the Organization in those instances where a Tier II rather than a Tier III replacement engine has been installed in accordance with the provisions of this paragraph."

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ANNEX 7

DRAFT MEPC RESOLUTION

2023 GUIDELINES AS REQUIRED BY REGULATION 13.2.2 OF MARPOL ANNEX VI IN RESPECT OF NON-IDENTICAL REPLACEMENT ENGINES NOT REQUIRED TO MEET THE TIER III LIMIT

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, at its fifty-eighth session, the Committee adopted, by resolution MEPC.176(58), a revised MARPOL Annex VI (hereinafter referred to as "MARPOL Annex VI") which significantly strengthens the emission limits for nitrogen oxides (NO_x) in light of technological improvements and implementation experience,

NOTING that regulation 13.2.2 of MARPOL Annex VI specifies which NO_x emission standard shall be applied when a marine diesel engine is replaced with a non-identical marine diesel engine,

RECOGNIZING the need to develop guidelines to set forth the criteria of when it is not possible for a replacement engine to meet the standards in regulation 13.5.1.1 (Tier III),

RECALLING that, at its sixty-fifth session, the Committee adopted, by resolution MEPC.230(65), the *2013 Guidelines as required by regulation 13.2.2 of MARPOL Annex VI in respect of non-identical replacement engines not required to meet the Tier III limit* (hereinafter referred to as the "2013 Guidelines"),

RECOGNIZING the need to update the 2013 Guidelines,

HAVING CONSIDERED, at its eightieth session, draft amendments to the 2013 Guidelines, prepared by the Sub-Committee on Pollution Prevention and Response at its tenth session,

1 ADOPTS the *2023 Guidelines as required by regulation 13.2.2 of MARPOL Annex VI in respect of non-identical replacement engines not required to meet the Tier III limit*, as set out in the annex to the present resolution;

2 INVITES Administrations to take the annexed Guidelines into account when certifying a marine diesel engine which is replaced with a non-identical marine diesel engine;

3 REQUESTS the Parties to MARPOL Annex VI and other Member Governments to bring the annexed Guidelines to the attention of shipowners, ship operators, shipbuilders, marine diesel engine manufacturers and any other interested groups;

4 AGREES to keep these Guidelines under review in light of the experience gained;

5 ALSO AGREES that these Guidelines supersede the 2013 Guidelines adopted by resolution MEPC.230(65).

ANNEX

DRAFT 2023 GUIDELINES AS REQUIRED BY REGULATION 13.2.2 IN RESPECT OF NON-IDENTICAL REPLACEMENT ENGINES NOT REQUIRED TO MEET THE TIER III LIMIT

1 When it becomes necessary to replace an engine to which regulation 13 of MARPOL Annex VI applies in principle (power output of more than 130 kW) the non-identical replacement engine shall comply with the standards set forth in paragraph 5.1.1 of the respective regulation (Tier III) when operating in an area designated under regulation 13.6 of MARPOL Annex VI if the replacement takes place on or after the dates in sub-paragraphs of regulation 13.5.1.2, as appropriate unless:

.1 a replacement engine of similar rating complying with Tier III is not commercially available; or

.2 the replacement engine, in order to be brought into Tier III compliance, needs to be equipped with a NO_x reducing device which owing to:

.1 size cannot be installed in the limited space available on board; or

.2 extensive heat release could have an adverse impact on the ships structure, sheeting, and/or equipment whilst additional ventilation and/or insulation of the engine-room/compartment will not be possible.

2 In making the determination that a Tier III engine is not a feasible replacement engine for a ship, it should be necessary to evaluate not just engine dimensions and weight but may also include other pertinent ship characteristics. These pertinent characteristics could include:

.1 downstream ship components such as drive shafts, reduction gears, cooling systems, exhaust and ventilation systems, and propeller shafts;

.2 electrical systems for diesel generators (indirect drive engines); and

.3 such other ancillary systems and ship equipment that would affect the choice of an engine.

3 Restrictions should also be considered concerning engine adjustment/matching needed to meet boundary conditions and performance data necessary for SCR operation at all relevant mode points.

4 If the replacement engine is part of a multi-engine (twin-engine) arrangement and it is replacing an engine that is not a Tier III compliant engine owing to it having been installed prior to the Tier III implementation date, a need to match a replacement engine within a multi-engine arrangement should be part of the criteria to be considered. In such cases, if it were decided to exempt a replacement engine in multi-engine arrangements it must be clear that is where engines are installed as matched pairs (or more) as propulsion engines and that matching is necessary to ensure comparable manoeuvring/drive response rather than where multiple engines are installed such as in the case of generators.

5 A replacement engine that meets the Tier III limit should be installed provided it does not incur an increase in the ship's electrical demand beyond the installed capacity.

6 In no case should modification to the ship's structure be allowed which weakens its structural stability below the acceptable level.

7 The Administration should consider how far the shipowner's specification of the device will determine whether a non-identical replacement engine is not required to meet the Tier III limit (for example, by requiring an excessive urea storage capacity – relative to bunker capacity – or that the SCR device is not to increase engine weight/volume by more than an unjustifiably low percentage).

8 There may be differences between a Tier III and a Tier II engine that should **not** affect the determination of whether a non-identical replacement engine should not be required to meet the Tier III limit, such as:

.1 warranty period or life expectancy;

.2 cost; or

.3 production lead time.

9 The shipowner should provide evidence to the Administration that a Tier III engine cannot be installed and should report specifically what prevents a Tier III compliant engine from being installed, taking into account the provisions of these guidelines. The shipowner should document the search for compliant Tier III engines and explain why the closest available engine with respect to size or performance is not appropriate for the ship. The search should include engines produced by manufacturers other than the original engine's manufacturer. This documentation, duly endorsed by the Administration, should be kept with the replacement engine's EIAPP Certificate.

10 In addition to the requirements of paragraphs 1 to 3 and 5 to 9, which specifically cover the replacement of one marine diesel engine by another, in the case where a steam system is to be replaced by a marine diesel engine, an Administration should also take the following points into account in evaluating a proposal that that engine should be to Tier II as opposed to Tier III:

.1 the total available engine-room space, including tanks, made available by the removal of the steam system being replaced should be considered with regard to the space and support service requirements of a Tier III engine;

.2 if the steam system is not removed but only decommissioned, that should not affect the determination as to whether a Tier III replacement engine could be installed; and

.3 the level of work required to provide the structural support for the to be installed marine diesel engine should be considered in relation to any additional work required in order to accommodate a Tier III engine as to whether such additional work should reasonably be expected to be undertaken.

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ANNEX 8

DRAFT REVISED UNIFIED INTERPRETATIONS TO REGULATION 13 OF MARPOL ANNEX VI

6 Identical replacement engines

Regulation 13
Nitrogen oxides (NO_x)

Regulation 13.1.1.2 reads as follows:

> "Each marine diesel engine with a power output of more than 130 kW that undergoes a major conversion on or after 1 January 2000 except when demonstrated to the satisfaction of the Administration that such engine is an identical replacement to the engine that it is replacing and is otherwise not covered under paragraph 1.1.1 of this regulation."

Regulation 13.2.2 reads as follows:

> "For a major conversion involving the replacement of a marine diesel engine with a non-identical marine diesel engine, or the installation of an additional marine diesel engine, the standards in this regulation at the time of the replacement or addition of the engine shall apply. For the purpose of this regulation, the installation of a marine diesel engine replacing a steam system shall be considered a replacement engine. In the case of replacement engines only, if it is not possible for such a replacement engine to meet the standards set forth in paragraph 5.1.1 of this regulation (Tier III, as applicable), then that replacement engine shall meet the standards set forth in paragraph 4 of this regulation (Tier II), taking into account the guidelines developed by the Organization. A Party shall notify the Organization in those instances where a Tier II rather than a Tier III replacement engine has been installed in accordance with the provisions of this paragraph."

Interpretation:

6.1 In regulation 13.1.1.2, the term "identical" (and hence, by application of the converse, in regulation 13.2.2 the term "non-identical") as applied to engines under regulation 13 should be taken as:

6.2 An "identical engine" is, as compared to the engine being replaced,[1] an engine which is of the same:

.1 design and model;

.2 rated power;

.3 rated speed;

.4 use;

[1] In those instances where the replaced engine will not be available to be directly compared with the replacing engine at the time of updating the Supplement to the IAPP Certificate reflecting that engine change, it is to be ensured that the necessary records in respect of the replaced engine are available in order that it can be confirmed that the replacing engine represents "an identical engine".

.5 number of cylinders; and

.6 fuel system type (including, if applicable, injection control software):

.1 for engines without EIAPP certification, have the same NO_x critical components and settings;[2] or

.2 for engines with EIAPP certification, belonging to the same Engine Group/Engine Family.

7 Time of replacement of an engine

Regulation 13
Nitrogen oxides (NO_x)

Regulation 13.2.2 reads as follows:

"For a major conversion involving the replacement of a marine diesel engine with a non-identical marine diesel engine, or the installation of an additional marine diesel engine, the standards in this regulation at the time of the replacement or addition of the engine shall apply. For the purpose of this regulation, the installation of a marine diesel engine replacing a steam system shall be considered a replacement engine. In the case of replacement engines only, if it is not possible for such a replacement engine to meet the standards set forth in paragraph 5.1.1 of this regulation (Tier III, as applicable), then that replacement engine shall meet the standards set forth in paragraph 4 of this regulation (Tier II), taking into account the guidelines developed by the Organization. A Party shall notify the Organization in those instances where a Tier II rather than a Tier III replacement engine has been installed in accordance with the provisions of this paragraph."

Interpretation:

7.1 The term "time of the replacement or addition" of the engine in regulation 13.2.2 should be taken as the date of:

.1 the contractual delivery date of the engine to the ship;[3] or

.2 in the absence of a contractual delivery date, the actual delivery date of the engine to the ship,[3] provided that the date is confirmed by a delivery receipt; or

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2 For engines without EIAPP Certification, there will not be the defining NO_x critical component markings or setting values as usually given in the approved Technical File. Consequently, in these instances, the assessment of "... same NO_x critical components and settings ..." shall be established on the basis that the following components and settings are the same:

Fuel system:

.1 fuel pump model and injection timing; and

.2 injection nozzle model.

Charge air:

.1 configuration and, if applicable, turbocharger model and auxiliary blower specification; and

.2 cooling medium (seawater/fresh water).

3 The engine is to be fitted on board and tested for its intended purpose within six months after the date specified in sub-paragraphs of regulation 13.5.1.2, as appropriate.

.3 in the event the engine is fitted on board and tested for its intended purpose on or after six months from the date specified in sub-paragraphs of regulation 13.5.1.2, as appropriate, the actual date that the engine is tested on board for its intended purpose applies in determining the standards in this regulation in force at the time of the replacement or addition of the engine.

7.2 Entry of the date in paragraph 7.1 above, provided the conditions associated with those dates apply, should be made in the item 8.a "Major conversion – According to regulations 13.2.1.1 and 13.2.2" of the Supplement of IAPP Certificate.

7.3 If the engine is not tested within six months after the date specified in sub-paragraphs of regulation 13.5.1.2, as appropriate owing to unforeseen circumstances beyond the control of the shipowner, then the provisions of "unforeseen delay in delivery" may be considered by the Administration in a manner similar to UI4 of MARPOL Annex I.

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ANNEX 9

DRAFT MEPC CIRCULAR

RECOMMENDATIONS FOR THE CARRIAGE OF PLASTIC PELLETS* BY SEA IN FREIGHT CONTAINERS

1 The Marine Environment Protection Committee, [at its eighty-first session (22 to 26 April 2024)] approved the *Recommendation for the carriage of plastic pellets by sea in freight containers* below, as a short-term measure with the aim of reducing the environmental risks associated with the carriage of plastic pellets in packaged form by sea, pending the Committee's consideration of future mandatory measures for the carriage of plastic pellets in freight containers:

.1 Plastic pellets should be packed in good quality packagings which should be strong enough to withstand the shocks and loadings normally encountered during transport. Packaging should be constructed and closed so as to prevent any loss of contents which may be caused under normal conditions of transport, by vibration or acceleration forces.

.2 Transport information should clearly identify, as an addition in the cargo information required by SOLAS regulation VI/2, those freight containers containing plastic pellets. In addition, the shipper should supplement the cargo information with a special stowage request requiring stowage as outlined in section 3 below.

.3 Freight containers containing plastic pellets should be properly stowed and secured so as to minimize the hazards to the marine environment without impairing the safety of the ship and persons on board. Specifically, freight containers containing plastic pellets should be stowed:

.1 under deck wherever reasonably practicable; or

.2 inboard in sheltered areas of exposed decks.

2 Member States are invited to use the Recommendation and bring it to the attention of shippers, manufacturers, terminal operators, shipowners, ship operators, charterers, shipmasters and all other entities concerned, requesting that additional care and appropriate action be taken during maritime transport of plastic pellets in packaged form.

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* *Plastic pellets* means solid polymeric substances, or blended mixtures (consisting of polymers and other substances of varying percentages), that are insoluble in water and transported in granule or nurdle form, or as powder or flakes [and have a diameter of x mm or less]. Plastic pellets include, but are not limited to, polymers such as polyethylene, polypropylene, polystyrene, polyethylene terephthalate, or polyvinyl chloride.

ANNEX 10

TABLE OF POTENTIAL INSTRUMENTS THAT COULD FORM A LEGAL BASIS FOR MANDATORY PROVISIONS FOR THE MARITIME TRANSPORT OF PLASTIC PELLETS IN FREIGHT CONTAINERS

Potential routes to explore and assess for introduction of mandatory provisions applicable to the maritime transport of plastic pellets in freight containers	Relevant documents
Assignment of an individual UN number (class 9) for plastic pellets.	• PPR 10/13 (Norway and Spain), paragraphs 33 to 47 • PPR 9/15/4 (FOEI, Pacific Environment and CSC) • PPR 10/13/5 (FOEI and CSC) • PPR 10/13/7 (CEFIC and DGAC)
An amendment to appendix I of MARPOL Annex III that would recognize plastic pellets as a "harmful substance" (harmful substance).	• PPR 10/13 (Norway and Spain), paragraphs 33 to 47 • PPR 9/15/1 (Cook Islands et al.) • PPR 10/13/5 (FOEI and CSC) • PPR 10/13/7 (CEFIC and DGAC)
A new chapter to MARPOL Annex III that would prescribe requirements for the transport of plastic pellets in freight containers without classifying the cargo as a harmful substance/dangerous goods.	• PPR 10/13 (Norway and Spain), paragraphs 33 to 47 • PPR 10/INF.6 (Norway) • PPR 10/13/5 (FOEI and CSC) • PPR 10/13/7 (CEFIC and DGAC)
Amendment to MARPOL Annex III to split the definition of harmful substances into substances covered by the IMDG Code and substances that are not (e.g. plastic pellets) combined with new regulations in MARPOL Annex III on transport of plastic pellets outside of the scope of the IMDG Code.	Verbal intervention during PPR 10 (see PPR 10/18, paragraph 13.18)
MARPOL Annex V	• PPR 10/13 (Norway and Spain), paragraph 46 • PPR 10/13/7 (CEFIC and DGAC) • PPR 9/15/1 (Cook Islands et al.)

Note: Summaries of the discussions at PPR 9 and PPR 10 and summaries of documents commenting on the documents listed above can be found in the reports of PPR 9, specifically in paragraphs 15.2 to 15.12 of document PPR 9/21 and paragraphs 13.1 to 13.27 and 13.50 to 13.59 of document PPR 10/18.

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ANNEX 11

DRAFT UNIFIED INTERPRETATION TO THE BWM CONVENTION

1 Date to meet the standard in regulation D-2 in accordance with resolution MEPC.297(72).

Regulation B-3
Ballast water management for ships

Regulations B-3.5 and B-3.10 read as follows:

"5 A ship constructed on or after 8 September 2017 shall conduct ballast water management that at least meets the standard described in regulation D-2.

10 Notwithstanding regulation E-1.1.2, the renewal survey referred to in paragraphs 1.1, 1.2, 2 and 4 is:

.1 the first renewal survey, as determined by the Committee*, on or after 8 September 2017 if:

.1 this survey is completed on or after 8 September 2019; or

.2 a renewal survey is completed on or after 8 September 2014 but prior to 8 September 2017; and

.2 the second renewal survey, as determined by the Committee,* on or after 8 September 2017 if the first renewal survey on or after 8 September 2017 is completed prior to 8 September 2019, provided that the conditions of paragraph 10.1.2 are not met."

Interpretation:

1.1 A ship constructed before 8 September 2017 which has undergone a major conversion on or after 8 September 2017 should be deemed as a ship constructed on or after 8 September 2017 and comply with regulation B-3.5. If the major conversion has occurred before the renewal survey specified in regulation B-3.10, the said ship should meet the D-2 standard from the date of completion of the major conversion. If the major conversion has occurred after the renewal survey specified in regulation B-3.10, the said ship should meet the D-2 standard from the date of completion of the renewal survey specified in regulation B-3.10.

2 "Date of construction" for a ship which has undergone a major conversion.

Appendix I
Form of International Ballast Water Management Certificate

The following information regarding "Date of construction" and "Date of major conversion" is to be provided on the certificate:

"Date of construction ...."

Interpretation:

2.1 For the International Ballast Water Management Certificate for a ship that has undergone a major conversion, the date of the commencement of the major conversion should be filled in the item "Date of construction".

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ANNEX 12

DRAFT UNIFIED INTERPRETATION TO REGULATIONS 18.5 AND 18.6 OF MARPOL ANNEX VI

NOTE: Paragraph 12.2 is new and concerns bunker delivery notes being acceptable in either hard copy of electronic format. The section below (section 12) will replace the existing section 12 in a further revision of MEPC.1/Circ.795 (i.e. MEPC.1/Circ.795/Rev.8).

12 Applicability of the requirements for a bunker delivery note

Regulation 18
Fuel oil availability and quality

Regulation 18.5 reads as follows:

> "For each ship subject to regulations 5 and 6 of this Annex, details of fuel oil for combustion purposes delivered to and used on board shall be recorded by means of a bunker delivery note that shall contain at least the information specified in appendix V to this Annex."

Regulation 18.6 reads as follows:

> "The bunker delivery note shall be kept on board the ship in such a place as to be readily available for inspection at all reasonable times. It shall be retained for a period of three years after the fuel oil has been delivered on board."

Interpretation:

12.1 For the application of these regulations, they should be interpreted as being applicable to all ships of 400 gross tonnage or above and, at the Administration's discretion, to ships of less than 400 gross tonnage.

12.2 The Bunker Delivery Note (BDN) required by regulation 18.5 is acceptable in either hard copy or electronic format provided it contains at least the information specified in appendix V to MARPOL Annex VI and is retained and made available on board in accordance with regulation 18.6. In addition, an electronic BDN should be protected from edits, modifications or revisions and authentication be possible by a verification method such as a tracking number, watermark, date and time stamp, QR code, GPS coordinates or other verification methods.

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ANNEX 13

BIENNIAL STATUS REPORT 2022-2023[1]

Sub-Committee on Pollution Prevention and Response (PPR)									
Reference to SD, if applicable	Output number	Description	Target completion year	Parent organ(s)	Associated organ(s)	Coordinating organ	Status of output for Year 1	Status of output for Year 2	References
1. Improve implementation	1.11	Measures to harmonize port State control (PSC) activities and procedures worldwide	Continuous	MSC/ MEPC	HTW/PPR/ NCSR	III	Ongoing	Ongoing	MEPC 77/16, paras. 10.1 to 10.6; and MEPC 79/15, paras. 7.65 and 9.3
1. Improve implementation	1.15	Revised guidance on methodologies that may be used for enumerating viable organisms	2022	MEPC	PPR		Completed		PPR 7/22, section 5; PPR 9/21, section 5; MEPC 78/17 para. 4.8
1. Improve implementation	1.21	Review of the 2011 Guidelines for the control and management of ships' biofouling to minimize the transfer of invasive aquatic species (resolution MEPC.207(62))	~~2023~~ 2025	MEPC	PPR		In progress	Extended	PPR 8/13, section 4; PPR 9/21, section 7; PPR 10/WP.1, section 5
Note: PPR 10 requested MEPC 80 to change the title of the output to "Development of guidance on matters relating to in-water cleaning" and set the target completion year from 2023 to 2025.									

[1] Proposed modifications to the Sub-Committee's 2022-2023 biennial status report, as set out in annex 10 to document MEPC 78/17/Add.1. Struck-out text indicates proposed deletions.

Sub-Committee on Pollution Prevention and Response (PPR)									
Reference to SD, if applicable	Output number	Description	Target completion year	Parent organ(s)	Associated organ(s)	Coordinating organ	Status of output for Year 1	Status of output for Year 2	References
1. Improve implementation	1.23	Evaluation and harmonization of rules and guidance on the discharge of discharge water from EGCS into the aquatic environment, including conditions and areas	2025	MEPC	PPR		Extended	In progress	PPR 9/21, section 10; MEPC 78/17, paras. 5.9 to 5.18 and 14.14; PPR 10/WP.1, section 17.
Note: MEPC 78 agreed to: extend the target completion year from 2022 to 2025; not include the output in the provisional agenda for PPR 10; and to consider reinstating the output in the provisional agenda of a future session of the Sub-Committee (after PPR 10) subject to further proposals to the Committee on part 3 (regulatory matters) and part 4 (database of substances) of the scope of work of the output by interested Member States and international organizations. MEPC 79 referred documents MEPC 79/5/1 (CESA), MEPC 79/5/4 (CESA) and MEPC 79/INF.4 (Netherlands) to PPR 11 and instructed the Sub-Committee to consider them further in conjunction with document MEPC 78/9/3 (Germany), with a view to advising the Committee accordingly.									
1. Improve implementation	1.26	Revision of MARPOL Annex IV and associated guidelines	~~2023~~ 2025	MEPC	III/HTW	PPR	In progress	Extended	PPR 9/21, section 14; MEPC 78/17, paras. 14.7 to 14.11; PPR 10/WP.1, section 12
Note: MEPC 78 agreed to amend the title of the existing output 1.26 to "Revision of MARPOL Annex IV and associated guidelines", and that specific work to be carried out be captured in the scope of work, i.e. (1) introduce provisions for record-keeping and measures to confirm the lifetime performance of sewage treatment plants; (2) consider amending the definition of "person" as provided in regulation 1 of MARPOL Annex IV, taking into account persons other than crew and passengers; and (3) prohibit fitting comminuting and disinfecting systems on new ships. PPR 10 requested the Committee to approve the expansion of the scope of work of output 1.26 to introduce provisions for a sewage management plan and record-keeping on all ships under MARPOL Annex IV. PPR 10 also requested an extension of the target completion year for the output from 2023 to 2025.									

Sub-Committee on Pollution Prevention and Response (PPR)									
Reference to SD, if applicable	Output number	Description	Target completion year	Parent organ(s)	Associated organ(s)	Coordinating organ	Status of output for Year 1	Status of output for Year 2	References
2. Integrate new and advancing technologies in the regulatory framework	2.3	Amendments to the IGF Code and development of guidelines for low-flashpoint fuels	Continuous	MSC	HTW/PPR/SDC/SSE	CCC	No work requested	No work requested	MSC 104/18, paragraph 15.16
2. Integrate new and advancing technologies in the regulatory framework	2.13	Review of the IBTS Guidelines and amendments to the IOPP Certificate and Oil Record Book	~~2023~~ 2025	MEPC	PPR		No work requested	Extended	MEPC 77/16, paragraphs 9.1 and 9.2; MEPC 78/17, paras. 9.11 to 9.19; PPR 10/WP.1, section 11
Note: PPR 10 invited the Committee to extend the target completion year from 2023 to 2025									
2. Integrate new and advancing technologies in the regulatory framework	2.15	Development of amendments to MARPOL Annex VI and the NO_x Technical Code on the use of multiple engine operational profiles for a marine diesel engine	~~2023~~ 2025	MEPC	PPR		In progress	Extended	PPR 9/21, section 11; MEPC 78/17, paras. 5.5 to 5.8; PPR 10/WP.1, section 8
Note: PPR 10 invited MEPC to expand the scope of the output to cover definitions of terminology and application related to EIAPP test cycles and related amendments to the NTC 2008 and to change the title of the description of the output to "Development of amendments to MARPOL Annex VI and the NO_x Technical Code on the use of multiple engine operational profiles for a marine diesel engine including clarifying engine test cycles". PPR 10 also requested MEPC to extend the target completion year from 2023 to 2025									
2. Integrate new and advancing technologies in the regulatory framework	2.18	Standards for shipboard gasification of waste systems and associated amendments to regulation 16 of MARPOL Annex VI	2023	MEPC	PPR		In progress	Completed	PPR 9/21, section 9; PPR 10/WP.1, section 7

Sub-Committee on Pollution Prevention and Response (PPR)									
Reference to SD, if applicable	Output number	Description	Target completion year	Parent organ(s)	Associated organ(s)	Coordinating organ	Status of output for Year 1	Status of output for Year 2	References
2. Integrate new and advancing technologies in the regulatory framework	2.19	Revision of guidelines associated with the AFS Convention as a consequence of the introduction of controls on cybutryne	2022	MEPC	PPR		Completed		PPR 9/21, section 6; MEPC 78/17, paras. 9.7 and 9.8
3. Respond to climate change	3.3	Reduction of the impact on the Arctic of emissions of Black Carbon from international shipping	~~2023~~ 2025	MEPC	PPR		In progress	Extended	PPR 9/21, section 8; PPR 10/WP.1, section 6
Note: PPR 10 invited the Committee to extend the target completion year for output to 2025									
4. Engage in ocean governance	4.3	Follow-up work emanating from the Action Plan to address marine plastic litter from ships	~~2023~~ 2025	MEPC	PPR/III/HTW		In progress	Extended	PPR 9/21, section 15; MEPC 78/17, section 8; PPR 10/WP.1, section 13
Note: PPR 10 invited the Committee to extend the target completion year from 2023 to 2025									
6. Address the human elements	6.1	Role of the human element	Continuous	MSC/ MEPC	III/PPR/CCC/ SDC/SSE/ NCSR	HTW	Ongoing	Ongoing	MEPC 78/17, paras. 10.4 and 13.1
6. Address the human elements	6.2	Validated model training courses	Continuous	MSC/ MEPC	III/PPR/CCC/ SDC/SSE/ NCSR	HTW	Ongoing	Ongoing	MSC 100/20, paragraphs 10.3 to 10.6 and 17.25; PPR 9/21, section 12

Sub-Committee on Pollution Prevention and Response (PPR)									
Reference to SD, if applicable	Output number	Description	Target completion year	Parent organ(s)	Associated organ(s)	Coordinating organ	Status of output for Year 1	Status of output for Year 2	References
6. Address the human elements	6.16	Development of an operational guide on the response to spills of hazardous and noxious substances (HNS)	2023	MEPC	PPR		Extended	Completed	PPR 9/21, section 4; PPR 10/WP.1, section 4
7. Ensure regulatory effectiveness	7.1	Unified interpretation of provisions of IMO safety, security, environment, facilitation, liability and compensation-related conventions	Continuous	MSC/ MEPC	III/PPR/CCC/ SDC/SSE/ NCSR		Ongoing	Ongoing	PPR 9/21, section 16; MEPC 78/17, section 4, and paras. 5.6 and 5.7; PPR 10/WP.1, section 14
7. Ensure regulatory effectiveness	7.3	Safety and pollution hazards of chemicals and preparation of consequential amendments to the IBC Code	Continuous	MEPC	PPR		Ongoing	Ongoing	PPR 9/21, section 3; MEPC 78/17, para. 9.3; PPR 10/WP.1, section 3
7. Ensure regulatory effectiveness	7.11	Development of measures to reduce risks of use and carriage of heavy fuel oil as fuel by ships in Arctic waters	~~2023~~ 2024	MEPC	PPR		Extended		PPR 9/21, section 12; MEPC 78/17, paras. 14.3 to 14.6; PPR 10/WP.1, section 10
Note: MEPC 78 agreed to extend the target completion year from 2022 to 2023. PPR 10 invited the Committee to extend the target completion year from 2023 to 2024									
7. Ensure regulatory effectiveness	7.16	Development of necessary amendments to MARPOL Annexes I, II, IV, V and VI to allow States with ports in the Arctic region to enter into regional arrangements for port reception facilities (PRFs)	2023	MEPC	PPR		Completed		PPR 9/21, section 13; MEPC 78/17, paras.9.9 and 9.10

Sub-Committee on Pollution Prevention and Response (PPR)									
Reference to SD, if applicable	Output number	Description	Target completion year	Parent organ(s)	Associated organ(s)	Coordinating organ	Status of output for Year 1	Status of output for Year 2	References
7. Ensure regulatory effectiveness	7.43	Revision of regulation 13.2.2 of MARPOL Annex VI to clarify that a marine diesel engine replacing a boiler shall be considered a replacement engine.	2023	MEPC		PPR	No work requested	Completed	MEPC 78/17, paragraph 14.13; PPR 10/WP.1, section 9
Note: The output was approved by MEPC 77 and included in the Committee's post-biennial agenda (one session required for its completion). MEPC 78 approved the provisional agenda for PPR 10. Therefore, the target completion year was set to 2023.									

OUTPUTS ON THE COMMITTEE'S POST-BIENNIAL AGENDA THAT FALL UNDER THE PURVIEW OF THE SUB-COMMITTEE

SUB-COMMITTEE ON POLLUTION PREVENTION AND RESPONSE									
ACCEPTED POST-BIENNIAL OUTPUTS				**Parent organ(s)**	**Associated organ(s)**	**Coordinating organ**	**Timescale (sessions)**	**Reference**
No.	**Biennium**[2]	**Reference to strategic direction, if applicable**	**Description**					
1	2022-2023	7. Ensure regulatory effectiveness	Development of a guide compiling best practices to develop local-level marine spill contingency plans to aid States, particularly local governments and key institutions, in implementing the OPRC Convention and OPRC-HNS Protocol	MEPC	PPR		2 sessions	MEPC 78/17, para. 14.2
3	2022-2023 (New)	7. Ensure regulatory effectiveness	Amendments to MARPOL Annex II in order to improve the effectiveness of cargo tank stripping, tank washing operations and prewash procedures for products with a high melting point and/or high viscosity	MEPC	PPR		2 sessions	MEPC 79/16, para. 12.4
Note: The above will be included in the proposed provisional agenda of PPR 11 and the biennial agenda of the Sub-Committee and MEPC for the 2024-2025 biennium, subject to the Committee's approval. The target completion year should be 2025, in line with the timescale (two sessions) considered necessary to complete the work when the outputs were agreed by MEPC.								
4	2022-2023 (New)	7. Ensure regulatory effectiveness	Revision of the *Revised guidelines and specifications for pollution prevention equipment for machinery space bilges of ships* (resolution MEPC.107(49))	MEPC	PPR		2 sessions	MEPC 79/16, para. 12.8

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2 Biennium when the output was placed on the post-biennial agenda.

ANNEX 14

PROPOSED BIENNIAL AGENDA FOR THE 2024-2025 BIENNIUM[1]

Reference to SD, if applicable	Output number	Description	Parent organ(s)	Associated organ(s)	Coordinating organ	Target completion year
1. Improve implementation	1.3	Validated model training courses	MSC / MEPC	III/PPR/CCC/ SDC/SSE/NCSR	HTW	Continuous
1. Improve implementation	1.11	Measures to harmonize port State control (PSC) activities and procedures worldwide	MSC / MEPC	HTW/PPR/NCSR	III	Continuous
~~1. Improve implementation~~	~~1.15~~	~~Revised guidance on methodologies that may be used for enumerating viable organisms~~	~~MEPC~~	~~PPR~~		~~2022~~
1.Improve implementation	1.21	**Development of guidance on matters relating to in-water cleaning** ~~Review of the 2011 Guidelines for the control and management of ships' biofouling to minimize the transfer of invasive aquatic species (resolution MEPC.207(62))~~	MEPC	PPR		2025
1. Improve implementation	1.23	**Evaluation and harmonization of rules and guidance on the discharge of discharge water from EGCS into the aquatic environment, including conditions and areas**	MEPC	PPR		2025
1. Improve implementation	1.26	**Revision of MARPOL Annex IV and associated guidelines**	MEPC	III/HTW	PPR	2025

[1] Struck-out text indicates proposed deletions and shaded text indicates proposed changes. Outputs shown in bold font have been selected for the provisional agenda for PPR 11 set out in annex 14.

Reference to SD, if applicable	Output number	Description	Parent organ(s)	Associated organ(s)	Coordinating organ	Target completion year
~~1. Improve implementation~~	~~1…~~	~~Development of an operational guide on the response to spills of Hazardous and Noxious Substances (HNS)~~	~~MEPC~~	~~PPR~~		~~2023~~
2. Integrate new and advancing technologies in the regulatory framework	2.3	Amendments to the IGF Code and development of guidelines for low-flashpoint fuels	MSC	HTW/PPR/ SDC/SSE	CCC	Continuous
2. Integrate new and advancing technologies in the regulatory framework	2.13	**Review of the IBTS Guidelines and amendments to the IOPP Certificate and Oil Record Book**	MEPC	PPR		2025
2. Integrate new and advancing technologies in the regulatory framework	2.15	**Development of amendments to MARPOL Annex VI and the NO_x Technical Code on the use of multiple engine operational profiles for a marine diesel engine including clarifying engine test cycles**	MEPC	PPR		2025
~~2. Integrate new and advancing technologies in the regulatory framework~~	~~2.18~~	~~Standards for shipboard gasification of waste systems and associated amendments to regulation 16 of MARPOL Annex VI~~	~~MEPC~~	~~PPR~~		~~2023~~
~~2. Integrate new and advancing technologies in the regulatory framework~~	~~2.19~~	~~Revision of guidelines associated with the AFS Convention as a consequence of the introduction of controls on cybutryne~~	~~MEPC~~	~~PPR~~		~~2022~~
3. Respond to climate change	3.3	**Reduction of the impact on the Arctic of Black Carbon emissions from international shipping**	MEPC	PPR		2025

Reference to SD, if applicable	Output number	Description	Parent organ(s)	Associated organ(s)	Coordinating organ	Target completion year
4. Engage in ocean governance	4.3	**Follow-up work emanating from the Action Plan to address marine plastic litter from ships**	MEPC	PPR/III/HTW		2025
6. Address the human element	6.1	Role of the human element	MSC / MEPC	III/PPR/CCC/ SDC/SSE/NCSR	HTW	Continuous
6. Address the human element	6.2	Validated model training courses	MSC / MEPC	III/PPR/CCC/ SDC/SSE/NCSR	HTW	Continuous
~~6. Address the human element~~	~~6.16~~	~~Development of an operational guide on the response to spills of hazardous and noxious substances (HNS)~~	~~MEPC~~	~~PPR~~		~~2023~~
7. Ensure regulatory effectiveness	7.1	**Unified interpretation of provisions of IMO safety, security and environment-related conventions**	MSC / MEPC	III/PPR/CCC/ SDC/SSE/NCSR		Continuous
7. Ensure regulatory effectiveness	7.3	**Safety and pollution hazards of chemicals and preparation of consequential amendments to the IBC Code**	MEPC	PPR		Continuous
7. Ensure regulatory effectiveness	7.11	**Development of measures to reduce risks of use and carriage of heavy fuel oil as fuel by ships in Arctic waters**	MEPC	PPR		2024
~~7. Ensure regulatory effectiveness~~	~~7.16~~	~~Development of necessary amendments to MARPOL Annexes I, II, IV, V and VI to allow States with ports in the Arctic region to enter into regional arrangements for port reception facilities (PRFs)~~	~~MEPC~~	~~PPR~~		~~2023~~

Reference to SD, if applicable	Output number	Description	Parent organ(s)	Associated organ(s)	Coordinating organ	Target completion year
~~7. Ensure regulatory effectiveness~~	~~7.43~~	~~Revision of regulation 13.2.2 of MARPOL Annex VI to clarify that a marine diesel engine replacing a boiler shall be considered a replacement engine.~~	~~MEPC~~	~~PPR~~		~~2023~~
7. Ensure regulatory effectiveness	7…[2]	**Development of a guide compiling best practices to develop local-level marine spill contingency plans to aid States, particularly local governments and key institutions, in implementing the OPRC Convention and OPRC-HNS Protocol**	MEPC	PPR		2025
7. Ensure regulatory effectiveness	7…[2]	**Amendments to MARPOL Annex II in order to improve the effectiveness of cargo tank stripping, tank washing operations and prewash procedures for products with a high melting point and/or high viscosity**	MEPC	PPR		2025

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[2] Moved to the biennial agenda of the Sub-Committee from the post-biennial agenda of MEPC.

ANNEX 15

PROPOSED PROVISIONAL AGENDA FOR PPR 11

Opening of the session

1 Adoption of the agenda

2 Decisions of other IMO bodies

3 Safety and pollution hazards of chemicals and preparation of consequential amendments to the IBC Code

4 Amendments to MARPOL Annex II in order to improve the effectiveness of cargo tank stripping, tank washing operations and prewash procedures for products with a high melting point and/or high viscosity

5 Development of guidance on matters relating to in-water cleaning

6 Reduction of the impact on the Arctic of Black Carbon emissions from international shipping

7 Evaluation and harmonization of rules and guidance on the discharge of discharge water from EGCS into the aquatic environment, including conditions and areas

8 Development of amendments to MARPOL Annex VI and the NO_x Technical Code on the use of multiple engine operational profiles for a marine diesel engine including clarifying engine test cycles

9 Development of a guide compiling best practices to develop local-level marine spill contingency plans to aid States, particularly local governments and key institutions, in implementing the OPRC Convention and OPRC-HNS Protocol

10 Development of measures to reduce risks of use and carriage of heavy fuel oil as fuel by ships in Arctic waters

11 Review of the IBTS Guidelines and amendments to the IOPP Certificate and Oil Record Book

12 Revision of MARPOL Annex IV and associated guidelines (1.26)

13 Follow-up work emanating from the Action Plan to address marine plastic litter from ships

14 Unified interpretation of provisions of IMO environment-related conventions (7.1)

15 Biennial agenda and provisional agenda for PPR 12

16 Election of Chair and Vice-Chair for 2025

17 Any other business

18 Report to the Marine Environment Protection Committee

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ANNEX 16

DRAFT BWM.2 CIRCULAR

Protocol on verification of ballast water compliance monitoring devices

1 The Marine Environment Protection Committee, at its [eightieth session (3 to 7 July 2023)] approved the *Protocol on verification of ballast water compliance monitoring devices* to provide a framework that can be used to verify the ability of a compliance monitoring device to assess non-compliance with the standard described in regulation D-2 of the BWM Convention, as set out in the annex.

2 Member Governments are invited to bring this Protocol to the attention of all parties concerned.

ANNEX

PROTOCOL FOR THE VERIFICATION OF BALLAST WATER COMPLIANCE MONITORING DEVICES

1 Purpose

1.1 The goal of this protocol is to provide a framework that can be used to verify the ability of a compliance monitoring device (CMD) to assess non-compliance with the standard described in regulation D-2 (the D-2 standard) of the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004 (the BWM Convention), and its ability to operate, as claimed by the manufacturer, with regard to the degree or level of non-compliance that can be detected and with regard to the stated intended use of the device. This protocol is intended to support effective implementation of the BWM Convention by enabling the use of ballast water CMDs that satisfy a common level of quality.

2 Definitions

2.1 Compliance monitoring device (CMD): an instrument and its associated indicative analytical methodology typically used as a rapid assessment of the concentration of viable (or living) organisms in treated ballast water for the purpose of determining compliance or non-compliance with a discharge standard.

2.2 Ambient challenge water: ambient water that meets the challenge water criteria without augmentation or concentration.

2.3 Ambient water: water from a natural, local source.

2.4 Challenge water: water used to test a CMD which meets specific criteria for water quality and organism diversity as described in paragraphs 6.9 to 6.16 of this protocol.

2.5 False negative: a test result declared negative, where it is in fact positive.

2.6 False positive: a test result declared positive, where it is in fact negative.

2.7 Field test: a practicability test to assess the ability of the device to work under real-life conditions, including a demonstration of producing accurate and reliable results in an onboard environment or the location of the intended use of the device. It is designed around the intended use of the device. Parameters included within the field test are assessed within a shipboard environment and/or at locations appropriate to the stated intended use and application of the device.

2.8 Negative control: any well-characterized material or substance that, when tested by a specific procedure, demonstrates the suitability of the procedure to yield a reproducible, appropriately negative, non-reactive or minimal response in the test system.

2.9 Positive control: any well-characterized material or substance that, when tested by a specific procedure, demonstrates the suitability of the procedure to yield a reproducible, appropriately positive or reactive response in the test system.

2.10 Prepared challenge water: water (from any source) that is augmented to meet the challenge water criteria.

2.11 Calibration standard: sample containing the analyte of interest at a known concentration either purchased from an external source or prepared in-house from materials of known purity or concentration, or both, and used to calibrate the measurement system.

2.12 Treated water: water that has been processed by a type-approved ballast water management system (BWMS) or by a process that replicates, as close as possible, the processes undertaken by a type-approved BWMS.

3 Introduction

3.1 The objective of this protocol is to provide a framework for the verification of the performance of ballast water CMDs intended for use in the implementation of the BWM Convention. These devices may be used for a variety of purposes: during commissioning testing of ballast water management systems, during port State control inspections, and during ships' self-monitoring. The protocol relies on laboratory and field tests conducted in accordance with standard test procedures such as those under development or published by the International Organization for Standardization; additional tests (e.g. vibration, humidity) may be carried out when applicable.

3.2 This protocol is applicable to the two designated size classes prescribed by the D-2 standard (organisms ≥ 50 µm; organisms ≥ 10 µm and < 50 µm) and to the group of specified indicator microbes (toxicogenic *Vibrio cholerae* (O1 and O139), *Escherichia coli* and intestinal enterococci). For consistency and brevity, these three items (i.e. the two-size classes and indicator microbes) are hereinafter called "groups of organisms".

3.3 CMDs can include various sensors, instruments, kits, methods and assays designed to measure the concentrations of organisms in ballast water to determine compliance with regulation D-2. Following collection, samples can be analysed in the laboratory, in the field (e.g. dockside), on board ships (e.g. hand-held or mobile units brought on board or that reside on board), or by in-line units integrated directly into a ship's ballast system or BWMS.

3.4 Any acknowledged or suspected chemical or physical factors affecting the device's efficacy, including any interactions due to the treatment technologies used to treat the ballast water (e.g. flow, bubbles) should be assessed and addressed as appropriate.

3.5 This protocol primarily intends to validate the device's ability to measure groups of organisms in ballast water, including, when such claims are made by the manufacturer, the ability to distinguish between viable and non-viable organisms. CMDs may consist of their own components and apparatus for preparing the sample for measurement, including, but not limited to, sample collection, filtering, sieving, incubation. Additional validation may be required for those functions if they are not integral to the CMD and sold as part of the device.

3.6 Depending on the intended use of the device, the manufacturers' claims and specifications may vary; as such CMDs may not measure all groups of organisms as described in paragraph 3.2, and may use differing measurement approaches (i.e. direct measurement comparable to the D-2 standard, indirect measurement not directly comparable to the performance standard or a binary "pass/fail" designation). This protocol is designed to determine devices' data quality, as well as the ability of devices to operate effectively within the environment they have been designed for use in. A CMD should be verified following this protocol only for the group(s) of organisms it is intended to quantify, as per the manufacturer's specifications. Likewise, if the manufacturer of a CMD indicates there are restrictions on its use (for example, it is intended only for use in fresh water), the device should be tested under the stated limiting conditions. Otherwise, it should be tested in accordance with the full matrix of laboratory and field testing, as described in sections 4 to 6 and shown in tables 1 and 2.

3.7 The diverse biological communities and water quality conditions required for BWMS certification testing should also be used to verify the performance of these devices. However, if specific variables are known or suspected to affect the performance of a device (e.g. water temperature, the ship's electrical noise or residual chemicals in ballast water), they should also be included as test parameters in verification testing.

3.8 All verifications of ballast water CMDs should be conducted by an independent, third-party testing entity (having implemented a rigorous quality assurance/quality control programme, e.g. in accordance with ISO/IEC 17025 or equivalent, that is approved, certified and audited by an independent accreditation body) and include expert review of specific test plans. The expert should be independent of the team involved in the verification of the CMD and have documented competences and experiences with knowledge and understanding of the enumeration of biological parameters and of the quality assurance approval of detailed analysis procedures being used as referenced in this protocol. The specific test plans/protocols and final reports should be approved by the testing entity.

3.9 For a given make and model of CMD, one unit should be randomly selected for testing, and the same unit should be used in all verification testing (laboratory and field), which should take place over several weeks to months.

3.10 BWMS that make use of ultraviolet irradiation (UV) or Active Substances have been identified as the two dominant technology types. These technology types are referred to throughout this protocol as the basis for ensuring the suitability of the CMD for use against the range of BWMS that may be encountered. It is acknowledged that new and novel BWMS technology types may be developed and as such consideration should be given to these new technologies when verifying a CMD for use with water treated by BWMS. The principles outlined within this protocol should be applied and any methods utilized to assess water treated by a novel BWMS technology type should be consistent with the aims and purpose of this protocol.

3.11 When considering the verification of a novel CMD, benchmarking against standard reference methods (direct counts), similar to the approach detailed in the *Procedure for approving other methods of ballast water management in accordance with regulation B-3.7 of the BWM Convention* (resolution MEPC.206(62), as may be amended), should be adopted. Any deviation from this protocol should be described and an equivalent level of confidence in the verification of the CMD ensured based on the parameters outlined in section 4.

3.12 Where the protocol references a standard that is not directly related to the verification of compliance monitoring devices, those undertaking the verification should refer only to the sections of the referenced standard that are relevant to the process or methodology that is being referred to in this protocol. It should be noted that a range of standards may be relevant to the methods in this protocol and could be considered appropriate for use. Where this protocol references a standard, other equivalent standards may be used or referred to in place of the referenced document.

4 Verification testing parameters

4.1 This protocol is designed to evaluate the performance or capability of a CMD to detect non-compliance with the performance standard within the performance claims of the device manufacturer. The CMD is evaluated as suitable or appropriate for its final use (i.e. detection of non-compliance with the performance standard) if the verification criteria listed in paragraph 8.4 are fulfilled.

4.2 At a minimum, the performance of a given make and model of a CMD should be verified based on measures of the following parameters under varying conditions that represent the device's intended use. The minimum parameters are described in this section and in tables 1 and 2.

4.3 Trueness – A measure of the closeness of agreement between a value obtained from a series of test results and an agreed reference standard value under multiple salinities, communities and concentrations of organisms, and other water quality parameters that may influence device performance (e.g. temperature, optical clarity). For these verifications, the trueness of the CMD should be determined in controlled laboratory tests and field tests. Repeated comparisons between a device's measurements and a reference standard (described below) should be completed; a minimum of three replicate test measurements at each test condition type, or the appropriate level of replication to ensure statistical confidence, are needed.

4.4 Precision – A measure of the repeatability of a measurement. The precision of an individual device should be determined under controlled laboratory tests. The standard deviation should be calculated from a minimum of 10 consecutive measurements of a reference solution under stable conditions (or the appropriate level of replication to ensure statistical confidence). This process should be repeated for multiple relevant conditions. For example, if the CMD claims to measure concentrations of organisms at the D-2 standard, then precision should be measured at a concentration similar to the performance standard.

4.5 Detection limits (also known as quantification limits) – The instrument or method detection limit of an individual device is the lowest (and, if applicable, the highest) value that can be detected with an acceptable level of confidence. Detection limits should be determined in controlled laboratory tests by quantifying the signal-to-noise ratio. Here, repeated (minimum of three, or the appropriate level of replication to ensure statistical confidence) measurements are made at low concentrations (at and below the D-2 standard) and of blanks (known zero), and the minimum concentration at which the known value can be quantified with a signal-to-noise ratio of 10:1 is determined.

4.6 Reliability – The ability to maintain integrity or stability of the CMD and data collection over time. Reliability of instruments should be determined in two ways from the data collected during all laboratory and field tests. First, comparisons should be made of the percentage of data points collected as a proportion of the data that the device was intended to have collected over a set period of time. Second, the percentage of time, and total number of times, that the device operated/functioned as designed without interruption or non-scheduled maintenance, calibration or repair should be reported. Comments on the physical condition of the device (e.g. physical damage, flooding, corrosion, battery failure, etc.) should also be recorded. Instruments should be tested and used in accordance with the manufacturers' instructions for calibration, operation and maintenance, and the reliability should be determined considering these time periods. When applicable, e.g. for in-line devices in continuous use, direct measures to assess drift over time should be collected.

4.7 Aspects of usability/vulnerability – the degree to which the CMD is fit for its intended use within the environments it is likely to encounter. Table 2 outlines the parameters that may form a part of the usability and vulnerability assessments which may be determined through field and laboratory testing. Unless the CMD is being verified against usability claims made by the manufacturer, the assessment is subjective in its nature and as such qualitative assessments of the CMD's performance can be used to provide an indication of the usability of the device.

5 Reference standard and verification protocol

5.1 While the true concentration of viable organisms in discharged ballast water is often unknown, accepted detailed analysis methods for quantifying viable organism concentrations are available. Methods used in type approving BWMS and identified in the *Code for Approval of Ballast Water Management Systems* (BWMS Code, resolution MEPC.300(72), as may be amended) and the *Guidance on methodologies that may be used for enumerating viable organisms* (BWM.2/Circ.61/Rev.1, as may be amended) should be used. When determining a suitable reference standard for use in verifying the performance of the CMD, consideration should be given to those identified within the BWMS Code. There is a range of available reference standards, each with associated uncertainties, and not all reference standards will be applicable to every device.

5.2 To maximize both the value and the harmonization of device testing, individual verification protocols should:

.1 be drafted separately for each specific type, or make and model, of CMD (e.g. to enumerate the group(s) of organisms the device is intended to quantify);

.2 be based on existing and accepted practices for instrument and method testing; and

.3 include independent expert review of test protocols.

6 Experimental design

6.1 Tests should be conducted in laboratory and field settings. All tests should be conducted (1) with sample volumes consistent with those required by the CMD and (2) with representative samples of the group(s) of organisms intended to be quantified by the device.

6.2 The range of tests undertaken should be designed to verify the ability of the CMD, taking into consideration the claims made by the manufacturer, including any limitations to the scope of the device's operation, to assess non-compliance with regulation D-2 of the BWM Convention. The experimental design should assess any claims made by the manufacturer with regard to interactions between the device and the treatment technologies being used to produce the treated water.

6.3 The laboratory tests should consist of tests using both treated and untreated water, such that the CMD is tested against samples with high and low organism concentrations, including a mixture of live and dead individuals in the same sample. The samples used for laboratory tests should be collected from a natural water source, containing a mix of ambient aquatic organisms (natural assemblages). The untreated test water should meet the salinity, dissolved organic carbon (DOC), particulate organic carbon (POC) and total suspended solid (TSS) thresholds for each of the three salinities (as prescribed in the BWMS Code) in which the device is to be verified (table 1). Where ambient water is unable to meet the set challenge criteria, the ambient water can be concentrated or augmented to achieve the minimum criteria, at which point the challenge water becomes "prepared challenge water"; therefore, ambient challenge water can only be used if it meets the set challenge criteria without concentration or augmentation. The organism concentrations may be adjusted to ensure a robust mix of species and an adequate range of organism concentrations to bracket the D-2 standard (described below).

6.4 The device should be tested as per the manufacturer's claims; however, where no claims are stated with regard to treatment technology interactions or suitability to address potential interferences caused by the treatment technology, the device should be tested with UV-treated challenge water and with challenge water treated using the most commonly used active substance. The treated water used should reflect typical treatment dosages as used in type-approved, commercially available BWMS. If no manufacturer claims are made and the previously mentioned testing is completed, the use of UV and most common active substance should be clearly stated in the CMD test report.

6.5 The field tests are practicability tests undertaken to assess the ability of the device to work under real-life conditions, including a demonstration of producing true and reliable results in an onboard environment or at the location of the intended use of the device. They should be designed around the intended use of the device. The parameters against which the CMD is assessed should include, but not be limited to, those detailed in table 2, as is appropriate to the intended use of the device. Field tests are undertaken within a shipboard environment and/or at locations appropriate to the stated intended use and application of the device. During field tests, treated discharged water from a functioning BWMS (with no manipulation or augmentation) should be tested. Where the intended use of the CMD does not include a shipboard environment, treated water, appropriate to the environment associated with the intended use of the CMD, should be tested.

6.6 During both laboratory and field tests any treated water used should be produced by a type-approved BWMS and the provenance (type of treatment, holding times, dosages, etc.) of the treated water should be documented. If a type-approved BWMS is not used to produce the treated water used during testing, reasons for this should be explained and the treatment of the water should replicate, as close as possible, the processes undertaken by a BWMS.

Reference standards

6.7 In all tests (laboratory and field), the results of the CMD should be compared to an accepted reference method using direct counts for enumerating viable organisms that is relevant to the device being tested, as described in section 5.

6.8 For each analysis day or group of analyses, the results of the CMD should be validated by a positive control (ISO 10993-10:2010) or a calibration through a calibration standard (ASTM D1129), and a negative control (ISO 10993-10:2010).

Laboratory tests using prepared challenge water

6.9 The use of local ambient organisms is favoured but laboratory cultures of organisms of the appropriate size and species variety and diversity may be used in order to ensure the appropriate level of organism concentration and "challenge" or to improve the diversity of organisms present. The addition of cultured organisms is also considered acceptable when the number of organisms present, before and/or after the treatment of the prepared challenge water, is close to the detection limits or standard thresholds of the device. For consistency at a given laboratory, healthy ambient or cultures of organisms (e.g. phytoplankton cultures in exponential growth phase) should be used, and a minimum of three diverse species (e.g. from three higher taxa) should be tested together in a mixture.

6.10 In order to ensure a sufficient level of challenge, when using cultured organisms, the following should be considered: (i) diversity of species used (minimum three species), representing all groups of organisms that the CMD is designed for; (ii) the resistance of organisms to treatment; (iii) organism concentrations; and (iv) whether the ratio of organisms should reflect natural/harbour waters. The BWMS Code requirements for challenge water should be referred to. If cultured test organisms are used, local applicable quarantine regulations should be taken into consideration during culturing and discharge.

6.11 It is appreciated that laboratory testing with cultures of toxicogenic strains of *Vibrio cholerae* is challenging and requires specific safety and handling conditions and procedures. However, if the CMD is designed to quantify toxicogenic *V. cholerae*, prepared challenge water laboratory testing is critical, since toxicogenic *V. cholerae* are rarely found in ambient waters or during shipboard type approval testing.

6.12 For each group of organisms, a dilution series should be created using filtered seawater or fresh water with the appropriate salinity. The dilution process should be completed following an internationally accepted standard. Each dilution series should have at least three, but preferably five, concentrations of organisms, with the concentrations created by diluting or concentrating the organism mix so that the dilution series brackets above and below the discharge standard. This step, and all other steps in preparing the challenge water, should be done carefully to minimize organism mortality and loss. The highest concentration of organisms should be at least 5x greater than the discharge standard (to ensure linearity measurements for devices that do not have pass/fail outputs). The verification report should state all organism concentrations tested.

6.13 The DOC, POC and TSS should be adjusted in the challenge water to meet the minimum thresholds in the BWMS Code for a given salinity. Temperature should not be manipulated, but it should be measured and reported.

6.14 The treated water should be prepared from the challenge water, as described above. If testing with two treatment technology types, as opposed to testing against the claims made by the manufacturer, if it is not possible to test one of those two treatment types in the laboratory, the treatment type not tested in the laboratory should be tested during field tests.

Laboratory tests using ambient challenge water

6.15 Ambient challenge water should not be manipulated to dilute or concentrate organisms, or manipulate temperature, salinity, DOC, POC and TSS. While these parameters should be measured and reported, ambient challenge water should simply be natural concentrations of organisms and natural conditions of physical and chemical parameters.

6.16 To characterize the ambient challenge water, it should be analysed for the concentration and taxonomic composition of organisms. That is, species should be identified to the lowest possible taxonomic level, e.g. species, genus or family. Recognizing that devices may have species-specific biases, the purpose of this step is to demonstrate the diversity of organisms that are quantified by the CMD by using waters containing various organisms. This step should be done using an accepted method or microscopy; it is not intended to be performed with the CMD.

Field tests

6.17 When verifying trueness and reliability during field tests:

.1 at least three tests should be conducted with treated discharged water from a functioning and type-approved BWMS (the type of treatment should be reported) (see paragraph 2.6 for definition or paragraph 6.5 for field test criteria). The three tests should be conducted on separate ballast water samples having variability in water quality parameters (e.g. different salinity or organism assemblages). In this type of testing, measurements of intake water are not required;

.2 the treated discharged water should be analysed for the concentration and taxonomic composition of organisms as in paragraph 6.16 and the reliability of the CMD should be evaluated for use under real-world conditions; and

.3 in the three field tests, only trueness (table 2) and reliability (paragraph 6.7) should be quantified, under conditions of the device's intended use.

6.18 To assess the practicability of the CMD, field tests should ensure that the device is able to operate in the static and dynamic conditions that may be experienced on board a ship or, as appropriate, the location of the intended use of the device. To assess the suitability of the device, the aspects of usability parameters that form the field test should be identified depending on whether the device is designed to be portable or to be a permanent installation. Parameters may be tested in situ on board a ship or, as appropriate, at the location of the intended use of the device, e.g. operability and readability of the device in a real-life situation, or within a laboratory, e.g. intrinsic safety, vibration testing, waterproof testing. The matrix of field test parameters (table 2) may be used as a basis for identifying parameters that should be assessed.

6.19 Where applicable, field test parameters should be assessed against any success criteria set and/or claims made by the manufacturer.

6.20 When assessing aspects of usability, it is acknowledged that some are subjective assessments of the device's practicability for use within its intended environment. These subjective assessments should only be used as an indicator for the practicability of the device's use as different users will have differing needs with regard to the usability aspects of a device, for example the need for two people to carry the equipment should not necessarily lead to a "fail".

6.21 When reporting on the outcome of these tests, the environmental conditions under which the tests were conducted should be recorded and commented on within the test report. The report should also include problems that occurred, along with any maintenance/repair information to help assess reliability and usability.

6.22 The results of this assessment should be used in order to provide an indication of the device's suitability within the location of the intended use of the device.

Ancillary data

6.23 At a minimum, water temperature, salinity (or conductance), pH and TSS should be measured in all laboratory and field tests. If possible, DOC and POC should be measured, as well as any other additional water quality parameters that are suspected to influence the performance of the CMD.

6.24 If the CMD performance claims are limited to monitoring treated water from specific BWMS technology types, this should be specified.

6.25 The evaluation of treated discharges should consider the effect of chemical/physical interferences, as applicable.

6.26 Verification testing should include evaluation of false positives and/or negatives.

Trueness, precision and detection limits

6.27 For these three parameters, the conditions for the laboratory tests and field tests are shown in tables 1 and 2 below. In all cases, the measurement/assessment of organism concentration that is collected by the CMD should be compared to the reference standard, and the appropriate statistical analysis should be conducted. Note that, if the manufacturer claims the CMD can measure concentrations well below the discharge standard, additional dilutions may be needed.

6.28 The measurements used to determine precision and detection limits (the last two rows of table 1) may be taken from the samples prepared for trueness testing, thereby reducing the total number of tests.

6.29 The applicable ISO standards should be used when determining trueness and precision.

Reliability tests

6.30 The reliability of the CMD should be determined as in paragraph 4.6 using data collected in all tests and specifically under the conditions of intended use (e.g. controlled laboratory bench top, field conditions on board a ship). First, reliability should be calculated as the percentage of data points collected as a proportion of the data that the device was intended to have collected over a given period of time. Second, reliability should also be calculated as the percentage of time, and total number of times, that the device operated as designed for each sample tested without interruption or requiring non-scheduled maintenance, calibration or repair. Third, the physical condition of the device (e.g. any physical damage, flooding, corrosion, battery failure) should be documented (e.g. with notes and photographs) and reported.

6.31 An applicable internationally recognized standard should be used when determining reliability.

Testing for viable/non-viable organisms

6.32 If a manufacturer claims that the CMD is able to distinguish between viable and non-viable organisms, this should be assessed using the appropriate methodology for the device being tested. Methods that may be employed to quantify viable organism concentrations have been provided within the BWMS Code.

Additional tests

6.33 The research and development stage of the device design should have ensured the suitability of the equipment for the environment in which its use is intended. Assessment or verification of product design considerations, including standard principles when considering the use of a piece of equipment for the shipboard environment, i.e. intrinsic safety, waterproofing, temperature tolerance, vibration, humidity, power supply consistency, robustness/durability of the CMD, etc., is required.

Parameter	Test type	Salinity	Minimum replicate measurements per group of organisms								
			Microbes			≥ 10 and < 50 µm			≥ 50 µm		
Trueness	**Untreated prepared challenge water**	Fresh	<DS n≥3	≈DS n≥3	>DS n≥3	<DS n≥3	≈DS n≥3	>DS n≥3	<DS n≥3	≈DS n≥3	>DS n≥3
		Brackish	<DS n≥3	≈DS n≥3	>DS n≥3	<DS n≥3	≈DS n≥3	>DS n≥3	<DS n≥3	≈DS n≥3	>DS n≥3
		Marine	<DS n≥3	≈DS n≥3	>DS n≥3	<DS n≥3	≈DS n≥3	>DS n≥3	<DS n≥3	≈DS n≥3	>DS n≥3
	Untreated ambient challenge water	Fresh	n≥3			n≥3			n≥3		
		Brackish	n≥3			n≥3			n≥3		
		Marine	n≥3			n≥3			n≥3		
	Treated water (for each tested technology type)	Fresh	n≥3			n≥3			n≥3		
		Brackish	n≥3			n≥3			n≥3		
		Marine	n≥3			n≥3			n≥3		
Precision	**Prepared challenge water (treated and untreated)**	1 salinity (different from the detection limits test)	Against the manufacturer's claims n≥10								
Detection limits	**Prepared challenge water (treated and untreated)**	1 salinity (different from the precision test)	Against the manufacturer's minimum and maximum claims n≥3								

Table 1: Matrix of verification tests for ballast water compliance monitoring devices

Note 1: The range of tests undertaken should reflect any claims made by the manufacturer; the full suite of tests represented by this table is only needed for a device that claims to (1) quantify all groups of organisms in the D-2 performance standard and (2) operate in all three salinities.
Note 2: Trueness testing is only needed for either prepared or ambient challenge water (as applicable) and treated water.
Note 3: The table indicates the minimum recommended level of replication that is needed for a statistically robust analysis.
Note 4: For the tests to calculate trueness and detection limits, the bracketing of the performance (discharge) standard is represented by <DS, ≈DS, and >DS to indicate below, approximately equal to, and above the discharge standard, respectively.
Note 5: Salinity ranges are to be as follows: fresh (<1 PSU), brackish (10-20 PSU), marine (28-36 PSU).

Table 2: Field test parameter matrix

Location of intended use / **Parameter**	On board a ship		Other
	Portable	Permanently installed	
Trueness according to the claim of the manufacturer, ≥3 replicates	✓	✓	✓
Reliability according to the claim of the manufacturer, ≥3 replicates	✓	✓	✓
Aspects of usability			
Is the device easy to set up for taking a measurement?	✓	-	(✓)
Can the display be easily read (with respect to light conditions, contrast, brightness, reflections, vibrations and temperature)?	✓	(✓)	✓
Is the device easy to transport to the location of use (weight, size, shape, volume)?	✓	-	(✓)
Is the device easy to operate (buttons, menu dialogues, command dialogues, user guidance)?	✓	✓	✓
Does the device have adequate power supply for taking measurements at the location of use (battery conditions, power consumption, battery life)?	✓	✓	✓
Other usability aspects	(✓)	(✓)	(✓)
Are the measurement outputs tamper-proof?	✓	✓	✓
Is the device easy to maintain?	✓	✓	✓
Vulnerability with respect to environmental aspects			
Humidity (display failure, electrical fault, etc.)	✓*	✓	(✓)
Vibrations (electrical fault, etc.)	✓*	✓	(✓)
Air temperature (result drift, display failure, battery life, etc.)	✓*	✓	(✓)

✓ = General requirement (✓) = If applicable - = Not applicable
* = Required but results from the research and development stage of the device design (paragraph 6.33) may be substituted

7 Data and quality management

7.1 The independent testing entity should follow standard/accepted data management and analysis procedures. For example, data logs should be recorded throughout testing, copied, or duplicated and archived daily. The datasheets should be signed by the analyst upon completion, verified by a quality officer and stored until the data are manually logged into a digital file. Data reported by the CMD should be manually transcribed on formatted data sheets and, if applicable, logged by the device itself. Additionally, data from other analyses should be recorded in standard formats, such as data-collection forms, bound and paginated laboratory and field notebooks, spreadsheets and electronic data files.

7.2 Specific data analyses should be conducted as prescribed in individual device test plans. For example, trueness should be measured relative to the reference method using a standard approach (e.g. per cent difference), and precision should be measured as the variation among replicate readings and subsamples.

7.3 All testing should occur at facilities with a rigorous quality assurance/quality control programme for laboratory activities (such as ISO/IEC 17025) that has been approved, certified and audited by an independent accreditation body. A test plan and standard operating procedures should be followed while conducting all tests.

7.4 The test plan should include procedures to ensure quality results, as appropriate.

7.5 For at least one randomly chosen subsample per test, two analysts should aliquot, distribute, process and analyse the same sample using the CMD. Readings differing by ≤ 25% are considered within typical variation. Likewise, the variation of the reference method used should be quantified and reported in this manner.

8 Reporting

Test report

8.1 The test report should:

- .1 include the following elements:
  - .1 a statement of verification;
  - .2 an executive summary;
  - .3 a description of the technology undergoing verification;
  - .4 details of the test design for laboratory and field tests (as applicable); and
  - .5 annexes to provide additional information or data;
- .2 include the specific information, where applicable, outlined in the example verification reporting format in the annex to this protocol;
- .3 follow the format provided in the annex to this protocol; and
- .4 be made available to the public.

8.2 A list of CMDs that have been verified in accordance with this protocol can be found at https://bwema.org. Any CMD manufacturers who wish their verified equipment to be included in this list should provide the relevant information via the URL above.

Verification criteria

8.3 A CMD being verified as a valid CMD by this testing protocol should assure the end users that the CMD is able to function as claimed. If performance is poor, troubleshooting may be required.

8.4 For this purpose, a list of verification success criteria should be provided by the manufacturer and agreed as appropriate by the testing facility. This list should include, as a minimum, the criteria below, which the CMD should, as a minimum, be able to meet:

.1 precision (repeatability): it might be assessed as the coefficient of variance (CV). A CV of less than 25% is considered as acceptable, while a CV of less than 10% indicates excellent repeatability;

.2 reliability: it might be assessed as the percentage of data recovered compared to the data that the device was intended to have collected over a set period of time. A per cent value >90% is considered as acceptable. Comments on the physical condition of the device (e.g. physical damage, flooding, corrosion, battery failure) should also be recorded. Instruments should be tested and used in accordance with the manufacturers' instructions for calibration, operation and maintenance; and

.3 agreement between CMD results and detailed analysis results: at least 80% of the CMD results should be in agreement with the conclusion given by the corresponding detailed analysis results regarding the results being in compliance or not with the D-2 discharge standard.

8.5 The measurement uncertainty (ISO TS 21748:2010) for both detailed and indicative analysis should be quantified, reported and taken into consideration for the comparison.

9 References

ASTM D1129 Standard Terminology Relating to Water

BWM.2/Circ.61/Rev.1 *2022 Guidance on methodologies that may be used for enumerating viable organisms*

International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004

ISO/IEC 17025 Testing and calibration laboratories

ISO 10993-10:2010 Tests for irritation and skin sensitization

ISO 21748:2010 Guidance for the use of repeatability, reproducibility and trueness estimates in measurement uncertainty estimation

MEPC.206(62) *Procedure for approving other methods of ballast water management in accordance with regulation B-3.7 of the BWM Convention*

MEPC.300(72) *Code for Approval of Ballast Water Management Systems*

ANNEX

VERIFICATION REPORT

The verification report should include, as applicable, the following information:

1 Statement of verification

A clear statement declaring whether or not the device passed (or failed) all verification tests to the agreed standard, including the type of evaluation(s) undertaken (laboratory, field testing or both) and any limitations of the device and its operation.

This section should also include:

- the name of the organization or individual making the statement of verification;
- the date and location at which verification was confirmed;
- the name of the organization providing testing facilities (if different than the organization making the statement);
- a description (manufacturer name, make and model) of the device that has been verified;
- details of any limitations of the verification (BWMS technology, organism sizes, deviations from verification criteria in paragraph 8.4); and
- a statement that the report is freely available to the public.

2 Executive summary

A high-level overview of the verification criteria tests undertaken, the objectives of the tests, the results gained and conclusions drawn.

3 Description of technology

Details of the device undergoing verification. This should include:

- manufacturer;
- model, including serial number and software version number (as applicable);
- operational claims made by the manufacturer; and
- limitations declared by the manufacturer.

4 Test design

This section should outline the objectives of the tests undertaken and include details of the criteria, including any claims made by the manufacturer, against which the device was tested. The experimental design and methodologies used should be described and relevant information provided as required to indicate adherence to this protocol. The following information is required:

- **Laboratory testing**

  - Name of testing organization(s) and any lead or primary personnel
  - Test facility accreditation status and standards, quality assurance and quality control programme(s) as a list and/or table of contents
  - Details of the calibration status of equipment used during testing, including details of certificates and calibration intervals
  - Location and dates of tests
  - Details of the tests undertaken, including descriptions of all verification criteria used and levels of replication
  - Information regarding challenge and ambient water used for testing, including:
    - Source and location of ambient water
    - Volumes used for testing
    - Water quality parameters analysed (including water temperature, salinity, DOC, POC, TSS and any other additional water quality parameters identified in the experimental design)
    - Description of biological community in the test water (organism size, diversity and relative abundances)
    - Details of any augmentation or concentration methods, including any natural organism assemblages (i.e. ≥50 µm or ≥10 to <50 µm) or cultured organisms added (i.e. species used)

  - Details of treated water
    - BWMS make and model or process used to produce treated water (as applicable)
    - Treatment type, including details of active substance type, as applicable
    - Water quality parameters analysed (including water temperature, salinity, DOC, POC, TSS and any other additional water quality parameters identified in the experimental design)
    - Applied treatment doses

  - Sample collection and processing methods in line with paragraph 6.1 of this protocol, including volumes collected, handling prior to analysis (i.e. condition of transportation and holding times) and volumes of samples used for analysis
  - Details of reference methods used
  - References to any applied standards
  - Details of failures or unexpected results or scenarios and actions taken
  - Results / outcomes for parameters as required by the protocol or claimed by the manufacturer
  - Discussion, including any implications of any findings
  - Conclusions

- **Field testing**

  - Name of testing organization(s) and any lead or primary personnel
  - Details of facility accreditation status and standards, quality assurance and quality control programme(s) as a list and/or table of contents
  - Details of the calibration status of equipment used during testing
  - Location(s), date(s) and ship(s) from which samples were taken
  - Location, date and time that tests were undertaken
  - Details of ballast water origin, including
    - Source location

    - Details of the BWMS type and model
    - Whether or not ballast water exchange has taken place
    - Description of biological community in the sample(s) (organism size, diversity and relative abundances)
    - Water quality parameters analysed (including water temperature, salinity, DOC, POC, TSS and any other additional water quality parameters identified in the experimental design)
  - Sample collection and processing methods, in line with paragraph 6.1 of this protocol, including volumes collected, handling prior to analysis (i.e. condition of transportation, storage conditions such as temperature and light shielding property and holding times) and volumes of samples used for analysis
  - Details of the tests undertaken, including descriptions of all verification criteria used and levels of replication
  - Details of reference methods used
  - References to any applied standards
  - Treated water quality parameters (e.g. temperature, salinity, DOC, POC, TSS, organisms present)
  - Environmental conditions including air temperature, water temperature, humidity, vibration, salinity, pH, TSS and any other additional water quality parameters that are suspected to influence the performance of the CMD
  - An assessment of the aspects of usability and vulnerability of the device, including any operational or technological factors as detailed in the protocol, including photographs
  - Details of failures, unexpected results or scenarios, or deviations from standard operating procedures and actions taken
  - Condition of the device, including any damage, wear and tear, battery status, software failures or any notable observations resulting from use of the device during field tests (including photographic evidence)
  - Results/outcomes for parameters as required by the protocol or claimed by the manufacturer
  - Discussion, including any implications of any findings
  - Conclusions

Annexes

Additional information to support the detail provided within the body of the verification report should include:

- Quality assurance/quality control documentation as a list and including details of how documentation can be accessed; this should include a URL that provides direct access to the documentation

- Standard operating procedures, either in full or as a list of documents that can be provided upon requested

- Details of the calibration of the CMD

- Raw data

- Data logged by the device (as applicable)

- Any sample and sample handling guidelines

- Instructions/operating manual for device use, as provided by the manufacturer

***

ANNEX 17

DRAFT MEPC RESOLUTION

2023 GUIDELINES FOR THE DEVELOPMENT OF THE INVENTORY OF HAZARDOUS MATERIALS

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 international conventions for the prevention and control of marine pollution from ships,

RECALLING ALSO that the International Conference on the Safe and Environmentally Sound Recycling of Ships held in May 2009 adopted the Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships, 2009 (the Hong Kong Convention) together with six Conference resolutions,

NOTING that regulations 5.1 and 5.2 of the annex to the Hong Kong Convention require that ships shall have on board an Inventory of Hazardous Materials which shall be prepared and verified taking into account guidelines, including any threshold values and exemptions contained in those guidelines, developed by the Organization,

NOTING ALSO that, at its sixty-second session, it adopted, by resolution MEPC.197(62), the *Guidelines for the development of the Inventory of Hazardous Materials*,

NOTING FURTHER that, at its sixty-eighth session, it adopted, by resolution MEPC.269(68), the *2015 Guidelines for the development of the Inventory of Hazardous Materials*, which superseded the Guidelines adopted through resolution MEPC.197(62), to improve the guidance on threshold values and exemptions,

RECOGNIZING the need for a consequential revision of the Guidelines associated with amendments to Annex 1 to the *International Convention on the Control of Harmful Anti-fouling Systems on Ships, 2001* (AFS Convention) (resolution MEPC.331(76)), which introduced controls on cybutryne and entered into force on 1 January 2023,

HAVING CONSIDERED, at its eightieth session, the recommendation made by the Sub-Committee on Pollution Prevention and Response at its tenth session,

1 ADOPTS the *2023 Guidelines for the development of the Inventory of Hazardous Materials* as set out in the annex to this resolution;

2 INVITES Member Governments to apply the 2023 Guidelines as soon as possible, or at the latest when the Convention enters into force;

3 AGREES to keep the 2023 Guidelines under review in the light of experience gained with their application;

4 AGREES ALSO that the 2023 Guidelines supersede the guidelines adopted by resolution MEPC.269(68).

ANNEX

2023 GUIDELINES FOR THE DEVELOPMENT OF THE INVENTORY OF HAZARDOUS MATERIALS

1 INTRODUCTION

1.1 Objectives

These guidelines provide recommendations for developing the Inventory of Hazardous Materials (hereinafter referred to as "the Inventory" or "the IHM") to assist compliance with regulation 5 (Inventory of Hazardous Materials) of the Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships, 2009 (hereinafter referred to as "the Convention").

1.2 Application

These guidelines have been developed to provide relevant stakeholders (e.g. shipbuilders, equipment suppliers, repairers, shipowners and ship management companies) with the essential requirements for the practical and logical development of the Inventory.

1.3 Objectives

The objectives of the Inventory are to provide ship-specific information on the actual hazardous materials present on board, in order to protect health and safety and to prevent environmental pollution at ship recycling facilities. This information will be used by the ship recycling facilities to decide how to manage the types and amounts of materials identified in the Inventory of Hazardous Materials (regulation 9 of the Convention).

2 DEFINITIONS

The terms used in these guidelines have the same meaning as those defined in the Convention, with the following additional definitions which apply to these guidelines only.

2.1 *Exemption* (as referred to in regulation 5 of the Convention) means materials specified in paragraph 3.3 in these guidelines that do not need to be listed on the IHM, even if such materials or items exceed the IHM threshold values.

2.2 *Fixed* means the conditions that equipment or materials are securely fitted with the ship, such as by welding or with bolts, riveted or cemented, and used at their position, including electrical cables and gaskets.

2.3 *Homogeneous material* means a material of uniform composition throughout that cannot be mechanically disjointed into different materials, meaning that the materials cannot, in principle, be separated by mechanical actions such as unscrewing, cutting, crushing, grinding and abrasive processes.

2.4 *Loosely fitted equipment* means equipment or materials present on board the ship by the conditions other than "fixed", such as fire extinguishers, distress flares and lifebuoys.

2.5 *Product* means machinery, equipment, materials and applied coatings on board a ship.

2.6 *Supplier* means a company which provides products; it may be a manufacturer, trader or agency.

2.7 *Supply chain* means the series of entities involved in the supply and purchase of materials and goods, from raw materials to final product.

2.8 *Threshold value* is defined as the concentration value in homogeneous materials.

3 REQUIREMENTS FOR THE INVENTORY

3.1 Scope of the Inventory

The Inventory consists of:

Part I: Materials contained in ship structure or equipment;

Part II: Operationally generated wastes; and

Part III: Stores.

3.2 Materials to be listed in the Inventory

3.2.1 Appendix 1 of these guidelines (Items to be listed in the Inventory of Hazardous Materials), provides information on the hazardous materials that may be found on board a ship. Materials set out in appendix 1 should be listed in the Inventory. Each item in appendix 1 of these guidelines is classified under tables A, B, C or D, according to its properties:

.1 table A comprises the materials listed in appendix 1 of the Convention;

.2 table B comprises the materials listed in appendix 2 of the Convention;

.3 table C (Potentially hazardous items) comprises items which are potentially hazardous to the environment and human health at ship recycling facilities; and

.4 table D (Regular consumable goods potentially containing hazardous materials) comprises goods which are not integral to a ship and are unlikely to be dismantled or treated at a ship recycling facility.

3.2.2 Tables A and B correspond to part I of the Inventory. Table C corresponds to parts II and III and table D corresponds to part III.

3.2.3 For loosely fitted equipment, there is no need to list this in part I of the Inventory. Such equipment which remains on board when the ship is recycled should be listed in part III.

3.2.4 Those batteries containing lead acid or other hazardous materials that are fixed in place should be listed in part I of the Inventory. Batteries that are loosely fitted, which include consumer batteries and batteries in stores, should be listed in part III of the Inventory.

3.2.5 Similar materials or items that contain hazardous materials that potentially exceed the threshold value can be listed together (not individually) on the IHM with their general location and approximate amount specified there (hereinafter referred to as "bulk listing"). An example of how to list those materials and items is shown in row 3 of table 1 of appendix 3.

3.3 Exemptions – Materials not required to be listed in the Inventory

3.3.1 Materials listed in table B that are inherent in solid metals or metal alloys, such as steels, aluminium, brasses, bronzes, plating and solders, provided they are used in general construction, such as hull, superstructure, pipes or housings for equipment and machinery, are not required to be listed in the Inventory.

3.3.2 Although electrical and electronic equipment is required to be listed in the Inventory, the amount of hazardous materials potentially contained in printed wiring boards (printed circuit boards) installed in the equipment does not need to be reported in the Inventory.

3.4 Standard format of the Inventory of Hazardous Materials

The Inventory should be developed on the basis of the standard format set out in appendix 2 of these guidelines: Standard format of the Inventory of Hazardous Materials. Examples of how to complete the Inventory are provided for guidance purposes only.

3.5 Revision of threshold values

Revised threshold values in tables A and B of appendix 1 should be used for IHMs developed or updated after the adoption of the revised values and need not be applied to existing IHMs and IHMs under development. However, when materials are added to the IHM, such as during maintenance, the revised threshold values should be applied and recorded in the IHM.

4 REQUIREMENTS FOR DEVELOPMENT OF THE INVENTORY

4.1 Development of part I of the Inventory for new ships[1]

4.1.1 Part I of the Inventory for new ships should be developed at the design and construction stage.

4.1.2 *Checking of materials listed in table A*

During the development of the Inventory (part I), the presence of materials listed in table A of appendix 1 should be checked and confirmed; the quantity and location of table A materials should be listed in part I of the Inventory. If such materials are used in compliance with the Convention, they should be listed in part I of the Inventory. Any spare parts containing materials listed in table A are required to be listed in part III of the Inventory.

4.1.3 *Checking of materials listed in table B*

If materials listed in table B of appendix 1 are present in products above the threshold values provided in table B, the quantity and location of the products and the contents of the materials

[1] In ascertaining whether a ship is a "new ship" or an "existing ship" according to the Convention, the term "a similar stage of construction" in regulation 1.4.2 of the annex to the Convention means the stage at which:

.1 construction identifiable with a specific ship begins; and

.2 assembly of that ship has commenced comprising at least 50 tonnes or 1% of the estimated mass of all structural material, whichever is less.

present in them should be listed in part I of the Inventory. Any spare parts containing materials listed in table B are required to be listed in part III of the Inventory.

4.1.4 *Process for checking of materials*

The checking of materials as provided in paragraphs 4.1.2 and 4.1.3 above should be based on the Material Declaration furnished by the suppliers in the shipbuilding supply chain (e.g. equipment suppliers, parts suppliers, material suppliers).

4.2 Development of part I of the Inventory for existing ships

4.2.1 In order to achieve comparable results for existing ships with respect to part I of the Inventory, the following procedure should be followed:

.1 collection of necessary information;

.2 assessment of collected information;

.3 preparation of visual/sampling check plan;

.4 onboard visual check and sampling check; and

.5 preparation of part I of the Inventory and related documentation.

4.2.2 The determination of hazardous materials present on board existing ships should, as far as practicable, be conducted as prescribed for new ships, including the procedures described in sections 6 and 7 of these guidelines. Alternatively, the procedures described in this section may be applied for existing ships, but these procedures should not be used for any new installation resulting from the conversion or repair of existing ships after the initial preparation of the Inventory.

4.2.3 The procedures described in this section should be carried out by the shipowner, who may draw upon expert assistance. Such an expert or expert party should not be the same as the person or organization authorized by the Administration to approve the Inventory).

4.2.4 Reference is made to appendix 4 (Flow diagram for developing part I of the Inventory for existing ships) and appendix 5 (Example of development process for part I of the Inventory for existing ships).

4.2.5 *Collection of necessary information (step 1)*

The shipowner should identify, research, request and procure all reasonably available documentation regarding the ship. Information that will be useful includes maintenance, conversion and repair documents; certificates, manuals, ship's plans, drawings and technical specifications; product information data sheets (such as Material Declarations); and hazardous material inventories or recycling information from sister ships. Potential sources of information could include previous shipowners, the shipbuilder, historical societies, classification society records and ship recycling facilities with experience working with similar ships.

4.2.6 *Assessment of collected information (step 2)*

The information collected in step 1 above should be assessed. The assessment should cover all materials listed in table A of appendix 1; materials listed in table B should be assessed as far as practicable. The results of the assessment should be reflected in the visual/sampling check plan.

4.2.7 *Preparation of visual/sampling check plan (step 3)*

4.2.7.1 To specify the materials listed in appendix 1 of these guidelines, a visual/sampling check plan should be prepared taking into account the collated information and any appropriate expertise. The visual/sampling check plan should be based on the following three lists:

.1 List of equipment, system and/or area for visual check (any equipment, system and/or area specified regarding the presence of the materials listed in appendix 1 by document analysis should be entered in the List of equipment, system and/or area for visual check);

.2 List of equipment, system and/or area for sampling check (any equipment, system and/or area which cannot be specified regarding the presence of the materials listed in appendix 1 by document or visual analysis should be entered in the List of equipment, system and/or area as requiring sampling check. A sampling check is the taking of samples to identify the presence or absence of hazardous material contained in the equipment, systems and/or areas, by suitable and generally accepted methods such as laboratory analysis); and

.3 List of equipment, system and/or area classed as "potentially containing hazardous material" (any equipment, system and/or area which cannot be specified regarding the presence of the materials listed in appendix 1 by document analysis may be entered in the List of equipment, system and/or area classed as "potentially containing hazardous material" without the sampling check. The prerequisite for this classification is a comprehensible justification such as the impossibility of conducting sampling without compromising the safety of the ship and its operational efficiency).

4.2.7.2 Visual/sampling checkpoints should be all points where:

.1 the presence of materials to be considered for the Inventory part I as listed in appendix 1 is likely;

.2 the documentation is not specific; or

.3 materials of uncertain composition were used.

4.2.8 *Onboard visual/sampling check (step 4)*

4.2.8.1 The onboard visual/sampling check should be carried out in accordance with the visual/sampling check plan. When a sampling check is carried out, samples should be taken and the sample points should be clearly marked on the ship plan and the sample results should be referenced. Materials of the same kind may be sampled in a representative manner. Such materials are to be checked to ensure that they are of the same kind. The sampling check should be carried out drawing upon expert assistance.

4.2.8.2 Any uncertainty regarding the presence of hazardous materials should be clarified by a visual/sampling check. Checkpoints should be documented in the ship's plan and may be supported by photographs.

4.2.8.3 If the equipment, system and/or area of the ship are not accessible for a visual check or sampling check, they should be classified as "potentially containing hazardous material". The prerequisite for such classification should be the same prerequisite as in section 4.2.7. Any equipment, system and/or area classed as "potentially containing Hazardous Material" may be investigated or subjected to a sampling check at the request of the shipowner during a later survey (e.g. during repair, refit or conversion).

4.2.9 *Preparation of part I of the Inventory and related documentation (step 5)*

If any equipment, system and/or area is classed as either "containing hazardous material" or "potentially containing hazardous material", their approximate quantity and location should be listed in part I of the Inventory. These two categories should be indicated separately in the "Remarks" column of the Inventory.

4.2.10 *Testing methods*

4.2.10.1 Samples may be tested by a variety of methods. "Indicative" or "field tests" may be used when:

.1 the likelihood of a hazard is high;

.2 the test is expected to indicate that the hazard exists; and

.3 the sample is being tested by "specific testing" to show that the hazard is present.

4.2.10.2 Indicative or field tests are quick, inexpensive and useful on board the ship or on-site, but they cannot be accurately reproduced or repeated, and cannot identify the hazard specifically, and therefore cannot be relied upon except as "indicators".

4.2.10.3 In all other cases, and in order to avoid dispute, "specific testing" should be used. Specific tests are repeatable, reliable and can demonstrate definitively whether a hazard exists or not. They will also provide a known type of the hazard. The methods indicated are found qualitative and quantitative appropriate and only testing methods to the same effect can be used. Specific tests are to be carried out by a suitably accredited laboratory, working to international standards[2] or equivalent, which will provide a written report that can be relied upon by all parties.

4.2.10.4 Specific test methods for appendix 1 materials are provided in appendix 9.

4.2.11 *Diagram of the location of hazardous materials on board a ship*

Preparation of a diagram showing the location of the materials listed in table A is recommended in order to help ship recycling facilities gain a visual understanding of the Inventory.

[2] For example ISO 17025.

4.3 Maintaining and updating part I of the Inventory during operations

4.3.1 Part I of the Inventory should be appropriately maintained and updated, especially after any repair or conversion or sale of a ship.

4.3.2 *Updating of part I of the Inventory in the event of new installation*

If any machinery or equipment is added to, removed or replaced or the hull coating is renewed, part I of the Inventory should be updated according to the requirements for new ships as stipulated in paragraphs 4.1.2 to 4.1.4. Updating is not required if identical parts or coatings are installed or applied.

4.3.3 *Continuity of part I of the Inventory*

Part I of the Inventory should belong to the ship and the continuity and conformity of the information it contains should be confirmed, especially if the flag, owner or operator of the ship changes.

4.4 Development of part II of the Inventory (operationally generated waste)

4.4.1 Once the decision to recycle a ship has been taken, part II of the Inventory should be developed before the final survey, taking into account that a ship destined to be recycled shall conduct operations in the period prior to entering the ship recycling facility in a manner that minimizes the amount of cargo residues, fuel oil and wastes remaining on board (regulation 8.2 of the Convention).

4.4.2 *Operationally generated wastes to be listed in the Inventory*

If the wastes listed in part II of the Inventory provided in table C (Potentially hazardous items) of appendix 1 are intended for delivery with the ship to a ship recycling facility, the quantity of the operationally generated wastes should be estimated and their approximate quantities and locations should be listed in part II of the Inventory.

4.5 Development of part III of the Inventory (stores)

4.5.1 Once the decision to recycle has been taken, part III of the Inventory should be developed before the final survey, taking into account the fact that a ship destined to be recycled shall minimize the wastes remaining on board (regulation 8.2 of the Convention). Each item listed in part III should correspond to the ship's operations during its last voyage.

4.5.2 *Stores to be listed in the Inventory*

If the stores to be listed in part III of the Inventory provided in table C of appendix 1 are to be delivered with the ship to a ship recycling facility, the unit (e.g. capacity of cans and cylinders), quantity and location of the stores should be listed in part III of the Inventory.

4.5.3 *Liquids and gases sealed in ship's machinery and equipment to be listed in the Inventory*

If any liquids and gases listed in table C of appendix 1 are integral in machinery and equipment on board a ship, their approximate quantity and location should be listed in part III of the Inventory. However, small amounts of lubricating oil, anti-seize compounds and grease which are applied to or injected into machinery and equipment to maintain normal performance do not fall within the scope of this provision. For subsequent completion of part III of the Inventory during the recycling preparation processes, the quantity of liquids and gases listed in table C of appendix 1 required for normal operation, including the related pipe system volumes, should be prepared and documented at the design and construction stage. This information belongs to the ship, and continuity of this information should be maintained if the flag, owner or operator of the ship changes.

4.5.4 *Regular consumable goods to be listed in the Inventory*

Regular consumable goods, as provided in table D of appendix 1 should not be listed in part I or part II but should be listed in part III of the Inventory if they are to be delivered with the ship to a ship recycling facility. A general description including the name of item (e.g. TV set), manufacturer, quantity and location should be entered in part III of the Inventory. The check on materials provided for in paragraphs 4.1.2 and 4.1.3 of these guidelines does not apply to regular consumable goods.

4.6 Description of location of hazardous materials on board

The locations of hazardous materials on board should be described and identified using the name of location (e.g. second floor of engine-room, bridge DK, APT, No.1 cargo tank, frame number) given in the plans (e.g. general arrangement, fire and safety plan, machinery arrangement or tank arrangement).

4.7 Description of approximate quantity of hazardous materials

In order to identify the approximate quantity of hazardous materials, the standard unit used for hazardous materials should be kg, unless other units (e.g. m^3 for materials of liquid or gases, m^2 for materials used in floors or walls) are considered more appropriate. An approximate quantity should be rounded up to at least two significant figures.

5 REQUIREMENTS FOR ASCERTAINING THE CONFORMITY OF THE INVENTORY

5.1 Design and construction stage

The conformity of part I of the Inventory at the design and construction stage should be ascertained by reference to the collected Supplier's Declaration of Conformity described in section 7 and the related Material Declarations collected from suppliers.

5.2 Operational stage

Shipowners should implement the following measures in order to ensure the conformity of part I of the Inventory:

.1 to designate a person as responsible for maintaining and updating the Inventory (the designated person may be employed ashore or on board);

.2 the designated person, in order to implement paragraph 4.3.2, should establish and supervise a system to ensure the necessary updating of the Inventory in the event of new installation;

.3 to maintain the Inventory including dates of changes or new deleted entries and the signature of the designated person; and

.4 to provide related documents as required for the survey or sale of the ship.

6 MATERIAL DECLARATION

6.1 General

Suppliers to the shipbuilding industry should identify and declare whether or not the materials listed in table A or table B are present above the threshold value specified in appendix 1 of these guidelines. However, this provision does not apply to chemicals which do not constitute a part of the finished product.

6.2 Information required in the declaration

6.2.1 At a minimum the following information is required in the Material Declaration:

.1 date of declaration;

.2 Material Declaration identification number;

.3 supplier's name;

.4 product name (common product name or name used by manufacturer);

.5 product number (for identification by manufacturer);

.6 declaration of whether or not the materials listed in table A and table B of appendix 1 of these guidelines are present in the product above the threshold value stipulated in appendix 1 of these guidelines; and

.7 mass of each constituent material listed in table A and/or table B of appendix 1 of these guidelines if present above threshold value.

6.2.2 An example of the Material Declaration is shown in appendix 6.

7 SUPPLIER'S DECLARATION OF CONFORMITY

7.1 Purpose and scope

7.1.1 The purpose of the Supplier's Declaration of Conformity is to provide assurance that the related Material Declaration conforms to section 6.2, and to identify the responsible entity.

7.1.2 The Supplier's Declaration of Conformity remains valid as long as the products are present on board.

7.1.3 The supplier compiling the Supplier's Declaration of Conformity should establish a company policy.[3] The company policy on the management of the chemical substances in products which the supplier manufactures or sells should cover:

.1 Compliance with law:

The regulations and requirements governing the management of chemical substances in products should be clearly described in documents which should be kept and maintained; and

[3] A recognized quality management system may be utilized.

.2 Obtaining of information on chemical substance content:

In procuring raw materials for components and products, suppliers should be selected following an evaluation, and the information on the chemical substances they supply should be obtained.

7.2 Contents and format

7.2.1 The Supplier's Declaration of Conformity should contain the following:

.1 unique identification number;

.2 name and contact address of the issuer;

.3 identification of the subject of the Declaration of Conformity (e.g. name, type, model number, and/or other relevant supplementary information);

.4 statement of conformity;

.5 date and place of issue; and

.6 signature (or equivalent sign of validation), name and function of the authorized person(s) acting on behalf of the issuer.

7.2.2 An example of the Supplier's Declaration of Conformity is shown in appendix 7.

8 LIST OF APPENDICES

Appendix 1: Items to be listed in the Inventory of Hazardous Materials

Appendix 2: Standard format of the Inventory of Hazardous Materials

Appendix 3: Example of the development process for part I of the Inventory for new ships

Appendix 4: Flow diagram for developing part I of the Inventory for existing ships

Appendix 5: Example of the development process for part I of the Inventory for existing ships

Appendix 6: Form of Material Declaration

Appendix 7: Form of Supplier's Declaration of Conformity

Appendix 8: Examples of table A and table B materials of appendix 1 with CAS-numbers

Appendix 9: Specific test methods

Appendix 10: Examples of radioactive sources

APPENDIX 1

ITEMS TO BE LISTED IN THE INVENTORY OF HAZARDOUS MATERIALS

Table A – Materials listed in appendix 1 of the Annex to the Convention

<table>
<tr><th rowspan="2">No.</th><th rowspan="2" colspan="2">Materials</th><th colspan="3">Inventory</th><th rowspan="2">Threshold value</th></tr>
<tr><th>Part I</th><th>Part II</th><th>Part III</th></tr>
<tr><td>A-1</td><td colspan="2">Asbestos</td><td>x</td><td></td><td></td><td>0.1%[4]</td></tr>
<tr><td>A-2</td><td colspan="2">Polychlorinated biphenyls (PCBs)</td><td>x</td><td></td><td></td><td>50 mg/kg[5]</td></tr>
<tr><td rowspan="9">A-3</td><td rowspan="9">Ozone-depleting substances</td><td>CFCs</td><td>x</td><td></td><td></td><td rowspan="9">no threshold value[6]</td></tr>
<tr><td>Halons</td><td>x</td><td></td><td></td></tr>
<tr><td>Other fully halogenated CFCs</td><td>x</td><td></td><td></td></tr>
<tr><td>Carbon tetrachloride</td><td>x</td><td></td><td></td></tr>
<tr><td>1,1,1-Trichloroethane (Methyl chloroform)</td><td>x</td><td></td><td></td></tr>
<tr><td>Hydrochlorofluorocarbons</td><td>x</td><td></td><td></td></tr>
<tr><td>Hydrobromofluorocarbons</td><td>x</td><td></td><td></td></tr>
<tr><td>Methyl bromide</td><td>x</td><td></td><td></td></tr>
<tr><td>Bromochloromethane</td><td>x</td><td></td><td></td></tr>
<tr><td rowspan="2">A-4</td><td colspan="2">Anti-fouling systems containing organotin compounds as a biocide</td><td>x</td><td></td><td></td><td>2,500 mg total tin/kg[7]</td></tr>
<tr><td colspan="2">Anti-fouling systems containing cybutryne</td><td>x</td><td></td><td></td><td>1,000 mg/kg[8]</td></tr>
</table>

Table B – Materials listed in appendix 2 of the annex to the Convention

No.	Materials	Inventory	Threshold value

4 In accordance with regulation 4 of the Convention, for all ships, new installation of materials which contain asbestos shall be prohibited. According to the UN recommendation "Globally Harmonized System of Classification and Labelling of Chemicals (GHS)" adopted by the United Nations Economic and Social Council's Sub-Committee of Experts on the Globally Harmonized System of Classification and Labelling of Chemicals (UNSCEGHS), the UN's Sub-Committee of Experts, in 2002 (published in 2003), carcinogenic mixtures classified as Category 1A (including asbestos mixtures) under the GHS are required to be labelled as carcinogenic if the ratio is more than 0.1%. However, if 1% is applied, this threshold value should be recorded in the Inventory and, if available, the Material Declaration and can be applied not later than five years after the entry into force of the Convention. The threshold value of 0.1% need not be retroactively applied to those Inventories and Material Declarations.

5 In accordance with regulation 4 of the Convention, for all ships, new installation of materials which contain PCBs shall be prohibited. The Organization set 50 mg/kg as the threshold value referring to the concentration level at which wastes, substances and articles containing, consisting of or contaminated with PCB are characterized as hazardous under the Basel Convention.

6 "No threshold value" is in accordance with the Montreal Protocol for reporting ODS. Unintentional trace contaminants should not be listed in the Material Declarations and in the Inventory.

7 This threshold value is based on the *2022 Guidelines for brief sampling of anti-fouling systems on ships* (resolution MEPC.356(78)).

8 When samples are directly taken from the hull, average values of cybutryne should not be present above 1,000 mg of cybutryne per kilogram of dry paint.

		Part I	Part II	Part III	
B-1	Cadmium and cadmium compounds	x			100 mg/kg[9]
B-2	Hexavalent chromium and hexavalent chromium compounds	x			1,000 mg/kg[8]
B-3	Lead and lead compounds	x			1,000 mg/kg[8]
B-4	Mercury and mercury compounds	x			1,000 mg/kg[8]
B-5	Polybrominated biphenyl (PBBs)	x			50 mg/kg[10]
B-6	Polybrominated diphenyl ethers (PBDEs)	x			1,000 mg/kg[8]
B-7	Polychlorinated naphthalenes (more than 3 chlorine atoms)	x			50mg/kg[11]
B-8	Radioactive substances	x			no threshold value[12]
B-9	Certain short-chain chlorinated paraffins (alkanes, C10-C13, chloro)	x			1%[13]

[9] The Organization set this as the threshold value referring to the Restriction of Hazardous Substances (RoHS Directive 2011/65/EU, Annex II).

[10] The Organization set 50 mg/kg as the threshold value referring to the concentration level at which wastes, substances and articles containing, consisting of or contaminated with PBB are characterized as hazardous under the Basel Convention.

[11] The Organization set 50 mg/kg as the threshold value referring to the concentration level at which wastes, substances and articles containing, consisting of or contaminated with PCN are characterized as hazardous under the Basel Convention.

[12] All radioactive sources should be included in the Material Declaration and in the Inventory. *Radioactive source* means radioactive material permanently sealed in a capsule or closely bonded and in a solid form that is used as a source of radiation. This includes consumer products and industrial gauges with radioactive materials. Examples are listed in appendix 10.

[13] The Organization set 1% as the threshold value referring to the EU legislation that restricts chlorinated paraffins from being placed on the market for use as substances or as constituents of other substances or preparations in concentrations higher than 1% (EU Regulation 1907/2006, Annex XVII Entry 42 and Regulation 519/2012).

Table C – Potentially hazardous items

No.	Properties		Goods	Inventory		
				Part I	Part II	Part III
C-1	Liquid	Oiliness	Kerosene			x
C-2			White spirit			x
C-3			Lubricating oil			x
C-4			Hydraulic oil			x
C-5			Anti-seize compounds			x
C-6			Fuel additive			x
C-7			Engine coolant additives			x
C-8			Antifreeze fluids			x
C-9			Boiler and feed water treatment and test re-agents			x
C-10			De-ionizer regenerating chemicals			x
C-11			Evaporator dosing and descaling acids			x
C-12			Paint stabilizers/rust stabilizers			x
C-13			Solvents/thinners			x
C-14			Paints			x
C-15			Chemical refrigerants			x
C-16			Battery electrolyte			x
C-17			Alcohol, methylated spirits			x
C-18	Gas	Explosives/ inflammables	Acetylene			x
C-19			Propane			x
C-20			Butane			x
C-21			Oxygen			x
C-22		Green House Gases	CO_2			x
C-23			Perfluorocarbons (PFCs)			x
C-24			Methane			x
C-25			Hydrofluorocarbon (HFCs)			x
C-27			Nitrous oxide (N_2O)			x
C-28			Sulphur hexafluoride (SF_6)			x
C-29	Liquid	Oiliness	Bunkers: fuel oil			x
C-30			Grease			x
C-31			Waste oil (sludge)		x	
C-32			Bilge and/or wastewater generated by the after-treatment systems fitted on machineries		x	
C-33			Oily liquid cargo tank residues		x	
C-34			Ballast water		x	
C-35			Raw sewage		x	
C-36			Treated sewage		x	
C-37			Non-oily liquid cargo residues		x	
C-38	Gas	Explosibility/ inflammability	Fuel gas			x

No.	Properties	Goods	Inventory		
			Part I	Part II	Part III
C-39	Solid	Dry cargo residues		x	
C-40		Medical waste/infectious waste		x	
C-41		Incinerator ash[14]		x	
C-42		Garbage		x	
C-43		Fuel tank residues		x	
C-44		Oily solid cargo tank residues		x	
C-45		Oily or chemical contaminated rags		x	
C-46		Batteries (incl. lead acid batteries)			x
C-47		Pesticides/insecticide sprays			x
C-48		Extinguishers			x
C-49		Chemical cleaner (incl. electrical equipment cleaner, carbon remover)			x
C-50		Detergent/bleacher (could be a liquid)			x
C-51		Miscellaneous medicines			x
C-52		Fire-fighting clothing and personal protective equipment			x
C-53		Dry tank residues		x	
C-54		Cargo residues		x	
C-55		Spare parts which contain materials listed in table A or table B			x

Table D – Regular consumable goods potentially containing hazardous materials[15]

No.	Properties	Example	Inventory		
			Part I	Part II	Part III
D-1	Electrical and electronic equipment	Computers, refrigerators, printers, scanners, television sets, radio sets, video cameras, video recorders, telephones, consumer batteries, fluorescent lamps, filament bulbs, lamps			x
D-2	Lighting equipment	Fluorescent lamps, filament bulbs, lamps			x
D-3	Non-ship-specific furniture, interior and similar equipment	Chairs, sofas, tables, beds, curtains, carpets, garbage bins, bed-linen, pillows, towels, mattresses, storage racks, decoration, bathroom installations, toys, not structurally relevant or integrated artwork			x

[14] Definition of garbage is identical to that in MARPOL Annex V. However, incinerator ash is classified separately because it may include hazardous substances or heavy metals.

[15] This table does not include ship-specific equipment integral to ship operations, which has to be listed in part I of the inventory.

APPENDIX 2

STANDARD FORMAT OF THE INVENTORY OF HAZARDOUS MATERIALS[16]

Part I

Hazardous materials contained in the ship's structure and equipment

I-1 – Paints and coating systems containing materials listed in table A and table B of appendix 1 of these guidelines

No.	Application of paint	Name of paint	Location	Materials (classification in appendix 1)	Approximate quantity		Remarks
1	Anti-drumming compound	Primer, xx Co., xx primer #300	Hull part	Lead	35.00	kg	
2	Anti-fouling	xx Co., xx coat #100	Underwater parts	TBT	120.00	kg	

16 Examples of how to complete the Inventory are provided for guidance purposes only in accordance with paragraph 3.4 of the Guidelines.

I-2 – Equipment and machinery containing materials listed in table A and table B of appendix 1 of these guidelines

No.	Name of equipment and machinery	Location	Materials (classification in appendix 1)	Parts where used	Approximate quantity		Remarks
1	Switchboard	Engine control room	Cadmium	Housing coating	0.02	kg	
			Mercury	Heat gauge	<0.01	kg	less than 0.01kg
2	~~Diesel engine, xx Co., xx #150~~	~~Engine room~~	~~LeadCadmium~~	~~BearingStarter for blower~~	~~0.02~~	~~kg~~	
3	Diesel engine, xx Co., xx #200	Engine-room	Lead	Starter for blower	0.01	kg	revised by XXX on Oct. XX, 2008 (revoking No.2)
4	Diesel generator (x 3)	Engine-room	Lead	Ingredient of copper compounds	0.01	kg	
5	Radioactive level gauge	No. 1 Cargo tank	Radioactive substances	Gauge	5 (1.8E+11)	Ci (Bq)	Radionuclides: ^{60}Co

I-3 - Structure and hull containing materials listed in table A and table B of appendix 1 of these guidelines

No.	Name of structural element	Location	Materials (classification in appendix 1)	Parts where used	Approximate quantity		Remarks
1	Wall panel	Accommodation	Asbestos	Insulation	2,500.00	kg	
2	Wall insulation	Engine control room	Lead	Perforated plate	0.01	kg	cover for insulation material
			Asbestos	Insulation	25.00	kg	under perforated plates
3							

Part II
Operationally generated waste

No.	Location[1]	Name of item (classification in appendix 1) and detail (if any) of the item	Approximate quantity		Remarks
1	Garbage locker	Garbage (food waste)	35.00	kg	
2	Bilge tank	Bilgewater	15.00	m^3	
3	No.1 cargo hold	Dry cargo residues (iron ore)	110.00	kg	
4	No.2 cargo hold	Waste oil (sludge) (crude)	120.00	kg	
5	No.1 ballast tank	Ballast water	2,500.00	m^3	
		Sediments	250.00	kg	

[1] The location of a part II or part III item should be entered in order based on its location, from a lower level to an upper level and from a fore part to an aft part. The location of part I items is recommended to be described similarly, as far as practicable.

Part III
Stores

III-1 - *Stores*

No.	Location[1]	Name of item (classification in appendix 1)	Unit quantity		Figure		Approximate quantity		Remarks[2)]
								m^3	
								kg	
								kg	
									Details are shown in the attached list.
5	Paint stores	Paint, xx Co., #600	20.00	kg	5	pcs	100.00	kg	Cadmium containing.

1 The location of a part II or part III item should be entered in order based on its location, from a lower level to an upper level and from a fore part to an aft part. The location of part I items is recommended to be described similarly, as far as practicable.

2 In column "Remarks" for part III items, if hazardous materials are integrated in products, the approximate amount of the contents should be shown as far as possible.

III-2 – Liquids sealed in ship's machinery and equipment

No.	Type of liquids (classification in appendix 1)	Name of machinery or equipment	Location	Approximate quantity		Remarks
1	Hydraulic oil	Deck crane hydraulic oil system	Upper deck	15.00	m^3	
		Deck machinery hydraulic oil system	Upper deck and bosun store	200.00	m^3	
		Steering gear hydraulic oil system	Steering gear room	0.55	m^3	
2	Lubricating oil	Main engine system	Engine-room	0.45	m^3	
3	Boiler water treatment	Boiler	Engine-room	0.20	m^3	

III-3 – Gases sealed in ship's machinery and equipment

No.	Type of gases (classification in appendix 1)	Name of machinery or equipment	Location	Approximate quantity		Remarks
1	HFC	AC system	AC room	100.00	kg	
2	HFC	Refrigerated provision chamber machine	AC room	50.00	kg	

III-4 – Regular consumable goods potentially containing hazardous materials

No.	Location[17]	Name of item	Quantity	Remarks
1	Accommodation	Refrigerators	1	
2	Accommodation	Personal computers	2	

[17] The location of a part II or part III item should be entered in order based on its location, from a lower level to an upper level and from a fore part to an aft part. The location of part I items is recommended to be described similarly, as far as practicable.

APPENDIX 3

EXAMPLE OF THE DEVELOPMENT PROCESS FOR PART I OF THE INVENTORY FOR NEW SHIPS

1 OBJECTIVE OF THE TYPICAL EXAMPLE

This example has been developed to give guidance and to facilitate understanding of the development process for part I of the Inventory of Hazardous Materials for new ships.

2 DEVELOPMENT FLOW FOR PART I OF THE INVENTORY

Part I of the Inventory should be developed using the following three steps. However, the order of these steps is flexible and can be changed depending on the schedule of shipbuilding:

.1 collection of hazardous materials information;

.2 utilization of hazardous materials information; and

.3 preparation of the Inventory (by filling out standard format).

3 COLLECTION OF HAZARDOUS MATERIALS INFORMATION

3.1 Data-collection process for hazardous materials

Materials Declaration (MD) and Supplier's Declaration of Conformity (SDoC) for products from suppliers (tier 1 suppliers) should be requested and collected by the shipbuilding yard. Tier 1 suppliers may request from their suppliers (tier 2 suppliers) the relevant information if they cannot develop the MD based on the information available. Thus the collection of data on hazardous materials may involve the entire shipbuilding supply chain (figure 1).

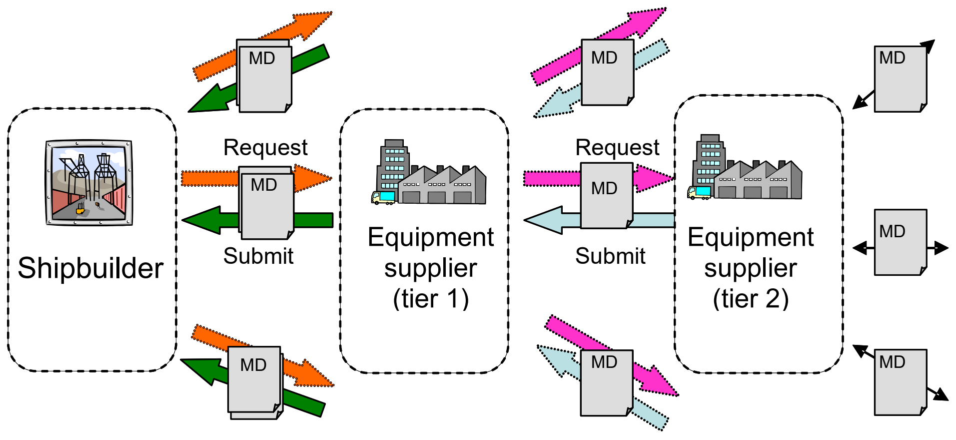


Figure 1 – Process of MD (and SDoC) collection showing involvement of supply chain

3.2 Declaration of hazardous materials

Suppliers should declare whether or not the hazardous materials listed in table A and table B in the MD are present in concentrations above the threshold values specified for each homogeneous material in a product.

3.2.1 *Materials listed in table A*

If one or more materials listed in table A are found to be present in concentrations above the specified threshold value according to the MD, the products which contain these materials shall not be installed on a ship. However, if the materials are used in a product in accordance with an exemption specified by the Convention (e.g. new installations containing hydrochlorofluorocarbons (HCFCs) before 1 January 2020), the product should be listed in the Inventory.

3.2.2 *Materials listed in table B*

If one or more materials listed in table B are found to be present in concentrations above the specified threshold value according to the MD, the products should be listed in the Inventory.

3.3 Example of homogeneous materials

Figure 2 shows an example of four homogeneous materials which constitute a cable. In this case, sheath, intervention, insulator and conductor are all individual homogeneous materials.

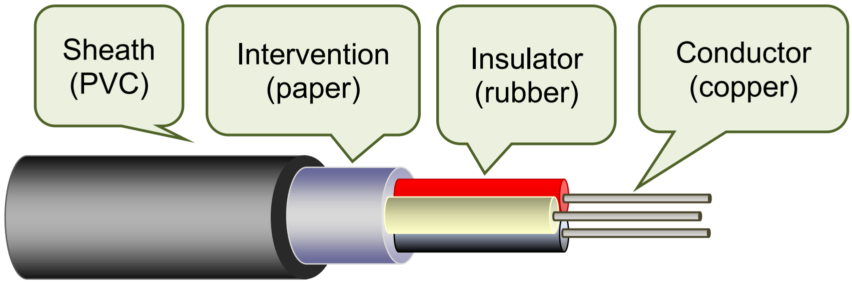


Figure 2 – *Example of homogeneous materials (cable)*

4 UTILIZATION OF HAZARDOUS MATERIALS INFORMATION

Products which contain hazardous materials in concentrations above the specified threshold values should be clearly identified in the MD. The approximate quantity of the hazardous materials should be calculated if the mass data for hazardous materials are declared in the MD using a unit which cannot be directly utilized in the Inventory.

5 PREPARATION OF INVENTORY (BY FILLING OUT STANDARD FORMAT)

The information received for the Inventory, as contained in table A and table B of appendix 1 of these guidelines, ought to be structured and utilized according to the following categorization for part I of the Inventory:

Part I-1 Paints and coating systems;

Part I-2 Equipment and machinery; and

Part I-3 Structure and hull.

5.1 "Name of equipment and machinery" column

5.1.1 *Equipment and machinery*

5.1.1.1 The name of each item of equipment or machinery should be entered in this column. If more than one hazardous material is present in the equipment or machinery, the row relating to that equipment or machinery should be appropriately divided such that all of the hazardous materials contained in the piece of equipment or machinery are entered. If more than one item of equipment or machinery is situated in one location, both name and quantity of the equipment or machinery should be entered in the column. Examples are shown in rows 1 and 2 of table 1.

5.1.1.2 For identical or common items, such as but not limited to bolts, nuts and valves, there is no need to list each item individually (see Bulk Listing in paragraph 3.2 of the guidelines). An example is shown in row 3 of table 1.

Table 1 – Example showing more than one item of equipment or machinery situated in one location

No.	Name of equipment and machinery	Location	Materials (classification in appendix 1)	Parts where used	Approximate quantity		Remarks
1	Main engine	Engine-room	Lead	Piston pin bush	0.75	kg	
			Mercury	Thermometer charge air temperature	0.01	kg	
2	Diesel generator (x 3)	Engine-room	Mercury	Thermometer	0.03	kg	
3	FC valve (x 100)	Throughout the ship	Lead and lead compounds		20.5	kg	

5.1.2 *Pipes and cables*

The names of pipes and of systems, including electric cables, which are often situated in more than one compartment of a ship, should be described using the name of the system concerned. A reference to the compartments where these systems are located is not necessary as long as the system is clearly identified and properly named.

5.2 "Approximate quantity" column

The standard unit for approximate quantity of solid hazardous materials should be kg. If the hazardous materials are liquids or gases, the standard unit should be either m^3 or kg. An approximate quantity should be rounded up to at least two significant figures. If the hazardous material is less than 10 g, the description of the quantity should read "<0.01 kg".

Table 2 – Example of a switchboard

No.	Name of equipment and machinery	Location	Materials (classification in appendix 1)	Parts where used	Approximate quantity		Remarks
	Switchboard	Engine control room	Cadmium	Housing coating	0.02	kg	
			Mercury	Heat gauge	<0.01	kg	less than 0.01 kg

5.3 "Location" column

5.3.1 *Example of a location list*

It is recommended to prepare a location list which covers all compartments of a ship based on the ship's plans (e.g. general arrangement, engine-room arrangement, accommodation and tank plan) and on other documentation on board, including certificates or spare parts lists. The description of the location should be based on a location such as a deck or room to enable easy identification. The name of the location should correspond to the ship's plans so as to ensure consistency between the Inventory and the ship's plans. Examples of names of locations are shown in table 3. For bulk listings, the locations of the items or materials may be generalized. For example, the location may only include the primary classification such as "Throughout the ship" as shown in the table 3 below.

Table 3 – Examples of location names

(A) Primary classification	(B) Secondary classification	(C) Name of location
Throughout the ship		
Hull part	Fore part	Bosun store
		…
	Cargo part	No.1 cargo hold/tank
		No.1 garage deck
		…
	Tank part	Fore peak tank
		No.1 WBT
		No.1 FOT
		…
		Aft Peak Tank
	Aft part	Steering gear room
		Emergency fire pump space
		…
	Superstructure	Accommodation
		Compass deck
		Nav. bridge deck
		…
		Wheel house
		Engine control room
		Cargo control room
		…
	Deck house	Deck house
		…
(A) Primary classification	(B) Secondary classification	(C) Name of location
Machinery part	Engine-room	Engine-room
		Main floor
		2nd floor
		…
		Generator space/room
		Purifier space/room
		Shaft space/room
		Engine casing
		Funnel
		Engine control room
		…
	Pump-room	Pump-room
		…
Exterior part	Superstructure	Superstructure
	Upper deck	Upper deck
	Hull shell	Hull shell
		bottom
		under waterline
		…

5.3.2 *Description of location of pipes and electrical systems*

5.3.2.1 Locations of pipes and systems, including electrical systems and cables situated in more than one compartment of a ship, should be described for each system concerned. If they are situated in a number of compartments, the most practical of the following two options should be used:

.1 listing of all components in the column; or

.2 description of the location of the system using an expression such as those shown under "primary classification" and "secondary classification" in table 3.

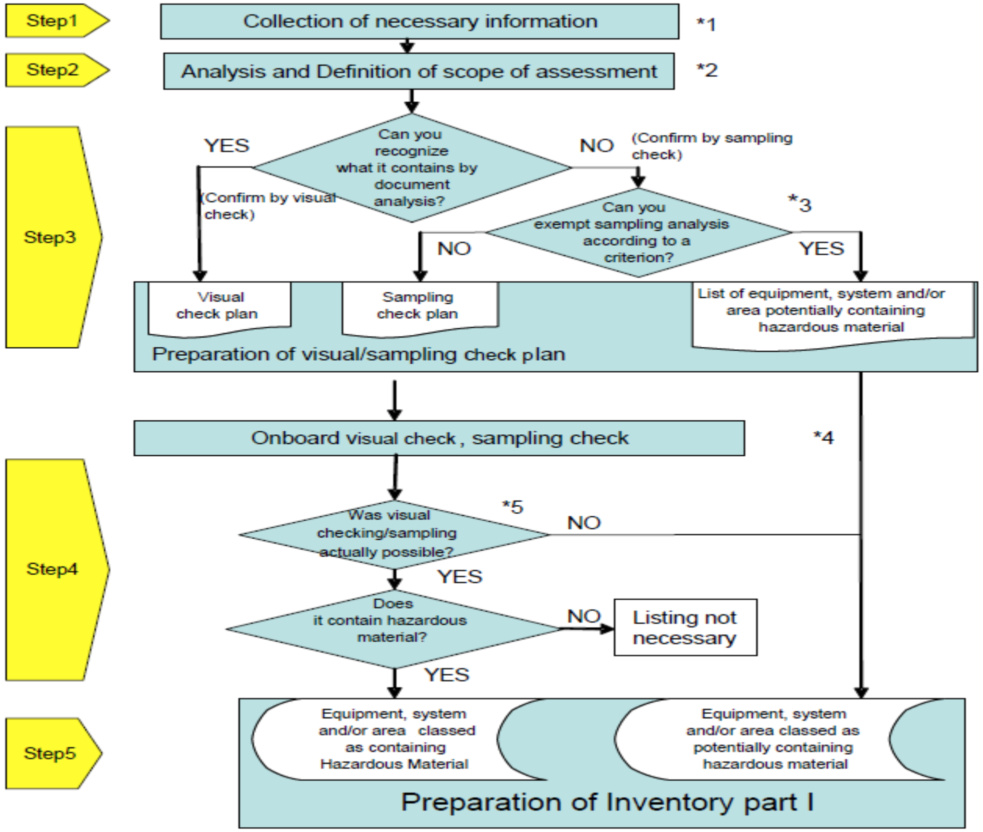
5.3.2.2 A typical description of a pipe system is shown in table 4.

Table 4 – Example of description of a pipe system

No.	Name of equipment and machinery	Location	Materials (classification in appendix 1)	Parts where used	Approximate quantity		Remarks
	Ballast water system	Engine-room, Hold parts					

APPENDIX 4

FLOW DIAGRAM FOR DEVELOPING PART I OF THE INVENTORY FOR EXISTING SHIPS



*1 : Documents may include any certificates, manuals, ship's plans drawings, technical specifications and information from sister and/or similar ships.

*2 : The assessment should cover all materials listed in table A of appendix 1 of the Guideline; the materials listed in table B should be listed as far as practicable.
It is impossible to assess all equipment and areas including those which are assumed not to contain hazardous materials described above.
Using analysis of available documents based on knowledge and experience, it must be made clear which equipment and/or area should be included in the scope of the assessment.

*3 : Equipment, system and/or areas which cannot be specified as containing materials listed in appendix 1 of these guidelines on the basis of documents can be listed in the List of equipment, system and/or area classed as "potentially containing hazardous material" without the sampling check. The prerequisite for this classification is a comprehensible justification of the conclusion, such as the impossibility to conduct samplings without compromising ship safety and operational efficiency.

*4 : Sampling check. This means sampling and identification of hazardous material contained in the equipment, systems, and/or areas, by laboratory analysis. The sampling check should be applied where the presence of prohibited and restricted hazardous material is assumed but cannot be recognized by analysis of the available documentation.

*5 : When equipment, systems and/or areas of a ship are not accessible for visual check or sampling check, this equipment, system and/or area is classified as "potentially containing hazardous material".

APPENDIX 5

EXAMPLE OF THE DEVELOPMENT PROCESS FOR PART I OF THE INVENTORY FOR EXISTING SHIPS

1 INTRODUCTION

1.1 In order to develop part I of the Inventory of Hazardous Materials for existing ships, documents of the individual ship as well as the knowledge and experience of specialist personnel (experts) is required. An example of the development process for part I of the Inventory of Hazardous Materials for existing ships is useful to understand the basic steps as laid out in the guidelines and to ensure a unified application. However, attention should be paid to variations in different types of ships.[18]

1.2 Compilation of part I of the Inventory of Hazardous Material for existing ships involves the following five steps which are described in paragraph 4.2 and appendix 4 of these guidelines.

Step 1: Collection of necessary information;

Step 2: Assessment of collected information;

Step 3: Preparation of visual/sampling check plan;

Step 4: Onboard visual/sampling check; and

Step 5: Preparation of part I of the Inventory and related documentation.

2 STEP 1 – COLLECTION OF NECESSARY INFORMATION

2.1 Sighting of available documents

A practical first step is to collect detailed documents for the ship. The shipowner should try to collate documents normally retained on board the ship or by the shipping company as well as relevant documents that the shipyard, manufacturers or classification society may have. The following documents should be used when available:

.1 Ship's specification
.2 General Arrangement
.3 Machinery Arrangement
.4 Spare Parts and Tools List
.5 Piping Arrangement
.6 Accommodation Plan
.7 Fire-Control Plan
.8 Fire Protection Plan
.9 Insulation Plan (Hull and Machinery)
.10 International Anti-Fouling System Certificate
.11 Related manuals and drawings
.12 Information from other inventories and/or sister or similar ships, machinery, equipment, materials and coatings
.13 Results of previous visual/sampling checks and other analysis

[18] The example of a 28,000 gross tonnage bulk carrier constructed in 1985 is used in this appendix.

2.1.2 If the ship has undergone conversions or major repair work, it is necessary to identify as far as possible the modifications from the initial design and specification of the ship.

2.2 Indicative list

2.2.1 It is impossible to check all equipment, systems and/or areas on board the ship to determine the presence or absence of hazardous materials. The total number of parts on board may exceed several thousand. In order to take a practical approach, an indicative list should be prepared that identifies the equipment, system and/or area on board that is presumed to contain hazardous materials. Field interviews with the shipyard and suppliers may be necessary to prepare such lists. A typical example of an indicative list is shown below.

2.2.2 Materials to be checked and documented

Hazardous Materials, as identified in appendix 1 of these guidelines, should be listed in part I of the Inventory for existing ships. Appendix 1 of the guidelines contains all the materials concerned. Table A shows those which are required to be listed and table B shows those which should be listed as far as practicable.

2.2.3 Materials listed in table A

2.2.3.1 Table A lists the following four materials:

.1 Asbestos
.2 Polychlorinated biphenyls (PCBs)
.3 Ozone-depleting substances
.4 Anti-fouling systems containing organotin compounds as a biocide

2.2.3.2 *Asbestos*

Field interviews were conducted with over 200 Japanese shipyards and suppliers regarding the use of asbestos in production. Indicative lists for asbestos developed on the basis of this research are shown below:

Structure and/or equipment	Component
Propeller shafting	Packing with low pressure hydraulic piping flange
	Packing with casing
	Clutch
	Brake lining
	Synthetic stern tubes
Diesel engine	Packing with piping flange
	Lagging material for fuel pipe
	Lagging material for exhaust pipe
	Lagging material turbocharger
Turbine engine	Lagging material for casing
	Packing with flange of piping and valve for steam line, exhaust line and drain line
	Lagging material for piping and valve of steam line, exhaust line and drain line

Structure and/or equipment	**Component**
Structure and/or equipment	Component
Boiler	Insulation in combustion chamber
	Packing for casing door
	Lagging material for exhaust pipe
	Gasket for manhole
	Gasket for hand hole
	Gas shield packing for soot blower and other hole
	Packing with flange of piping and valve for steam line, exhaust line, fuel line and drain line
	Lagging material for piping and valve of steam line, exhaust line, fuel line and drain line
Exhaust gas economizer	Packing for casing door
	Packing with manhole
	Packing with hand hole
	Gas shield packing for soot blower
	Packing with flange of piping and valve for steam line, exhaust line, fuel line and drain line
	Lagging material for piping and valve of steam line, exhaust line, fuel line and drain line
Incinerator	Packing for casing door
	Packing with manhole
	Packing with hand hole
	Lagging material for exhaust pipe
Auxiliary machinery (pump, compressor, oil purifier, crane)	Packing for casing door and valve
	Gland packing
	Brake lining
Heat exchanger	Packing with casing
	Gland packing for valve
	Lagging material and insulation
Valve	Gland packing with valve, sheet packing with piping flange
	Gasket with flange of high pressure and/or high temperature
Pipe, duct	Lagging material and insulation
Tank (fuel tank, hot water, tank, condenser), other equipment (fuel strainer, lubricant oil strainer)	Lagging material and insulation
Electric equipment	Insulation material
Airborne asbestos	Wall, ceiling
Ceiling, floor and wall in accommodation area	Ceiling, floor, wall
Fire door	Packing, construction and insulation of the fire door
Inert gas system	Packing for casing, etc.
Air conditioning system	Sheet packing, lagging material for piping and flexible joint

Structure and/or equipment	Component
Miscellaneous	Ropes
	Thermal insulating materials
	Fire shields/fire proofing
	Space/duct insulation
	Electrical cable materials
	Brake linings
	Floor tiles/deck underlay
	Steam/water/vent flange gaskets
	Adhesives/mastics/fillers
	Sound damping
	Moulded plastic products
	Sealing putty
	Shaft/valve packing
	Electrical bulkhead penetration packing
	Circuit breaker arc chutes
	Pipe hanger inserts
	Weld shop protectors/burn covers
	Fire-fighting blankets/clothing/equipment
	Concrete ballast

2.2.3.3 *Polychlorinated biphenyl (PCBs)*

Worldwide restriction of PCBs began on 17 May 2004 as a result of the implementation of the Stockholm Convention, which aims to eliminate or restrict the production and use of persistent organic pollutants. In Japan, domestic control began in 1973, with the prohibition of all activities relating to the production, use and import of PCBs. Japanese suppliers can provide accurate information concerning their products. The indicative list of PCBs has been developed as shown below:

Equipment	**Component of equipment**
Transformer	Insulating oil
Condenser	Insulating oil
Fuel heater	Heating medium
Electric cable	Covering, insulating tape
Lubricating oil	
Heat oil	Thermometers, sensors, indicators
Rubber/felt gaskets	
Rubber hose	
Plastic foam insulation	
Thermal insulating materials	
Voltage regulators	
Switches/reclosers/bushings	
Electromagnets	
Adhesives/tapes	
Surface contamination of machinery	
Oil-based paint	
Caulking	
Rubber isolation mounts	
Pipe hangers	

Equipment	Component of equipment
Light ballasts (component within fluorescent light fixtures)	
Plasticizers	
Felt under septum plates on top of hull bottom	

2.2.3.4 *Ozone-depleting substances*

The indicative list for ozone-depleting substances is shown below. Ozone-depleting substances have been controlled according to the Montreal Protocol and MARPOL Convention. Although almost all substances have been banned since 1996, HCFC can still be used until 2020.

Materials	Component of equipment	Period for use of ODS in Japan
CFCs (R11, R12)	Refrigerant for refrigerators	Until 1996
CFCs	Urethane formed material	Until 1996
	Blowing agent for insulation of LNG carriers	Until 1996
Halons	Extinguishing agent	Until 1994
Other fully halogenated CFCs	The possibility of usage in ships is low	Until 1996
Carbon tetrachloride	The possibility of usage in ships is low	Until 1996
1,1,1-Trichloroethane (methyl chloroform)	The possibility of usage in ships is low	Until 1996
HCFC (R22, R141b)	Refrigerant for refrigerating machine	It is possible to use it until 2020
HBFC	The possibility of usage in ships is low	Until 1996
Methyl bromide	The possibility of usage in ships is low	Until 2005

2.2.3.5 *Organotin compounds*

Organotin compounds include tributyl tins (TBT), triphenyl tins (TPT) and tributyl tin oxide (TBTO). Organotin compounds have been used as anti-fouling paint on ships' bottoms, and the International Convention on the Control of Harmful Anti-fouling Systems on Ships (AFS Convention, as amended) stipulates that all ships shall not apply or reapply organotin compounds after 1 January 2003, and that, after 1 January 2008, all ships shall either not bear such compounds on their hulls or shall bear a coating that forms a barrier preventing such compounds from leaching into the sea. The above-mentioned dates may have been extended by permission of the Administration bearing in mind that the AFS Convention entered into force on 17 September 2008.

2.2.3.6 *Cybutryne*

Cybutryne has been used as biocide in anti-fouling systems, and the International Convention on the Control of Harmful Anti-fouling Systems on Ships (AFS Convention, as amended) stipulates that all ships shall not apply or reapply cybutryne after 1 January 2023, and that ships bearing an anti-fouling system that contains this substance in the external coating layer of their hulls or external parts or surfaces on 1 January 2023 shall either remove the anti-fouling system or apply a coating that forms a barrier to this substance leaching from the underlying non-compliant anti-fouling system at the next scheduled renewal of the anti-fouling system after 1 January 2023, but no later than 60 months following the last application to the ship of an anti-fouling system containing cybutryne.

2.2.4 *Materials listed in table B*

For existing ships it is not obligatory for materials listed in table B to be listed in part I of the Inventory. However, if they can be identified in a practical way, they should be listed in the Inventory, because the information will be used to support ship recycling processes. The Indicative list of materials listed in table B is shown below:

Materials	Component of equipment
Cadmium and cadmium compounds	Plating film, bearing
Hexavalent chromium compounds	Plating film
Mercury and mercury compounds	Fluorescent light, mercury lamp, mercury cell, liquid-level switch, gyro compass, thermometer, measuring tool, manganese cell, pressure sensors, light fittings, electrical switches, fire detectors
Lead and lead compounds	Corrosion resistant primer, solder (almost all electric appliances contain solder), paints, preservative coatings, cable insulation, lead ballast, generators
Polybrominated biphenyls (PBBs)	Non-flammable plastics
Polybrominated diphenyl ethers (PBDE)	Non-flammable plastics
Polychlorinated naphthalenes	Paint, lubricating oil
Radioactive substances	Refer to appendix 10
Certain short-chain chlorinated paraffins	Non-flammable plastics

3 STEP 2 – ASSESSMENT OF COLLECTED INFORMATION

Preparation of a checklist is an efficient method for developing the Inventory for existing ships in order to clarify the results of each step. Based on collected information including the indicative list mentioned in step 1, all equipment, systems and/or areas on board assumed to contain hazardous materials listed in tables A and B should be included in the checklist. Each listed equipment, system and/or area on board should be analysed and assessed for its hazardous materials content.

The existence and volume of hazardous materials may be judged and calculated from the Spare parts and tools list and the maker's drawings. The existence of asbestos contained in floors, ceilings and walls may be identified from Fire Protection Plans, while the existence of TBT in coatings can be identified from the International Anti-Fouling System Certificate, Coating scheme and the History of Paint.

Example of weight calculation

No.	Hazardous Materials	Location/equipment/ component	Reference	Calculation
1.1-2	TBT	Flat bottom/paint	History of coatings	
1.2-1	Asbestos	Main engine/ exh. pipe packing	Spare parts and tools list	250 g x 14 sheet = 3.50 kg
1.2-3	HCFC	Ref. provision plant	Maker's drawings	20 kg x 1 cylinder = 20 kg
1.2-4	Lead	Batteries	Maker's drawings	6kg x 16 unit = 96 kg
1.3-1	Asbestos	Engine-room ceiling	Accommodation plan	

When a component or coating is determined to contain hazardous materials, a "Y" should be entered in the column for "Result of document analysis" in the checklist, to denote "Contained". Likewise, when an item is determined not to contain hazardous materials, the entry "N" should be made in the column to denote "Not contained". When a determination cannot be made as to the hazardous materials content, the column should be completed with the entry "Unknown".

Checklist (step 2)

Analysis and definition of scope of assessment for "Sample Ship"

No.	Table A/B	Hazardous materials *1	Location	Name of equipment	Component	Quantity Unit (kg)	Quantity No.	Quantity Total (kg)	Manufacturer/brand name	Result of documents analysis *2	Procedure of check *3	Result of check *4	Reference/DWG No.
[Inventory part I-1.1]													
1	A	TBT	Top side	Painting and coating	A/F Paints			NIL	Paints Co./marine P1000	N			・On Aug., 200X, Sealer Coat applied to all over submerged area before tin-free coating.
2	A	TBT	Flat Bottom				3000m^2		Unknown AF	Unknown			
[Inventory part I-1.2]													
1	A	Asbestos	Lower deck	Main engine	Exh. pipe packing	0.25	14		Diesel Co.	Y			M-100
2	A	Asbestos	3rd deck	Aux.boiler	Lagging		12		Unknown lagging	Unknown			M-300
3	A	Asbestos	Engine room	Piping/flange	Packing					PCHM			
4	A	HCFC	2nd deck	Ref. provision plant	Refrigerant(R22)	20.00	1		Reito Co.	Y			Maker's dwg
5	B	Lead	Nav. Br. deck	Batteries		6	16		Denchi Co.	Y			E-300
[Inventory part I-1.3]													
1	A	Asbestos	Upper deck	Back deck ceilings	Engine room ceiling		20m^2		Unknown ceiling	Unknown			O-25

Notes

*1 Hazardous materirials: material classification

*2 Result of documents analysis: Y=Contained, N=Not contained, Unknown, PCHM=Potentially containing hazardous material

*3 Procedure of Check:. V=Visual check, S=Sampling check

*4 Result of Check: Y=Contained, N=Not contained, PCHM=Potentially containing hazardous material

4 STEP 3 – PREPARATION OF VISUAL/SAMPLING CHECK PLAN

4.1 Each item classified as "Contained" or "Not contained" in step 2 should be subjected to a visual check on board, and the entry "V" should be made in the "Check procedure" column to denote "Visual check".

4.2 For each item categorized as "unknown", a decision should be made as to whether to apply a sampling check. However, any item categorized as "unknown" may be classed as "potentially containing hazardous material" provided comprehensive justification is given, or if it can be assumed that there will be little or no effect on disassembly as a unit and later ship recycling and disposal operations. For example, in the following checklist, in order to carry out a sampling check for "Packing with aux. boiler" the shipowner needs to disassemble the auxiliary boiler in a repair yard. The costs of this check are significantly higher than the later disposal costs at a ship recycling facility. In this case, therefore, the classification as "potentially containing hazardous material" is justifiable.

Checklist (step 3)

Analysis and definition of scope of assessment for "Sample Ship"

No.	Table A/B	Hazardous materials *1	Location	Name of equipment	Component	Quantity Unit (kg)	Quantity No.	Quantity Total (kg)	Manufacturer/brand name	Result of documents analysis *2	Procedure of check *3	Result of check *4	Reference/DWG No.
[Inventory part I-1.1]													
1	A	TBT	Top side	Painting & Coating	A/F Paints			NIL	Paints Co./marine P1000	N	V		・On Aug., 200X, Sealer Coat applied to all over submerged area before tin-free coating.
2	A	TBT	Flat bottom				$3000m^2$		Unknown AF	Unknown	S		
[Inventory Part I-1.2]													
1	A	Asbestos	Lower deck	Main engine	Exh. pipe packing	0.25	14		Diesel Co.	Y	V		M-100
2	A	Asbestos	3rd deck	Aux.boiler	Lagging		12		Unknown lagging	Unknown	S		M-300
3	A	Asbestos	Engine room	Piping/flange	Packing					PCHM	V		
4	A	HCFC	2nd deck	Ref. provision plant	Refrigerant(R22)	20.00	1		Reito Co.	Y	V		Maker's dwg
5	B	Lead	Nav. Br. deck	Batteries		6	16		Denchi Co.	Y	V		E-300
[Inventory Part I-1.3]													
1	A	Asbestos	Upper deck	Back deck ceilings	Engine room ceiling		$20m^2$		Unknown ceiling	Unknown	S		O-25

Notes

*1 Hazardous materirials: material classification

*2 Result of documents analysis: Y=Contained, N=Not contained, Unknown, PCHM=Potentially containing hazardous material

*3 Procedure of check:. V=Visual check, S=Sampling check

*4 Result of check: Y=Contained, N=Not contained, PCHM=Potentially containing hazardous material

4.3 Before any visual/sampling check on board is conducted, a "visual/sampling check plan" should be prepared. An example of such a plan is shown below.

4.4 To prevent any incidents during the visual/sampling check, a schedule should be established to eliminate interference with other ongoing work on board. To prevent potential exposure to hazardous materials during the visual/sampling check, safety precautions should be in place on board. For example, sampling of potential asbestos containing materials could release fibres into the atmosphere. Therefore, appropriate personnel safety and containment procedures should be implemented prior to sampling.

4.5 Items listed in the visual/sampling check should be arranged in sequence so that the onboard check is conducted in a structured manner (e.g. from a lower level to an upper level and from a fore part to an aft part).

Example of visual/sampling check plan

Name of ship	XXXXXXXXXX
IMO number	XXXXXXXXXX
Gross tonnage	28,000 GT
L x B x D	xxx.xx × xx.xx × xx.xx m
Date of delivery	dd.mm.1987
Shipowner	XXXXXXXXXX
Contact point (Address, Telephone, Fax, Email)	XXXXXXXXXX Tel: XXXX-XXXX Fax: XXXX-XXXX Email: abcdefg@hijk.co.net
Check schedule	Visual check： dd, mm, 20XX Sampling check：dd, mm, 20XX
Site of check	XX shipyard, No. Dock
In charge of check	XXXX XXXX
Check engineer	XXXX XXXX, YYYY YYYY, ZZZZ ZZZZ
Sampling engineer	Person with specialized knowledge of sampling
Sampling method and anti-scattering measure for asbestos	Wet the sampling location prior to cutting and allow it to harden after cutting to prevent scatter. Notes: Workers performing sampling activities shall wear protective equipment.
Sampling of fragments of paints	Paints suspected to contain TBT should be collected and analysed from load line, directly under bilge keel and flat bottom near amidships.
Laboratory	QQQQ QQQQ
Chemical analysis method	Method by ISO/DIS 22262-1 Bulk materials – Part 1: Sampling and qualitative determination of asbestos in commercial bulk materials and ISO/CD 22262-2 Bulk materials – Part 2: Quantitative determination of asbestos by gravimetric and microscopic methods. ICP Luminous analysis (TBT)
Location of visual/sampling check	Refer to lists for visual/sampling check

Listing for equipment, system and/or area for visual check
See attached "Analysis and definition of scope of investigation for sample ship"

List of equipment, system and/or area for sampling check				
Location	**Equipment, machinery and/or zone**	**Name of parts**	**Materials**	**Result of doc. checking**
Upper deck	Back deck ceilings	Engine-room ceiling	Asbestos	Unknown
Engine-room	Exhaust gas pipe	Insulation	Asbestos	Unknown
Engine-room	Pipe/flange	Gasket	Asbestos	Unknown
Refer to attached "Analysis and definition of scope of investigation for sample ship" and "Location plan of hazardous materials for sample ship"				

List of equipment, system and/or area classed as PCHM				
Location	**Equipment, machinery and/or zone**	**Name of part**	**Material**	**Result of doc. checking**
Floor	Propeller cap	Gasket	Asbestos	PCHM
Engine-room	Air operated shut-off valve	Gland packing	Asbestos	PCHM
Refer to attached "Analysis and definition of scope of investigation for sample ship" and "Location plan of hazardous materials for sample ship"				

This plan is established in accordance with the guidelines for the development of the Inventory of Hazardous Materials

・Document check・date/place：
dd, mm, 20XX at XX Lines Co. Ltd.

・Preparation date of plan：dd. mm, 20XX

5 STEP 4 – ONBOARD VISUAL/SAMPLING CHECK

5.1 The visual/sampling check should be conducted according to the plan. Checkpoints should be marked in the ship's plan or recorded with photographs.

5.2 A person taking samples should be protected by the appropriate safety equipment relevant to the suspected type of hazardous materials encountered. Appropriate safety precautions should also be in place for passengers, crew members and other persons on board, to minimize the potential exposure to hazardous materials. Safety precautions could include the posting of signs or other verbal or written notification for personnel to avoid such areas during sampling. The personnel taking samples should ensure compliance with relevant national regulations.

5.3 The results of visual/sampling checks should be recorded in the checklist. Any equipment, systems and/or areas of the ship that cannot be accessed for checks should be classified as "potentially containing hazardous material". In this case, the entry in the "Result of check" column should be "PCHM".

6 STEP 5 – PREPARATION OF PART I OF THE INVENTORY AND RELATED DOCUMENTATION

6.1 *Development of part I of the Inventory*

The results of the check and the estimated quantity of hazardous materials should be recorded on the checklist. Part I of the Inventory should be developed with reference to the checklist.

6.2 *Development of location diagram of hazardous materials*

With respect to part I of the Inventory, the development of a location diagram of hazardous materials is recommended in order to help the ship recycling facility gain a visual understanding of the Inventory.

Checklist (step 4 and step 5)

Analysis and definition of scope of assessment for "Sample Ship"

No.	Table A/B	Hazardous materials *1	Location	Name of equipment	Component	Quantity: Unit (kg)	Quantity: No.	Quantity: Total (kg)	Manufacturer/brand name	Result of documents analysis *2	Procedure of check *3	Result of check *4	Reference/DWG No.
[Inventory part I-1.1]													
1	A	TBT	Top side	Painting & Coating	A/F Paints			NIL	Paints Co./marine P1000	N	V	N	･On Aug., 200X, Sealer Coat applied to all over submerged area before tin-free coating.
2	A	TBT	Flat Bottom			0.02	$3000m^2$	60.00	Unknown AF	Unknown	S	Y	
[Inventory part I-1.2]													
1	A	Asbestos	Lower deck	Main engine	Exh. pipe packing	0.25	14	3.50	Diesel Co.	Y	V	Y	M-100
2	A	Asbestos	3rd deck	Aux. boiler	Lagging		12		Unknown lagging	Unknown	S	N	M-300
3	A	Asbestos	Engine room	Piping/flange	Packing					PCHM	V	PCHM	
4	A	HCFC	2nd deck	Ref. provision plant	Refrigerant(R22)	20.00	1	20.00	Reito Co.	Y	V	Y	Maker's dwg
5	B	Lead	Nav. Br. deck	Batteries		6	16	96.00	Denchi Co.	Y	V	Y	E-300
[Inventory part I-1.3]													
1	A	Asbestos	Upp.deck	Back deck ceilings	Engine room ceiling	0.19	$20m^2$	3.80	Unknown ceiling	Unknown	S	Y	O-25

Notes
*1 Hazardous materirials: material classification
*2 Result of documents analysis: Y=Contained, N=Not contained, Unknown, PCHM=Potentially containing hazardous material
*3 Procedure of check:. V=Visual check, S=Sampling check
*4 Result of check: Y=Contained, N=Not contained, PCHM=Potentially containing hazardous material

Example of the Inventory for existing ships

Inventory of Hazardous Materials for "Sample Ship"

Particulars of the "Sample Ship"

Distinctive number or letters	XXXXNNN
Port of registry	Port of World
Type of vessel	Bulk carrier
Gross tonnage	28,000 GT
IMO number	NNNNNNN
Name of shipbuilder	xx Shipbuilding Co. Ltd
Name of shipowner	yy Maritime SA
Date of delivery	MM/DD/1988

This inventory was developed in accordance with the guidelines for the development of the Inventory of Hazardous Materials.

Attachment:

1: Inventory of Hazardous Materials

2: Assessment of collected information

3: Location diagram of hazardous materials

Prepared by XYZ (Name & address) (dd/mm/20XX)

Inventory of Hazardous Materials: "Sample Ship"

Part I – *Hazardous materials contained in the ship's structure and equipment*

I-1 Paints and coating systems containing materials listed in table A and table B of appendix 1 of the guidelines

No.	Application of paint	Name of paint	Location*	Materials (classification in appendix 1)	Approximate quantity		Remarks
1	AF paint	Unknown paints	Flat bottom	TBT	60.00	kg	Confirmed by sampling
2							
3							

I-2 Equipment and machinery containing materials listed in table A and table B of appendix 1 of the guidelines

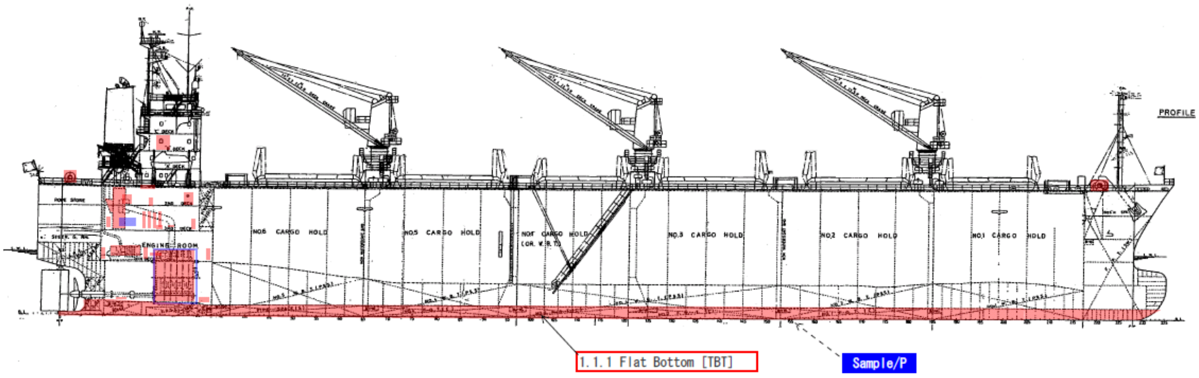
No.	Name of equipment and machinery	Location *1	Materials (classification in appendix 1)	Parts where used	Approximate quantity		Remarks
1	Main engine	Lower floor	Asbestos	Exh. pipe packing	3.50	kg	
2	Aux. boiler	3rd deck	Asbestos	Unknown packing	10.00	kg	PCHM (potentially containing hazardous material)
3	Piping/flange	Engine-room	Asbestos	Packing	50.00	kg	PCHM
4	Ref. provision plant	2nd deck	HCFC	Refrigerant (R22)	20.00	kg	
5	Batteries	Navig. bridge deck	Lead		96.00	kg	

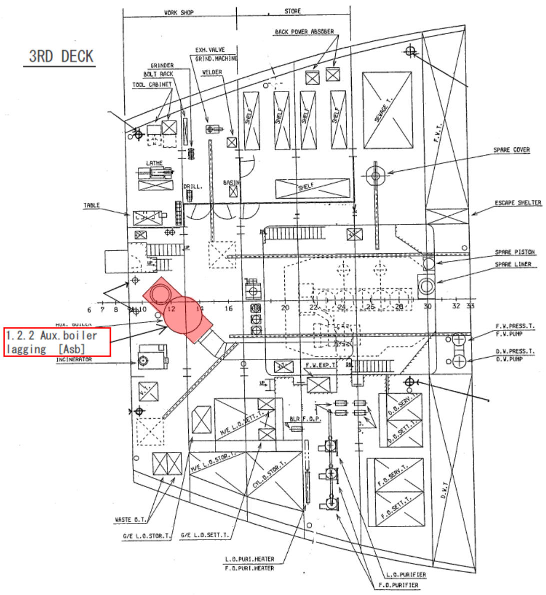
I-3 Structure and hull containing materials listed in table A and table B of appendix 1 of the guidelines

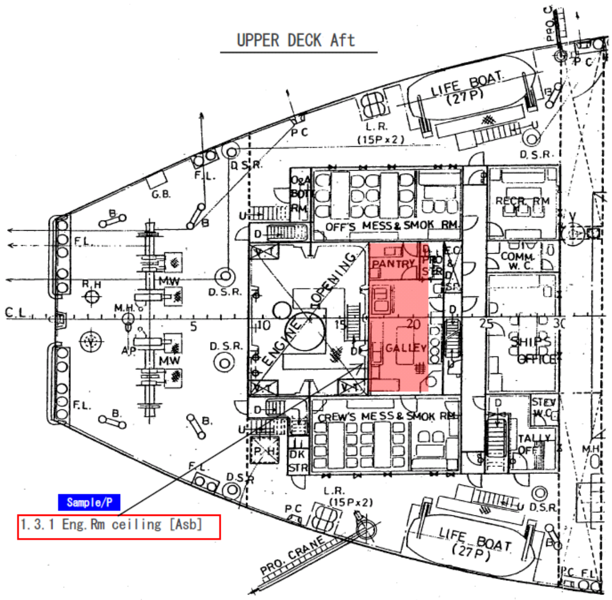
No.	Name of structural element	Location *1	Materials (classification in appendix 1)	Parts where used	Approximate quantity		Remarks
1	Back deck ceiling	Upper deck	Asbestos	Engine-room ceiling (A class)	3.80	kg	Confirmed by sampling
2							
3							

* Each item should be entered in order based on its location, from a lower level to an upper level and from a fore part to an aft part.

Example of location diagram of hazardous materials







APPENDIX 6

FORM OF MATERIAL DECLARATION

<Date of declaration>

Date	

<MD ID number>

MD- ID No.	

<Other information>

Remark 1	
Remark 2	
Remark 3	

<Supplier (respondent) information>

Company name	
Division name	
Address	
Contact person	
Telephone number	
Fax number	
Email address	
SDoC ID no.	

<Product information>

Product name	Product number	Delivered unit			Product information
		Amount	Unit		

<Materials information>

		Unit	
This materials information shows the amount of hazardous materials contained in	1		(unit: piece, kg, m, m^2, m^3, etc.) of the product.

Table	Material name		Threshold value	Present above threshold value	If yes, material mass		If yes, information on where it is used
				Yes / No	Mass	Unit	
Table A (materials listed in appendix 1 of the Convention)	Asbestos	Asbestos	0.1%[19]				
	Polychlorinated biphenyls (PCBs)	Polychlorinated biphenyls (PCBs)	50 mg/kg				
	Ozone-depleting substance	Chlorofluorocaobons (CFCs)	no threshold value				
		Halons					
		Other fully halogenated CFCs					
		Carbon tetrachloride					
		1,1,1-Trichloroethane					
		Hydrochlorofluorocaobons					
		Hydrobromofluorocaobons					
		Methyl bromide					
		Bromochloromethane					
	Anti-fouling systems containing organotin compounds as a biocide		2,500 mg total tin/kg				
	Anti-fouling systems containing cybutryne		1,000 mg/kg[20]				

19 In accordance with regulation 4 of the Convention, for all ships, new installation of materials which contain asbestos shall be prohibited. According to the UN recommendation "Globally Harmonized System of Classification and Labelling of Chemicals (GHS)" adopted by the United Nations Economic and Social Council's Sub-Committee of Experts on the Globally Harmonized System of Classification and Labelling of Chemicals (UNSCEGHS), the UN'S Sub-Committee of Experts, in 2002 (published in 2003), carcinogenic mixtures classified as Category 1A (including asbestos mixtures) under the GHS are required to be labelled as carcinogenic if the ratio is more than 0.1%. However, if 1% is applied, this threshold value should be recorded in the Inventory and, if available, the Material Declaration and can be applied not later than five years after the entry into force of the Convention. The threshold value of 0.1% need not be retroactively applied to those Inventories and Material Declarations.

20 When samples are directly taken from the hull, average values of cybutryne should not be present above 1,000 mg of cybutryne per kilogram of dry paint.

Table	Material name	Threshold value	Present above threshold value	If yes, material mass		If yes, information on where it is used
			Yes / No	Mass	Unit	
Table B (materials listed in appendix 2 of the Convention)	Cadmium and cadmium compounds	100 mg/kg				
	Hexavalent chromium and hexavalent chromium compounds	1,000 mg/kg				
	Lead and lead compounds	1,000 mg/kg				
	Mercury and mercury compounds	1,000 mg/kg				
	Polybrominated biphenyl (PBBs)	50 mg/kg				
	Polybrominated dephenyl ethers (PBDEs)	1,000 mg/kg				
	Polychloronaphthalenes (Cl >= 3)	50 mg/kg				
	Radioactive substances	no threshold value				
	Certain short-chain chlorinated paraffins	1%				

APPENDIX 7

FORM OF SUPPLIER'S DECLARATION OF CONFORMITY

SUPPLIER'S DECLARATION OF CONFORMITY FOR MATERIAL DECLARATION MANAGEMENT

1 Identification number ___________

2 Issuer's name ______________________________

Issuer's address ______________________________

3 Object(s) of the declaration ______________________________

____

____

4 The object(s) of the declaration described above is in conformity with the following documents :

Document No.	Title	Edition/date of issue
5 ____________	______________________	____________
____________	______________________	____________
____________	______________________	____________

6 Additional information ______________________________

____

Signed for and on behalf of

____

____

(place and date of issue)

7 ______________________________ ______________________________

(name, function) *(signature)*

APPENDIX 8

EXAMPLES OF TABLE A AND TABLE B MATERIALS OF APPENDIX 1 WITH CAS NUMBERS

This list was developed with reference to Joint Industry Guide No.101. This list is not exhaustive; it represents examples of chemicals with known CAS numbers and may require periodical updating.

Table	Material Category	Substances	CAS Numbers
Table A (materials listed in appendix 1 of the Convention)	Asbestos	Asbestos	1332-21-4
		Actinolite	77536-66-4
		Amosite (Grunerite)	12172-73-5
		Anthophyllite	77536-67-5
		Chrysotile	12001-29-5
		Crocidolite	12001-28-4
		Tremolite	77536-68-6
	Polychlorinated biphenyls (PCBs)	Polychlorinated biphenyls	1336-36-3
		Aroclor	12767-79-2
		Chlorodiphenyl (Aroclor 1260)	11096-82-5
		Kanechlor 500	27323-18-8
		Aroclor 1254	11097-69-1
	Ozone-depleting substances/ isomers (they may contain isomers that are not listed here)	Trichlorofluoromethane (CFC11)	75-69-4
		Dichlorodifluoromethane (CFC12)	75-71-8
		Chlorotrifluoromethane (CFC 13)	75-72-9
		Pentachlorofluoroethane (CFC 111)	354-56-3
		Tetrachlorodifluoroethane (CFC 112)	76-12-0
		Trichlorotrifluoroethane (CFC 113) 1,1,2 Trichloro-1,2,2 trifluoroethane	354-58-5 76-13-1
		Dichlorotetrafluoroethane (CFC 114)	76-14-2
		Monochloropentafluoroethane (CFC 115)	76-15-3
		Heptachlorofluoropropane (CFC 211)	422-78-6 135401-87-5
		Hexachlorodifluoropropane (CFC 212)	3182-26-1
		Pentachlorotrifluoropropane (CFC 213)	2354-06-5 134237-31-3
		Tetrachlorotetrafluoropropane (CFC 214) 1,1,1,3-Tetrachlorotetrafluoropropane	29255-31-0 2268-46-4
		Trichloropentafluoropropane (CFC 215) 1,1,1-Trichloropentafluoropropane 1,2,3-Trichloropentafluoropropane	1599-41-3 4259-43-2 76-17-5
		Dichlorohexafluoropropane (CFC 216)	661-97-2
		Monochloroheptafluoropropane (CFC 217)	422-86-6
		Bromochlorodifluoromethane (Halon 1211)	353-59-3
		Bromotrifluoromethane (Halon 1301)	75-63-8
		Dibromotetrafluoroethane (Halon 2402)	124-73-2
		Carbon tetrachloride (Tetrachloromethane)	56-23-5
		1,1,1, - Trichloroethane (methyl chloroform) and its isomers except 1,1,2-trichloroethane	71-55-6
		Bromomethane (Methyl bromide)	74-83-9
		Bromodifluoromethane and isomers (HBFC's)	1511-62-2
		Dichlorofluoromethane (HCFC 21)	75-43-4
		Chlorodifluoromethane (HCFC 22)	75-45-6
		Chlorofluoromethane (HCFC 31)	593-70-4

Table	Material Category	Substances	CAS Numbers
		Tetrachlorofluoroethane (121) HCFC 1,1,1,2-tetrachloro-2-fluoroethane (HCFC 121a) 1,1,2,2-tetracloro-1-fluoroethane	134237-32-4 354-11-0 354-14-3
		Trichlorodifluoroethane (HCFC 122) 1,2,2-trichloro-1,1-difluoroethane	41834-16-6 354-21-2
		Dichlorotrifluoroethane(HCFC 123) Dichloro-1,1,2-trifluoroethane 2,2-dichloro-1,1,1-trifluroethane 1,2-dichloro-1,1,2-trifluroethane (HCFC-123a) 1,1-dichloro-1,2,2-trifluroethane (HCFC-123b) 2,2-dichloro-1,1,2-trifluroethane (HCFC-123b)	34077-87-7 90454-18-5 306-83-2 354-23-4 812-04-4 812-04-4
		Chlorotetrafluoroethane (HCFC 124) 2-chloro-1,1,1,2-tetrafluoroethane 1-chloro-1,1,2,2-tetrafluoroethane (HCFC 124a)	63938-10-3 2837-89-0 354-25-6
		Trichlorofluoroethane (HCFC 131) 1-Fluoro-1,2,2-trichloroethane 1,1,1-trichloro-2-fluoroethane (HCFC131b)	27154-33-2; (134237-34-6) 359-28-4 811-95-0
		Dichlorodifluoroethane (HCFC 132) 1,2-dichloro-1,1-difluoroethane (HCFC 132b) 1,1-dichloro-1,2-difluoroethane (HFCF 132c) 1,1-dichloro-2,2-difluoroethane 1,2-dichloro-1,2-difluoroethane	25915-78-0 1649-08-7 1842-05-3 471-43-2 431-06-1
		Chlorotrifluoroethane (HCFC 133) 1-chloro-1,2,2-trifluoroethane 2-chloro-1,1,1-trifluoroethane (HCFC-133a)	1330-45-6 1330-45-6 75-88-7
		Dichlorofluoroethane(HCFC 141) 1,1-dichloro-1-fluoroethane (HCFC-141b) 1,2-dichloro-1-fluoroethane	1717-00-6; (25167-88-8) 1717-00-6 430-57-9
		Chlorodifluoroethane (HCFC 142) 1-chloro-1,1-difluoroethane (HCFC142b) 1-chloro-1,2-difluoroethane (HCFC142a)	25497-29-4 75-68-3 25497-29-4
		Hexachlorofluoropropane (HCFC 221)	134237-35-7
		Pentachlorodifluoropropane (HCFC 222)	134237-36-8
		Tetrachlorotrifluropropane (HCFC 223)	134237-37-9
		Trichlorotetrafluoropropane (HCFC 224)	134237-38-0
		Dichloropentafluoropropane, (Ethyne, fluoro-) (HCFC 225) 2,2-Dichloro-1,1,1,3,3-pentafluoropropane(HCFC 225aa) 2,3-Dichloro-1,1,1,2,3-pentafluoropropane (HCFC 225ba) 1,2-Dichloro-1,1,2,3,3-pentafluoropropane (HCFC 225bb) 3,3-Dichloro-1,1,1,2,2-pentafluoropropane (HCFC 225ca) 1,3-Dichloro-1,1,2,2,3-pentafluoropropane (HCFC 225cb) 1,1-Dichloro-1,2,2,3,3-pentafluoropropane(HCFC 225cc) 1,2-Dichloro-1,1,3,3,3-pentafluoropropane (HCFC 225da) 1,3-Dichloro-1,1,2,3,3-pentafluoropropane (HCFC 225ea) 1,1-Dichloro-1,2,3,3,3-pentafluoropropane(HCFC 225eb)	127564-92-5; (2713-09-9) 128903-21-9 422-48-0 422-44-6 422-56-0 507-55-1 13474-88-9 431-86-7 136013-79-1 111512-56-2
		Chlorohexafluoropropane (HCFC 226)	134308-72-8
		Pentachlorofluoropropane (HCFC 231)	134190-48-0
		Tetrachlorodifluoropropane (HCFC 232)	134237-39-1
		Trichlorotrifluoropropane (HCFC 233) 1,1,1-Trichloro-3,3,3-trifluoropropane	134237-40-4 7125-83-9
		Dichlorotetrafluoropropane (HCFC 234)	127564-83-4
		Chloropentafluoropropane (HCFC 235) 1-Chloro-1,1,3,3,3-pentafluoropropane	134237-41-5 460-92-4
		Tetrachlorofluoropropane (HCFC 241)	134190-49-1
		Trichlorodifluoropropane (HCFC 242)	134237-42-6
		Dichlorotrifluoropropane (HCFC 243) 1,1-dichloro-1,2,2-trifluoropropane 2,3-dichloro-1,1,1-trifluoropropane 3,3-Dichloro-1,1,1-trifluoropropane	134237-43-7 7125-99-7 338-75-0 460-69-5
		Chlorotetrafluoropropane (HCFC 244)	134190-50-4

Table	Material Category	Substances	CAS Numbers
		3-chloro-1,1,2,2-tetrafluoropropane	679-85-6
		Trichlorofluoropropane (HCFC 251) 1,1,3-trichloro-1-fluoropropane	134190-51-5 818-99-5
		Dichlorodifluoropropane (HCFC 252)	134190-52-6
		Chlorotrifluoropropane (HCFC 253) 3-chloro-1,1,1-trifluoropropane (HCFC 253fb)	134237-44-8 460-35-5
		Dichlorofluoropropane (HCFC 261) 1,1-dichloro-1-fluoropropane	134237-45-9 7799-56-6
		Chlorodifluoropropane (HCFC 262) 2-chloro-1,3-difluoropropane	134190-53-7 102738-79-4
		Chlorofluoropropane (HCFC 271) 2-chloro-2-fluoropropane	134190-54-8 420-44-0
	Organotin compounds (tributyl tin, triphenyl tin, tributyl tin oxide)	Bis(tri-n-butyltin) oxide	56-35-9
		Triphenyltin N,N'-dimethyldithiocarbamate	1803-12-9
		Triphenyltin fluoride	379-52-2
		Triphenyltin acetate	900-95-8
		Triphenyltin chloride	639-58-7
		Triphenyltin hydroxide	76-87-9
		Triphenyltin fatty acid salts (C=9-11)	47672-31-1
		Triphenyltin chloroacetate	7094-94-2
		Tributyltin methacrylate	2155-70-6
		Bis(tributyltin) fumarate	6454-35-9
		Tributyltin fluoride	1983-10-4
		Bis(tributyltin) 2,3-dibromosuccinate	31732-71-5
		Tributyltin acetate	56-36-0
		Tributyltin laurate	3090-36-6
		Bis(tributyltin) phthalate	4782-29-0
		Copolymer of alkyl acrylate, methyl methacrylate and tributyltin methacrylate(alkyl; C=8)	-
		Tributyltin sulfamate	6517-25-5
		Bis(tributyltin) maleate	14275-57-1
		Tributyltin chloride	1461-22-9
		Mixture of tributyltin cyclopentanecarboxylate and its analogues (Tributyltin naphthenate)	-
		Mixture of tributyltin 1,2,3,4,4a, 4b, 5,6,10,10adecahydro-7-isopropyl-1, 4a-dimethyl-1-phenanthlenecarboxylate and its analogues (Tributyltin rosin salt)	-
		Other tributyl tins & triphenyl tins	-
	Anti-fouling systems containing cybutryne	Cybutryne	28159-98-0
Table B (Materials listed in appendix 2 of the Convention)	Cadmium/ cadmium compounds	Cadmium	7440-43-9
		Cadmium oxide	1306-19-0
		Cadmium sulfide	1306-23-6
		Cadmium chloride	10108-64-2
		Cadmium sulfate	10124-36-4
		Other cadmium compounds	-
	Chromium VI compounds	Chromium (VI) oxide	1333-82-0
		Barium chromate	10294-40-3
		Calcium chromate	13765-19-0
		Chromium trioxide	1333-82-0
		Lead (II) chromate	7758-97-6
		Sodium chromate	7775-11-3
		Sodium dichromate	10588-01-9
		Strontium chromate	7789-06-2
		Potassium dichromate	7778-50-9
		Potassium chromate	7789-00-6

Table	Material Category	Substances	CAS Numbers
		Zinc chromate	13530-65-9
		Other hexavalent chromium compounds	-
	Lead/lead compounds	Lead	7439-92-1
		Lead (II) sulfate	7446-14-2
		Lead (II) carbonate	598-63-0
		Lead hydrocarbonate	1319-46-6
		Lead acetate	301-04-2
		Lead (II) acetate, trihydrate	6080-56-4
		Lead phosphate	7446-27-7
		Lead selenide	12069-00-0
		Lead (IV) oxide	1309-60-0
		Lead (II,IV) oxide	1314-41-6
		Lead (II) sulfide	1314-87-0
		Lead (II) oxide	1317-36-8
		Lead (II) carbonate basic	1319-46-6
		Lead hydroxidcarbonate	1344-36-1
		Lead (II) phosphate	7446-27-7
		Lead (II) chromate	7758-97-6
		Lead (II) titanate	12060-00-3
		Lead sulfate, sulphuric acid, lead salt	15739-80-7
		Lead sulphate, tribasic	12202-17-4
		Lead stearate	1072-35-1
		Other lead compounds	-
	Mercury/ mercury compounds	Mercury	7439-97-6
		Mercuric chloride	33631-63-9
		Mercury (II) chloride	7487-94-7
		Mercuric sulfate	7783-35-9
		Mercuric nitrate	10045-94-0
		Mercuric (II) oxide	21908-53-2
		Mercuric sulfide	1344-48-5
		Other mercury compounds	-
	Polybrominated biphenyls (PBBs) and polybrominated diphenyl ethers (PBDEs)	Bromobiphenyl and its ethers	2052-07-5 (2-Bromobiphenyl)
			2113-57-7 (3-Bromobiphenyl)
			92-66-0 (4-Bromobiphenyl)
			101-55-3 (ether)
		Decabromobiphenyl and its ethers	13654-09-6
			1163-19-5 (ether)
		Dibromobiphenyl and its ethers	92-86-4
			2050-47-7 (ether)
		Heptabromobiphenylether	68928-80-3
		Hexabromobiphenyl and its ethers	59080-40-9
			36355-01-8 (hexabromo-1,1'-biphenyl)
			67774-32-7 (Firemaster FF-1)
			36483-60-0 (ether)
		Nonabromobiphenylether	63936-56-1
		Octabromobiphenyl and its ethers	61288-13-9
			32536-52-0 (ether)
		Pentabromobidphenyl ether (note: commercially available PeBDPO is a complex reaction mixture containing a variety of brominated diphenyloxides)	32534-81-9 (CAS number used for commercial grades of PeBDPO)
		Polybrominated biphenyls	59536-65-1
		Tetrabromobiphenyl and its ethers	40088-45-7
			40088-47-9 (ether)
		Tribromobiphenyl ether	49690-94-0
	Polychlorinated naphthalenes	Polychlorinated naphthalenes	70776-03-3
		Other polychlorinated naphthalenes	-
	Radioactive substances	Uranium	-
		Plutonium	-

Table	Material Category	Substances	CAS Numbers
		Radon	-
		Americium	-
		Thorium	-
		Caesium	7440-46-2
		Strontium	7440-24-6
		Other radioactive substances	-
	Certain short-chain chlorinated paraffins (with carbon length of 10-13 atoms)	Chlorinated paraffins (C10-13)	85535-84-8
		Other short-chain chlorinated paraffins	-

APPENDIX 9

SPECIFIC TEST METHODS

1 Asbestos

Types to test for: Actinolite CAS 77536-66-4 Amosite (Grunerite) CAS 12172-73-5 Anthophyllite CAS 77536-67-5 Chrysotile CAS 12001-29-5 Crocidolite CAS 12001-28-4 Asbestos Tremolite CAS 77536-68-6.

Specific testing techniques: Polarized Light Microscopy, electron microscope techniques and/or X-Ray Diffraction (XRD) as applicable.

Specific reporting information: The presence/no presence of asbestos, indicate the concentration range, and state the type when necessary.

Notes: .1 The suggested three kinds of testing techniques are most commonly used methods when analysing asbestos and each of them has its limitation. Laboratories should choose the most suitable methods to determine, and in most cases, two or more techniques should be utilized together.

.2 The quantification of asbestos is difficult at this stage, although the XRD technique is applicable. Only a few laboratories conduct the quantification rather than the qualification, especially when a precise number is required. Considering the demand from the operators and ship recycling parties, the precise concentration is not strictly required. Thereby, the concentration range is recommended to report, and the recommended range division according to standard VDI 3866 is as follows:

- Asbestos not detected
- Traces of asbestos detected
- Asbestos content approx. 1% to 15% by mass
- Asbestos content approx. 15% to 40% by mass
- Asbestos content greater than 40% by mass

Results that specified more precisely must be provided with a reasoned statement on the uncertainty.

.3 As to the asbestos types, to distinguish all six different types is time-consuming and in some cases not feasible by current techniques; while on the practical side, the treatment of different types of asbestos is the same. Therefore, it is suggested to report the type when necessary.

2 Polychlorinated biphenyls (PCBs)

Note: There are 209 different congeners (forms) of PCB of it is impracticable to test for all. Various organizations have developed lists of PCBs to test for as indicators. In this instance two alternative approaches are recommended. Method 1 identifies the seven congeners used by the International Council for the Exploration of the Sea (ICES). Method 2 identifies 19 congeners and seven types of aroclor (PCB mixtures commonly found in solid shipboard materials containing PCBs). Laboratories should be familiar with the requirements and consequences for each of these lists.

Types to test for: Method 1: ICES7 congeners (28, 52, 101, 118, 138, 153, 180). Method 2: 19 congeners and seven types of aroclor, using the US EPA 8082a test.

Specific testing technique: GC-MS (congener specific) or GC-ECD or GC-ELCD for applicable mixtures such as aroclors. Note: standard samples must be used for each type.

Sample Preparation: It is important to properly prepare PCB samples prior to testing. For solid materials (cables, rubber, paint, etc.), it is especially critical to select the proper extraction procedure in order to release PCBs since they are chemically bound within the product.

Specific reporting information: PCB congener, ppm per congener in sample, and for Method 2, ppm per aroclor in sample should also be reported.

Notes:

.1 Certain field or indicator tests are suitable for detecting PCBs in liquids or surfaces. However, there are currently no such tests that can accurately identify PCBs in solid shipboard materials. It is also noted that many of these tests rely on the identification of free chlorine ions and are thus highly susceptible to chlorine contamination and false readings in a marine environment where all surfaces are highly contaminated with chlorine ions from the seawater and atmosphere.

.2 Several congeners are tested for as "indicator" congeners. They are used because their presence often indicates the likelihood of other congeners in greater quantities (many PCBs are mixes, many mixes use a limited number of PCBs in small quantities, therefore the presence of these small quantities indicates the potential for a mix containing far higher quantities of other PCBs).

.3 Many reports refer to "total PCB", which is often a scaled figure to represent likely total PCBs based on the sample and the common ratios of PCB mixes. Where this is done the exact scaling technique must be stated, and is for information only and does not form part of the specific technique.

3 Ozone-depleting substances

Types to test for: as per appendix 8 of these guidelines all the listed CFCs, Halons, HCFCs and other listed substance as required by Montreal Protocol.

Specific testing technique: Gas Chromatography-Mass Spectrometry (GC-MS), coupled Electron Capture Detectors (GC-ECD) and Electrolytic Conductivity Detectors (GC-ELCD).

Specific reporting information: Type and concentration of ODS.

4 Anti-fouling systems containing organotin compounds as a biocide and/or cybutryne

4.1 Anti-fouling systems containing organotin compounds as a biocide

Types to test for: Anti-fouling compounds and systems regulated under annex I to the International Convention on the Control of Harmful Anti-fouling Systems on Ships, 2001 (AFS Convention, as amended), including: tributyl tins (TBT), triphenyl tins (TPT) and tributyl tin oxide (TBTO).

Specific testing technique: As per resolution MEPC.356(78) (*2022 Guidelines for brief sampling of anti-fouling systems on ships*), adopted on 10 June 2022, using ICPOES, ICP, AAS, XRF, GC-MS as applicable.

Specific reporting information: Type and concentration of organotin compound.

Note: For "field" or "indicative" testing it may be acceptable to simply identify presence of tin, owing to the expected good documentation on anti-fouling systems.

4.2 Anti-fouling systems containing cybutryne

Types to test for: Anti-fouling systems containing cybutryne regulated under Annex 1 to the International Convention on the Control of Harmful Anti-fouling Systems on Ships, 2001 (AFS Convention, as amended).

Specific testing technique: As per resolution MEPC.356(78) (*2022 Guidelines for brief sampling of anti-fouling systems on ships*), adopted on 10 June 2022, using GC-MS.

Specific reporting information: Concentration of cybutryne.

4.3 Simplified approach to detect organotin compounds or cybutryne

Types to test for: Anti-fouling systems containing organotin compounds as biocides and/or cybutryne regulated under Annex 1 to the International Convention on the Control of Harmful Anti-fouling Systems on Ships, 2001 (AFS Convention, as amended).

Specific testing technique: As per resolution MEPC.356(78) (*2022 Guidelines for brief sampling of anti-fouling systems on ships*), adopted on 10 June 2022, using GC-MS.

Specific reporting information: Concentration of organotin compound and/or cybutryne.

APPENDIX 10

EXAMPLES OF RADIOACTIVE SOURCES

The following list contains examples of radioactive sources that should be included in the Inventory, regardless of the number, the amount of radioactivity or the type of radionuclide.

Examples of consumer products with radioactive materials

Ionization chamber smoke detectors (typical radionuclides ^{241}Am; ^{226}Ra)
Instruments/signs containing gaseous tritium light sources (^{3}H)
Instruments/signs containing radioactive painting (typical radionuclide ^{226}Ra)
High intensity discharge lamps (typical radionuclides ^{85}Kr; ^{232}Th)
Radioactive lighting rods (typical radionuclides ^{241}Am; ^{226}Ra)

Examples of industrial gauges with radioactive materials

Radioactive level gauges
Radioactive dredger gauges[21]
Radioactive conveyor gauges[21]
Radioactive spinning pipe gauges[21]

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21 Typical radionuclides: ^{241}Am; $^{241}Am/Be$; ^{252}Cf; ^{244}Cm; ^{60}Co; ^{137}Cs; ^{153}Gd; ^{192}Ir; ^{147}Pm; ^{238}Pu; $^{239}Pu/Be$; ^{226}Ra; ^{75}S; ^{90}Sr (^{90}Y); ^{170}Tm; ^{169}Yb

ANNEX 18

DRAFT SCOPE OF WORK ON REDUCTION OF VOLATILE ORGANIC COMPOUND EMISSIONS

With the aim of investigating how the reduction of volatile organic compound (VOC) emissions could contribute to the implementation of the IMO GHG Strategy, a need has been identified to examine the potential of the existing regulatory framework, notably regulation 15 of MARPOL Annex VI, and to consider possible ways to improve it, taking into account the cost-effectiveness of possible control measures.

The scope of work on the reduction of VOC emissions includes:

.1 consider how to involve terminals in the reduction of VOC emissions;

.2 consider new and existing regulations on VOCs, including the application of a revised regulation 15 of MARPOL Annex VI, taking into account ship design safety and effectiveness, as well as safety of ship operations;

.3 consider new and existing guidance documents on VOCs, taking into account ship design safety and effectiveness, as well as safety of ship operations;

.4 request input of SSE or other Sub-Committees as appropriate, with a view to advising the PPR Sub-Committee on how best to proceed on matter under their preview; and

.5 recommend to the Committee on how to best to proceed with an improved framework for the reduction of VOC emissions.

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ANNEX 19

STATEMENTS BY DELEGATIONS AND OBSERVERS*

ITEM 6

Statement by the observer from ISO

"I would like to give an update on the work undertaken by ISO/TC 28/SC 4/WG6 (ISO WG6) to provide the maritime industry with an indicator to characterise whether a marine fuel tends to be more paraffinic or aromatic in nature.

As reported at PPR 9 meeting, the approach taken was to find - and apply - a well-established method already used by the petroleum industry to characterise fuels in terms of their paraffinic or aromatic nature. The 'Viscosity Gravity Constant' (VGC) and the 'Bureau of Mines Correlation Index' (BMCI), both offering an indication of a fuels tendency to be more paraffinic, or aromatic were studied with VGC (published as the ASTM D2501 calculation method) providing a more straightforward approach being dependent only on the viscosity and the density of the fuel oil's routinely analysed parameters.

Calculation of VGC was applied to different sets of test data for residual type marine fuels to derive an indication whether the fuel leans more towards being paraffinic or aromatic in nature when comparing one fuel to another. VGC values should be used as a range and can range from 0.82 (or lower) for products more paraffinic in nature and up to 0.92 (or above) for products more aromatic in nature.

ISO WG6 reviewed the options on how to incorporate this indicator in the 7th edition of ISO 8217 and agreed to include an informative annex on the characterization of marine fuels in the draft international standard, providing a summary of the approach taken, the methods that were considered and the VGC calculation. In addition, an informative Technical Report has been developed providing more detailed information and examples on the application of VGC to different sets of test data for residual type marine fuels. These examples will show that VLSFOs generally have lower VGC values than HSFO. This supports previous findings that VLSFOs are more paraffinic in nature than HSFO.

The revised ISO 8217 standard and the Technical Report on the characterisation of marine fuels are expected to be published in the first quarter of 2024."

Statement by the delegation of Germany

"Thank you, Mr. Chair,

We would like to thank ISO for the statement on the status of the activities for issuing the new 2023 revision of the marine fuels ISO 8217 standard which was made in plenary on Monday and is related to their intervention provided during PPR 9 (as stated in PPR 9/21 Add. 1, Annex 16). ISO suggests to include the viscosity gravity constant (VGC) in the marine fuels standard as an indicator to characterise whether a marine fuel tends to be more paraffinic or aromatic in nature.

* Statements have been included in this annex as provided by delegations/observers, in the order in which they were given, sorted by agenda item, and in the language of submission (including translation into any other language if such translation was provided). Statements are accessible in all official languages on audio file at: http://docs.imo.org/Meetings/Media.aspx

We highly appreciate the ISO work on marine fuel standardisation, in particular their tireless efforts coping with the sulphur cap issues entered into force 2020.

On the matter at hand regarding the VGC issue, our understanding is that the VGC is calculated based on viscosity and density of the fuels. The analysis data this indicator is based on is going several decades back and this is similar to the CCAI, another existent indicator in the marine fuels standard, also calculated on viscosity and density.

The point here is that the VGC and CCAI - with the change of HFO composition to comply with the global sulphur cap – seems to have lost its meaning owing to their analysis base data going back decades.

And it seems we are not alone; engine manufactures tend to share our discomfort about the meaningfulness of the CCAI indicator as expressed in document PPR 7/8/1 by EUROMOT.

As the VGC and the CCAI are based on the same parameter, namely density and viscosity, the VGC is not sufficient to describe what we are aiming for – and just to be clear about our stance here, our understanding on what is crucial here is a useful qualifier for aromaticity. Therefore, we don't think that the VGC is sufficient for our purpose and we have suggested an re-iterate our call here to include a H/C ratio within the ISO marine fuels standard. The H/C ratio has been shown to strongly correlate with aromatic content of a fuel, we therefore suggest to include the H/C ratio in ISO 8217 and would like ISO to reconsider their decision."

Statement by the observer from FOEI

"Thank you Chair,

As those in the Air Pollution Working Group will know, FOEI is extremely frustrated at the lack of progress this week on mandatory measures to reduce black carbon emissions which impact the Arctic and have consequences for the whole planet. After more than a decade this body has still to agree to any action that will reduce emissions of black carbon, indeed black carbon emissions from ships remain unregulated.

Chair, on Tuesday during a lunchtime side event, I underscored the unequivocal warnings of the recent IPCC 6th Assessment Synthesis Report - that without rapid, deep and sustained emissions reductions in every sector, including shipping - we are bound to see widespread and more pronounced climate impacts, and climate-induced loss and damages of epic proportions.

In 2018, Leaders from 18 Pacific Island countries, including my own, recognised climate change as the single greatest security threat to our region, and last year the Leaders declared that the region is facing a climate emergency. Indeed the whole planet is facing a climate emergency. What's more, we know the root of the problem, and we know what we must do to tackle this existential threat.

We know that black carbon is not only a major contributor to global warming, but it also poses serious health and environmental impacts. The IMO has a moral obligation and a critical role to play in the effort to accelerate climate action, by adopting measures which will significantly reduce the impact on the Arctic of black carbon emissions from shipping. Something that IMO's Member States committed to address 13 years ago.

The cost of inaction will far outweigh the cost of action. Every decision that allows shipping to continue with business as usual, allows pollution, allows harmful black carbon pollutants into the atmosphere; directly relates to the loss of lives, the loss of livelihoods, human rights being undermined, and the future of this planet being threatened.

So we call on Member States to urgently bring forward proposals for mandatory measures which will result in rapid, deep and sustained black carbon emission reductions without which losses and damages will continue to increase and the most vulnerable populations will be disproportionately affected."

Statement by the observer from Pacific Environment

"Thank you Chair,

Pacific Environment shares the concerns expressed by others. I live near the Arctic, and the changes I am seeing are a daily reminder of the need for urgent action by all sectors which pollute the atmosphere with black carbon. It is unbelievable in this day and age that a potent short-lived climate forcer remains totally unregulated by the shipping sector, particularly when other sectors are already reporting significant reductions in emissions. Indeed, it is hard to understand why the shipping sector is able to avoid practices that have long been adopted by land-based transport to reduce black carbon - cleaner fuels and technology to lower emissions.

Reducing black carbon emissions would have a near instantaneous double benefit by not only slowing Arctic warming, but also protecting northern communities who live near ports or along shipping lanes from the severe human health consequences of an atmosphere polluted by black carbon and other elements of PM2.5.

We add our voice to calls for Member States to urgently bring forward proposals that will result in rapid, deep and sustained black carbon emission reductions this decade.

Thank you."

Statement by the observer from CSC

" Thank you Chair,

As my colleague from Friends of the Earth has already expressed, CSC is also very frustrated at the lack of progress made this week on mandatory black carbon measures. To me, the lack of interest expressed during Working Group to continue working on this important issue over the next year in Correspondence Group is a symptom of a greater problem. Despite some general statements in support of regulating black carbon emissions in the Arctic, not a single member state in the room has expressed a willingness to submit a concrete proposal to this effect. As I said in my statement on Monday, we have been discussing black carbon emissions in the Arctic for 13 years. And after 13 years, we do not even have a concrete regulatory proposal to consider.

As public servants, you have an obligation to take action to protect your citizens from the worst consequences of climate warming. And while I recognize that part of your decision to regulate pollution must account for the regulatory cost, we also know that the cost of inaction on climate change will greatly outweigh the cost of action. Until we finally start accounting for the financial and humanitarian costs of climate warming, we will always have an excuse to postpone our work.

We know that black carbon is a significant climate forcer, that burning heavy fuels oil results in significant levels of black carbon emissions, and that black carbon emissions have a greater impact on the Arctic than anywhere else in the world. Regardless of what you think the correct approach to black carbon regulation in the Arctic might be, it is time to propose something tangible.

I am not here because I think I hold some moral high ground or because caring about the consequences of climate change allows me to sleep at night. I am here because I know that the decisions we make today, and in the next several years, will impact both the people I love as well as the people you love.

And while I take heart in some of the measures that individual countries are taking in order to combat climate warming, this type of piecemeal approach is not what is best for our planet. It is also not what is best to ensure the value of this organization. We need collective action. And only the people in this room hold the power to take collective action to address shipping emissions. For this reason, I urge member states to submit proposals for the mandatory regulation of black carbon pollution in and near the Arctic.

Thank you."

Statement by the observer from the Inuit Circumpolar Council

"Thank you Chair,

Inuit Circumpolar Council is deeply concerned with the prospect of coming out of this important meeting without a way forward on mandating the reduction of black carbon emissions from shipping in and near the Arctic and Inuit Nunaat.

- black carbon is 20% of the shipping industry's climate impact,
- its emissions in the Arctic have doubled from 2015-2021 and are 5 times more potent a climate disruptor when emitted in the Arctic,
- black carbon melts snow and ice resulting in habitat loss and disruptions in Inuit harvesting, culture and mobility,
- rapid changes to the Arctic environment have major implications for the global climate system contributing to severe weather events around the world,
- particulate matter and black carbon can have health impacts on Indigenous coastal communities increasing the risk of premature mortality from respiratory ailments.

Arctic shipping has increased in the past years at a significant rate. The list of reasons to urgently mandate emissions reductions is long and convincing, and will become even more urgent as shipping traffic increases further; yet there continue to be delays and a lack of will to develop clear, concrete, and effective next steps for mandating black carbon emission reductions.

This isn't a theoretical issue for Inuit, our homeland is rapidly changing before our eyes yet very little is being done about it. Inuit didn't cause the climate crisis but we are the ones on the front lines dealing with the consequences. As the IMO leads up to revising its GHG reduction strategy and targets, we must urgently deal with one fifth of the sector's climate pollutants so as not to put shipping on a path of global temperature rise above 1.5 degrees and to protect our Inuit homeland from severe impacts.

Inuit Circumpolar Council urges the IMO to discuss or propose an urgent agenda item for MEPC 80 on a way forward to mandate black carbon emission reductions, such as requiring a switch to distillate or cleaner alternative fuels in or near the Arctic and Inuit Nunaat.

Lastly, we would like to acknowledge the statement just now from Canada on developing a proposal for an Emission Control Area in the Canadian Arctic. ICC looks forward to engaging with Canada on this promising proposal. Emission Control Areas can have a significant effect on reducing black carbon emissions from shipping.

Thank you, Chair."

ITEM 12

Statement by the observer from IACS

"IACS appreciates the hard work of the coordinator and all participants of the Correspondence Group, which allowed for the substantial progress in the revision of MARPOL Annex IV and associated guidelines. IACS notes that there are still issues that need consideration in order to facilitate further development of the draft amendments to MARPOL Annex IV.

IACS would like to bring to the Sub-Committee's attention the potential issues that may arise if the surveys are implemented as outlined in section 4.1.1 of the draft amendments to MARPOL Annex IV, as well as the draft Guidelines on implementation of MARPOL Annex IV for sewage treatment plan as set out in annex 3 to document PPR 10/12.

Firstly, IACS notes that according to regulation 4.1.1 of the draft amendments to MARPOL Annex IV, it would be necessary to issue the ISPP certificate twice. This obligation presents a challenge not only in terms of the additional administrative burden but also because it suggests that the Administration is prepared to accept a short-term certificate, valid for at least six months. Nevertheless, if the intended course of action is to accept the aforementioned conditions, IACS considers that it will be imperative to include an additional paragraph in the ISPP that specifies the date of the commissioning test. This measure will facilitate the differentiation between the short-term and full-term certificates issued before and after the commissioning test.

Furthermore, IACS recommends that the consequences of not passing the commissioning test be explicitly stated in the draft amendments to MARPOL Annex IV, such as potential limitations on sewage discharge resulting from a non-compliant test. IACS is of the opinion that such situations should be addressed on a case-by-case basis and subject to acceptance by the flag Administration of the ship.

Secondly, IACS would like to express its concern regarding the feasibility of conducting the commissioning test within the 6-month delay after the initial survey as outlined in regulation 4.1.1 of the draft amendments to MARPOL Annex IV (as set out in annex 1 to document PPR 10/12). IACS believes that there may be difficulties in collecting the required data as it may take more than 6 months to ensure a stable operation of the STP and obtain the necessary samples as per annex 3 to document PPR 10/12, i.e., five samples during a 30-day period for passenger ships and 3 samples during a 6-month period for other ships.

Additionally, laboratory capacity limitations could potentially cause delays, further increasing the risk of extended timelines. To address this concern, IACS recommends carrying out the commissioning test during the ship's first annual survey for sewage treatment plant subject to regulation 9.1.1 and 9.2.1 of the draft amendments to MARPOL Annex IV (annex 1, page 7 of document PPR 10/12). This proposal is founded on the fact that a surveyor can easily verify the completion of the test during the annual survey and, if the ship meets the necessary requirements, issue the ISPP certificate.

In the same context of practicalities, IACS would like to draw the attention to the fact that the commissioning test procedure as outlined in annex 3 to document PPR 10/12 renders unfeasible for surveyors to attend, and witness taking of the sample and ensure that the sample preservation and the custody chain are carried out according to the guidelines. IACS suggests that due consideration be given to these and other practicalities."

ITEM 13

Statement by the representative of FAO

"The FAO Voluntary Guidelines on the Marking of Fishing Gear (VGMFG) endorsed by the 33rd meeting of COFI in 2018, provides guidance for the development of 'systems' for the marking of gear to identify ownership. Systems include reporting, retrieval and disposal. The key purpose of the guidelines is to address and prevent MPL in the form of ALDFG, ghost fishing and other negative impacts on the marine environment.

Gear marking also contributes to:

- MCS activities including the fight against IUU fishing; and
- Reducing hazards to navigation

The guidelines apply to all fishing gear types used in all types of fishing activities in all oceans and seas and provide a basis for developing regulation.

Two Supplements to the guidelines have recently been published in early 2023. These are:

Supp I - "A Framework for Conducting a Risk Assessment for a System on the Marking of Fishing Gear"

This document provides examples of how to identify risks associated with various fishing gear when not marked under both normal operating conditions and once they become ALDFG. It also provides means for estimating likelihood of occurrence of risks and a method for estimating scores for different impacts.

It is important to note that the guidelines state that a system of marking fishing gear should be put in place for all gear types unless the relevant authority, as a result of risk assessment or other appropriate means, deems otherwise.

Supp II is a "Manual for the marking of fishing gear "

The manual provides practical guidance on how to mark common fishing gears, drawing on currently available marking techniques and approaches, for the purpose of identifying ownership.

Another relevant recent publication is entitled "Operationalization of the VGMFG for the IOTC"

At the request from IOTC this document was developed to provide a framework to operationalise the VGMFG for fishing gears being used to target IOTC species, tuna and tuna like species. The main focus being to address MPL in the form of ALDFG. The framework Incudes a risk assessment, examines current IOTC CMMs related to gear marking, and considers financial implications of implementing a gear marking system.

Additional FAO Activities to Support the Implementation of the FAO VGMFG
FAO in partnership with IMO through the Glolitter Project, is developing a publication entitled "Legislative options for implementing gear marking systems" and is due to be published beginning of 2024.

Other Relevant GloLitter publications, not included in the paper and already available, include

- Legal Aspects of ALDFG
- Reporting & Retrieval of lost fishing gear

The FAO document recommends that the VGMFG and its supporting guidelines are considered as appropriate tools for the development and implementation of systems for the marking of fishing gear and as such relevant for discussions on the development of a goal-based requirement for the mandatory marking of fishing gear.

On the surface marking of fishing gear for the purpose of identifying ownership may seem like a relatively easy task. Successful development of gear marks that won’t impede fishing operations and therefore the safety of crew for gears such as gillnets and long lines is one thing, but this achieves little if not part of an effective ‘system of gear marking’ that allows the owner to be traced.

If not done so already I urge members to consult with their fisheries counterparts on the development of gear marking and reporting systems, and existing management capacities, and possible needs, to handle these. This will be important information to feed into the process, facilitating development of a measure that may be implemented successfully.

The physical design of gear marks is important for certain gears. I would also like to all on members to consider the potential safety risks that attaching a physical mark to some fishing gears may bring during the course of fishing operations.

FAO stands by to assist IMO and members by providing input where we can, and share information on activities related to the marking of fishing gear.

Thank you Chair.

Link to FAO Publications https://www.fao.org/responsible-fishing/resources/en/ "

Statement by the delegation of Argentina

"Mr. Chair,

Argentina thanks the coordinator of Working Group 3 on plastics in the marine environment, Ms. Annalisse Sly, from Australia, for presenting document WP.7.
Argentina would like to make two general comments on the issues addressed therein, mainly because future work requires recognizing certain premises that emerged from the plenary session of this subcommittee, particularly given that participation in the working groups and correspondence groups is more limited, because many countries, particularly developing ones,

cannot participate effectively. So, we must always keep in mind what has emerged from the plenary.

Thus, regarding the transport of plastic pellets:

- The guidelines should reflect their consensus and do not prejudge the issue of legal instrument for future standards.

Trying to advance substantive positions on the legal instrument only leads to long and complex discussions, when we should concentrate on developing practical and feasible measures to address this challenge in a concrete manner in the short term. We mention this aspect because in the WG it seemed, at times, that we forgot about this premise and that we had agreed to it, and it seemed that we were negotiating, in the context of the guidelines, what the future legal instrument should be. This led to complex and lengthy exchanges, between those who favor the concept of "dangerous goods" and those who understand that this is not the right approach (and that is the case of Argentina). These discussions to a large extent made demands on the President and the Secretariat. In this regard, Argentina would like to remind that the list of instruments contained in WP.7 serves the sole purpose of facilitating the assessment of elements for making recommendations on packaging for the guidelines, without prejudging the discussions on the future legal instrument.

- On the other hand, the experience gained in the application of the guidelines should serve for the design of the future instrument,

- Finally, existing or possible guidelines and best practices should be taken into account, as well as the evolution of the negotiation of a future agreement on plastics in the marine environment by the UNEP Environment Assembly.

Regarding fishing gear:

- The contribution of the FAO is essential in this aspect, since it has primary competence in fishing, has adopted a set of guidelines regarding the loss and discarding of fishing gear, and its knowledge of the fishing activity should be an important element in our work,

- In a situation in which many delegations are in favor of a non-binding instrument for fishing gear marking (and that is the case of Argentina), the meeting point seems to be that of a phased approach, starting with guidelines and then, based on from that experience, negotiate a binding instrument.

Having said that, our delegation once again thanks the Working Group Chair, our colleague Annalisse Sly from Australia, for her efforts and patience, as well as the Secretariat for supporting our work.

Thank you so much."

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SUB-COMMITTEE ON POLLUTION PREVENTION AND RESPONSE
10th session
Agenda item 18

PPR 10/18/Add.2
26 May 2023
Original: ENGLISH

REPORT TO THE MARINE ENVIRONMENT PROTECTION COMMITTEE

Attached is annex 3 to the report of the Sub-Committee on Pollution Prevention and Response on its tenth session (PPR 10/18).

(See document PPR 10/18/Add.1 for annexes 1, 2, and 4 to 19)

LIST OF ANNEXES

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ANNEX 3*

DRAFT OPERATIONAL GUIDE ON THE RESPONSE TO SPILLS OF HAZARDOUS AND NOXIOUS SUBSTANCES (HNS)

VOLUME 1 (Preparedness)

Authors:
Luigi Alcaro, Julke Brandt, William Giraud, Michela Mannozzi, Annabelle Nicolas-Kopec

Disclaimer
To be included at time of publishing

Preface
To be drafted by secretariat at time of publishing

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* Available in English only.

1.INTRODUCTION

Maritime transport is often described as "the backbone of globalized trade and the manufacturing supply chain", since more than 80% of the global merchandise trade by volume is carried by sea.

Some of the goods transported are defined as Hazardous and Noxious Substances (HNS). HNS might be released into the sea as the consequence of illegal discharges or maritime accidents such as groundings or collisions; and whilst major incidents involving an HNS spill are rare, they can be very complex and potentially have severe impacts on human health, the environment, and socio-economic resources. The particular challenges associated with responding to HNS incidents are linked to the heterogeneity of the various substances considered as HNS, which include substances presenting various hazards (physical hazards such as fire and explosion, health hazards such as toxicity, and environmental hazards) and behaviours (gases/evaporators, floaters, dissolvers, sinkers).

The objective of this Marine HNS Response Manual is to provide operational guidance for first responders and decision-makers during a maritime incident at sea or in port involving HNS. The manual does not cover all aspects of an incident involving HNS, but specifically addresses relevant offshore and onshore spill response techniques (but excludes topics such as search and rescue, salvage, medical treatment). The HNS Marine Response Manual consists of three parts:

1. Introductory background information relevant for understanding the concepts driving an HNS response strategy in seven chapters;

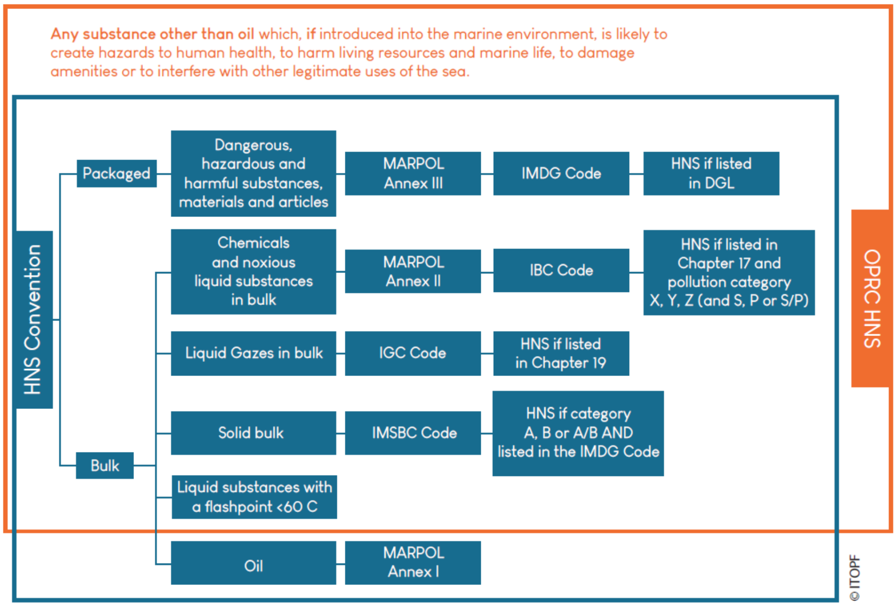
2. Operational fact sheets and decision-making flowcharts relevant for responders;

3. Annexes I, II and III include regional specificities (information on maritime transport, sensitive resources, etc.) for the Baltic Sea (Helsinki Commission (HELCOM)), North Sea (Bonn Agreement) and Mediterranean Sea (The Regional Marine Pollution Emergency Response Centre for the Mediterranean Sea (REMPEC)) respectively.

1.2 HNS definition

There are two different key definitions of HNS: that of the **2000 OPRC-HNS Protocol** and that of the **2010 HNS Convention**. Under the **2000 OPRC-HNS Protocol** (IMO, 2002), HNS are defined as "*any substance other than oil which, if introduced into the marine environment, is likely to create hazards to human health, to harm living resources and marine life, to damage amenities or to interfere with other legitimate uses of the sea*".

Figure 1: Definition of HNS according to HNS Convention and OPRC HNS Protocol



The **HNS Convention** (IMO, 2010) on the other hand includes oil and provides a detailed list of HNS categories as defined by various International Maritime Organization (IMO) conventions and codes:

a) *"any substances, materials and articles carried on board a ship as cargo, referred to in (i) to (vii) below:*

i. oils, carried in bulk, as defined in regulation 1 of annex I to the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto, as amended;

ii. noxious liquid substances, carried in bulk, as defined in regulation 1.10 of Annex II to the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto, as amended, and those substances and mixtures provisionally categorized as falling in pollution category X, Y or Z in accordance with regulation 6.3 of the said Annex II;

iii. dangerous liquid substances carried in bulk listed in chapter 17 of the International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk, as amended, and the dangerous products for which the preliminary suitable conditions for the carriage have been prescribed by the Administration and port administrations involved in accordance with paragraph 1.1.6 of the Code;

iv. dangerous, hazardous and harmful substances, materials and articles in packaged form covered by the International Maritime Dangerous Goods Code, as amended;

v. liquefied gases as listed in chapter 19 of the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk, as amended, and the products for which *preliminary suitable conditions for the carriage have been prescribed by the Administration and port administrations involved in accordance with paragraph 1.1.6 of the Code;*

vi. liquid substances carried in bulk with a flashpoint not exceeding 60°C (measured by a closed-cup test);

vii. solid bulk materials possessing chemical hazards covered by the International Maritime Solid Bulk Cargoes Code, as amended, to the extent that these substances are also subject to the provisions of the International Maritime Dangerous Goods Code in effect in 1996, when carried in packaged form; and

b) residues from the previous carriage in bulk of substances referred to in (a) (i) to (iii) and (v) to (vii) above."

2) IMO CONVENTIONS, PROTOCOLS

The International Maritime Organization (IMO) is a specialised agency of the United Nations and is the standard-setting authority for the safety, security and environmental performance of international shipping. Its main role is to create a universally adopted and effective regulatory framework for the shipping industry. To achieve this goal, IMO uses five important instruments: Conventions, Protocols, Amendments, Recommendations (includes Codes and Guidelines) and Resolutions. IMO adopts these instruments and the national governments of the current 174 Member States are responsible for implementing them. So far IMO has adopted more than 50 international conventions and agreements, as well as numerous protocols and amendments.

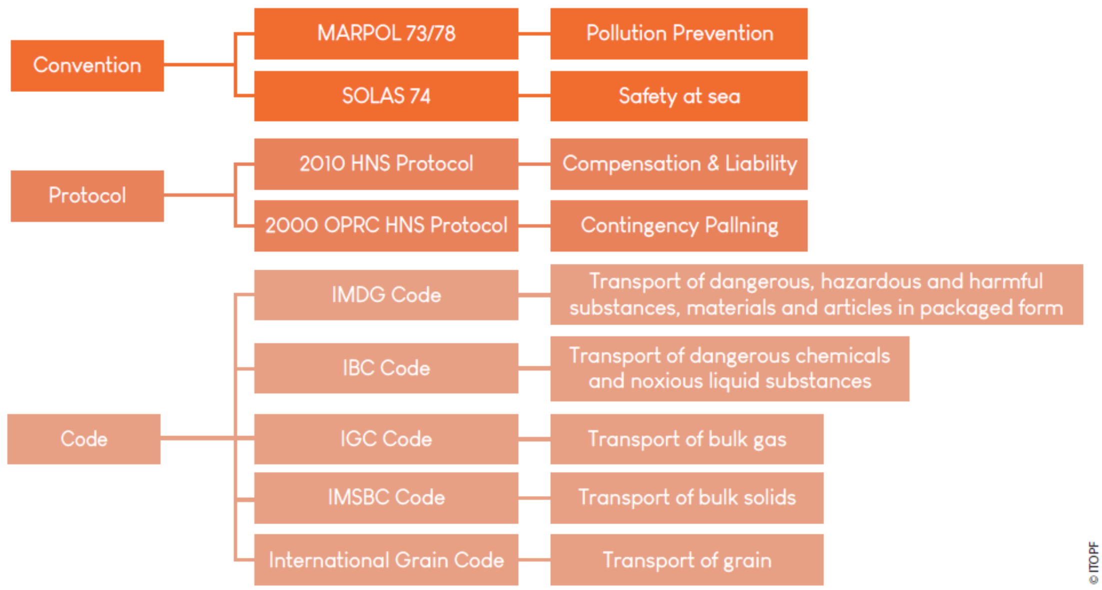


Figure 2: IMO conventions, protocols and codes relevant for the transport of HNS at sea

The two main IMO conventions concerning the safety of merchant ships and the prevention of pollution of the marine environment by ships are: the International Convention for the Safety of Life at Sea (**SOLAS 74**) and the International Convention for the Prevention of Pollution from Ships (**MARPOL 73/78**) respectively. SOLAS (IMO, 2020b) and MARPOL (IMO, 2017) refer to various IMO Codes, relevant for the carriage of HNS as per the HNS Convention:
IMDG Code (International Maritime Dangerous Goods Code);
IBC Code (International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk);
IGC Code (International Gas Carrier Code);
IMSBC Code (International Maritime Solid Bulk Cargoes Code).
Conventions become mandatory for Contracting Parties/Member States once they are ratified and implemented into national law. IMO Codes (such as IMDG Code), on the other hand, are often a recommendation.

In addition to conventions, the 2010 HNS Protocol addresses the topic of liability and compensation and the OPRC-HNS Protocol focuses on contingency planning and preparedness.

A protocol forms additional legislation which adds to or complements an existing convention or treaty. Parties to the original Convention may separately accede to its Protocol.

2.1 IMO conventions related to HNS transport

SOLAS 1974 specifies minimum standards for the construction, equipment and operation of ships, compatible with their safety. Chapter VII of the Convention specifically addresses the carriage of dangerous goods in packaged form, in solid form in bulk, dangerous liquid chemicals in bulk and liquefied gases in bulk.

MARPOL 73/78 is the main international convention covering the prevention of pollution of the marine environment by ships from operational or accidental causes and addresses regulations for the prevention of pollution by oil (Annex I), noxious liquid substances in bulk (Annex II), harmful substances carried by sea in packaged form (Annex III), sewage (Annex IV), garbage (Annex V) and air pollution (Annex VI).

MARPOL Annex II and the IBC Code divide noxious **liquid substances** into four pollution categories:
Category X: substances which present a major hazard to either marine resources or human health, therefore, the discharge into the marine environment is prohibited (e.g. phosphorus, white or yellow);
Category Y: substances which present a hazard to either marine resources or human health or cause harm to amenities or other legitimate uses of the sea and therefore justify a limitation on the quality and quantity of the discharge into the marine environment (e.g. styrene);
Category Z: substances which present a minor hazard to marine resources and/or human health and therefore justify less stringent restrictions on the quality and quantity of the discharge into the marine environment (e.g. acetone);
Category OS: other substances, which are not considered harmful and are not subject to any requirements of MARPOL Annex II (e.g. molasses).
MARPOL Annex III sets out regulations for the prevention of pollution by harmful substances in **packaged form** and includes general requirements for the issuing of detailed standards on packing, marking, labelling, documentation, stowage, quantity limitations, exceptions and notifications for preventing pollution by harmful substances.

2.2 IMO protocols related to HNS transport

The Protocol on Preparedness, Response and Co-operation to Pollution Incidents by Hazardous and Noxious Substances (**2000 OPRC-HNS Protocol**) seeks to provide a global framework for international co-operation and compel national preparedness for combating major incidents or threats of marine pollution from ships carrying HNS. It follows the principles of the International Convention on Oil Pollution Preparedness, Response and Co-operation (**OPRC 1990**).

The International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea (**1996 HNS Convention**) was adopted in 1996. It aims to ensure compensation to those who have been affected by damage to persons and/or property. It is modelled on the International Convention on Civil Liability for Oil Pollution Damage (**CLC Convention**) and International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (**1992 Fund Convention**) which cover pollution damage from persistent oil from tankers. However, by 2009, the 1996 HNS Convention had still not entered into force (due to an insufficient number of ratifications) therefore a protocol to the HNS Convention (**2010 HNS Protocol**) was developed and adopted. The 2010 HNS Protocol was designed to address practical problems that had prevented a number of States from ratifying the original Convention (IOPC Funds, 2019). The 2010 HNS Protocol is not yet in force, therefore compensation following an HNS incident remains subject to national regulations (6.1.1 Legislation - Legal basis for compensation).

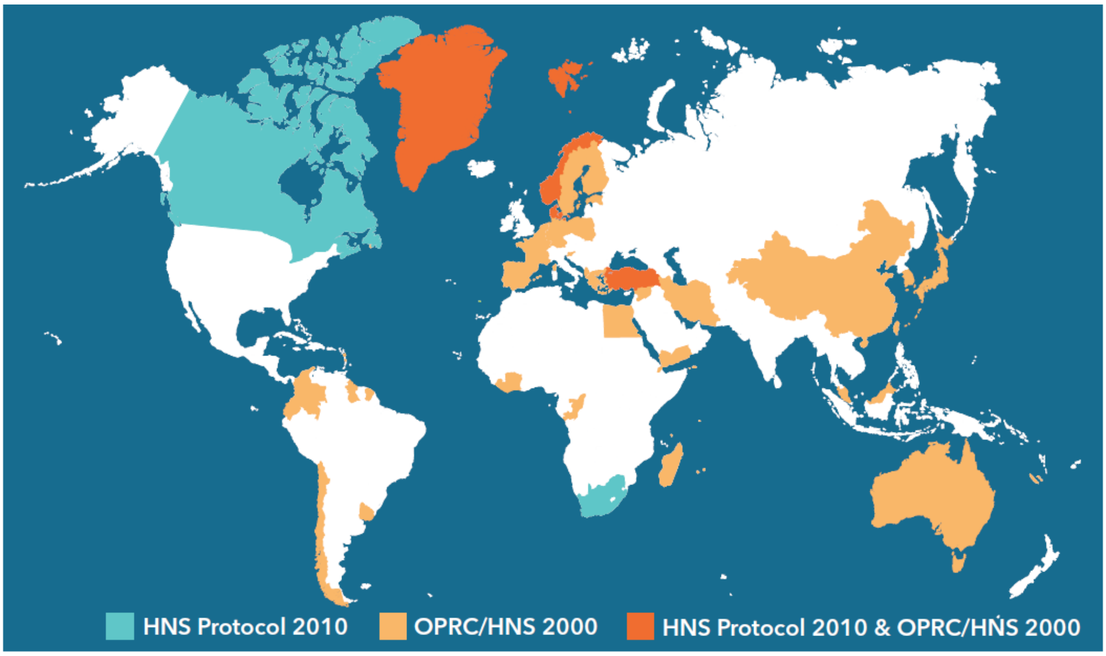


Figure 3: Countries which have ratified the 2010 HNS Protocol and/or 2000 OPRC-HNS (IMO, 2020) Updated information can be found on www.imo.org/en/About/Conventions/Pages/StatusOfConventions.aspx

2.3 IMO codes related to HNS transport

There are various IMO codes addressing the safe transport of HNS and grain, all of which are explained in more detail in the relevant sub-sections. All codes are amended periodically. It is worth noting that the IBC, IGC and IMSBC Codes include provisions for non-hazardous cargo, whereas the IMDG Code only addresses HNS.

The International Code for the Safe Carriage of Grain in Bulk (International Grain Code) covers specific transport considerations for wheat, maize (corn), oats, rye, barley, rice, pulses, seeds and processed forms thereof. Since the Code's content does not address physical or environmental hazards associated with a spill of such substances, it is not further elaborated.

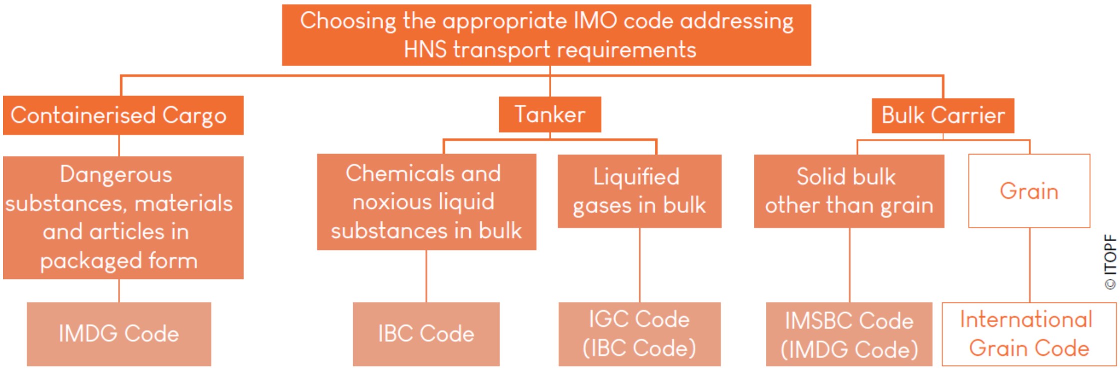


Figure 4: Overview of IMO codes

2.3.1 International Code of the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code)

Coral Leaf *ethylene carrier in heavy seas*

The **IGC Code (International Code of the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk)** sets out the international standards for the safe carriage of liquefied gases in bulk by sea. The Code defines vessel design and construction standards as well as equipment requirements aiming to minimise the risk to the ship, its crew and the environment (IMO, 2016). Additional standards for vessels operating with gas or low flash point liquids such as fuel are provided in the **IGF Code** (International Code of Safety for Ships using Gases or other Low-flashpoint Fuels).

The three types of gas cargoes to be distinguished are **LNG** (Liquefied Natural Gas), **LPG** (Liquefied Petroleum Gas) covering butane and propane (or a mixture of the two) and **a variety of chemical gases** (such as ammonia).

Depending on the nature of the cargo, it might be transported in LNG carriers, fully refrigerated ships, ethylene carriers, semi-pressurised ships or pressurised ships. All vessels subject to the IGC Code are assigned one of four types (1G, 2G, 2PG, 3G) based on the hazard potential of the cargo they carry:

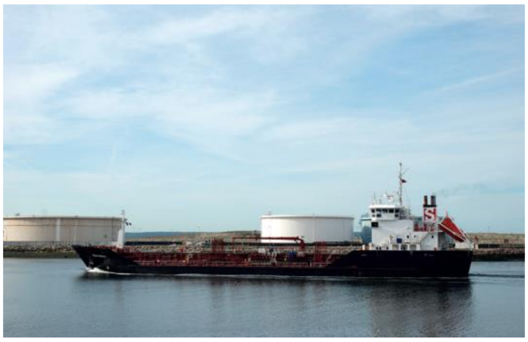
- Type 1G vessels are intended to transport products which present the greatest overall hazard (e.g. chlorine, ethylene oxide),
- Types 2G/2PG are designed to carry cargoes with a lesser degree of a hazard (e.g. ammonia, propane)
- Type 3G carry the least hazardous products (e.g. nitrogen, carbon dioxide).

Depending on the type of vessel, the product can be carried in independent tanks:

- Type A (box-shaped or prismatic)
- Type B (spherical or prismatic)
- Type C (spherical or cylindrical), membrane tanks, integral tanks or semi-membrane tanks.

All liquefied gases considered in the Code are listed in Chapter 19 of the IGC Code; all product names followed by an asterisk are also covered by the IBC Code.

2.3.2 International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk (IBC Code)



Chemical tanker

Chemical tankers built after 1st July 1986 are required to comply with the IBC Code, which sets out the international standards for the safe carriage of dangerous chemicals and noxious liquid substances, in bulk by sea. The IBC Code prescribes the design and construction standards of ships involved in the transport of bulk liquid chemicals and identifies the equipment to be carried to minimise the risks to the ship, its crew and to the environment, with regard to the nature of the products carried (IMO, 2016a).

The IBC Code (in concordance with MARPOL Annex II) divides noxious liquid substances into four pollution categories.

In addition to these pollution categories, the Code also indicates whether a substance is a safety ("S") and/or a pollution ("P") hazard with regard to fire, health, reactivity and marine pollution hazards.

Chapter 17 of the IBC Code contains a list of chemicals, organised by their product name (column a), followed by the pollution category (column c) and hazards (column d), followed by columns addressing ship/ tank type and minimum equipment requirements.

a	c	d	e	f
Hydrochloric acid	Z	S/P	3	1G

Table 1: Example of hydrochloric acid entry as per IBC Code

(a) Product name: Hydrochloric Acid, (c) Pollution category: Z, substance which presents a minor hazard to marine resources and/or human health for operational discharges but is considered (d) Hazard: Safety/Pollution, (f) Tank type: 1G, independent gravity tanks

(a)	**(c)**	**(d)**	**(e)**	**(f)**
Product name	Pollution category	Hazards	Ship type	Tank type
Hydrochloric acid	Z	S/P	3	1G
	Substance which presents a minor hazard to marine resources and/ or human health and therefore justifies less stringent restrictions on the quality and quantity of the discharge into the marine environment	Safety/pollution hazard	Chemical tanker intended to transport products with sufficiently severe environmental and safety hazards which require a moderate degree of containment to increase survival capability in a damaged	Independent gravity tanks

	condition

Table 2: Example of a partial IBC Code entry for Hydrochloric acid

The hazards of all noxious liquid substances transported in bulk (MARPOL Annex II) listed in the IBC Code are evaluated by the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP). GESAMP is an advisory body, established in 1969, that advises United Nations (UN) bodies on the scientific aspects of marine environmental protection **2.1 GESAMP hazard profiles**

2.3.3 International Maritime Solid Bulk Cargoes Code (IMSBC Code)

Handysize La Briantais

The **IMSBC Code (International Maritime Solid Bulk Cargoes Code)** addresses special requirements for the safe stowage and shipment of solid bulk cargoes by providing information on the hazards associated with their carriage (IMO, 2020c). The IMSBC Code categorises cargoes into three groups:
Group A: cargoes that may liquefy (e.g. fish, coal slurry);
Group B: cargoes possessing chemical hazards (according to either the IMDG Code's hazard criteria (e.g. magnesium nitrate) or the IMSBC Code's "materials hazardous only in bulk" (MHB) criteria (e.g. lime);
Group C: cargoes that are neither liable to liquefy nor possess chemical hazards (e.g. iron ore, pebbles).

Appendix 1 of the IMSBC Code lists the physical properties of each substance to which the Code applies, its hazards, equipment and shipping requirements as well as emergency procedures.

Magnesium Nitrate UN 1474

Description

White crystals, soluble in water. Hygroscopic.

Characteristics

Physical properties			
Size	Angle of repose	Bulk density (kg/m³)	Stowage factor (m³/t)
Not applicable	Not applicable		
Hazard classification			
Class	Subsidiary hazard(s)	MHB	Group
5.1	Not applicable		B

Emergency Procedures

Special emergency equipment to be carried	Emergency procedures	Emergency action in the event of fire	Medical first aid
Protective clothing (gloves, boots, cove-ralls and headgear). Self-contained brea-thing apparatus . Spray nozzles.	Wea r protecti v e clothing and self-contained breathing apparatus	Use copious quantity of water, which is best applied in the form of a spray to avoid distur-bing the surface of the material. The material may fuse or melt, in which condition application of water may result in extensive scattering of the molten materials. Exclusion of the aire or use of CO_2 will not control the fire. Due consi-deration should be given to the effect on the stability of the ship due to the accumulated water.	Refer to the Medi-cal First Aid Guide (MFAG), as amended.

Figure 5: IMSBC Code entry example - magnesium nitrate UN 1474

2.3.4 International Maritime Dangerous Goods Code (IMDG Code)

Container ship/RoRo vessel

The **IMDG Code (International Maritime Dangerous Goods Code)** sets provisions for the safe transport of dangerous, hazardous and harmful substances, materials and articles in packaged form by sea (IMO, 2020a). IMDG Code is based on the UN Recommendations on the Transport of Dangerous Goods, also known as the UN Model Regulations (**3.2 GHS vs UN TDG**), which provides a framework of rules for the safe carriage of dangerous goods by all modes of transport (air, road, rail and sea).

The term "dangerous goods" in this context means the substances, materials and articles covered by the IMDG Code. **Dangerous substances** have an immediate physical or chemical effect, whereas **hazardous substances** pose a risk to human health. **Harmful substances** are those identified as a marine pollutant in the IMDG Code.

At sea, packaged goods are usually transported in "cargo transport units" (CTU) such as freight containers on board container ships or car carriers. There are multiple types of intermodal containers such as dry storage, tank containers, flat racks and temperature-controlled containers, of which the most common standard sizes are 20 ft and 40 ft (which differ in volume but not in maximum gross weight). One 20-foot container equals one TEU (twenty-foot equivalent unit).

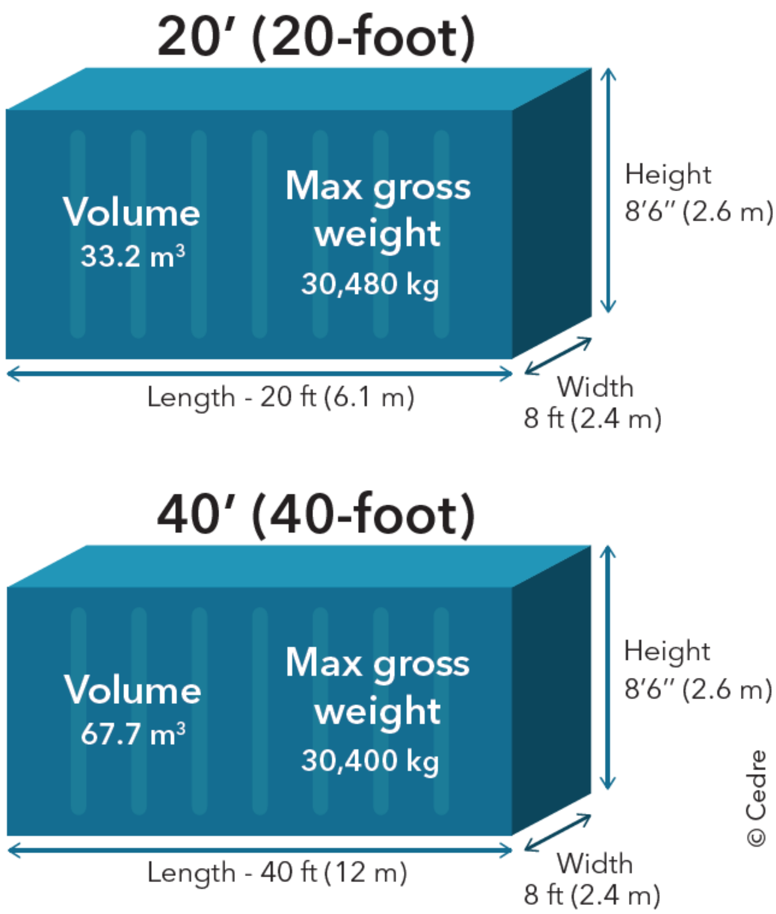


Figure 6: Dimensions of the two most common intermodal dry freight container sizes

Inside a container, packaged goods are carried in inner packaging (such as drums, boxes, bags) which is most commonly fixed onto wooden pallets. The IMDG Code specifies which inner packaging and which CTU is suitable for which HNS.

The IMDG Code comprises two volumes and a supplement, which are published bi-annually:

Volume 1 addresses general provisions/definitions/training, classification, packing and tank provisions, consignment procedures, testing requirements for receptacles and transport operations requirements.
Volume 2 covers the Dangerous Goods List (DGL), special provisions and exceptions where substances are listed by their assigned UN number and proper shipping name.
The supplement contains Emergency Response Procedures for Ships Carrying Dangerous Goods (EmS Guide) and the Medical First Aid Guide for Use in Accidents Involving Dangerous Goods (MFAG), which is the supplement to the International Medical Guide for Ships published by the World Health Organization (WHO). The information contained in the EmS Guide and MFAG is primarily for shipboard use but may be of use to shore-based personnel when responding to an incident involving a container within a terminal.

All goods listed in the IMDG Code are allocated one of nine “classes” (excluding subdivisions), according to the main danger they present. More detail in **Chapter 3**.

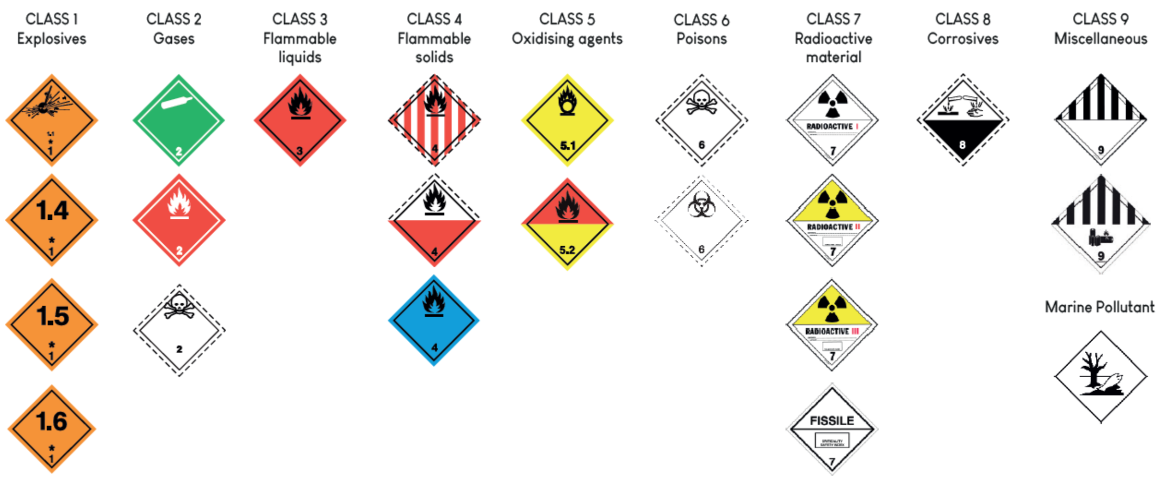


Figure 7: IMDG Code classes’ pictograms

The UN number is a four-digit number which identifies and groups all dangerous, hazardous and harmful substances, materials and articles according to their hazard profile and composition with regard to their international transport. There are four different types of UN Number entries:

Single entries for well-defined substances or articles (e.g. UN 1194 ETHYL NITRITE SOLUTION)
Generic entries for well-defined groups of substances or articles (e.g. UN 1130 PERFUMERY PRODUCTS)
Specific entries not otherwise specified (N.O.S.) (e.g. UN 1987 ALCOHOLS, N.O.S)
Generic entries not otherwise specified (N.O.S.) (e.g. UN 1993 FLAMMABLE LIQUID, N.O.S).

A chemical in its solid state may receive a different UN number to the liquid phase if their hazardous properties differ significantly. Similarly, substances with different levels of purity (or concentration in solution) may also receive different UN numbers.

UN numbers are different from CAS Registry Numbers, which are assigned to each chemical compound uniquely, indifferently of its physical state, by the Chemical Abstract Service (CAS). As of 2020, there were 159,000,000 unique chemical substances indexed by CAS.

Example:
UN 1823 Sodium hydroxide, solid
UN 1824 Sodium hydroxide solution
BUT CAS Sodium Hydroxide: 1310-73-2

For each UN Number, there are coded instructions on packaging, labelling, marking, stowage and segregation based on the substance's hazard classification, including one of three packing groups in accordance with the degree of danger they present:
Packing Group I: high danger
Packing Group II: medium danger
Packing Group III: low danger

UN No.	Proper shipping name (PSN)	Class or division	Subsidiary hazard(s)	Packing group	Special provisions	Limited and excepted quatity provisions		Packing		IBC	
(1)	(2) 3.1.2	(3) 2.0	(4) 2.0	(5) 2.0.1.3	(6) 3.3	Limited quantities (7a) 3.4	Excepted quantities (7b) 3.5	Instructions (8) 4.1.4	Provisions (9) 4.1.4	Instructions (10) 4.1.4	Provisions (11) 4.1.4
1001	Acetylene, dissolved	2.1	-	-	-	0	E0	P200	-	-	-
1002	Air, compressed	2.2	-	-	-	120 mL	E1	P200	-	-	-
1003	Air, refrigerated liquid	2.2	5.1	-	-	0	E0	P203	-	-	-
1005	Ammonia, anhydrous	2.3	8 P	-	23 379	0	E0	P200	-	-	-

Portable tanks and bulk containers			EmS	Stowage and handling	Segregation	Properties and observations	UN No.
(12)	Tank instructions (13) 4.2.5 4.3	Provisions (14) 4.2.5	(15) 5.4.3.2 7.8	(16a) 7.1 7.3-7.7	(16b) 7.2-7.7	(17)	(18)
-	-	-	F-D, S-U	Category D SW1 SW2	SG46	Flammable gas with slight odour. Explosive limits: 2.1% to 80%. Lighter than air (0.907). Rough handling and exposure to local heating should be avoided, since these conditions may result in delayed axplosion. Empty cylinders should be carried with the same precautions as filled cylinders.	1001
-	-	-	F-C, S-V	Category A	-	Non-flammable gas.	1002
-	T75	2.2	F-C, S-W	Category D	-	Liquefied, non-flammable gas. Strong oxidizing agent. Mixtures of liquid air with combustible materials or oils may explode. May ignite organic materials.	1003
-	T50	-	F-C, S-U	Category D SW2	SGG18 SG35 SG46	Liquefied, non-flammable, toxic and corrosive gas with a pungent odour. Lighter than air (0.6). Suffocating in low concentrations. Even though this substance has a flammability hazard, it only exhibits such hazard under extreme fire conditions in confined areas. Reacts violently with acids. Highly irritating to skin, eyes and mucous membranes.	1005

Figure 8: IMDG Code page entry example

The Dangerous Goods List (DGL) specifies which substances when transported in small quantities may be carried as **Limited** or **Excepted Quantities**, which are exempt from some of the transport regulations (since small quantities are considered safer to carry). A **Limited Quantity** is defined as "the maximum quantity per inner packaging or article for transporting dangerous goods as limited quantities". An

Excepted Quantity is defined as "the maximum quantity per inner and outer packaging for transporting dangerous goods as excepted quantities".

In addition, the IMDG Code specifies that packaged dangerous goods must be accompanied by the appropriate transport documents or a signed declaration (**Multimodal Dangerous Goods Form**, Figure 8) stating that the consignment is properly packaged, marked, labelled and in proper condition for carriage. The document must contain information relating to transport (sender/receiver, vessel name, etc.) but also details about the article itself such as UN Number, Proper Shipping Name, Hazard Class, Packing Group (where assigned) and if the article is a marine pollutant (**Chapter 3.2.6.1 Hazardous to the environment (ecotoxicity)**).

1. Shipper/Consignor/Sender	2. Transport document number	
	3. Page 1 of pages	4. Shipper's reference
		5. Freight fowarder's reference
6. Consignee	7. Carrier (to be completed by the carrier)	
	SHIPPER'S DECLARATION I hereby declare that the contents of this consignement are fully and accurately described below by the proper shipping name, and are classified, packaged, marked and labelled/placarded and are in all respects in proper condition for transport according to the applicable international and national governmental regulations.	

8. This shipment is within the limitations prescribed for: (Delete non-applicable)		9 Additional handling information
PASSENGER AND CARGO AIRCRAFT	CARGO AIRCRAFT ONLY	
10.Vessel/flight No. and date	11. Port/Place of loading	
12. Port/place of discharge	13. Destination	

14. Shipping marks	Number and kind of packages; description of goods	Gross mass (kg)	Net mass (kg)	Cube (m^3)

15. Container identification No./ vehicle registration No.	16. Seal number(s)	17. Container/vehicle size and type	18. Tare mass (kg)	19. Total gross mass (including tare) (kg)

CONTAINER/VEHICLE PACKING CERTIFICATE I hereby declare that the goods described above have been packed/loaded into the container/vehicle identified above in accordance with the applicable provisions. **MUST BE COMPLETED AND SIGNED FOR ALL CONTAINER/VEHICLE LOADS BY PERSON RESPONSIBLE FOR PACKING/LOADING**	21. RECEIVING ORGANISATION RECEIPT Received the above number of packages/containers/trailers in apparent good order and condition, unless stated hereon: **RECEIVING ORGANISATION REMARKS:**	
20. Name of company	Haulier's name	22. Name of company (OF SHIPPER PREPARING THIS NOTE)
Name/status of declarant	Vehicle registration no.	Name/status of declarant
Place and date	Signature and date	Place and date
Signature of declarant	DRIVER'S SIGNATURE	Signature of declarant

Figure 9: Multimodal Dangerous Goods Form, as given in the IMDG Code. The layout of the form is non-binding, but the content is mandatory (IMDG Code Vol.1 p. 294)

3) HNS HAZARD AND BEHAVIOUR CLASSIFICATIONS

During a marine incident involving HNS, it is crucial to obtain information about the spilled substance's chemical and physical properties, associated hazards and likely behaviour when spilled at sea. This information is key in the development of a response strategy.

Decisions on the first actions to be taken are often driven by the potential hazards associated with HNS, such as explosion, flammability, oxidation, corrosivity, reactivity, toxicity and ecotoxicity. However, depending on the timespan of the hazards, the longer term response strategy will tend to be driven by the chemical's behaviour (as described by the Standard European Behaviour Classification (SEBC)).

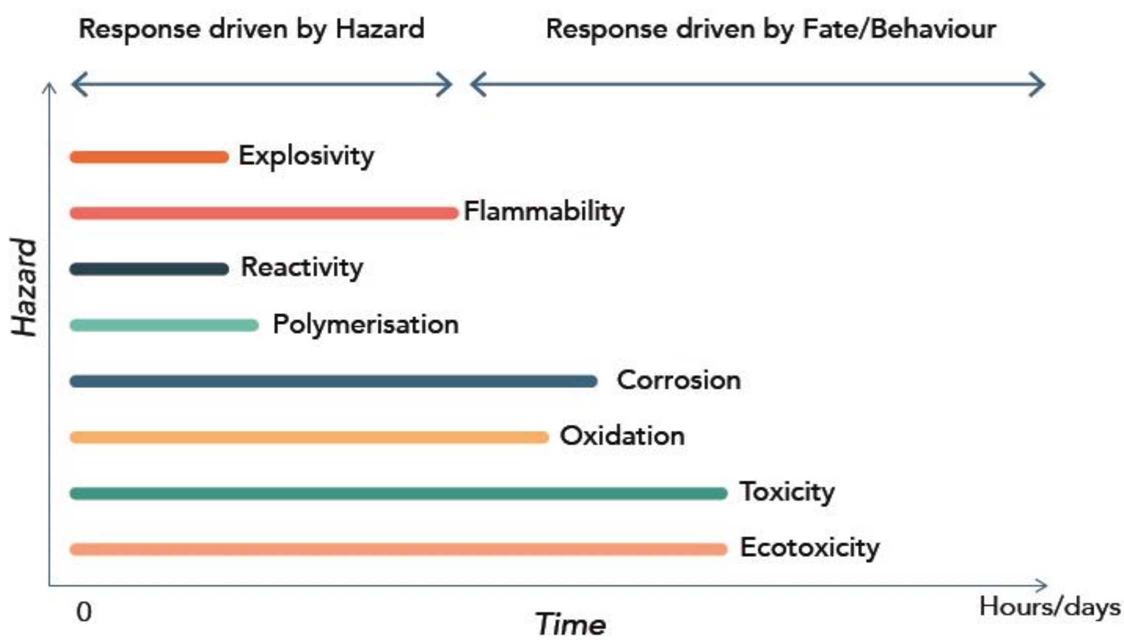


Figure 10: How first response actions driven initially by hazards and later by fate and behaviour change over time

For operational advice related to hazards and fate/behaviour, see **Chapter 5**.

3.1 Physical fate and behaviour of HNS when spilled at sea

The **Standard European Behaviour Classification (SEBC)** determines the theoretical behaviour of a substance according to its physical and chemical properties, and classifies it into one of the five main categories **gases** (G), **evaporators** (E), **floaters** (F), **dissolvers** (D), **sinkers** (S). However, substances might show not only one but several behavioural phases throughout a spill – depending on the characteristics of the product(s) and its/their exposure to environmental processes; this explains why seven further sub-categories were developed (Figure 11).

The four physical/chemical properties relevant to predict a substance's behaviour are solubility, density, vapour pressure, and viscosity. These are usually documented for a standard temperature, typically 20°C, which is generally used in the **3.1 Safety data sheet content**. However, the atmospheric temperature will affect the values of these properties and adjustments may need to be applied.

The **Safety Data Sheet (SDS)** is a document which provides information on chemical products that helps users in their situation assessment. It is mandatory for all chemical suppliers to issue SDS and they should be made available online. The document includes information about a chemical's properties and hazards, and provides information on handling, storage and emergency measures in case of accident.

Solubility (S) is the ability of a given substance (the solute) to dissolve into a liquid (the solvent); it is usually measured in mg/L (or ppm) or in percentage (where 1% is 1 g of solute in 100 mL of solvent). Therefore, a solubility of 500 mg/L equals 0.05%. If not specified, water is considered to be the solvent.

A substance is soluble if S > 5%

The **relative density** (d) (or specific mass) of a substance is defined as its mass per unit volume – or its "compactness". It is often measured in g/cm^3 or kg/m^3 and is used to determine whether the substance is heavier or lighter than a reference (air or water typically).

A liquid floats if its $d < d_{seawater}$, *(1,025* kg/m^3 *at 20°C)*

Vapour pressure (Vp) is an indicator describing the tendency of a liquid to change into the gaseous state. Vapour pressure is measured in Pascal (Pa) and the standard atmospheric pressure is 101.3 kPa.

A substance is an evaporator if its Vp > 3 kPa

Viscosity is the measure of a liquid's resistance to flow measured in cSt centistokes (mm^2/s). Viscosity varies with temperature, and in most cases an increase in temperature will lead to a decrease in a substance's viscosity and an increase in the substance's tendency to spread.

A substance will form persistent slicks if v> 10 cSt at 20°C with a density $d < d_{seawater}$ *, Vp ≤ 0.3 kPa, S ≤0.1% (for liquids) or S ≤10% (for solids)*

It is important to note, the SEBC does not take viscosity into consideration.

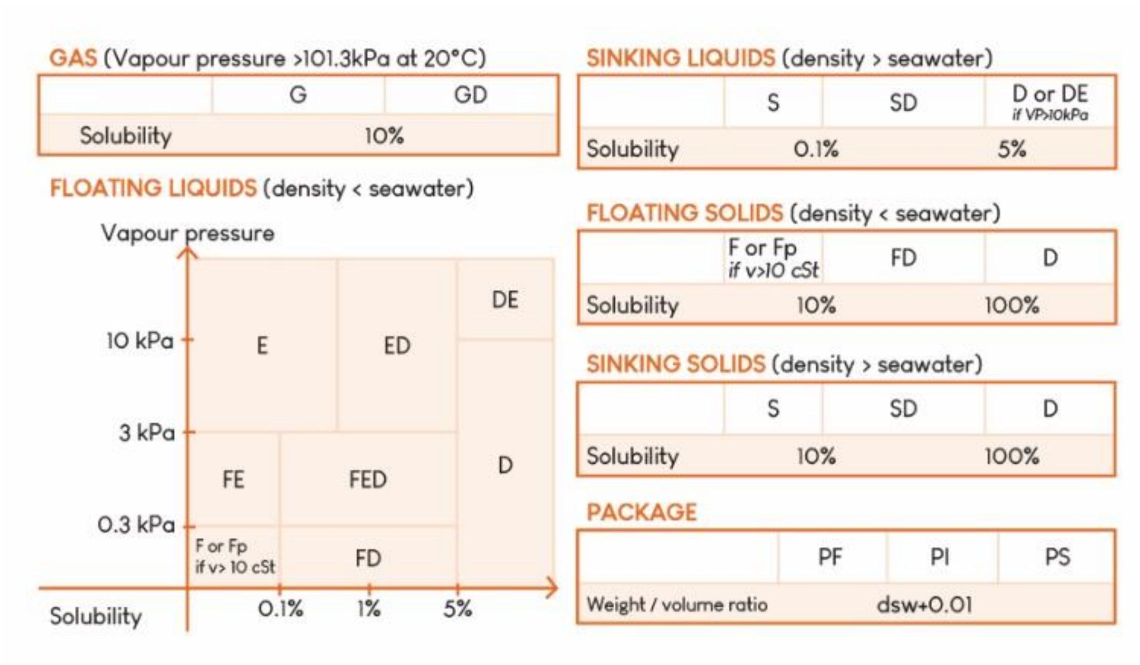


Figure 11: Using solubility, vapour pressure and density to determine a substance's behaviour in seawater

Classifications are based on laboratory experiments conducted in a controlled environment. Therefore, a substance's behaviour observed during an incident may differ significantly from the predictions.

If a substance is carried in packaged form, the weight weight/volume (w/v) ratio of the unit will give an indication as to whether a package will float, immerse or sink. The formula given below is provided for information purposes only, as it does not take into consideration whether a package is airtight.

If $w/v > d_{seawater} + 0.01$, the package will sink

3.2 Hazards

A substance's chemical and physical properties not only determine its behaviour but also its hazard(s). In general terms, a hazard is defined as something that can cause harm to people and the environment whereas a risk is the probability to be harmed if exposed to the hazard. Flammability, explosivity and toxicity are some of the hazards that are crucial to assess in order to understand the potential effects and risks of an HNS spill on human health, the environment, and other resources.

There are two main guidance documents governing and harmonising all communication on substances' hazards:

1. The "UN Orange Book" or "UN Recommendations on the Transport of Dangerous Goods – Model Regulations" (UNECE, 2015), which forms the basis for most transport regulations such as the IMDG Code and IATA.
2. The "UN Purple Book" or "Globally Harmonized System of Classification and Labelling of Chemicals (GHS)" (UNECE, 2019), which defines physical, health and environmental hazards of chemicals, harmonises classification criteria and standardises the content and format of chemical labels and Safety Data Sheets.

The key differences between the two are explained in **3.2 GHS vs UN TDG**. As per the UN Model Regulations, there are nine hazard classes (**Chapter 2**). The following sub-chapters introduce the concepts behind the hazards: explosivity, flammability, oxidation, corrosion, toxicity, ecotoxicity and reactivity, and link them to the corresponding UN Hazard Class. Infectious Substances (Class 6.2) and Radioactive Materials (Class 7) are outside of the scope of this manual and will not be addressed further.

Dangerous substances have an immediate physical or chemical effect, whereas hazardous substances pose a risk to human health. Harmful/environmentally hazardous substances are harmful to the aquatic environment.

3.2.1 Hazard: explosivity

An explosion is a reaction that produces gas at a greatly accelerated rate, in a brief period of time. The explosion can be a detonation (due to rapid decomposition and high pressure, such as TNT) or deflagration (due to fast burning and low pressure, such as black and smokeless powders). In a confined environment, deflagration explosives build up pressure, which can lead to detonation. The energy produced during the release is dissipated in the form of a shockwave that can cause significant damage.

UN Model Regulations

An explosive substance is "a solid or liquid substance (or a mixture of substances) which is in itself capable by chemical reaction of producing gas at such a temperature and pressure and at such a speed as to cause damage to the surroundings."

UN Class 1: Explosives includes six subcategories:

Projection Hazard (e.g. Rockets)

Fire Hazard and Minor Blast and/or Minor Projection Hazard

Mass Explosion Hazard (e.g. Octonal)

Very Insensitive with Mass Explosion Hazard

Extremely Insensitive; No Mass Explosion Hazard

Minor Explosion Hazard (e.g. Pyrotechnics)

Boiling liquid expanding vapour explosions

In the field of maritime emergency response, it is important to understand the concept of a Boiling Liquid Expanding Vapour Explosion (**BLEVE**) especially in cases involving liquefied gas tankers.

As see in Figure 12, when a tank containing pressurised liquid on board a ship is heated, the pressure inside the tank increases (a). This activates a pressure relief valve -a requirement of the IGC Code- which can temporarily reduce the overpressure in the tank (b). If the liquid's temperature exceeds its boiling point and the pressure relief valve's capacity is exceeded, the tank might no longer be able to contain the pressure (c). This leads to a mechanical failure, causing an explosion (d). A BLEVE does not systematically involve a fire, however if the substance is flammable, it is likely to ignite and potentially form a "fireball" or vapour cloud explosion.

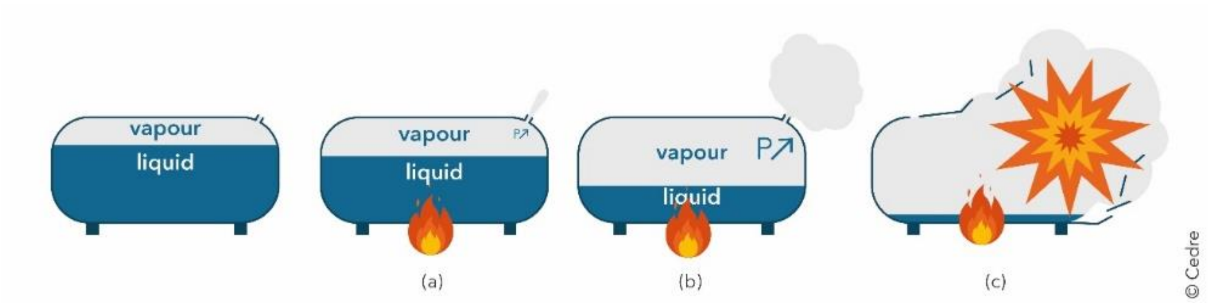


Figure 12: Boiling Liquid Expanding Vapour Explosion (BLEVE) sequence

3.2.2 Hazard: flammability

UN Model Regulations

UN Class 2.1: Flammable gases at a standard pressure of 101.3 kPa at 20°C (e.g. propane)

UN Class 3: Flammable liquids with a flash point of not more than 60°C (e.g. diesel/gasoline)

UN Class 4.1: Flammable solids, which are readily combustible or may cause or contribute to fire through friction (e.g. magnesium)

The flammability of a substance is defined as the ease with which a combustible substance can be ignited, causing fire or explosion. For a fire to ignite, three components are necessary: an combustion source, an ignition source and a flammable source. This is often called the fire triangle or combustion triangle to illustrate that a fire can be fought or prevented by removing one of the three components.

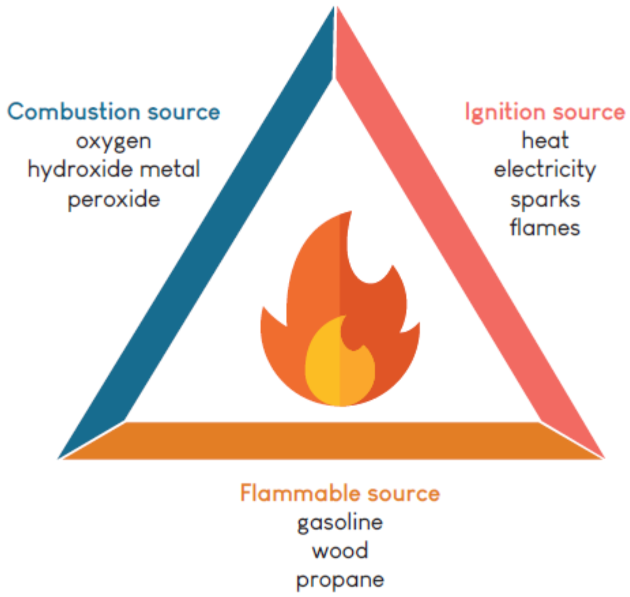


Figure 13: Combustion triangle

The defining properties of flammability are the flash point, the auto-ignition temperature and the lower/upper flammable/ explosive limits:

The flash point is the lowest temperature at which the vapours of a material can ignite when exposed to an ignition source.

The lower the flash point temperature, the easier it is to ignite a material.

E.g. benzene: -11.1°C (in closed capsule)

The auto-ignition temperature is the lowest temperature at which the vapours of a material can self-ignite (without an ignition source).

The lower the auto-ignition temperature, the easier it is for the material to self-ignite.

E.g. benzene: 538°C

The lower flammable/explosive limit (LFL/LEL) and **upper flammable/explosive limit** (UFL/UEL) mark the range within which a concentration of combustible material and oxygen in the air can burn (flammable range).
If a flammable substance is released during an incident, its concentration in the air may vary – the atmosphere can change from a highly concentrated non-flammable mixture, too rich to burn, to flammable (combustible substance/ air mixture) when it drops below the UEL. The atmosphere will change from flammable to non-flammable (substance/air mixture too lean to burn) when it drops below the LEL.

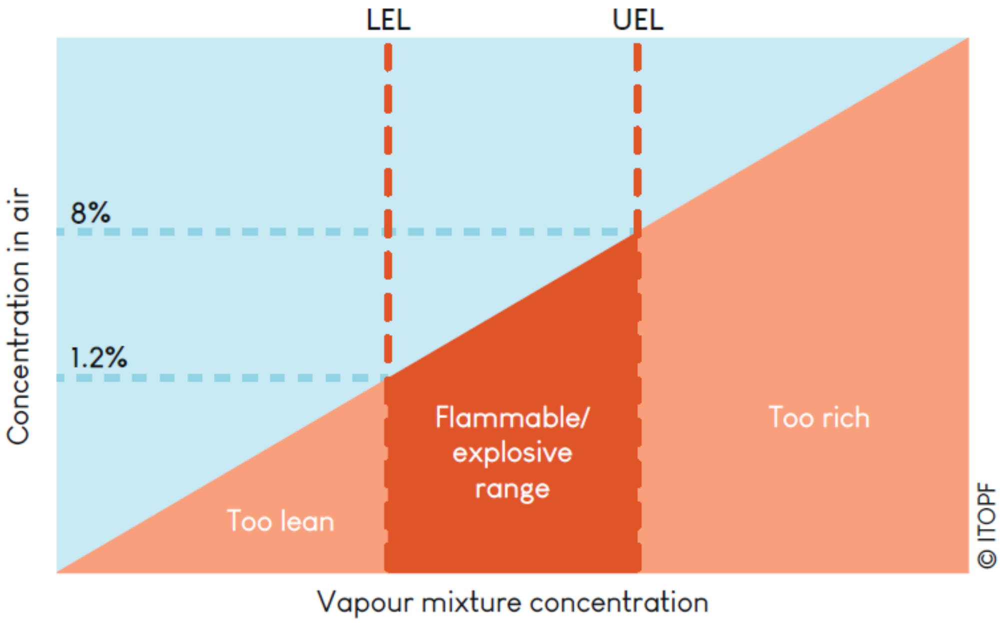


Figure 14: Flammable range of benzene. Benzene: 1.2 % or 12,000 ppm LFL/LEL and 8% or 80,000 ppm UFL/UEL [% in air]

3.2.3 Hazard: oxidation

UN Model Regulations

UN Class 5.1: Oxidising substances includes "substances which, while not necessarily combustible, may, generally by yielding oxygen, cause, or contribute to, the combustion of other material" (e.g. hydrogen peroxide)

UN Class 5.2: Organic peroxides "are thermally unstable substances, which may undergo exothermic self-accelerating decomposition". In addition they may be liable to explosion or fire and react with other substances" (e.g. benzoyl peroxides)

Oxidising materials have the ability to decompose and release oxygen or an oxidising substance. In case of fire, they can cause the fire to expand by providing oxygen. Oxidising materials may also cause a combustible material to ignite without the presence of an ignition source.

3.2.4 Hazard: corrosion

UN Model Regulations

UN Class 8 Corrosive substances (liquids and solids) are substances which, "by chemical action, will cause irreversible damage to the skin, or, in case of leakage, will materially damage, or even destroy, other goods or the means of transport".

A corrosive material is defined as a highly reactive substance that causes damage to or destroys another material by chemical reaction. The deterioration process might be almost instantaneous (e.g. hydrochloric acid on skin) or slow progressing (e.g. rusting metal through oxidation). Corrosive

substances can cause death or severe tissue damage to living organisms. A corrosive substance might be called an irritant at low concentrations.
An indicator of corrosiveness is a substance's pH, which specifies how acidic or basic a solution is. Pure water has a neutral pH of 7 and is neither acidic nor basic, whereas the pH of seawater varies between 7.5 and 8.4. In the absence of additional information, a substance with a pH < 2 or > 11.5 is classified as skin corrosive by GHS.

Corrosive substances and human health

• Corrosive liquids (such as sulphuric acid) present a severe hazard to the eyes and skin by direct contact;

• Corrosive gases (such as ammonia) are hazardous to all body parts, but certain areas such as the respiratory tract might be particularly sensitive;

• Corrosive solids (such as sodium hydroxide pellets) can cause severe burns to the skin. Inhalation of corrosive solid dust might also impact the respiratory tract.

3.2.5 Hazard: reactivity

UN Model Regulations

UN Class 4.1: Flammable solids/self-reactive substances are readily combustible substances or may cause or contribute to fire through friction; "thermally unstable substances liable to undergo a strongly exothermic decomposition even without participation of oxygen" (e.g. matches)

UN Class 4.2: Spontaneously combustible solids are either pyrophoric substances "which even in small quantities ignite within five minutes of coming in contact with air" or self-heating substances which in contact with air are liable to self-heating (e.g. white phosphorus)

UN Class 4.3: Dangerous when wet includes substances "which, by interaction with water, are liable to become spontaneously flammable or to give off flammable gases" (e.g. sodium)

In addition to a substance's individual fate, behaviour and hazards, responders need to consider its reactivity with water, air, other products, and/or itself (e.g. polymerization) potentially producing heat, and or flammable/explosive gases.

Reactive substances can be gaseous, liquid or solid. They do not belong to a homogeneous chemical group and show very different properties and behaviour. The hazard classification for these substances is therefore associated with the type of reaction and the related by-products.

Substances reacting with themselves, each other or the environment often release heat (exothermic reaction) or produce flammable gases or explosive, corrosive or toxic materials, with serious consequences for human health and the environment. During an incident involving multiple HNS (such as container ship incidents), substance reactivity and the related risk of explosion/fire are often challenging to predict, which increases the difficulties associated with any response operations.

5.6 Response considerations: Flammable and explosive substances
5.7 Response considerations: Toxic substances
5.8 Response considerations: Corrosive substances
5.9 Response considerations: Reactive substances

Examples of self-reacting substances

Monomers (e.g. vinyl acetate, styrene) can self-react (polymerisation) violently, hence they are usually transported with either:
an inhibitor (such as quinones) which almost completely suppresses the polymerisation reaction. The inhibitor has to be completely consumed before the polymerisation reaction can continue;
a retarder, which reduces the rate of polymerisation, hence the rate of reaction steadily increases as the retarder is consumed.

Without an inhibitor or retarder (or incorrect concentrations of them) the cargo might self-react, triggering the polymerisation process, which causes heat and expansion of the cargo, following which the structural integrity of a cargo tank could be impacted.

Examples of substances reacting with water
Calcium carbide is a solid which sinks, reacting with water and forming acetylene, a highly flammable and explosive gas. Lithium, sodium and potassium are very reactive metals which float and react violently with water, forming flammable hydrogen gas mixtures with air. The heat of the reaction often causes the hydrogen to ignite and explode.

Mixed substance reactivity
Substances can react violently with each other when spilled. Avoiding such substance reactions during transport is one of the key components addressed in the IMO codes listed in **Chapter 2**, which include elaborate storage and segregation plans for bulk cargo as well as for packaged goods. However, in case of an HNS incident, substances might mix. Predicting the behaviour of multiple substances and their interactions during an incident is extremely challenging.

Some response software or compatibility charts include predictions on reactivity. However, it is crucial to be aware that these rarely consider individual substances. Instead, they usually consider substance groups (e.g. alcohol, ketones, etc.) at concentrations encountered in air/ water and/or packaging.

3.2.6 Hazard for the Environment and Human Health

3.2.6.1 Hazardous to the environment (ecotoxicity)

Marine pollutants

The phrases “Harmful substances carried by sea in packaged form” (MARPOL Annex III), “Marine Pollutant” (IMDG Code) and “Environmentally hazardous substance (aquatic environment)” (GHS) can be used interchangeably and are based on the same GHS, UN Model Regulations and GESAMP criteria **2.1 GESAMP Hazard Profile**.

Marine pollutants are goods with properties that are adverse to the marine environment (e.g. hazardous to aquatic life (marine flora and fauna), tainting seafood, or accumulating in aquatic organisms).

Toxicity is defined as the degree to which a substance can harm a cell, an organ, or a whole organism. Toxicological data are usually expressed as dose descriptors, which identify the relationship between a specific effect of a chemical and the dose at which it takes place. These dose descriptors, usually expressed in mg/L or ppm, can therefore be used to describe the no-effect threshold for human health or the environment. They are derived from toxicological and ecotoxicological studies to assess a substance hazard profile and usually consist in:

No Observed Effect Concentration (NOEC): concentration below which an unacceptable effect is unlikely to be observed;
Lowest Observed Effect Concentration (LOEC): lowest tested concentration at which no effects were observed;
Median Effective Concentration (EC_{50}): concentration of a substance expected to produce a certain effect in 50% of test organisms. Usually expressed in mg/L or ppm;
Median Lethal Concentration (LC_{50}): concentration of a substance at which 50% of the test species are expected to die. Usually expressed in mg/L or ppm.

When assessing a substance's toxicity, short-term as well as long term effects need to be considered, therefore a differentiation is made between acute and chronic toxicity.

- **Acute toxicity** describes the adverse effects of a substance on a specific test species resulting from a single exposure or from multiple exposures during a short period of time (usually less than 24 hours). It is measured in EC_{50} and LC_{50}.

  The higher the LC_{50} or EC_{50} of a given chemical, the lower the acute toxicity.

- **Chronic toxicity** describes the adverse effects of a substance occurring as a result of repeated daily dosing with, or exposure to, a substance for a long period of time (up to the lifespan of the test species). It is usually expressed as NOEC or LOEC – all within a given exposure time.

  The higher the LC_{50} or EC_{50} of a chemical of concern, the lower is the acute toxicity.

Both acute and chronic toxicity can have short and long-term consequences (Table 3).

Table 3: Short and long-term exposure and effects - examples

	Short-term effect	Long-term effect
Acute exposure	Short-term skin irritation due to acute contact with a diluted solution of caustic soda	Persistent respiratory issues due to short term exposure to a high concentration of chlorine gas
Chronic exposure	Short-term skin irritation due to chronic exposure to a substance such as use of acetone in a lab and dermatitis	Cancer linked to chronic vinyl chloride exposure

Whilst toxicity focuses on individual organisms or even individual cells, ecotoxicity combines ecology and toxicity and addresses the potential for a substance to affect a specific community of organisms or an entire ecosystem.

There are several parameters which determine whether a substance is considered hazardous to the aquatic environment:
acute and chronic aquatic toxicity;
potential for bioaccumulation;
persistence;
degradability (biotic or abiotic).

Bioaccumulation is the increase of contaminant concentrations in organisms following uptake from the environmental medium. The bioaccumulation potential of a substance depends on its affinity for water – the lower the affinity, the higher the bioaccumulation potential. In Safety Data Sheets,the bioaccumulation potential is often given in the form of a Log Kow value, also named Log Pow, which represents the octanol/water partition coefficient. The Log Kow value ranges between -3 and 7 and, as a general rule, substances with Log Kow values >4.5 are likely to bioaccumulate. For organic chemicals with Log Pow values of ≥4, a measured Bioconcentration factor (BCF) is required to provide definitive information on the potential of a substance to bioaccumulate under steady state conditions. The bioconcentration factor is defined as the ratio (on a wet weight basis, normaliszed to a 5% fish fat content) between the concentration of the chemical in biota and the concentration in the surrounding water, at steady state (GESAMP, 2020).

Degradability refers to the potential for a substance to degrade in the environment through chemical, physical or biological processes (e.g. oxidation, hydrolysis, biodegradation). Degradability data is sparse, especially for marine environments, hence, it is not always included in SDSs. Degradability data can be given as degradation half-lifes, which refers to the time it takes for an amount of a substance to be reduced by half through degradation. A substance with an extended degradation half-life is considered persistent. An organic substance is considered “readily biodegradable” if it passes the corresponding laboratory test, which indicates that the chemical is expected to undergo rapid and ultimate biodegradation in the environment.

Persistence refers to the resistance of a chemical to degradation; as such, persistence cannot be measured directly, and only the continued measurable presence of a certain chemical in the environment, or the systematic resistance to degradation under laboratory conditions can suggest its persistence.

Whilst toxicity data relevant for human health and safety are relatively easy to access, ecotoxicological data focusing on aquatic species might be more difficult to obtain and interpret (**5.3 Information resources**). In the case of an HNS incident, it might be necessary to complement existing data by additional sampling/monitoring to assist the hazard assessment and guide the response.

There might also be a discrepancy between published/lab-based ecotoxicity data and information collected/observations made in-situ. This might be due to a) different species being tested or b) the effects of dilution encountered in the open sea, which is an important factor when considering detrimental effects. Careful consideration must be given to the applicability and transferability of lab-based studies to real-life incidents.

3.2.6.2 Hazardous for human health

UN Model Regulations

UN Class 2.3: Toxic gases are either known to be so toxic or corrosive as to pose a human health hazard or gases which “are presumed to be toxic or corrosive to humans because they have an LC50 value equal to or less than 5 000 ml/m_3 (ppm)”.

UN Class 6.1: Toxic substances are “substances liable to cause death or serious injury or to harm human health if swallowed or inhaled or by skin contact”.

Occupational exposure limits are published by many different organisations around the world and different limit values and terminology might be used. For occupational health and safety, exposure limits are often stated for various routes of contact such as inhalation, dermal exposure, ingestion with different exposure times.

The Protective Action Criteria for Chemical (PAC) dataset uses a single set of values (PAC-1, PAC-2, and PAC-3) for each chemical, but the source of those values are likely to vary depending on data availability.

During an emergency response, PACs can be used to evaluate the severity of the event, to identify potential outcomes, and to decide what protective actions should be taken. Each threshold stands for:
PAC-1: Mild, transient health effects.
PAC-2: Irreversible or other serious health effects that could impair the ability to take protective action.
PAC-3: Life-threatening health effects.

The PAC dataset uses various occupational exposure limits, which are explained below.

The international term **Threshold Limit Value** (TLV) (equivalent to the EU Occupational Exposure Limit, EU OEL) of a chemical substance is the level to which a **worker** can be safely exposed 8 hours a day, 5 days a week without adverse effects. There are typically three categories of TLV:
Threshold Limit Value: Time-Weighted Average (TLV-TWA) for daily life-time exposure;
Threshold Limit Value: Short-Term Exposure Limit (TLV-STEL) for maximum exposure during a 15-minute period;
Threshold Limit Value: Ceiling (TLV-C) for maximum exposure at any given time.

To predict the severity of chemical exposure in humans, emergency response planners and responders use public exposure guidelines such as **Acute Exposure Guideline Levels (AEGL)**. AEGLs are expressed as concentrations of airborne chemicals at which health effects might occur following "rare/once in a lifetime" exposure. They are calculated for five exposure periods (10 minutes, 30 minutes, 1 hour, 4 hours, and 8 hours) and concentrations are given in three "levels":

AEGL Level 1: the concentration predicted for the population to experience notable discomfort. The effects are not disabling and are transient upon cessation of exposure.
AEGL Level 2: the concentration predicted for the population to experience irreversible, serious, long-lasting health effects or an impaired ability to escape.
AEGL Level 3: the concentration predicted for the population to experience life-threatening health effects or death.

	10 min	30 min	60 min	4 hr
AEGL-1	30 ppm	30 ppm	30 ppm	30 ppm
AEGL-2	220 ppm	220 ppm	160 ppm	110 ppm
AEGL-3	2,700 ppm	1,600 ppm	1,100 ppm	550 ppm

Table 4: AEGL Example - ammonia (Source: EPA)

In the USA, if AEGLs are not available, Emergency Response Planning Guidelines (ERPG) or Temporary Emergency Exposure Limits (TEELs) may be used.

ERPGs estimate the concentrations at which most people will begin to experience health effects if they are exposed to a hazardous airborne chemical for 1 hour. It also has three levels and for responders, the most useful being ERPG-2, which corresponds to the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without developing irreversible or other serious health effects.

TEELs can be used when AEGLs and EPRGs are not available. These limits are developed through a formulaic approach using available data on LD50 values, occupational exposure limits etc. for the substances involved. TEELs are divided into four levels and are defined for 1 hour of exposure.

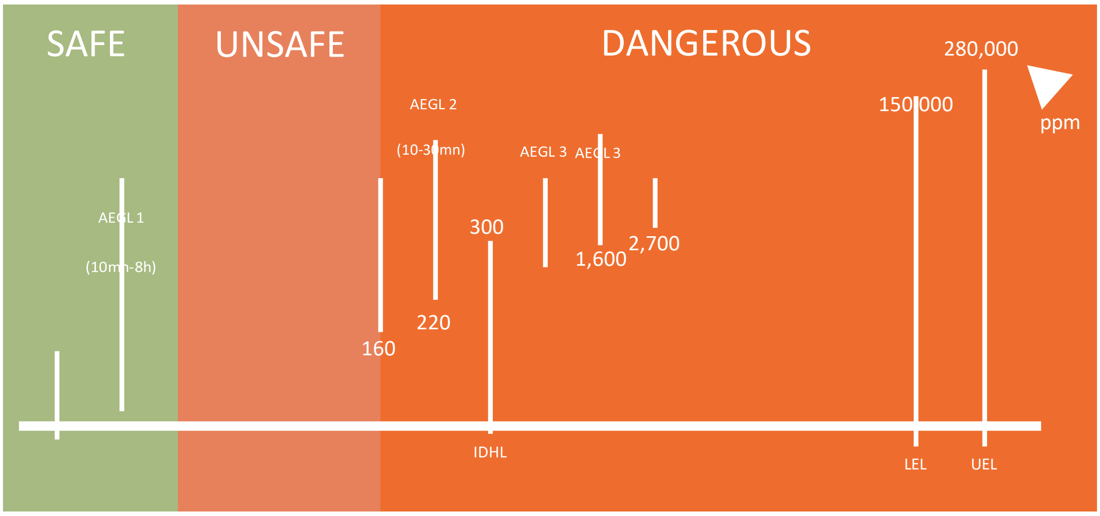


Figure 15: Representation of flammability and inhalation hazards of ammonia for responders

Responders may also encounter the IDLH value (Immediately Dangerous to Life and Health), which is the maximum concentration from which one could escape within 30 minutes without irreversible adverse effects. In practice, if airborne concentrations are above the IDLH, SCBA must be worn.

For a given chemical, several values and limits may be available, and it is useful to put these values into perspective for responders. In the example in Figure 15, the flammable range is higher than the AEGL-3 and the IDLH.

Some atmospheric modelling software can estimate how a toxic cloud from a chemical release might travel and disperse **5.11 HNS spill modelling**. Such modelling results often include the visualisation of a "threat zone", which is the area where predicted hazards (such as toxicity, flammability, thermal radiation, or damaging overpressure) exceed a specific value. These can help to guide the **5.18 First actions (responders).**

4) PREPAREDNESS

4.1 Introduction

Because of the variety of behaviours, properties and fates of chemicals, HNS spills are likely to require expertise not only from civil and governmental agencies but also private entities and industries. Certain components of preparedness are more critical for HNS spills, in particular health and safety aspects. Therefore, aspects relating to Personal protective equipment (PPE), decontamination and monitoring must be thoroughly planned.

Once the scope and objectives have been clearly defined, the overall preparedness process will follow different steps which are illustrated in the diagram below and detailed within the present chapter.

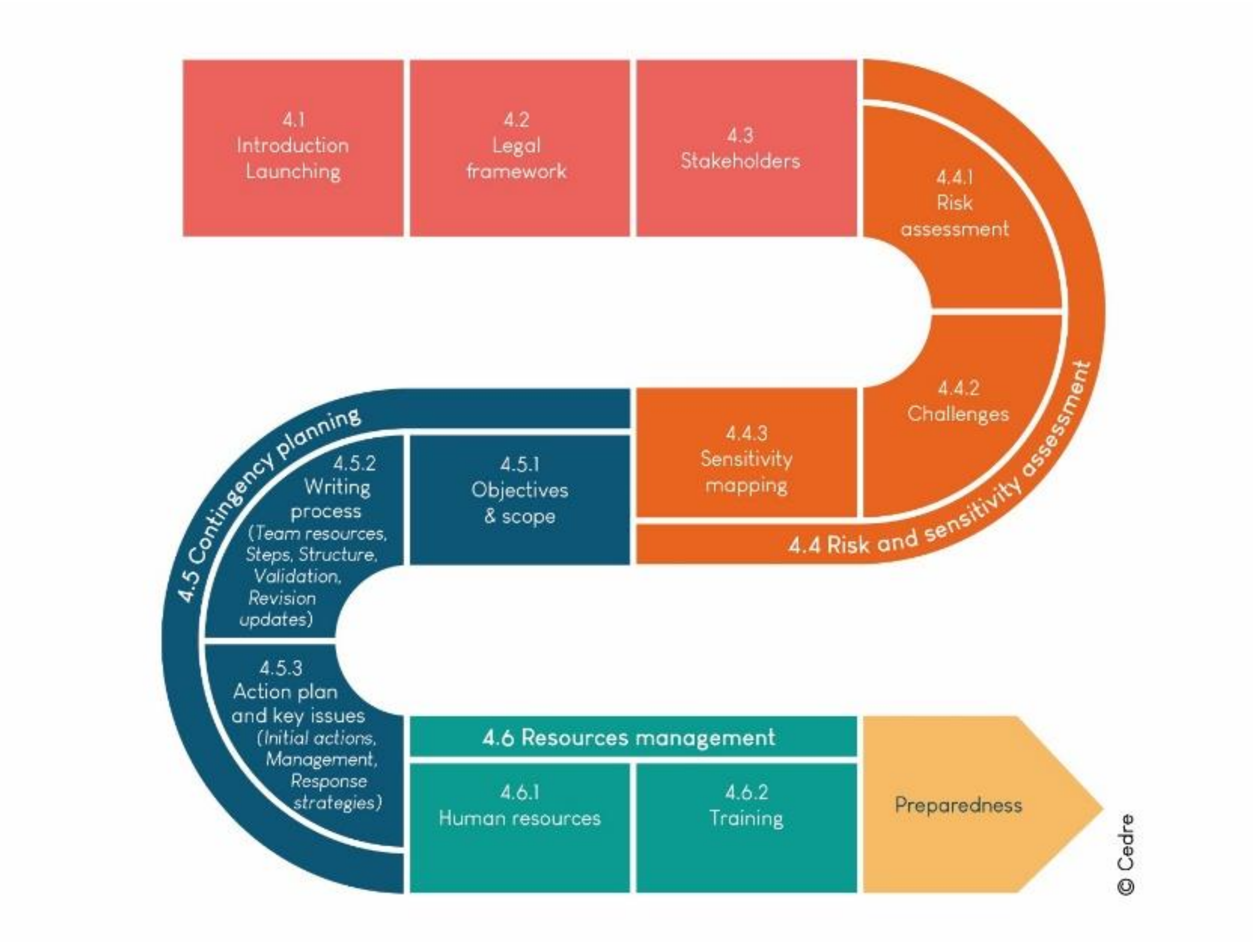


Figure 16: Main steps in the preparedness process

4.2 Legal framework

The 2000 OPRC-HNS Protocol highlights the importance of preparedness through contingency planning and a national system as defined in Article 4 of the Protocol; it prompts contracting states to develop an integrated framework of HNS spill response plans extending from individual facilities handling HNS to a major incident on a national or international scale. These arrangements are intended to provide the ability to escalate a response to an incident through a series of interlocking and compatible plans.

Authorities developing a contingency plan therefore need to consider the international, national, regional and local regulations and agreements in place in conjunction with other emergency plans (harbours, industrial plans, etc.) to ensure a seamless framework.

As per MARPOL Annex I, Annex II and Article 3 of the 2000 OPRC-HNS Protocol, vessels are required to carry onboard an approved Shipboard Marine Pollution Emergency Plan (SMPEP). The plan stipulates the reporting requirements, the steps to be taken to control the discharge and the national and local-contact points (List of National Operation Contact Points). **5.17 First actions (casualty)**

4.3 Stakeholders

Stakeholders are a group or organisation with an interest in or concern for response preparedness and likely to be consulted or participate in spill response. Engagement with stakeholders is a key to a successful contingency planning process and response.

Early identification of stakeholders and consistent engagement throughout the contingency planning process should lead to meaningful discussions and the resolution of conflicting interests and opinions while in a non-emergency situation. It also provides planners with the opportunity to identify important environmental resources and socio-economic features and their value to the community, a keystone before contingency plan drafting.

The figure below presents the main stakeholders involved in the preparedness process and HNS spill response.

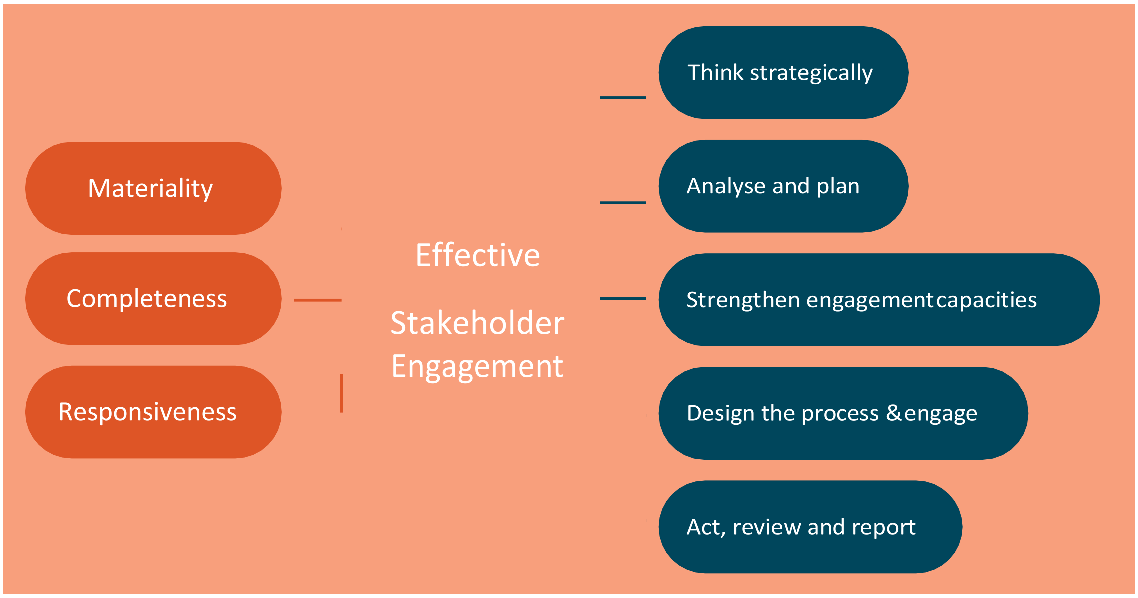


Figure 18: Attributes and main tasks of effective stakeholders involved in a spill response

AUTHORITIES

Navy, coastguard - R, I *Usually lead or oversee the response depending on the scale of the inci-dent. Liaise with other governmental agencies in particular when potential impacts are expected on land* **Civil defense/Fire brigade/First HNS responders - R, I** *Usually lead the first actions res-ponse and works with salvers to take the first measures on board or on the shore* **Local/Regional/National authorities - R, T, I, DP** *Liaise with the at sea responders and are involved mostly if spill is likely to impact the shore* **Elected officials - D, R, T, I, DP Harbour master - D, R, T, I, DP Terminal operator - D, R, T, DP**

EXPERTISE

The bodies listed below may fall under authorities **Aerial/Maritime/Shoreline/Wildlife expertise, Public health specialist, R, I, DP Environmental protection agencies - R, I, DP** *Provide specific input and make recommendations on their field of expertise during response operations and damage assessment* **Chemical expertise - R, I, DP** *MAR-ICE network, CEFIC, Chemi-cal industries, manufacturers. Useful sources of information of the subs-tances, their behaviour and how to handle a spill.* **Surveyors/Technical advisers R, I, DP** *Government, department, agencies or independent technical specialists. Carry out surveys, make recommen-dations on their field of expertise. Assess and propose strategies, tech-niques.*

CONCERNED PARTIES

Sea professionals, tourist industry - D, R, T, I *May suffer economic losses (due to interruption of activities or spill). May be involved in the response (logistics or operations). May claim for compensation under national or international legislation.* **Local communities - D, T, I, DP** *May suffer from health hazards (loss of life, injuries) and financial loss due to the exposure to the subs-tance(s) spilled (loss of recreatio-nal space, loss of activities due to lockdown).* **NGOs - T, DP Media - T, I, DP**

Liable parties

Shipowner - D, R, T, I, DP *Responsible for carrying out the res-ponse supervised by authorities, until they take the entire responsability of it. May be represented on site by a local shipping agent (DPA, Designated Per-son Ashore), surveyors or lawyers.* **Cargo owner - D, R, T, I, DP** *Support response efforts by providing precise information on the cargo. May participate in the clean-up or waste treatment if they have the necessary resources available.* **P&I - 3rd party insurers - R, T, I, DP** *Assist the shipowner in dealing with the incident, legal advice, finding appropriate advisers/contractors, approving claims. Represented on site by a local correspondent.* **Expert for P&I (ITOPF) - I, DP** *Mobilised by the P&I Clubs and make recommendations on their field of expertise.*

Responders

Salvage contractors - R, T, DP *Usually appointed by the P&I Club, shipowner or authorities. Lead the effort to salvage the ship and reduce environmental damage caused by the ship or its cargo at source. May appoint additionnal experts (e.g. marine chemists).* **Clean-up Contractors - D, R, I** *Contracted by the shipowner, P&I Club or authorities. Provide the equip-ment and workforce for response acti-vities.* **Public responders - D,R,I** *First responders (Firemen, civil defence, etc.) or member of adminis-tration, local communities, harbours.* **Volunteers - D, T, DP**

D = Dependency, those who are directly or indirectly dependent on the organisation or those whom the organisation is dependent upon for operation; R = Responsibility, those towards whom the organisation has, or in the future may have, legal, operational, commercial, or moral/ethical responsibilities; T = Tension, groups or individuals who need immediate attention with regard to financial, wider economic, social, or environmental issues; I = Influence, those who can have an impact on strategic or operational decision-making; DP = Diverse perspectives, those whose different views can lead to a new understanding of the situation and identification of unforeseen opportunities

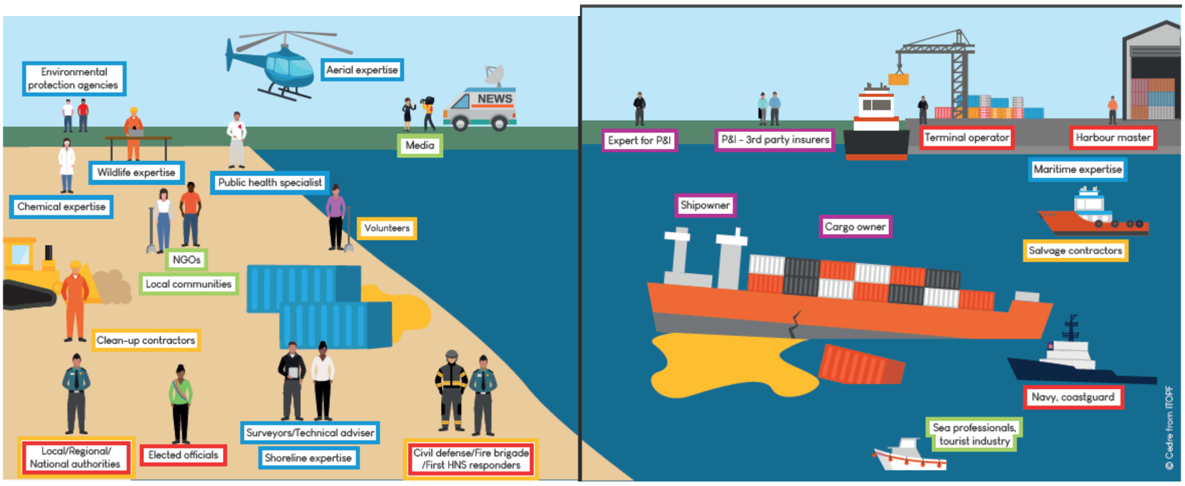


Figure 19: Main roles and relevance of potential stakeholders involved in the response implemented after a marine HNS incident

4.4 Risk and sensitivity assessment

4.4.1 Risk assessment

What is a risk assessment?

According to the International Organization for Standardization's Risk management Guidelines (ISO 31000:2018):

"The risk management process involves the systematic application of policies, procedures and practices to the activities of communicating and consulting, establishing the context and assessing, treating, monitoring, reviewing, recording and reporting risk."

Various international standards or examples of risk assessment exist and can be used to kick-start an assessment.

Understanding and assessing the risk posed by transported chemicals is an essential starting point for writing a contingency plan. Conducting a risk assessment is a multi-sectorial effort. By modelling and analysing volumes of chemicals transported locally or regionally, a representation of risk can be derived. This must be coupled with the likelihood of a spill occurring as well as determining the probable consequences for the health and safety of workers and the population, whilst identifying environmental and economic resources that could potentially be affected. The incorporation of local marine/land sensitivity data as well as weather conditions into the assessment can further improve the risk assessment process. All this data drives the determination of likely spill scenarios (Figure 20).

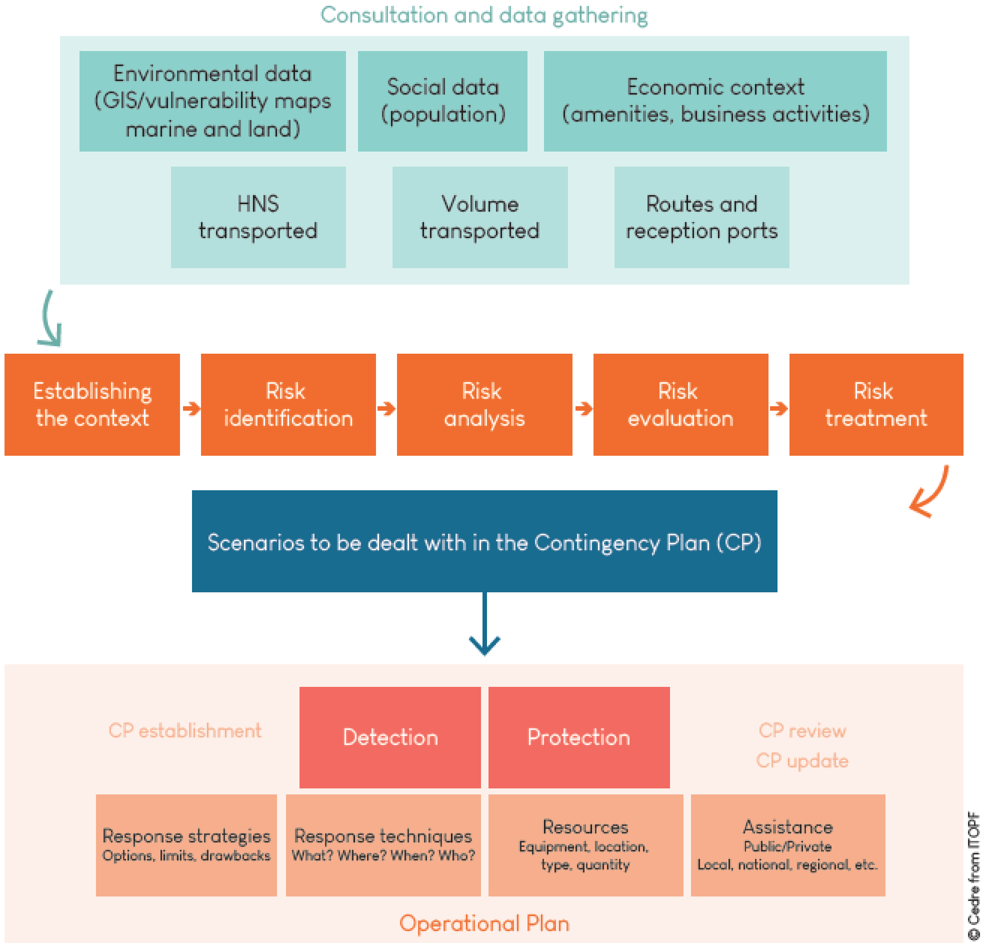


Figure 20: Risk assessment process and downstream steps to elaborate a Contingency Plan (CP)

4.4.2 Challenges

Some challenges are specifically linked to the location of an incident (at sea or in port) and can be very diverse. Therefore, it is essential to tailor risk assessments to the reality of the risks for each location or each situation.

		Port	At sea
Detection		Can be stationary and computerised Otherwise led by a dedicated specialised team	Specialised team to be sent on board with dedicated equipment (logistics to plan) Aerial detection should be considered
Evaluation	Resources	Specialised team Assisted by and headquartered in the harbour area	On board for immediate actions (specialised crew member) External specialised team sent on board Support and decision-making at external headquarters on shore
	Information access	Information on extent of contamination relatively easy to obtain	Potentially difficult to assess
	Affected area	Heterogeneous	Homogenous
Modelling		Usually difficult due to the lack of reliable data and micrometeorological phenomena near shore	More complex in areas close to the coast and in sheltered areas Bathymetric and current data to be integrated into the model
Hazards	Navigation	Floating & sinking containers	Floating or sunken containers
	Amenities	Nearby and very exposed	Remote and not very exposed (except in the case of onshore winds)
	Other legitimate uses	Navigation, etc.	Commercial, touristic, fishing activities Water intakes/outfalls to be careful of
Evacuation if required	Crew		

		Relatively straightforward	Asset depending, potentially challenging
	General public	Might become necessary in case of toxic gas cloud for example	Unlikely to occur
Response	Personnel, vessel and equipment availability	Potentially in close proximity	Not readily available
	Strategies and techniques	May be possible and recommended to contain and manage spill	Potentially difficult to contain and manage Monitoring to be planned

Table 5: Response challenges of actions to be implemented after an HNS spill, in different environments

Some ports have produced detailed risk assessments for each of the HNS commonly loaded and discharged. These, coupled with rapid access to information during an incident by trained responders, are the key to an effective response.

4.4.3 Sensitivity mapping

Once planners have defined what incidents could occur, where the pollutant might go and how it could behave and weather in the environment, it is necessary to:

- determine which environmental, geomorphological and socio-economic resources could be affected;
- define the degree of sensitivity of those resources to HNS spills.

The combined modelling output of all the spill scenarios defines the overall zone of potential spill impact and outlines the geographic area of interest for sensitivity mapping. Potentially vulnerable sites within this area of interest should be identified and characterised, and the probability of the HNS spill having an impact on these resources should be considered. The sensitivity data is used in the risk assessment process to determine the potential consequences of a spill scenario and the probable impacts. The evaluation will provide planners with the information on the location of high risk areas and resources to support their priority ranking for protection or response.

Strategic sensitivity maps should be developed in addition to standardised sensitivity atlases. Such maps can also be expanded to contain a wide range of operational planning information such as logistics data, site specific tactics for priority protection areas, trajectory modelling, equipment stockpiles, staging areas, emergency medical facilities, potential command centres, etc. Such maps will convey essential information to planners, decision-makers, as well as to on-site responders in charge of equipment deployment.

Sensitivity mapping can be presented as a simple hard-copy map with tables listing resource details, or integrated into a geographic information system (commonly referred to as GIS) capable of containing large volumes of data. GIS-based sensitivity maps can also be integrated into electronic emergency management systems, and linked to other databases for enhanced command and control and a depiction of response activities, resources and status.

Figure 21: Example of sensitivity mapping with colour coded areas corresponding to different levels of sensitivity

4.5 Contingency planning

4.5.1 Objectives and scope

Based on risk assessments, an effective contingency plan is an operational document formalising the actions and procedures to be implemented in the event of an incident and aims at minimising unforeseen events. Therefore, a fully developed contingency plan is not merely a written document but comprises all the practical requirements necessary for an immediate and effective response.

To do so, a contingency plan must comprise all the actions that can be completed ahead of time to ensure a prompt and appropriate response in the event of an emergency in order to mitigate the impacts on:

- Population;
- Environment;
- Property and socioeconomic activities.

Why a plan?

- To comply with legal frameworks and internal policies
- To provide a response framework

Establish alert and communication procedures and immediate actions to be implemented;

Define roles and responsibilities

- To develop a complex response in a non-emergency context free from pressures;

Prioritise sites for protection;

Specify response strategies and techniques;

Identify and allocate resources to be mobilised.

4.5.2 Writing process

4.5.2.1 Teams and resources

First of all, a team in charge of drawing up the contingency plan must be called together. Regardless of the scope of the document to be created, the project team must be aware of the context and more specifically of the regulatory framework within which the plan will apply.

The drafting may be entrusted to expert organisations who will submit each deliverable for validation by the management team. In addition, for each specific section of the plan, complementary resources and expertise may be mobilised, notably:

- authorities to specify what is expected when taking over the supervision or management of operations;
- geomatics specialists and environmentalists to produce sensitivity maps and atlases;
- modelling specialists for the study of product fate behaviour;

- pollution experts for the definition of strategies, techniques and equipment;
- insurer or P&I representatives for input to the sections dedicated to record-keeping and compensation procedures, etc.
- the drafting of a contingency plan should be managed like any standard project and therefore requires the:
- setting up of an action plan and a schedule;
- definition of a global budget for carrying out such an action and the method for monitoring the associated expenditure;
- holding of regular meetings to check on the work progress and to identify any obstacles;
- procurement of adapted tools (GIS, drift models, fate and behaviour models for example) or the outsourcing/sub-contracting of such tools and expertise to use them;
- establishment of a review process by specialists with the appropriate expertise;
- definition of a validation procedure by the legitimate organisations.

4.5.2.2 Steps to consider

Generally speaking, contingency plans address five crucial points:

- identification of risks related to substances handled or transported;
- identification of potential stakeholders and their responsibilities;
- inventory and preparation of equipment (protective equipment, response equipment);
- actions to be taken in the event of a spill;
- training of persons liable to be involved in response.

Figure 22: The overall process for industrial contingency planning

4.5.2.3 Structure

Contingency planning is an exercise in preparing response strategies and tactics to minimise the adverse impacts of a pollution incident and in bringing together numerous aspects of spill operations, environmental policy, and regulatory compliance. Effective guidance for on-scene initial emergency response and transition into a project-managed response is fundamental to the success of a spill response plan.

During the writing process, a large amount of material will be produced and generate difficulties in navigating the core procedure. Simple techniques, such as the use of tabs, arranging pages into sections, and creation of a well-organised table of contents will help users to navigate to key information in the plan, and will also simplify the plan update process. Moreover, some materials may be integrated as appendices or as separate documents, for instance: modelling results, action cards, forms, sensitivity atlases, tactical maps or material requiring frequent updates and redistribution such as contacts and resource directories. Background information and capability justification, which has been compiled over the course of the planning effort, should be included as a separate supporting document.

Numerous guides and examples are available for the content of a National Contingency Plan (NCP), including a "fill-in-the-blanks" template. The IMO Manual on Oil Pollution Section II – Contingency Planning lists the following basic content for a NOSCP (National Oil Spill Contingency Plan).

While a variety of templates exist for NCPs dedicated to oil spills, there are fewer examples available for HNS spills. Arguably, the two will be quite similar but with an additional focus on health and safety and collaboration with experts. On the other hand, as for oil, the format of these contingency plans should vary depending on the specific scope and should be scalable.

Arpel (2005). How to develop a national oil spill contingency Plan. Available at : https://arpel.org/library/publication/195/

IMO (2005). Manual on oil pollution. Section IV : Combating oil spills. London : IMO, 212 p. **IMO** (2018). Manual on Oil Pollution. Section II: Contingency planning. London: IMO, 103 p. **IMO** (2020). Guide on the implementation of the OPRC convention and OPRC-HNS Protocol.
Available at: wwwcdn.imo.org/localresources/en/publications/Documents/Newsletters%20and%20 Flyers/Flyers/I559E.pdf

Ipieca and IOGP (2015). Contingency planning for oil spills on water. Available at: www.ipieca.org/resources/good-practice/contingency-planning-for-oil-spills-on-water/

Figure 23: Tools and references for drafting a contingency plan

A basic structure is given, as an example, in the table below.

	Action plan
Introduction	• Table of contents • Document control (distribution, review, update and records, level of confidentia- lity) • Scope and perimeter • Overall response priorities and objectives • Interface with other existing plans
Initial actions	• Alert and notification (alert flowchart, assessment, notification) • Tier level assessment and escalation • Health and safety issues and initial actions • Activation of Contingency Planning (CP) and response management team
Management	• Activation and location • Organisation (location, functioning, composition) • Roles and responsibilities/assignment sheets • Processes and procedures to ensure pollution follow-up • Communication (internal/external) • Financial management
Response strategies	**Scenario** **Assessment (NEBA/SIMA)** • Site health, safety and security assessments • Spill surveillance methods (aerial surveillance, tracking buoys, etc.) • Spill trajectory modelling • Identification of vulnerable and sensitive resources **Strategies**: Decision support flowcharts, Response procedures • First actions • Protection • Monitoring • Response **Waste management Material resources** • Inventory of equipment and resources available for deployment • Specialised expertise and back-up resources
Termination	Demobilisation of equipment and personnel • Crisis closure • Document archiving • Claims and compensation • Feedback and debrief • CP review • Equipment renewal and maintenance

Table 6: Example of a basic structure for a contingency plan

Appendices or supporting documentation	
Back- ground information	• Regulatory context • Description of the context (framework/activities/sites to be considered) • Baseline environmental and socio-economic information • Meteorological and hydro-dynamic information (including both prevailing and limiting/extreme conditions)
Sensitivity atlases	• Environmental • Socio-economic • Geomorphological
Potential pollutants	• Type • Characteristics • Behaviour when spilled • Risks and safety issues
Response	• Strategical andtactical maps • Incidence response sheets • Description oftechniques and operational aspects
Actions cards	• Detailing roles and tasks of key actors
Directories	• Contact details for each stakeholder, partners, technical experts, or potential subcontractors
Wildlife	• Dedicated management plan or procedure to deal with impacted or endangered wildlife
Plan justification	• Risk assessment and scenario planning • Spill prevention and detection • Training and exercise programme • Plan and equipment review and audit schedule

Table 7: Appendices or supporting documentation

4.5.2.4 Validation

A contingency plan must be tested through exercises in order to ensure that it is relevant and that the personnel likely to be mobilised to implement the plan are fully familiar with it. Through training and exercises, contingency plans can be implemented, validated and improved (see **Chapter 4.6.1**).

4.5.2.5 Revisions and updates

Intrinsically, a contingency plan is a living document and it is the responsibility of everyone involved to ensure it remains relevant. The plan must be regularly updated, in particular following an incident or organisational change, or when new protection or response measures become available. Any major changes in the level of HNS transport activities, populations or neighbouring industrial activities require a revised risk analysis and, consequently, a revision of the contingency plan.

When the contingency plan is adopted by a law, updating it can be difficult. Therefore, it is essential to define, from the beginning and within the legislative process, the contingency plan's section or supporting documents which will require to be updated on a regular basis (also to be defined). The 2000 OPRC-HNS Protocol and the IMO manuals on chemical pollution define the living documents of contingency plans.

4.5.3 Action plan – Key issues

4.5.3.1 Initial actions

Alert and notification

Initial response information is critical in guiding responders through the first hours or days of an incident. The first information to be obtained in the alert phase is necessary to:

- assess an incident and mitigate hazards;
- activate an informed, immediate response;
- make required notifications;
- activate additional response resources including the incident management team, as needed.

Timely notification of key internal and external personnel and organisations is instrumental in mounting an effective response. Notification procedures, responsibilities and regulatory requirements (including forms, timelines and instructions) should be provided along with a directory of contact information. Flowcharts and diagrams are effective ways of displaying the flow of notifications that are often required.

The provision of a checklist and log will assist in the documentation and evidence of timely reporting and alerts. It is important to specify the management role responsible for ensuring that notification and reporting requirements are met (IPIECA and IOGP, 2015).

Level of response

Tiered preparedness and response are recognised as the basis for a robust framework. This establishes a capability that can be escalated and cascaded to the scene. This avoids the proliferation of impractical stockpiles of large quantities of response resources yet can still provide an appropriate and credible response through the integration of local, regional and international capabilities.

The established three-tiered structure allows contingency planners to describe how an effective response to any spill will be provided, i.e. from small operational spillages to a worst credible case release at sea or on land.

The tier classification system helps to define the resources required to deal with potential spill scenarios and are broadly considered as follows:

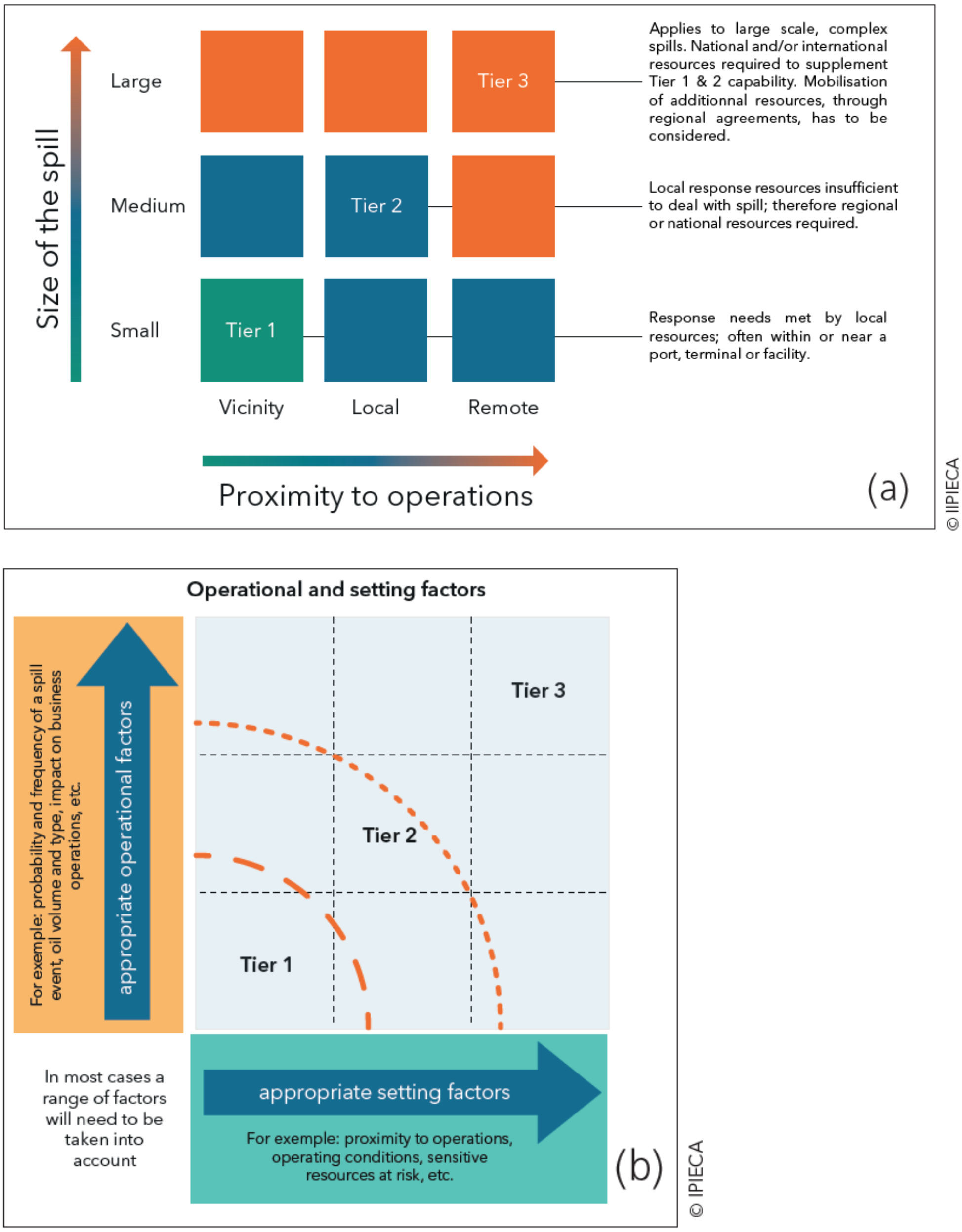


Figure 24: The conventional definition of tiered preparedness and response (a) and concentric circle model to define tiered response capability (b)

4.5.3.2 Management

Organisation

Contingency plans provide the structure for the management of response operations and should be prepared and updated by agencies, organisations and stakeholders liable to be involved in the response and that have specific knowledge of the context.

An organisational structure or **Incident Management System (IMS)** is necessary to provide leadership through the difficult decisions and compromises that have to be made at all stages of the response. Organisational structures vary considerably from country to country. Many examples are available, most of which have evolved according to national preferences, prior experience and lessons learnt during incidents and exercises. The primary difference between **generic functions** and **team-based** structures are the division and location of command and the management of specific activities.

- The **Incident Command System (ICS)**, commonly used in the US and by the oil and gas sector, is an example of a standardised, function-based organisational structure. The ICS is designed specifically to bring together personnel from different organisations and agencies at short notice to work as members of a single structure, within which their roles and responsibilities are well established and understood. Familiarity with the structure provides a practical means of building a coherent, transferable and replicable response organisation within a very short timescale. The ICS requires substantial pre-investment and resources, on a scale which is usually unavailable in many other countries.

- The alternative **team-based structure** has been used successfully in the response to incidents in various parts of the world. The same principles are applied but the structure is less strict and the teams are not separated into individual functions. Instead, positions are established to fulfil different aspects of the response, most commonly at sea and onshore, with support services allocated to each. This has the advantage of promoting self-contained units that can focus on specific elements of the response within their remit and can readily accommodate the requirements of the response and the organisations involved.

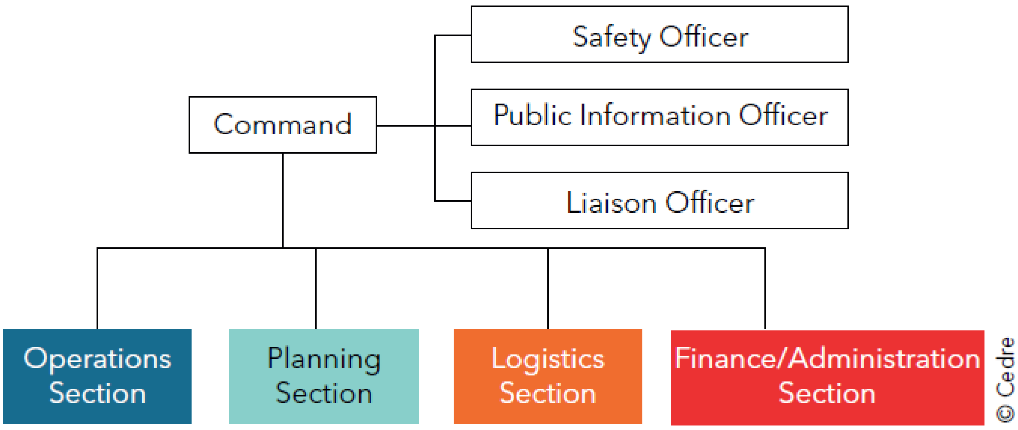


Figure 25: Typical Incident Command System structure

Communication

Cooperation at all levels is likely to be a key factor in the success of an effective and coordinated response. Two very distinct communication strategies need to be established:

- Internal, which highlights how the various teams involved in the response communicate with each other;
- External, which deals with how the information is shared with the wider public using various media.

<u>4.1 External communication</u>
<u>4.2 Press conferences</u>
<u>4.3 Internal communication</u>

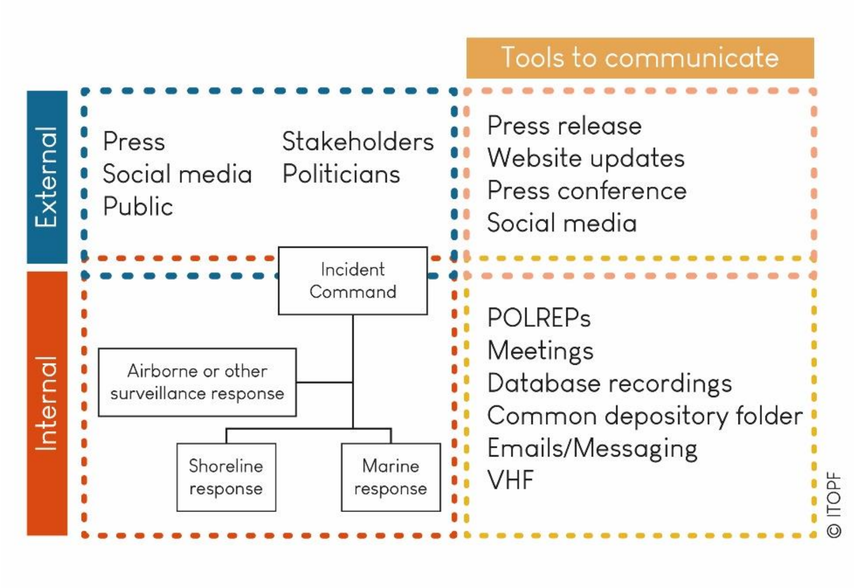


Figure 26: Flowchart of a typical communication structure in a function-based structure

4.5.3.3 Response strategies

Scenarios

Preparing an effective operational response requires various incident scenarios to be defined and analysed and their consequences examined. To make these scenarios as realistic as possible, they should be based on past incidents and a recent analysis of the context and the risks associated with activities involving HNS. They must be adapted to the various response levels indicated in the contingency plan. The plan should include a limited number of scenarios along with the associated initial operational response strategies. In order to specify the pollution scenarios as precisely as possible, modelling can be useful in order to:

- anticipate pollutant fate and behaviour;
- determine potential impacted areas;
- define response timeframes.

To do so, different types of models exist: prediction and stochastic models.

<u>5.11 HNS spill modelling</u>

This information is also useful for developing training activities and exercises for personnel directly involved in handling HNS during transport as well as for responders in the event of an incident.

For each scenario, the impact assessment must be realistic and must consider the immediate vicinity, in particular the population, the environment and industrial activities.

Assessment

Once a range of oil spill planning scenarios have been selected, consideration shifts to the development of appropriate response strategies, which are comprised of available and viable response techniques to adequately mitigate the impact and consequences of each scenario.

Planners should consider how the response for a given scenario might develop over time and how the strategy may need to be adjusted as the spill evolves. The realities of the situation and the limitations of techniques and equipment must be well understood. The choice of response strategy is essentially dictated by three criteria which should be outlined in the contingency plan:

- the accident area (offshore, inshore, port area);
- the location of the product (in the vessel or released);
- the behaviour of the product spilt.

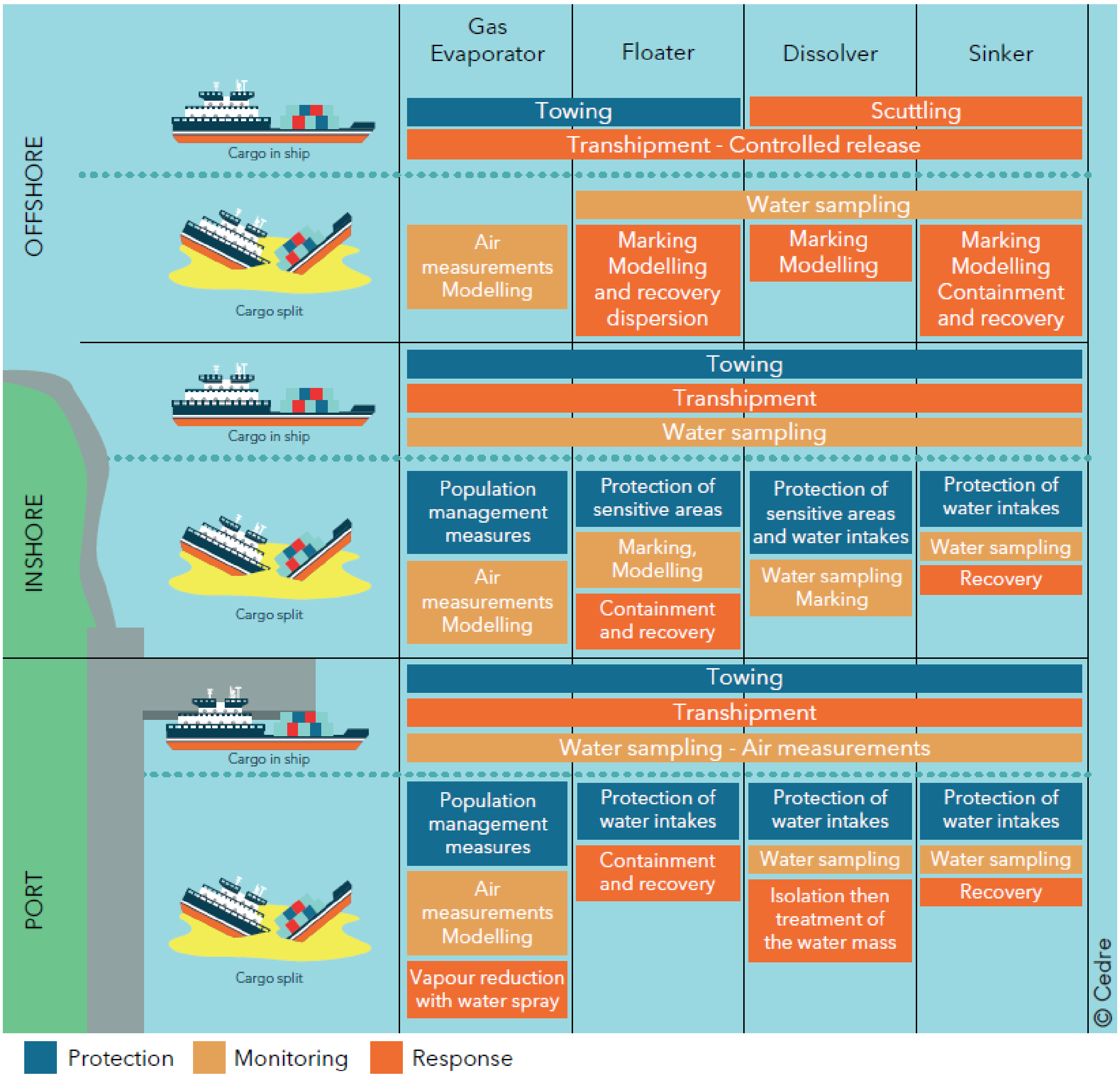


Figure 27: Decision support for response to spills of bulk HNS cargoes depending on their main behaviour and the location of the incident

For each strategy, see the dedicated response sheets in **Chapter 5**.

As the situation may evolve very quickly, the chosen strategy must be adjusted according to the reality in the field.

The selection of suitable response techniques can be heavily influenced and restricted by various factors: extreme weather conditions, hazards of HNS spilled, remote locations, and proximity to highly sensitive areas. Strategies should be focused on clear, attainable goals by taking into account a number of inputs:

- health, safety and security issues for responders and the public;
- regulatory requirements and restrictions regarding the use of specific strategies (dispersion or in situ burning for instance);
- equipment availability and mobilisation timeframe;

- sensitive sites within the potentially impacted area.

All response techniques have advantages and disadvantages. A response strategy therefore generally consists of a combination of techniques. An appropriate strategy for a minor scenario may comprise one or two techniques. Scenarios that are more complex may require various combinations of techniques at different tier levels, possibly in different locations or for varying seasonality. Whatever the case, the strategy should be established in consultation with the stakeholders, with consideration given to the greatest net environmental benefit. The NEBA (Net Environmental Benefits Analysis) process provides a useful framework to achieve science-based planning and stakeholder consensus prior to, and away from, the emotive atmosphere prevalent at the time of a spill. It weighs up the advantages and disadvantages, or trade-offs, of the available techniques so that an effective response may be formulated to achieve the maximum overall benefit for the environment.

NEBA

The term NEBA (Net Environmental Benefits Analysis) has been used to describe a process for guiding the selection of the most appropriate response option(s) to minimise the net impacts of spills on people, the environment and other shared resources. Considering that the selection of the appropriate response action(s) may be in practice guided by additional considerations, the oil and gas industry sought to introduce a term that also reflects the process, its objectives and the decision-making framework. In 2016, the process of Spill Impact Mitigation Assessment (SIMA) was introduced as a methodology for supporting the NEBA process as well as explicitly encompassing ecological, socio-economic and cultural considerations (National Academy of Sciences, 2020).

Strategies

Varying degrees of response may be required: prevention measures, assessment and monitoring of the spreading of the pollution and/or clean-up actions. For each of them, decision trees are commonly used within contingency plans to facilitate choices for decision-makers. For responders on site, each technique to be implemented will also be detailed in specific and operational action cards (often attached in the appendices).

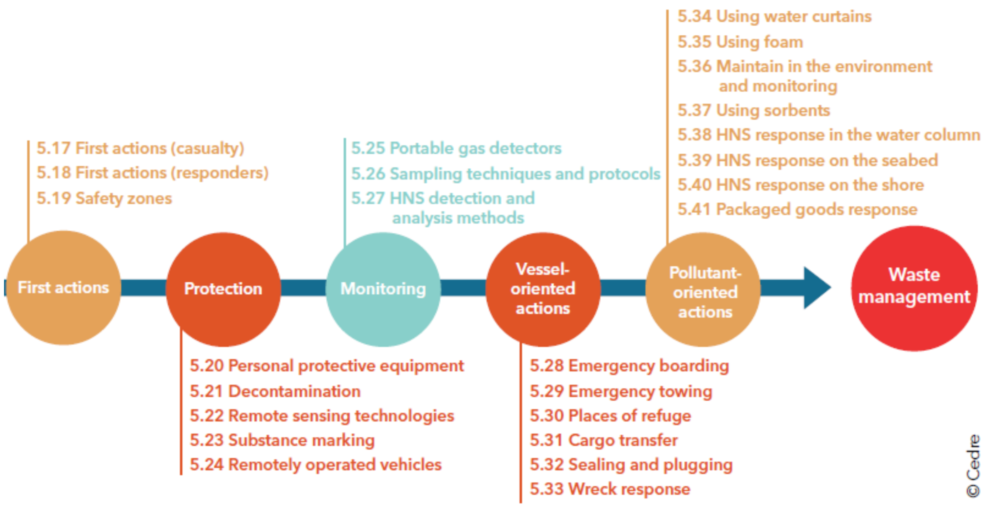


Figure 28: Main steps to be detailed within strategies and developed through operational action cards

Each of the following steps is described in detail in **Chapter 5**.

Waste management

HNS-contaminated liquids and solids collected in the context of recovery, dredging or decontamination operations implemented following an HNS spill are considered as "waste". "Waste" is "*any substance or object which the holder discards or intends or is required to discard*", according to the Directive 2008/98/EC of 19 November 2008 on waste (the Waste Framework Directive (WFD)).

In the event of a maritime pollution incident involving HNS (carried in bulk or packaged form), recovery operations can generate diverse hazardous (as well as non-hazardous) waste materials, with a wide range of hazard level, toxicity or ecotoxicity, sometimes in great quantities. The classification of waste as non-hazardous or hazardous is regulated by the WFD. The WFD Annex III defines hazardous waste as waste that displays one or more of the hazardous properties (HPs) HP1 to HP15: it refers for most hazardous properties directly to the hazard statement codes (HSCs) introduced in the CLP (Classification, Labelling and Packaging) Regulation for chemical substances or mixtures having hazardous properties.

One of the objectives of the contingency plan is to anticipate, and to detail, the global process to implement for waste management should it need to be in place.

The upstream phase should take place at the same time as operations begin. This covers:

- **temporary storage facilities**, in the immediate vicinity of the site and linked to the duration of the site;
- **intermediate storage facilities**, serving several primary storage sites, set up a few hundred metres or even up to several kilometres from the clean-up sites (these intermediate storage sites are closed once operations at the clean-up sites have been completed);
- **final storage area(s)**, to which all the separated polluted waste from one geographical area is transferred. Such sites may be in operation for over a year depending on the performance of the downstream phases;
- **transportation between storage sites**.

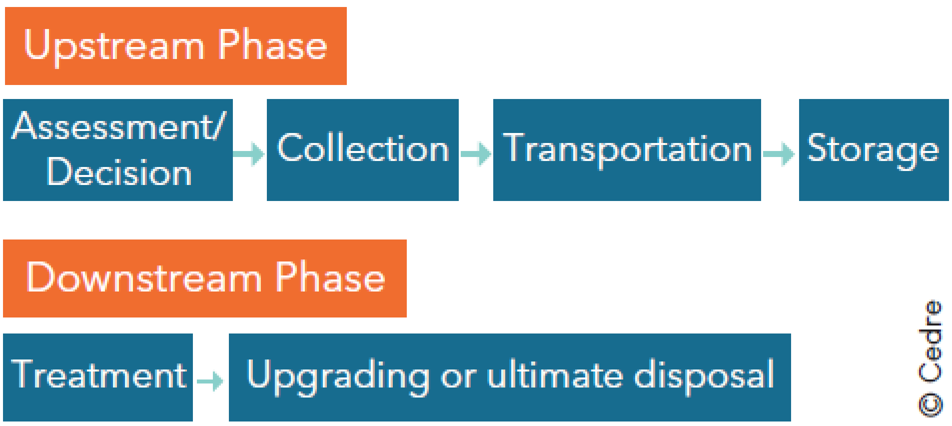


Figure 29: Global waste management process

The implementation of the downstream phase can be deferred. This stage includes:

- **treatment processes**, with different procedures suitable for different waste types;
- **disposal of treated waste**;
- **restoration of sites** dedicated to intermediate or final storage.

A useful model when dealing with a waste stream originating from any source is the "waste hierarchy". This concept uses principles of waste reduction, reuse and recycling to minimise the amount of ultimate waste produced, thus reducing environmental and economic costs and ensuring that regulatory and legislative requirements are met. It provides a tool for structuring a waste management strategy and can be used as a model for all operations. In the past, most spills have involved crude oil or refined products, so the diagram below is based on oil.

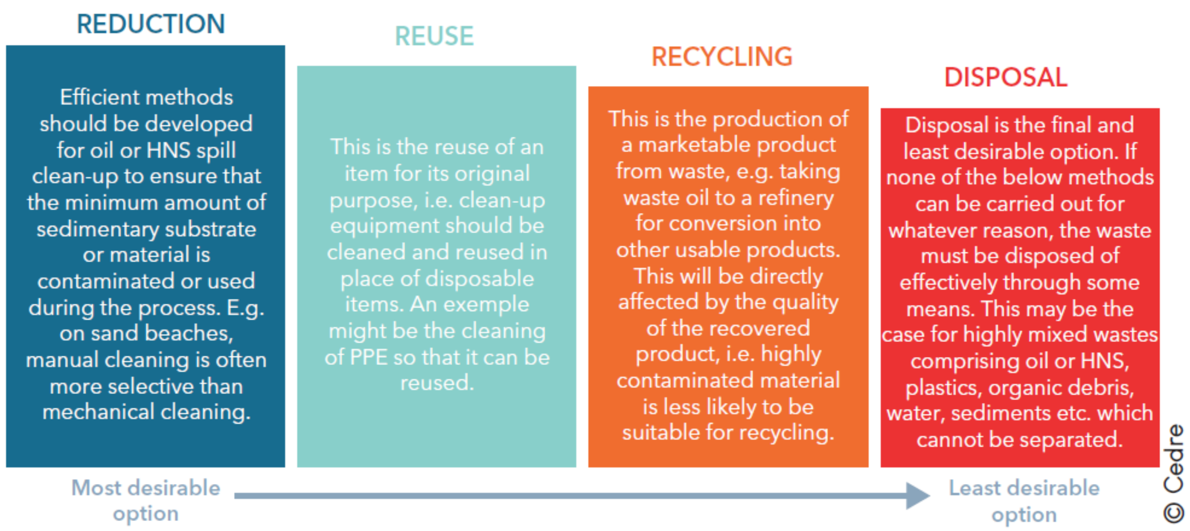


Figure 30: The 'waste hierarchy' or waste management steps

It is essential that planners do not lose sight of the need to pre-plan waste management. The lack of proper waste handling, storage, transport and disposal or a simple weak link in this chain will reduce the response capacity of the whole process and can lead to potential violations of regulatory requirements. Details and guidance for implementing the waste management strategy and recycling, treatment or disposal arrangements should be included in the contingency plan or as a separate waste management plan. They should specify in advance:

- responsibilities;
- type and capacity of facilities required;
- methods and rules of collection and transportation.

4.4 Waste management

4.6 Resource management

An effective response to an HNS spill critically relies on the preparedness of the entities and individuals involved. Responding to an HNS spill affecting a broad range of people and organisations requires a wide variety of decisions to be made very quickly. This can only be achieved if teams in charge of the response:

- are sufficiently prepared to appreciate the unfolding situation;
- can make crucial decisions;
- can safely mobilise appropriate resources without delay.

Such skills rely on resource preparedness; for both responders and managers, it relies on training and exercises.

4.6.1 Human resources

Robust preparedness should include training and exercises carried out on a regular basis, aimed at:

- providing responders with knowledge of how to minimise impacts on human health and the environment due to HNS spills in the ecosystem;
- familiarising stakeholders with response methods aiming to minimise the effects of chemical pollution and techniques to recover or neutralise chemical substances;
- exchanging expertise, experience, and opinions amongst stakeholders;
- enhancing the capability of institutions tasked with managing maritime emergencies because they are likely to differ from other incidents;
- regularly checking the applicability of the HNS contingency plan and making any necessary improvements;
- improving the overall response capability.

4.6.2 Training

Providing training and organising exercises for response teams are the best ways to improve the overall response capability. All personnel liable to be called upon to handle hazardous materials must acquire specific knowledge and skills. In particular, they must be familiar with:

- the intrinsic hazards of various substances, in particular by referring to the UN Recommendations on the Transport of Dangerous Goods (TDG), and understand their fate and behaviour; **3.2 GHS vs UN TDG**
- all relevant sources of information, such as Safety Data Sheets (SDS), dangerous good declarations, shipping documents, as well as all other relevant documents;
- protective equipment and clothing;
- chemical detection kits;
- amergency procedures, first actions to implement;
- specialised response strategies, techniques and equipment;
- methods and procedures for communicating clearly as per the communication plans.

4.6.3 Exercises

Regular and realistic exercises are essential for validating the response plan and response capability, and enable all parties involved to:

- maintain and improve the theoretical and technical knowledge acquired during training;
- clarify roles and responsibilities;
- optimise communications within the Incident Management System (IMS);
- meet and exchange with various people involved in the response (often from different departments with otherwise very little interaction);
- integrate the procedures set out in the contingency plans to be validated or updated;
- validate the response capabilities;
- to effectively prepare first responders, various types of exercises should be organised as part of an exercise programme.

The frequency with which the exercises are carried out should be tailored to the complexity of preparation and implementation, but will also be regulated according to the human, material and financial resources available. For instance, if table-top exercises are to be carried every six months, large-scale exercises may be carried out on a three-yearly basis.

	Seminars	Workshops	Table-top ALPHA	Functional BRAVO	Equipment deployment CHARLIE	Full Scale DELTA
Aims	Provide an overview of oil spill contingency plans and their related policies.	Build or achieve a product. Produce new or revised plans, procedures, mutual cooperation agreements, etc.	Test procedures for cooperation. Learn and test the framework on response matters relating e.g. to organisation, communication and logistics.	Test the agreed procedures and communication for reporting. Test requesting and providing assistance. Get a picture of the current response readiness of the contracting parties.	Test and learn the use of specific equipment.	Test the national or multi-national response capability and equipment. Test and train complex cooperative abilities or the coordination of several different participants, units and equipment.
Who' s for	Public or private operators. Local, regional, national authorities.	Operators & authorities. Level of interaction increased compared to seminar.	Decision-makers.	Different levels of decision-makers.	Responders.	All levels of the pollution response task.
Type	Informal orientation event.	Informal orientation event.	Paper format. No deployment of equipment. Remotely tested or in one location.	Exercise scenario with event updates drives activity.	Deployment on site.	Several crisis management cells. On different sites. At sea and on the shoreline.
May involve	Organisations that are developing or making major changes to existing plans or procedures.	Organisations that are developing or making major changes to existing plans or procedures.		Movement of personnel and equipment is usually simulated.		Public or private operators. Local, regional, national and international authorities.
Timing	One for induction. No constraints imposed by real-time simulation	One per heading.	One per quarter.	One per semester.	One per semester.	One per year.

Figure 31: Progressive development of different types of exercise programmes

4.6.4 Material and equipment

4.6.4.1 Response equipment

Certain response equipment is required to respond to an incident involving HNS. There are various categories of pollution response equipment to be inventoried (type/quantity/origin):

- plugging and sealing devices (e.g. inflatable plugs, sealing plates for sewer manhole cover);

Equipment storage room

- fire hose nozzles;
- neutralising agents (e.g. lime, vinegar, citric acid);
- dispersants;
- sorbents (socks, pads, etc.);
- containment devices (e.g. floating boom);
- pumps and skimmers;
- waste storage and recovery systems (e.g. leak-proof drums or containers).

4.6.4.2 Stockpiles and storage

Response equipment is often deployed in an emergency. The location and mode of storage must therefore be selected and arranged to allow for a rapid response and easy deployment, preferably near high risk sites. Their position should be defined in advance to ensure maximum efficiency in case of deployment; such positions should be specified in the contingency plan or located on strategical/tactical maps.

Within stockpiles, it is advisable to gather in the same place, rack or pack (container, trailer, etc.) all the equipment necessary for a given technique. For instance, a skimmer will be packed with a pump, power unit, set of hoses, ropes, etc. Containment devices will be grouped together, and so on.

It is preferable to protect the equipment from sunlight, frost and bad weather (sea spray, wind, rain...). In areas where the climate is cold, hot or humid, special care must be taken. Ventilation will prevent mould and accelerated deterioration. Protection against rodents must also be ensured.

4.6.4.3 Maintenance and care

As part of the preparedness process, it is essential to draw up detailed and regularly updated inventories of the available equipment (number, type, quantity, state) and to associate them with technical data sheets as well as implementation and maintenance protocols.

4.6 Acquisition and maintenance

5) POST-SPILL MANAGEMENT

5.1 Documenting, recording and recovering costs incurred during a ship-source HNS incident

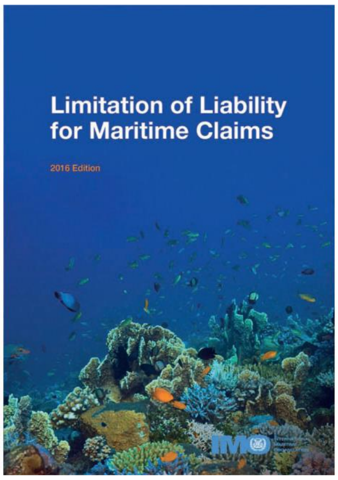
A marine spill involving HNS can cause significant loss or damage to a variety of organisations and individuals: HNS may cause harm to human health, environment, damage to property and lead to economic loss. Despite the best efforts of those concerned, the clean-up can be protracted and costly. Those placed at a financial disadvantage as a result of an HNS spill may be eligible for compensation.

5.1.1 Legislation - Legal basis for compensation

International legislation
At this point in time, there is no international convention in force governing compensation from marine HNS spills (a gap that the HNS Convention, see below, aims to close). Therefore, in the case of an incident, compensation will be dependent upon national legislation but may be subject to limitation under the global limitation regime by virtue of LLMC. It is therefore essential that the national contingency plan clearly states the sources of compensation available and the legislation that would be applicable, known by all.

National legislation
Liability and compensation for loss or damage caused by hazardous and noxious substances transported by sea currently depends on national legislation, and applicable international conventions. As a result, liability and compensation vary widely.

This may mean that, in the absence of specific legislation or strict liability, potential claimants may be required to prove fault on the part of the shipowner and that compensation will be limited to any damages recovered from the shipowner. The shipowner may be entitled to limit liability under applicable national or international regimes such as under the **Convention on Limitation of Liability for Maritime Claims (LLMC)** (IMO, 1996). The 1996 Protocol, as amended, is in force in 61 countries, with the earlier 1976 Convention solely in force in a further 20 countries.



LLMC Convention cover

The LLMC Conventions allows the shipowners or salvors of a sea-going ship to establish limitation for a wide range of maritime claims, with the exception of certain circumstances, including those that may arise out of an HNS incident, such as:

- claims for loss of life and personal injury;
- claims for loss or damage to property;
- claims in respect of the raising, removal, destruction or the rendering harmless of a ship which is sunk, wrecked, stranded or abandoned, including anything that is or has been on board such a ship;
- claims in respect of the removal, destruction or the rendering harmless of the cargo of the ship (which could cover HNS cargo in bulk or packaged form);
- claims for clean-up costs in respect of measures taken to avert or minimise loss and further loss caused by these measures.

The Convention sets two separate limits for claims related to:
1. loss of life or personal injury
2. other claims (e.g. property claims, economic loss)

Liability is limited to an amount dependent on the size of the ship.

LLMC Protocol 1996 as amended	Shipowner's limit of liability (approximate US$)	Liability limits for five vessel sizes (approx.US$)
Property	The limit of liability for property claims i.e. excluding loss of life and personal injury, for ships not exceeding 2,000 gross tonnage is SDR 1.51 million SDR ($2.1 million). For larger ships, the following additional amounts are used in calculating the limitation amount: • For each tonne from 2,001 to 30,000 tonnes, 604 SDR ($845) • For each tonne from 30,001 to 70,000 tonnes, 453 SDR ($630) • For each tonne in excess of 70,000 tonnes, 302 SDR ($420).	2,000GT = $2.1 million 10,000GT = $8.8 million 50,000GT = $38.4 million 100,000GT = $63.8 million 200,000GT = $106 million
Loss of life/ Personal injury	The separate limit of liability for loss of life or personal injury claims for ships not exceeding 2,000 gross tonnage is SDR 3,02 million ($4.1 million). For larger ships, the following additional amounts are used in calculating the limitation amount: • For each tonne from 2,001 to 30,000 tonnes, 1,208 SDR ($1,662) • For each tonne from 30,001 to 70,000 tonnes, 906 SDR ($1,246) • For each tonne in excess of 70,000, 604 SDR ($831)	2,000GT = $4.1 million 10,000GT = $17.3 million 50,000GT = $75.5 million 100,000GT = $125.4 million 200,000GT = $291.6 million

Table 8: Shipowner's liability limits under the amendments to the LLMC 1996 Protocol (SDR: Special Drawing Rights. The daily conversion rates for Special Drawing Rights (SDRs) can be found on the International Monetary Fund (IMF).

In the event of an HNS incident, the applicable legislation will set out the provisions addressing liability and compensation. These may include information regarding the timeframe within which claims should be made. Should the shipowner be liable by law to provide compensation to those who suffered loss or damage as a result of the incident, third party claims will normally be covered by the P&I insurer of the ship.

5.1.2 Protection & Indemnity (P&I) Club/ The insurer

Claims for compensation should be made in the first instance to the shipowner or to the insurer of the vessel's third party liabilities, usually a Protection & Indemnity (P&I) Club. The shipowner's P&I Club will provide insurance cover for ship sourced pollution damage and will handle and assess any pollution damage claims accordingly, and up to an amount set by relevant international conventions (often with a direct liability on the insurer/P&I Club where this is the case) or by national legislation.

The 13 P&I Clubs that are members of the International Group of P&I Clubs (IG), between them, provide cover for approximately 90% of the world's ocean-going tonnage. These P&I Clubs provide cover on behalf of their shipowner and charterer members for a wide range of third party liabilities relating to the operation of ships, including:

- loss of life and personal injury to crew, passengers and others on board;
- cargo loss and damage;
- pollution by oil and other hazardous substances;
- wreck removal, collision and damage to property.

P&I Clubs also provide a wide range of services to their members on claims, legal issues and loss prevention, and often play a leading role in the management of casualties. P&I Clubs are non-profit mutual (i.e. cooperative) insurance associations enabling shipowners to share risk and the payment of claims.

A number of commercial vessels, many of which operate solely in domestic markets, are insured for third party liabilities by other, usually smaller, P&I providers either on a mutual or fixed-premium basis. Military vessels as well as other government vessels, including warships and other vessels on military duty or charter, usually operate outside established P&I and other commercial insurance.

Sinking of Ievoli Sun

In the event of a large incident where the total cost of claims exceeds the compensation available from the shipowner, the settled claims may be pro-rated to the maximum amount available. Compensation to supplement money available from a vessel's insurer may be available from other sources, including international and domestic funds.

Examples of HNS incidents where compensation was provided by the shipowner and P&I insurer: *Ievoli Sun*, chemical tanker incident in France, 2000.

6.1.2.1 HNS Convention and its 2010 Protocol

At the time of writing, the HNS Convention (its 2010 Protocol) is not yet in force. When in force, the HNS Fund will be a potential source of additional compensation for the ratifying countries, in addition to potential money available from the shipowner's insurer (IMO, 2010).

The 2010 HNS Convention will cover damage caused by HNS within the Economic Exclusion Zone (EEZ) of a country in which the Convention is in force, as well as damage caused by HNS carried on board ships registered in, or entitled to fly the flag of, a signatory country outside the territory of any State (country). Compensation will be available for pollution damage and damage caused by other risks, e.g. fire and explosion, for loss of life or personal injury on board or outside the ship carrying HNS, damage to property outside the ship, damage caused by contamination of the environment, loss of income in fishing, tourism and other economic sectors, and the costs of preventive measures.

Where damage is caused by HNS in bulk, the shipowner will normally be able to limit their financial liability to an amount between 10 million and 100 million SDR (approximately US$15 million to US$150 million), depending on the gross tonnage of the ship. Where damage is caused by packaged HNS, the maximum liability for the shipowner is 115 million SDR (approximately US$175 million), also dependent on the vessel's gross tonnage. The HNS Fund will provide an additional tier of compensation up to a maximum of 250 million SDR (approximately US$380 million), including any amount paid by the shipowner and their insurer.

Once in force, claims under the HNS Convention should be submitted within three years of the damage or ten years of the date of the incident, whichever is sooner.

5.1.3 Type of claims

There are four main categories of claims in general arising from an HNS incident:

- **Clean-up and preventive measures**

Cost will be incurred as the result of the deployment of resources to prevent/minimise pollution damage, protect sensitive areas and carry out clean-up response. Activities such as aerial observation, at-sea response, and shoreline clean-up all fall under this category as well as the personnel engaged for carrying out this work.

- **Property damage**

Property damage may arise for cleaning, repairing or replacing items damaged by the chemicals or as a result of clean-up activities (e.g. damage to roads used for access by workers).

- **Economic losses (pure economic losses, consequential economic loss)**

A spill may impact companies, individuals or organisations in a different way: either pure economic loss when no damage to the property has occurred (e.g. beach access blocked by response activities, business interruption) or consequential economic loss when the spill has directly damaged assets (e.g. fishing nets).

- **Environmental monitoring, damage and restoration**

These claims are related to monitoring, impact assessment studies and possibly restoration studies.

Fishing nets

5.1.4 The claims process

Anyone who has suffered a loss or damage as a result of an incident, provided a link of causation can be established, is entitled to submit a claim. Claimants can file either an individual claim or submit it as a group (group of municipalities or consolidated government claims) to the relevant paying parties. Ultimately, it is the responsibility of the claimants to prove their loss.

Detailed information on the preparation and submission of claims in general can be found in a number of claim manuals (e.g. EMSA 2019, MCA). Whilst the IOPC Funds' claims manuals (IOpC Funds, 2019) are specifically tailored for oil pollution damage resulting from spills of persistent oil from tankers, they provide helpful guidance for other incidents outside of their scope (IOPC Funds, 2019). Good practice recommendations can be found in the sheet **6.1 Claims process**. The entity paying compensation may send a representative on site and may appoint experts to provide advice on claim submission to those involved in the incident. If the incident is likely to generate a large number of claims, the insurers are likely to set up a local claim office to help, collect and guide the submission of the claims.

Before and during an incident, key steps should be followed to ensure all necessary documentation for recovering costs is recorded and can be submitted promptly (ITOPF, 2014).

When drafting and updating the national contingency plan, clear guidance should be included on cost recovery, the importance of on-going recording of costs incurred and evidencing such, and the department in charge of this aspect.

During an incident, it is recommended to keep and document all records of activities, damage and actions undertaken. Together with early engagement with the compensating body, these are key to ensure a smooth claim submission process and a common understanding by both parties of the issues that would naturally arise during an incident.

The claim submission and assessment are an iterative process between the parties until a suitable settlement can be reached.

Figure 37: From incident to settlement: the claim process

5.1.5 Summary

- All costs should be fully identified, recorded and supported at the time they are incurred as ultimately, it is the responsibility of the claimants to prove their loss.

- The sources of compensation should be identified and engagement with their representatives should be made at an early stage.

- Understanding the types of costs that are admissible under the applicable regimes is key to the submission of claims.

- Early engagement with the compensating body will facilitate the assessment and is likely to speed up the settlement process.

- The compilation of the claim and its submission to the paying party may have to be done quickly.

- The process leading to settlement is iterative and can be lengthy.

5.2 Post-spill monitoring

Post-spill monitoring is a very useful activity, in order to evaluate the:

- environmental consequences of an HNS spill and the extension of the effects both in space and in time;
- natural recovery of the environment involved as well as the effectiveness of any restoration and recovery activities and assess when these activities are considered to be complete.

6.2 Environmental restoration and recovery

This is a very complex matter, therefore it could be considered in a post-spill monitoring guide included in the contingency plan to define the objectives to be achieved and strategies for sampling, transport and analysis of sediment samples, water and marine organisms (IMO and UNEP, 2009; Kirby and Law, 2010; Kirby et al., 2018; Kirby, Gioia, Law, 2014; Neuparth et al., 2012).

It is especially necessary in case of spills of significant quantities of pollutants and in the case of permanent substances in the marine environment and/or products with long-term effects (e.g. mutagenicity and carcinogenicity effects).

To perform good post-spill monitoring, the quality of data acquired during the emergency phase is important and especially useful for understanding the behaviour of substances involved and their final fate in the marine environment. This allows the biota most involved (seafloor, shoreline, water column ecosystems) to be identified and investigations to focus on these. For this reason, field activities must be preceded by a detailed post-spill monitoring plan.

Monitoring is usually carried out by comparing data obtained with baseline data, when available, or with data measured at a reference site, chosen with environmental and morphological characteristics similar to those of the affected area but certainly not affected by spilled pollutants.

Choosing a reference site is a challenging process due to the difficulties in identifying an area with characteristics very similar to those of impacted one, where there are no other possible impacts that alter its characteristics. Statistical comparison of results obtained in terms of chemical, biological, ecotoxicological and ecological status analyses leads to an understanding of the extent of negative effects on the affected area.

The monitoring strategy must prioritise surveys on matrices that are representative of the environment that is intended to be assessed. For this reason, analyses of marine sediments are a priority with respect to water and air, which will move on, driven by sea currents and winds. The choice of organisms to be sampled must also take the same approach: sampling of specimens that live in close contact with the bottom (sedentary species with a small home range) compared to species that have more erratic behaviour (e.g. pelagic fish).

Post-spill monitoring uses a multidisciplinary approach to acquire evidence; common elements monitored to assess impact could include ecological community structure (abundance, diversity, etc.), sub-lethal biomarkers of effect in a range of species (e.g. enzyme levels, reproductive and behavioural parameters), contamination and/or tainting in commercial species, ecotoxicological assessments of contaminated water/sediment and recovery and recruitment measurements in the affected area. Indicators for ecological and chemical status are currently being developed as part of the European Water and Marine Strategy Framework Directives and it would also make sense for those conducting post-incident impact assessments to take account of them.

The investigations that could be taken into consideration during post-spill monitoring include:

- chemical analysis of samples, mainly sediment and possibly air and water;
- biological assays on sediment and water samples;
- ecotoxicology of specimens of sedentary marine organisms;
- assessment of the ecological status of characteristic populations of the area.

Equipment useful for sampling sediment, water and biota is reported in the fact sheet **6.2 Environmental restoration and recovery**

Chemical analyses

As previously mentioned, chemical analyses are mainly conducted on sediments which represent the sector of the marine environment indicating long-term pollution. Investigations that can be conducted are both generic and specific to the pollutants involved: particle size, pH and Eh, Total Organic Carbon (TOC), concentrations of pollutant(s) and their degradation products.
Granulometry (particle size) is an important value to know, because smaller particles are more able to "retain" pollutants, therefore fine-grain sediment is a better matrix in which to search for the presence of spilled substances.
Total Organic Carbon indicates the quantity of the organic component capable of "retaining" lipophilic and hydrophobic pollutants.

As an alternative to sediment and water analyses, the latest scientific research suggests the use of passive sampler devices, capsule-shaped instruments to be placed in the sea, containing a resin, specific to each category of substance, capable of concentrating pollutants present in the water column or in sediment.

Biological assays
A biological assay (or bioassay) is an analytical method to determine the concentration or potency of a substance by its effect on living animals (in vivo) or tissue/ cell culture systems (in vitro) (Cunha et al., 2017). In practical terms, the water or sediment sample is placed in contact with living marine organisms or with cells or tissues and specific variations are observed such as: the presence of the contaminant in the tissues; alteration of enzymatic activity, change in mortality rate, change in larval development, etc. Comparison with results obtained with similar samples taken in the reference area provides indications of effects related to the presence of pollutant(s).
Also in this case, use of sediment matrix or the so-called interstitial water (water that is between sediment grains) is preferable. For the purposes of example only, some examples of possible bioassays are:

- a set of three biological tests conducted on sediment as it is or on the interstitial water by means of species representing three trophic levels: *Vibrio fischeri bacterium* (Microtox®) (variation of bioluminescence); alga *Dunaliella tertiolecta* (its development); *crustacean Tigriopus fulvus* (its larval development). The application of a set of tests provides an indication of the existence of acute pollution at different levels of the food web.
- spermiotoxicity and larval development test on specimens of *Paracentrotus lividus* (sea urchin). The test is performed on the interstitial water and also in this case it provides an indication of the existence of acute pollution.
- Bioaccumulation on annelid *Hediste diversicolor*; the test is carried out by placing specimens of the worm in the sediment for about 10, 15 days. The results provide an indication of the accumulation of chemicals.

Ecotoxicology
Many analyses conducted with bioassays can be applied to specimens of marine organisms taken from the affected and reference areas. In this case, researchers are applying ecotoxicology. As mentioned above, the use of sedentary species is important because their health status can be an indicator of the state of the environment studied. Examples of sedentary organisms: fish such as rockfish, scorpion fish, conger eel or moray eel; sea urchin, mussels.

Below are some examples of ecotoxicological analyses:

- bioaccumulation of pollutant and its degradation products in target tissues;
- analysis of cellular damage, such as: lysosomal stability; lipid peroxidation; typical biomarkers of detoxification and oxidative stress processes (enzymatic alterations); histopathology;
- spermiotoxicity and larval development;
- Health Assessment Index (HAI), macroscopic evaluation of the state of the sampled organisms and their internal tissues.

Assessment of impacted area's ecological status
Finally, it is possible to evaluate effects at ecosystem level by carrying out an assessment of the ecological status of some characteristic biocoenoses (living communities) present in the area. Some characteristic parameters of each biocoenosis are analysed, which are based above all on the abundance and diversity of species, whose values are used to establish specific indices that help to define the ecological status which is usually expressed with qualitative evaluations such as: high, good, sufficient, insufficient, poor.

Assessment of the ecological status can be conducted on the water column, on typical populations of the seabed or on the shore. In the Mediterranean Sea, for example, the ecological status of coastal areas can be assessed by evaluating the status of the populations of Posidonia oceanica, an endemic phanerogam (typical of the Mediterranean basin) which forms meadows at depths between 5 and 50 metres. At the international level, several specific indices have been defined for these meadows that are used to provide a judgment of its ecological status (high, good, sufficient, insufficient, poor). If a Posidonia meadow has been damaged by an HNS spill, once the source of damage has been eliminated, it is possible to evaluate its ecological status, compare it with that of the reference area and evaluate over time when its natural recovery is complete. **6.2 Environmental restoration and recovery**

5.3 Incident review

Every crisis management and incident response, independently of its size or nature, will be exposed to scrutiny. Such scrutiny can be helpfulto learn lessons from past incidents and to improve the response for future operations.
The main objectives of incident review are to:

- draw lessons that are primarily of benefit to local stakeholders;
- keep track of events;
- identify avenues for progress;
- strengthening communication and co-ordination between different stakeholders during the response

For this purpose, the incident review can be substantiated through the following items, depending on the size of the incident: statistics, briefing note/report or even description and analysis of events for better understanding.

Most of all, incident reviews as well as lessons learned must be used to raise awareness and to update the contingency plan (**Chapter 4**). The guidelines or policy to conduct incident review should be written, or at least referred to, in it. Among other relevant information, the triggering criteria for conducting, or not conducting, an incident review should be included. The criteria can be based on the level of current affair disruption, the learning potential and the main evolution of the response and/or crisis management.

Incident review is a two-step process, composed of an informal evaluation followed by a formal review, both described in the following table:

Type of evaluation	**Informal evaluation**	**Formal review**
When should it be held?	Immediately after an incident when emergency personnel and units are still on the scene (hot wash up).	No later than a few months after the end of the incident.
What should be assessed?	All aspects of spill management should be covered (techniques, decision-making process, internal/external communication, etc.).	
	- For small incidents: how well specific tactics worked and what changes might induce better results.	- Detailed analysis and review of large- scale and other complex or tactically challenging operations. - Every aspect of the incident is carefully reviewed (including compliance with standard operating procedures (SOPs)) and analysed to identify root causes for problems.

Who should be involved?	Tactical and response team who conduc- ted the response on scene and within the crisis management team. A dedicated trained member of the crisis management team will gather all information and feelings about how the incident was managed.	- Representative/head of responders, Government /contractors/head of departments/NGOs/shipowners. Some contributions might be preferred indirectly (e.g. for shipowners).
How should it be assessed?	In all cases a project manager should be appointed to conduct the incident review and keep this responsibility up until the delivery of the final incident report.	
	- Depending on the incident this can be done orally or possibly through a short questionnaire.	- Detailed questionnaire specific to the incident
Advantages	- Gather all impressions and facts, reducing the risks of forgetting, - Actions taken are still fresh in people's minds	- Sufficient time is allocated to go into specific details of the response, - Possibility to make recommendations or changes to the SOPs in the contingency plan
Limitations	- Ensure that informal evaluation will not publicly embarrass those responsible for any mistakes, - Possibly, lack of time allocated to complete the review.	- Not all incidents have the same level of importance or frequency. For this reason the level of evaluation for incident review must be adjusted.

Table 9: Main characteristics of informal evaluation and formal review to establish incident reviews

The project manager must have a reliable structural organisation, communication and trained people. Performing incident review requires honest dialogue between all stakeholders (in charge, counteractant, responders, etc.), and discussions to favour disagreement over disrespect.

Everyone involved in the management of the incident, regardless of their hierarchical level or status, should be involved in the review.

The timeline to conduct an incident review is summed up in the following figure:

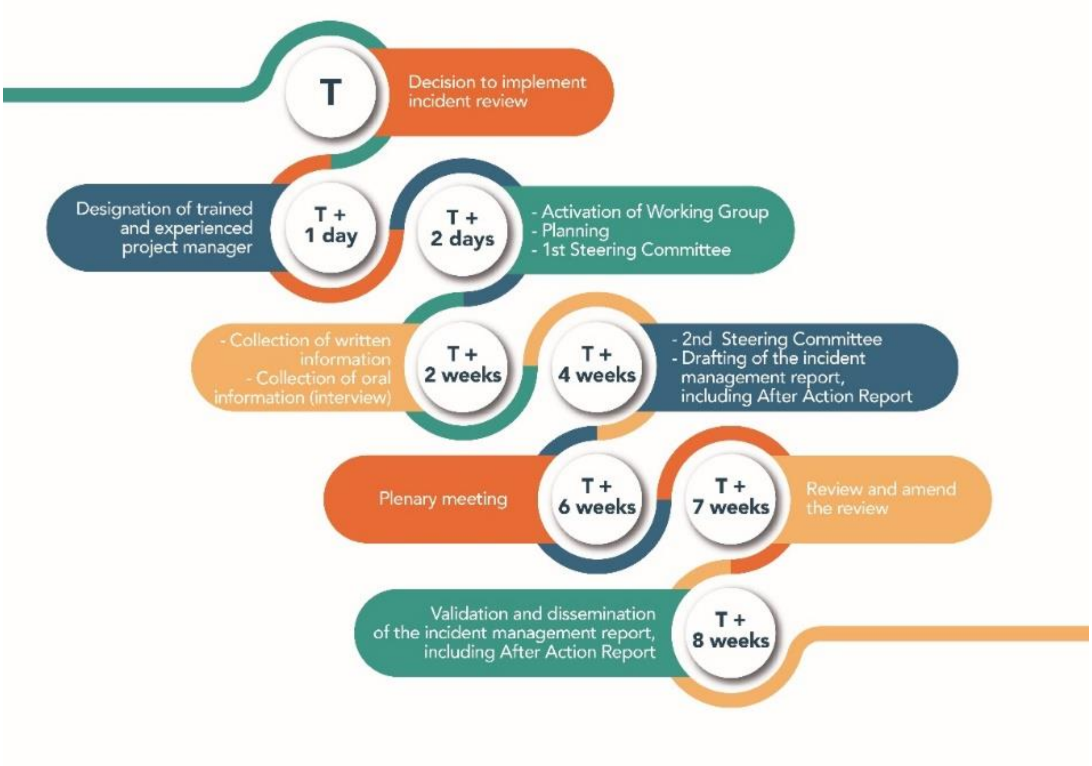


Figure 38: Main steps to conduct the incident review process

Ideally, this process is led by a project manager (usually the operations manager and/or an external moderator), if possible experienced in the field of incident management. Their role is to:

- ensure proper feedback from the incident and the related documentary monitoring;
- maintain a network of correspondents, sources of feedback information;
- identify, according to the local context, the structures that should participate or would bring added value to the feed-back;
- improve the procedures or channels for collecting feedback;
- ensure training is provided to those in charge of gathering feedback;
- choose a trained person to question incident management personnel.

The aim of the process is to produce a management-approved action plan to resolve the issues raised in the lessons learned portion of the critique.

The After Action Report fulfils the needs of the following critical functions:

- source of documentation for response activities;
- identification of failures and successes during emergency operations;
- analysis of the effectiveness of the participating components;
- description and definition of lessons learned;
- provision of a plan of action for implementing prevention, improvements and closing gaps;
- recommendations to be implemented in the contingency plan.

6) CASE STUDIES

Case studies are of high importance as they can be useful for decision-makers to find out which strategies, tactics or techniques were useful and efficient, and which ones were not, for similar cases or in similar conditions. Some databases exist and are regularly updated and the MIDSIS-TROCS tool also contains summarised information on past incidents for many chemicals.

As examples, the following case studies are presented in this manual for different types of transport or behaviour:

Type of transport/behaviour	Name of incident
Bulk/Evaporator	***7.1 Bow Eagle***
Bulk/Dissolver	***7.2 Ece***
Bulk/Floater	***7.3 Aleyna Mercan***
Bulk/Sinker	***7.4 Eurocargo Venezia***
Packaged goods/-	***7.5 MSC Flaminia***

Case Study 1 – *Bow Eagle* (Evaporator)

Vessel information

- Built in 1984, 15,829 GT, 24,725 DWT
- Norwegian flag

Information on chemicals

- Ethyl Acetate (CAS 141-78-6), SEBC DE.
  Usage: many applications, for instance as a solvent for nitrocellulose and other cellulose derivatives, various resins in protective coatings and plastics.

- Cyclohexane (CAS 110-82-7), SEBC E.
  Usage: manufacture of nylon intermediates, adipic acid, caprolactam, and hexamethylenediamine.

Date & location

26th August 2002, off the coast of Sein island, Finistère, France

Hazard identification

- Ethyl Acetate
- UN number: 1173
- GHS pictograms:
- hazard class: 3 flammable liquids
- MARPOL Category: C Cyclohexane
- UN number: 1145
- GHS pictograms:
- hazard class: 3 flammable liquids
- MARPOL Category: C

Short summary of incident

On Monday 26th August 2002, in the middle of the afternoon, the chemical tanker Bow Eagle, on the way from Brazil to Rotterdam, informed the MRCC (Marine Rescue Co-ordination Centre) CROSS Jobourg of a breach on her port side, which led to a leak and hence the loss of 200 tonnes of Ethyl Acetate.

The French Maritime Authority for the Channel and North Sea ordered the intervention of aerial and maritime assets. It also requested advice from the French Navy analysis laboratory (LASEM) and Cedre about the pollution risks.

Meanwhile, the French Maritime Authority for the Atlantic was looking for the ship responsible for sinking the trawler Cistude and made the connection between the two incidents. The incident unfortunately turned out to be a tragedy. Investigations showed that on Monday 26th August, at 2 a.m., a nightly collision occurred between the port bow bulb of the chemical tanker Bow Eagle and the trawler Cistude. The crew of the Bow Eagle did not offer assistance and four fishermen from the Cistude died. The description of this incident will focus on the risk of pollution due to the HNS present onboard the chemical tanker.

The Maritime Prefect decided to stop the vessel and to be escorted by a coastguard patrol boat towards Dunkirk. She anchored on the morning of the 28th August as the harbour was not equipped to treat the cargo in safe conditions. An assessment team and law officers boarded the ship. Two crew members confessed to having been aware of the collision, and the shipowner's representative admitted liability. In the middle of the afternoon, the Bow Eagle was authorised to leave the harbour and to make for her destination, Rotterdam.

The cargo

-Bulk Packaged PG

-Quantities:

•510 MT soy lecithin (MARPOL category D);

•1,652 MT sunflower oil (MARPOL category D);

•1,050 MT of methyl ethyl ketone (MARPOL category III);

•4,750 MT of cyclohexane (MARPOL category C);

•3,108 MT of toluene (MARPOL category C);

•500 MT of vegetable oil FA201 (MARPOL category D);

•2,100 MT of ethyl acetate (MARPOL category D);

•4,725 MT of benzene (MARPOL category C);

•5,250 MT of ethanol (MARPOL category III) .

Risk assessment

Assessment of Ethyl Acetate shows that this is a colourless volatile solvent, which has a perceptible odour, evaporates easily in the air and is moderately water-soluble. It is a highly flammable liquid and its vapours may in certain conditions form explosive combinations with air, and water can help spread such a fire.

However, there was almost no risk of a marine pollution, a fact established by the GESAMP's data base.

This information was immediately sent to the French Maritime Authority for the Channel and North Sea, and contributed, alongside the possible involvement of the Bow Eagle in the Cistude tragedy, to the Maritime Prefect's decision to stop the vessel entering a French harbour.

The French Maritime Authority called upon chemical experts from Cedre.

Cyclohexane is a highly evaporable product, whose vapour is three times denser than air. Cyclohexane is not soluble in seawater. As a result, a leakage can produce a flammable and irri- tant gas cloud, which may be blown along the water surface by the wind. This substance can be harmful to aquatic organisms in large spills. The cocktail of chemicals on the vessel was such that an accidental grounding would have been absolutely disastrous (see the Cason case).

Worsening parameters

Due to the hazards of both Ethyl Acetate and Cyclohexane, certain basic precautions had to be taken by the assessment team as there was no equipment available to treat the cargo in safe conditions.

Favourable parameters

The tanker belonged to a highly reputable company, Odfjell, the second largest international chemical transport company, insured by the world-class Protection and Indemnity Club Gard.

Response

On Tuesday 27th August, further information was obtained about the situation in terms of risk of pollution. The Ethyl Acetate tank leakage had been controlled, by transferring the product to another tank and sealing work was in progress. However the vessel was transporting nine different products, of which two were heavy pollutants (Benzene and Toluene). There was also a breach in the tank next to the one which had been leaking Ethyl Acetate, containing Cyclohexane. Chemical tankers transport many different products, and the mixture of these products can pose a serious threat to the environment. Moreover, collisions between fishing boats and merchant ships, which end up too often in the loss of human lives, can also be a source of water pollution.

Post-spill

No specific restoration had to be implemented as the substance spilled was an evaporator (Cyclohexane).

Case Study 2 – *Ece* (Dissolver)

Vessel information

- Built in 1988, 23,409 GT, 38,498 DWT
- Maltese flag

Information on chemical

- Phosphoric Acid (CAS 7664-38-2), SEBC D. Usage: manufacture of fertiliser (super- phosphates), the protection of metals, the pharmaceutical industry, water treatment, cleaning, paint and certain food product.

Date & location

31st January 2006, 50 nautical miles (90 km) west of Cherbourg, near the Casquet Traffic Separation Scheme in international waters.

Hazard identification

- Phosphoric Acid
- UN number: 1805
- GHS pictograms:
- Hazard class: 8 corrosives
- Marine pollutant: yes no

Short summary of incident

On the night of 30th to 31st January 2006, the Maltese bulk carrier the General Grot Rowecki, transporting 26,000 tonnes of Phosphates from Safi in Morocco to Police in Poland, collided with the Marshall Islands chemical tanker the Ece en route from Casablanca in Morocco to Ghent in Belgium.

The Ece, transporting 10,000 tonnes of Phosphoric Acid, developed a leak and a significant list.

The regional MRCC, CROSS-Jobourg, coordinated the crew rescue operation, in collaboration with the British Maritime and Coastguard Agency. The 22 crew members were safely evacuated to Guernsey. The tug boat the Abeille Liberté was sent to the scene of the accident.

The French Maritime Authority for the Channel and North Sea then carried out a pollution risk analysis, with the support of the French Navy Centre of Practical Expertise in Pollution Response (CEPPOL) and Cedre. The General Grot Rowecki, whose bluff bow was slightly damaged, was able to continue her journey.

The tug boat the Abeille Liberté arrived on site on 31st January towards 7 a.m. The assessment teams did not note any pollution, and boarded the two damaged ships. The Ece showed a 25° stabilized list to port and was no longer operating. When the assessment had been completed, the vessel was taken in tow by the tug the Abeille Liberté at around 3:30 p.m., bound for the port of Le Havre. In the course of towing, the Ece sank 70 m deep 50 nautical miles west of the point of La Hague, on 1st February at 3:37 a.m. The wreck lies in international waters, on the continen- tal shelf of the United Kingdom, in the French exclusive economic zone and the French pollution response zone. The Manche Plan, a bilateral Franco-British mutual aid agreement for rescue and pollution response, was activated on 1st February.

The cargo

- Bulk Packaged PG
- Quantities:
  - 10,000 MT Phosphoric Acid (MARPOL category Z);
  - 70 MT of Propulsion Fuel (IFO 180);
  - 20 MT of Marine Diesel;
  - 20 MT of Lubricating Oil.

Risk assessment

Oil sheen surfaced and exploration of the wreck confirmed the hypothesis that Phosphoric Acid may seep out via cracks in the hull, piping, or tank vents. The leakage could reach 25 m^3/hour. There were therefore no major pollution risks, but a risk of progressive leakage remained.

The main risk for humans was essentially linked to contact with the skin or mucus membranes, causing irritation or even burns in the case of prolonged contact with a concentrated solution. The same risk applies to marine animals. Phosphoric Acid leaking from the wreck would mix with water and acidify the immediate surroundings. Once the leaking stopped, the neutralising power of the seawater would quickly raise the pH back to its original value (around 8) in the affected zone. The environmental impact would be too temporary and localised to be quantifiable.

GESAMP gave the pollution 0, on a scale of 0 to 5, for persistence in the environment, 1, on a scale of 0 to 6, for acute aquatic toxicity and 3, on a scale of 0 to 4, for toxicity to aquatic mam- mals due to contact or ingestion.

Worsening parameters

Phosphoric Acid is a colourless or nearly colourless chemical, with a refractive index close to that of water. Leaks were therefore difficult to detect by video observation. Media highlighting the presence of heavy metals.

Favourable parameters

Phosphoric Acid is non volatile and does not produce vapour. It has a higher density than that of seawater and therefore sinks when spilled. It is totally soluble in water and does not accumulate in the food chain.

Response

There was therefore no immediate major pollution risk from the Phosphoric Acid. However the question which came to light, as with all wrecks, was the question of whether to remove the potential pollutants (Acid and Fuel) trapped in the wreck.

To help decide what observation operations should be carried out and what action should be taken, a series of dilution tests were carried out in Cedre's laboratory using coloured Phosphoric Acid and water acidity measurements. The first results showed that the acid spread out at the bot- tom, before diluting in a matter of a few minutes without any currents. When strong currents were simulated, the acid diluted rapidly as soon as it touched the water. It progressively decomposed into hydrogen ions (H+), responsible for the decrease in pH, and into phosphate ions (PO4--).

Cedre was asked about the possible fertilising effect of the phosphate ions, which could lead to an anarchical development of green algae in the event of a major spill. This question is Ifremer's domain. However in this case the pollution did not involve a major spill and the availability of phosphate ions in February is not a key factor in the development of green algae.

Negotiations between French and British authorities on the one hand and the ship-owner and insurers on the other led to an agreement being met on 16th June 2006 for the removal of the oil remaining onboard the wreck (approximately 40 tonnes) and for the planned controlled release of the Phosphoric Acid, by opening the access channels to the six tanks using a remote controlled robot. The operation was undertaken by the ship-owner during the summer period, under the control of the authorities. The operations was completed by 15th September. Until this date, fishing continued to be banned around the wreck. The flag state was asked to take position.

Post-spill

No specific restoration or monitoring survey was implemented.

Case Study 3 – ***Aleyna Mercan*** (Floater)

Vessel information

- Built in 2005, 2,897 GT, 4,037 DWT
- Maltese flag

Information on chemical

- Identity: Paraffin wax, CAS number: 8002-74-2
- SEBC Fp
- Usage: lubrication, electrical insulation, candles

Date & location 15th – 23rd June 2017 North Thyrrenian Sea, Tuscany Archipelago

Hazard identification

- UN number: 1993
- Hazard class: Class 3
- Marine pollutant: yes (category Y, noxious substance, MARPOL Annex II)

Short summary of incident

- Cause: illicit discharge during navigation from washing process of cargo tanks after unloading of paraffin wax in Genoa harbour. The operation was carried out in violation of Annex II of the MARPOL Convention and IBC Code. In particular, the temperatures of the unloaded product were manually modified on the Cargo Record Book.

- No Notification; illicit discharge has been communicated by Italian Coast Guard when product reached shoreline and the Ministry of the Environment activated the pollution response system

- Environmental conditions: It has been observed that after its release into the sea, the parafin wax was solid, floated and persisted in the marine environment (floaters Fp). Therefore the surface of the sea and shoreline were the main environments involved. Its low rate of solubility and evaporation led to the hypothesis that there were no evident consequences for the marine ecosystems.

- Specificities on the location: the summer period in which the spill occurred led to the temporary closure of the beaches and some bathing facilities.

The cargo:

- Bulk

- Quantity: estimated at a few tonnes

Risk assessment:

- No emergency response by the crew;

- No salvage actions;

- Monitoring: visual observation (from vessels or along shoreline) and partially aerial observations (the product moved just below the sea surface due to the wave motion and was therefore partially visible). Modelling was applied to locate, the possible source of pollution through backtracking

- First actions: none

- Communication: illicit discharge reported by Italian Coast Guard when product reached shoreline.

Worsening parameters

- Summer season, presence of tourists along the coast.

Favourable parameters

- Good weather conditions;

- Relatively limited quantities spilled;

- Good cooperation between the institutions to identify the party responsible for the illegal discharge.

Response

- Recovery of spilled product was carried out manually along the coast and using special baskets mounted on antipollution vessels;

- Identification of the pollution source identification was carried out by laboratory analyses of the product characteristics and investigating which ships transported this product on waters of Northern Tyrrhenian Sea in the days prior to the spill;

- Lesson learned: relevance of cooperation between institutions to identify the perpetrator of illegal discharges, especially useful for avoiding new episodes in the future.

Post-spill

-Restoration: no restoration because of no evident negative consequences for any marine eco-system;

-Environmental monitoring: none;

-Compensation: investigation by the Italian judiciary for illegal dumping of pollutants.

Parafin on the coast

Parafin wax collected with special baskets

Case Study 4: *Eurocargo Venezia* (Sinker)

Vessel information

- Built in 2011, 32,841 GT, 10,765 DWT

- Italian flag

Information on chemical:

- Identity: Molybdenum oxide, CAS number 1313-27-5

- Nickel oxide, CAS number 1313-99-1

- SEBC S. Product is in granules, a few millimetres in diameter, denser than water and not soluble in water

- Usage: catalyst for desulfurisation in refining pro- cess of crude oil

Date & location 17th December 2011 North Thyrrenian Sea, Tuscany Archipelago, off Gorgona Island

Hazard identification:

- UN number: 3191

- Hazard class: 4.2

- Marine pollutant: no

Short summary of incident:

- Cause: during the night, the Ro-Ro Cargo Eurocargo Venezia, sailing from the port of Catania to Genoa harbour, lost two semi-trailers that fell into the sea, carrying 224 drums containing exhausted catalyst made from nickel and molybdenum oxides. 26 drums were still found on board in the aft area. The incident was caused by a sudden change of route to avoid a collision with another cargo vessel during severe weather conditions;

- Notification: notification of the loss of the drums was made at sunrise by the captain of the ship as soon as the accident was discovered. Backtrack reconstruction indicated that accident area was likely to be the Tuscany archipelago, near to Gorgona Island;

- Environmental conditions: the drums sunk to a depth of about 400 metres (410-450 m) on a muddy bottom composed of typical ecosystems of bathyal environments;

- Specificities on the location: trawling activities are conducted along these seafloor areas.

The cargo:

- Packaged PG

- Quantities: each drum contained 170/180 kg of product stored in high-thickness PET plastic bags. As a result, 33-34,000 kg of products were lost at sea.

Risk assessment:

- Emergency response by the crew: Securing drums left on board;

- No salvage actions;

- Monitoring: no on board monitoring measurements of air and water, only sediment monitoring as part of environmental monitoring;

- Communication: notification of the loss triggered the intervention of the Italian Coast Guard and the Ministry of the Environment which, with the support of ISPRA, developed the search and recovery strategy for the drums. The polluter was in charge of proposing and funding the survey and recovery project as well as environmental monitoring.

Worsening parameters

- The incident occurred during the night and this led to a delay in notification and therefore an extension of the possible stretch of sea where searching activities for the sunken drums were required;

- Drums sank at great depths (about 400 metres) making search and recovery operations more difficult and expensive.

Favourable parameters

- Nickel/Molybdenum oxides were contained inside high thickness PET plastic bags which reduced the dispersion of the substances on the seabed.

Response

In February 2012 a survey of the main release area was carried out with side scan sonar (SSS) and a Remotely Operated Vehicle (ROV). A total area of 9 nm at a depth of 400–550 m was inves- tigated, resulting in the discovery of the two trailers and many of the drums (about 130) concen- trated in an area 0.8 km2 wide. The material was in different states of conservation: closed bag without drum, closed drum, open drum with bag inside. In June 2012 the drums were recovered using a robotic system. A work class ROV was able to place the drums found in specific racks and skips placed on the seabed. The racks were then recovered on board a supply vessel and transported to the shore for disposal. About 70 drums and their content were dispersed across the seafloor at 400-600 m depth. Due to the high depth and the supposed wide dispersion, public institutions deemed that it was not feasible and not reasonable to continue searching for unrecovered drums.

Lesson learned: transport of HNS must be avoided during severe weather conditions.

Post-spill

- Restoration: no restoration activities. Fishing and other uses of the seabed are banned near the sea bottom where the unrecovered drums are thought to be located. Specific recommendations have been given to fishermen, describing pollutant behaviour and procedures to be adopted if they accidentally collect drums in their fishing nets

- Environmental monitoring: a triennial environmental monitoring program has been carried out to evaluate the environmental status of involved benthic ecosystems, involving bioassays on the pollutant, chemical and ecotoxicological analyses of sediment and biological samples. Bioassay analyses confirmed the negative consequences of pollutants on marine biota; chemical and ecotoxicological analyses indicated that after three years there was no evidence of adverse effects on the sea bottom where residual pollutant was located. It has been supposed that in the future exhausted catalyst will disperse on the seafloor in a solid phase with a grain size of few millimetres. It could generate negative environmental consequences when ingested by benthic organisms with several feeding behaviours: scavengers, non-selective benthic predators, filter-feeders, suspension feeders;

- Compensation: the polluter covered the costs of searching for and recovering the drums as well as those relating to environmental monitoring activities.

- Open drum with bag inside

Specific racks where recovered drums were placed on sea bottom by a work class ROV

Case Study 5: MSC *Flamina* (Packaged Goods)

Vessel information

- Container Ship (6,732 TEU) built in 2001, 75,590 DWT
- German flag

Information on chemical (DG Class)

- 2.1 gases (flammable) (2 containers on board in total /1 container damaged)
- 2.2 gases (non-flammable) (14/13)
- 3 flammable liquids (33/16)
- 4.1 flammable solids (1/1)
- 4.2 substances liable to spontaneous combustion (3/2)
- 4.3 substances which in contact with water emit flammable gases (1/1)
- 6.1 toxic substances (18/5)
- 8 corrosive substances (35/22)
- 9 miscellaneous dangerous substances (44/35)

Date & location

14th July 2012, 08:04 UTC (Explosion), Atlantic ocean, ɸ 48°13,8'N λ 027°57,9'W

Hazard identification

- All hazard classes except class 1 and 7
- Marine pollutant: yes

Short summary of incident:

- The MSC Flaminia was in transit across the Atlantic from New Orleans to Antwerp when smoke was detected in cargo hold No4. The smoke turned out to be vapour from a cargo of Divinyl- benzene (DVB, UN 3082) that had begun a runaway autopolymerisation process;

- Efforts to extinguish what was thought to be a fire led to an explosion and ensuing fire that extensively damaged the vessel and its cargo and led to the loss of three lives;

- The vessel was abandoned. A salvage team remanned the vessel later, extinguished the fire as far as possible and the vessel was towed to Europe. A place of refuge was granted at Wil- helmshaven, Germany where the vessel was unloaded under a high level of protection (envi- ronment and personnel). On the 15th March 2013 the vessel sailed from Germany to Romania for repair.

The cargo:

- Packaged

- Quantities: 151 containers of dangerous goods

Risk assessment:

- Before granting a place of refuge two very detailed risk assessments were performed by the German government, the first one on the Atlantic, the second one in the German Bight;

- The first salvage activities (fire fighting) were performed by a professional salvage company after the vessel was abandoned by the crew;

- Monitoring: very close monitoring of the vessel was performed out at sea and in the harbour. Chemists took several samples and the water and air quality was permanently monitored with different devices (e.g. GC-MS) The offloading in the harbour was monitored under safety regulations for daily working places.

Worsening parameters:

Explosion and ongoing fire that heavily damaged the cargo holds 3-7, producing huge amounts of contaminated waste and water

Favourable parameters:

None, no impact on the World Heritage Wadden Sea or any damage to working personnel except for the crew of the vessel

Response:

- The fire fighting in the damaged environment was challenging and resulted in a huge amount of extinguishing water;

- The offloading operation was also challenging as most of the containers were at least partly damaged and normal equipment could not be used.

Post-spill:

A monitoring programme was launched.

Annex 1 - General information

International level

HNS Convention Secretariat: www.hnsconvention.org

IMO

- List of conventions: www.imo.org/fr/About/Conventions/ListOfConventions

- Chemical response: www.imo.org/en/OurWork/Environment/PollutionResponse

- Global integrated shipping information system: gisis.imo.org

- List of IMO OPRC-HNS related guidance and manuals: www.imo.org/en/OurWork/ Environment/Pages/List-of-IMO-OPRC-HNS-related-guidance-and-manuals.aspx EQUASIS: www.equasis.org

UNECE: www.unece.org

ITOPF - Technical Information Paper 17 - Response to Marine Chemical Incidents - https://www.itopf.org/knowledge-resources/documents-guides/tip-17-response-to-marine-chemical-incidents/

Regional Level

European Commission

- Transport data hub: https://ec.europa.eu/eurostat/web/transport/data/database

- Chemical substances: https://echa.europa.eu/information-on-chemicals**EMSA**

- MAR-ICE: https://www.ice-chem.org/_files/ugd/bb9d72_c00a3a28b0f34689bf10a83f75110861.pdf

- Vessel traffic monitoring in EU waters (SafeSeaNet): https://www.emsa.europa.eu/ssn-main.html

- CleanSeaNet: https://www.emsa.europa.eu/csn-menu.html

Useful tools or manuals

SAR: https://www.international-maritime-rescue.org/chemsar-manual

Emergency response guide: c.canada.ca/en/dangerous-goods

- Chemical response guides: www.cedre.fr

- Decision support tool: www.hns-ms.eu

- MIDSIS-TROCS: www.rempec.org

Knowledge tool to access projects related to HNS: knowledgetool.mariner-project.eu/

DRAFT OPERATIONAL GUIDE ON THE RESPONSE TO SPILLS OF HAZARDOUS AND NOXIOUS SUBSTANCES (HNS)

VOLUME 2 (Response)

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Disclaimer
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Preface
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Introduction

There are no universally applicable response and intervention techniques in case of incidents involving HNS at sea: each response to tackle a release at sea and mitigate the potential impacts is unique and depends on numerous variables:

- The list of HNS potentially involved in a spill is very long and their behaviour is difficult to predict;
- The complexity is increased by the specificities of the incident location, environmental conditions, possible mixing of chemicals, reactivity, etc.;
- The level of preparedness as well as the availability of suitable equipment and training level are key factors in the effectiveness of the response.

This manual aims to guide involved personnel (decision-makers, responders) through the different phases of a marine HNS emergency, and assist with the response. It is essential to be able to rely on a well-developed contingency plan.

The response phases are not necessarily sequential, they may be carried out simultaneously, always keeping in mind that the priority objective must be to save lives in danger and to preserve the health of responders.

Chronologically the following phases can be identified:

Incident notification

- reporting of incident by observers (casualty's captain, pollution observation systems, general public)

5.1 Incident notification

Information gathering

- data gathering: research into the characteristics of involved substances (physical, chemical and biological data) and/or containers as well as their behaviour, weather and sea conditions and forecasts, ecological and economic characteristics of affected area.

5.2 Incident data gathering

Decision-making

- selection of strategies to eliminate or reduce the pollution (or threat thereof) based on:
  - **Hazards**: evaluation of hazards deriving from the released substances;
  - **Behaviour**: their behaviour which will make it possible to identify the compartment(s) (air, surface, water column, seabed) that will be impacted by the pollution;
  - **Modelling**: to predict the trajectory, fate and behaviour of spilled pollutants.

5.11 HNS spill modelling

First actions

- usually initial emergency measures taken by responders and crew of involved ship(s)

5.5 Situation assessment
5.18 First actions (responders)
5.19 Safety zones

On-scene response

- once response strategy is established, multiple actions may be conducted:
  - Protection: identification of the necessary Personal protective equipment

5.20 Personal protective equipment
5.21 Decontamination

  - Monitoring: depending on the characteristics of the accident, different types of monitoring could be carried out: remote detection (wherever possible), use of portable detectors, and sampling of water, sediment and biota for laboratory analyses

5.22 Remote sensing technologies
5.23 Substance marking
5.24 Remotely operated vehicles
5.25 Portable gas detectors for first responders
5.26 Sampling techniques and protocols
5.27 HNS detection and analysis methods

  - Response techniques: in combination with monitoring, two types of intervention can be distinguished:
    - Vessel-oriented actions – direct interventions on the vessel such as:

5.28 Emergency boarding
5.29 Emergency towing
5.30 Places of refuge
5.31 Cargo transfer
5.32 Sealing and plugging
5.33 Wreck response

    - Pollutant-oriented actions – operations to contain, treat and/or recover pollutants on the vessel or in the environment:

5.34 Using water curtain
5.35 Using foam
5.37 Using sorbents
5.38 HNS response in the water column
5.39 HNS response on the seabed
5.40 HNS response on the shore
5.42 Containment techniques: Booms
5.43 Recovery techniques: Pumps and skimmers

  - Logistical organisation: identification of suitable areas for setting up decontamination zones; establishment of a waste management strategy.

4.4 Waste management

Post-spill management

- the following topics must be taken into consideration:
  - Documentation and record-keeping: these aspects are important from the very the beginning of the response and become crucial during the claims process.
  - Before, during and after an incident, key steps should be followed to ensure all necessary documentation for recovering costs is recorded and can be submitted promptly

6.1 Claim process

  - Post-spill monitoring: necessary to assess environmental damage and decide upon measures for environmental restoration and recovery.

6.2 Environmental restoration and recovery

  - Incident review and lessons learnt: identify strengths and weaknesses of the response, implement changes to the contingency plan.

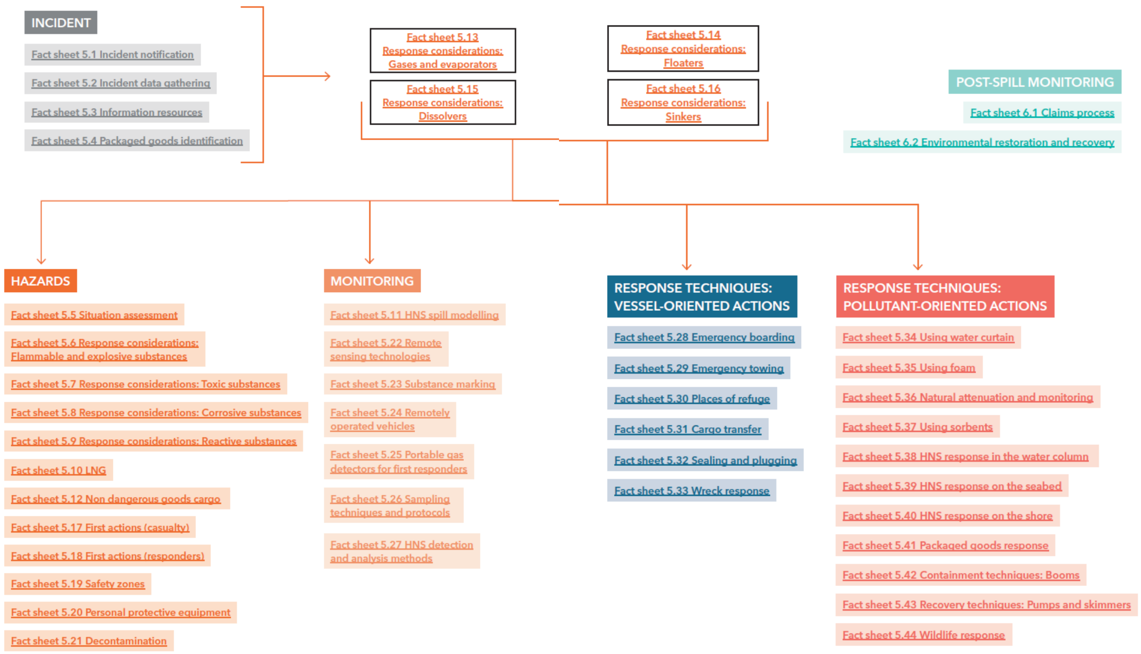
5.13 Response considerations: Gases and evaporators

5.14 Response considerations: Floaters

5.15 Response considerations: Dissolvers

5.16 Response considerations: Sinkers

2 Overview of possible response options



3 Notification and information gathering

3.1 Notification

Notification of an incident involving HNS can be received via:

- ship reporting system produced by the captain of the casualty or a responding or passing vessel;
- Pollution Report (POLREP) by a coastal state as part of their intergovernmental pollution notification system

5.1 Incident notification

- pollution observation report/detection log produced by a trained aerial observer **5.1 Incident notification**
- automated spill response notifications (satellite-based surveillance);
- unofficial written/verbal reports from members of the general public (report of visually observed pollution in port for example).

The level of detail of any initial report will be dependent on whether there is a direct link between the pollution observed and the polluter: if there is no attributable source to the pollution observed, information about the type of cargo spilled will not be immediately available but instead will need to be gathered by first responders on site through monitoring and sampling (**Chapter 5.6**).

3.2 Data gathering

Once the initial incident notification has been received, it is crucial for decision-makers and responders to gather objective information about the case to support the first response actions **5.18 First actions (responders).** Initially, data might be scarce and difficult to verify. However, with time and access to various information sources, the overall understanding of the situation increases. The quantity of incoming information might be challenging to verify, prioritise and filter.

All information should be funnelled and relayed to the Command Centre, which is in charge of analysing it and passing it Once the initial incident notification has been received, it is crucial for decision-makers and responders to gather objective information about the case to support the first response actions **5.18 First actions (responders)**. Initially, data might be scarce and difficult to verify. However, with time and access to various information sources, the overall understanding of the situation increases. The quantity of incoming information might be challenging to verify, prioritise and filter.

All information should be funnelled and relayed to the Command Centre, which is in charge of analysing it and passing it on to responders **4.3 Internal communication**) and to the relevant stakeholders **4.1 External communication**.

There are two types of data that can be collected:

Information specific to the incident that could not have been known ahead of time:
Responders should aim to obtain essential information on the location of the incident and the status of the vessel, bunkers and cargo, as well as in-situ meteorological data, as quickly as possible.
5.2 Incident data gathering
The first information likely to be received would be from the captain and the vessel's crew as they follow the procedures outlined in the Shipboard Marine Pollution Emergency Plan (SMPEP), which includes reporting requirements, response protocols/procedures and national and local contact points.
5.17 First actions (casualty).
Shipping documents such as Cargo Certificate/Shipper's Declaration/Dangerous Good Declaration and the appropriate SDS are the best initial sources of information for substance-specific information. **5.4 Packaged goods identification**

Information on resources:
Additional information, that could be collected prior to an incident, might be required to complement the reports obtained directly from the incident in order to aid the design and implementation of the response strategy **5.3 Information resources.** HNS contingency plans (**Chapter 4**) should include an information resource directory covering human health and safety issues **5.20 Personal protective equipment** and environmental resources (Environmental Sensitivity Index maps) and should make reference to operational response guides.

In order to assist in predicting the fate/ behaviour and trajectory of a spilled substance, software models can be useful throughout the response **5.11 HNS spill modelling**. Modelling results can add valuable information to the decision-making process with regard to first actions and emergency response measures **5.19 Safety zones**. However, modelling results need to be verified in situ and the general rule applies that any model result is only as good as the underlying data.

4 Decision-making

4.1 Who is in charge of decision-making?

The Incident Commander establishes the strategy to be followed to stop the spill and mitigate impacts. For this purpose, they are in charge of announcing command and immediate priorities and approves the **Incident Action Plan**. They are also responsible for ordering demobilisation. They are also the focal point for deciding on the release of information through the Public Information Officer.

An **Incident Action Plan** (IAP) is established in order to convert the overall strategy, goals and objectives into tactics. The IAP represents a roadmap to guide the implementation of actions. Just as the situation should be regularly reassessed, the IAP should also be periodically updated.

4.2 Decision-making dynamics within the Incident Management Team

The decision-making process should not be improvised (**Chapter 4**). As far as possible, the structure, organisation, resources (human and material) and procedures must have been prepared and included in the contingency plan as a reference document. The exercises organised beforehand must have made it possible to evaluate the response capacity in the face of realistic HNS spill scenarios.

However, every incident is unique and the incident management team will have to make important decisions in a context of potentially high pressure, especially from media or political leaders. It will be necessary to make crucial decisions quickly, sometimes with a very incomplete picture of the situation. The Incident Management Team must be capable of making reasonable decisions, tailored to the situation and the extent of the pollution (Tier 1, 2 or 3).

4.2.1 Escalation

Information obtained through notification **5.1 Incident notification** and data gathering **5.2 Incident data gathering** can be crucial to support the situation assessment **5.5 Situation assessment**. During the first moments following the incident, the situation assessment may both be limited and offer an opportunity to trigger first actions that could drastically mitigate the impact of the HNS spill. Indeed, certain provisional measures, mostly based on real risks or the possible worsening of the situation, could be implemented, especially when previously identified in the contingency plan.

Risks can be generated by the HNS transported but also by the bunkers. It is important to note that the propulsion fuels currently in use may be of different natures. The risks and behaviour of these products must therefore be taken into account, as well as possible mixtures or reactions with a cargo of HNS, or interactions related to environmental conditions (e.g. contact between a gas and a nearby source of ignition). With this in mind, a sheet is provided on a propulsion fuel which is becoming very widely used: **5.10 LNG**.

Considering these aspects, the first actions are mostly orientated towards protecting the population, the environment or amenities. Examples of first actions to respond to the HNS are stopping the leakage or mitigating the extent or the impact of the spill. A decision tree based on hazards is presented in the following figure and can trigger first actions **5.17 First actions (casualty).**

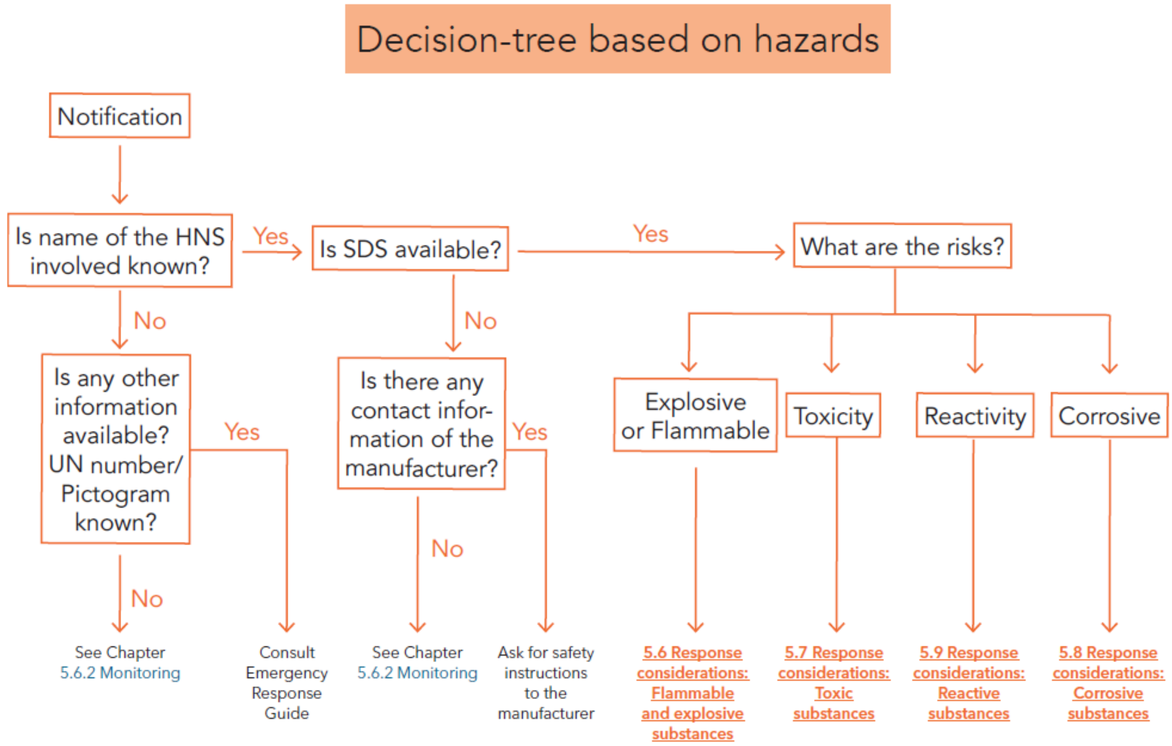


Figure 32: Decision tree based on hazards

Modelling is a decision support tool that can provide relevant information for the decision-making process and can be a high priority, especially when the risks for the population or environment require to be assessed in more detail.

5.11 HNS spill modelling.

When an incident occurs with HNS that are not classified as dangerous goods, their release in water or storage in improper conditions may nonetheless create risky conditions for responders or the population. Such substances should also be thoroughly considered.

5.12 Non dangerous goods cargo

4.2.2 Feedback loop for decision-making based on hazards and response

Throughout the management of the HNS incident, the decision-making process should integrate a continuous assessment of the risks and behaviour.

Every new or relevant output from the situation itself (for instance weather conditions) or from actions implemented (for instance stopping of leakage) can provide input for information gathering. The situation assessment can therefore be conducted at regular intervals or triggered by a particular event in the field and may lead to new decision-making.

Knowledge of both chemical hazards and behaviour represents decisive information required to drive the response with the most suitable approach. Indeed the response tactics are mostly based on the behaviour of the chemical, while hazards must be considered with the greatest of care to continue to conduct the response in safe conditions. Flowcharts have been established to help decision-makers to select possible techniques to respond to the vessel or the pollutant (**Chapter 5.2**).

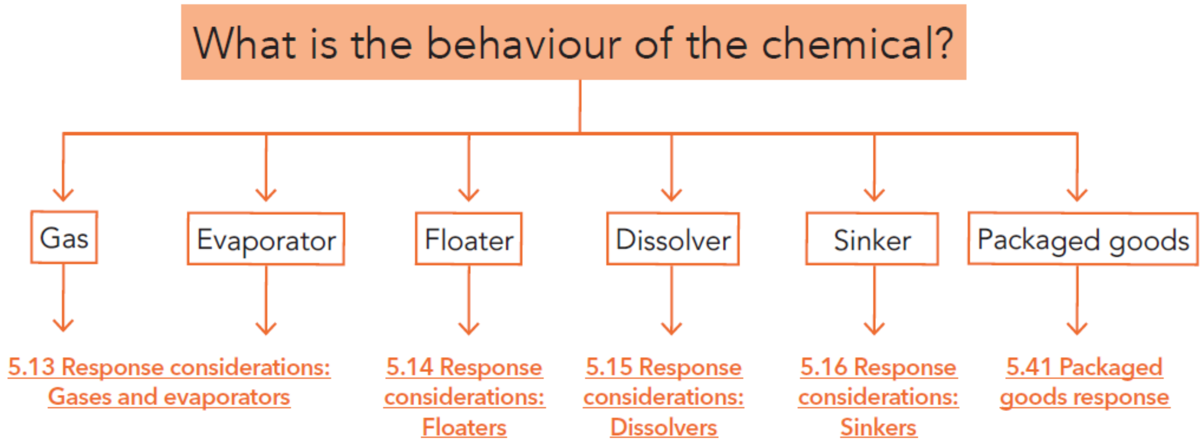


Figure 33: Decision tree to access flowchart based on behaviour

All the efforts deployed during the response should aim to ultimately return the scene to normal or acceptable pre-emergency conditions. Moreover, the response tactics and techniques used must not be more harmful to the environment than the pollutant itself. The guidelines defined by the Incident Action Plan should meet stakeholders' expectations as far as possible and seek their agreement through a collaborative approach. However, agreement can lead to significant delays in decision making, for instance when stakeholders are numerous. In case of disagreement, the Incident Commander is responsible for deciding on the best way forward.

While the strategy represents a guideline, the actions implemented for the response are based on the tactics defined. The On-scene Commander is responsible for the management of tactical operations, including supervision of operations, management of resources, consolidation of divisions bordering on overload and coordination of simultaneous operations. The objectives should meet the SMART criteria:

Specific	Instructions must be clear, as well as for as must the description of activities and logistics. They must cover correspond to a set of time called an operational period (hours, day, etc.) and be regularly updated during the response and its evolution.
Measurable	
Action oriented	
Realistic	
Timely	

5 First actions

First actions cover all actions that should be implemented at an early stage after notification of an HNS incident as soon as they are deemed necessary and can be implemented in safe conditions. The aim is to deploy a response team in the field in order to immediately mitigate the potential impact on human lives, the environment and amenities.

5.17 First actions (casualty)
5.18 First actions (responders)
5.19 Safety zones

6 On-scene response

6.1 Protection

Decision-making must necessarily take into consideration what equipment is suitable to be used in response to an HNS spill. During an HNS spill it is necessary to devote greater attention to the choice of suitable **Personal protective equipment (PPE)** for the protection of responders, considering the different hazards that numerous substances present. Moreover, the choice of equipment always needs to take into consideration chemical compatibility with the substance involved.

It is essential that the contingency plan (**Chapter 4**) foresees how to obtain the appropriate PPE, related stockpiles and that involved personnel is trained in its use. Particular attention must be paid to maintenance as this is often delicate equipment which, if necessary, must be immediately ready for use.

4.6 Acquisition and maintenance

It is necessary to appoint, and include in the contingency plan (**Chapter 4**), a person in charge of the management of PPE and a health and safety officer to ensure the correct use of equipment, especially PPE.

5.20 Personal protective equipment

Every time equipment is used, the subsequent decontamination phase, as well as waste management, should be considered.

5.21 Decontamination
4.4 Waste management

The main objective of the decontamination phase is to remove or neutralise contaminants that have accumulated on personnel and equipment, reducing risks inherent to the presence of toxic substances on the Personal protective equipment of responders. The method used involves neutralising the toxicity of the chemical substance(s) present and washing equipment with water or a cleaning agent. Decontamination operations must be managed and carried out by trained personnel.

6.2 Monitoring

Assessment of the extent and severity of impacted environmental compartments is based on three main components of monitoring methods (Figure 34).

These monitoring systems are complementary and might all need to be considered during a response. Indeed, remotely sensed data needs to be verified with in situ data, while models rely on in situ measurements and remote sensing. The integration or consultation of environmental monitoring experts in the Incident Management Team is recommended. The objective is to help decision-makers to provide information to allow for a rapid response in case of an HNS incident.

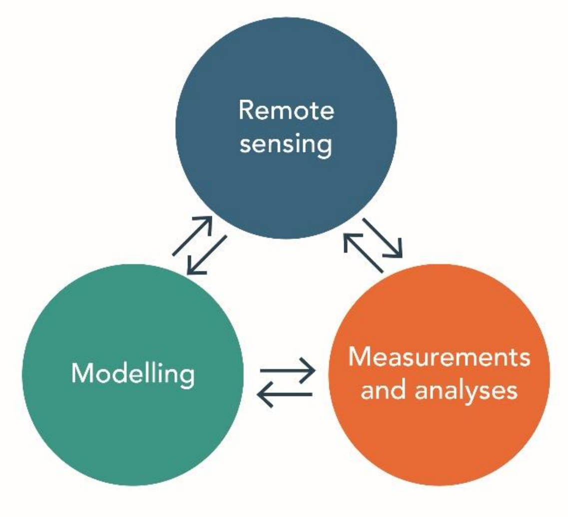


Figure 34: Three main components of surveying and monitoring

6.2.1 Modelling

Computer-based HNS fate, behaviour and trajectory are used to predict and prepare for potential impacts. However, the level of relevance and reliability depends, on the one hand, on the capability and reliability of the modelling software and, on the other hand, on information gathered as input for the model (**Chapter 5.3**). To validate the outputs from modelling, it is thus necessary to obtain quantified field data, either by remote sensing or by measurements obtained via in situ measurements or sampling and analysis.

5.11 HNS spill modelling

6.2.2 Remote sensing

Existing remote sensors used to detect and map oil spills may be used to detect floating HNS or packaged goods. For HNS with other types of behaviour, remote sensing still remains challenging. For instance the kinetics dissemination of a vapour cloud is too fast to be detected easily with satellite detection. However emerging technologies, such as autonomous sensors integrated on Remotely Piloted Aircraft Systems (RPAS), may be promising to improve the detection of HNS. The development of innovative and miniaturised sensors may offer the possibility to identify a wider range of HNS and, their integration on RPAS will improve the capacity to detect HNS, avoiding direct exposure to responders in the field, especially for explosive, flammable or toxic plumes. In the aquatic compartment, remote sensing may be possible with active sonar to detect sinker HNS or packages on the seabed, or some floating HNS.

5.22 Remote sensing technologies
5.23 Substance marking
5.24 Remotely operated vehicles

6.2.3 Measurements and analyses

Both in situ and laboratory analysis, described hereafter, may sometime be used to obtain different level of information or for different purpose. For instance a rough or qualitative analysis performed in situ may be useful to get first operational information while further sampling and analysis at laboratory may appear necessary to obtain more accurate information. As much as possible duplication of efforts should be avoided and anticipated through preparedness (See **Chapter 4**).

- **In situ analysis**

In-situ analysis can be carried out provided that certain requirements can be met. The performance of the detector must be sufficient in relation to the expected measurement result (For instance limit of

detection or accuracy) but it must also be able to operate under possibly harsh conditions and over a given period of time.
5.27 HNS detection and analysis methods

The use of portable or miniaturised detectors has been largely developed over recent decades and on-going improvements should be expected in the coming years, offering a greater response capacity for responders and more reactivity for the Incident Management Team.

Ensuring the health and safety of all responders during an incident should be the highest priority of the response. Incidents involving HNS can frequently involve substances in a gaseous state, increasing the risk when conducting search and rescue operations, entering confined spaces, or working in the vicinity of the spill. Therefore, anyone responding to the incident, especially those first on the scene, should be adequately protected **5.20 Personal protective equipment**. Portable gas monitors are one of the key equipment to assess the level of protection.
5.25 Portable gas detectors for first responders

- **Laboratory analysis**

Sampling for future laboratory analysis may be required or desired for a variety of reasons, some of which are listed below:
- In situ analysis might not possible for technical reasons (e.g. lack of portable equipment for analysis, time limitations, risky or harsh conditions in the field);
- The chain of custody for liability investigations might require specific procedures excluding in situ analysis;
- The chemical of interest is unknown;
5.26 Sampling techniques and protocols
5.27 HNS detection and analysis methods

6.2.4 Implementation of monitoring

6.2.4.1 Why monitor?

Monitoring should be implemented as soon as possible after notification and might potentially be continued throughout the emergency response phase and during post-spill monitoring. The following figure shows the reasons for monitoring during different phases of the incident management.

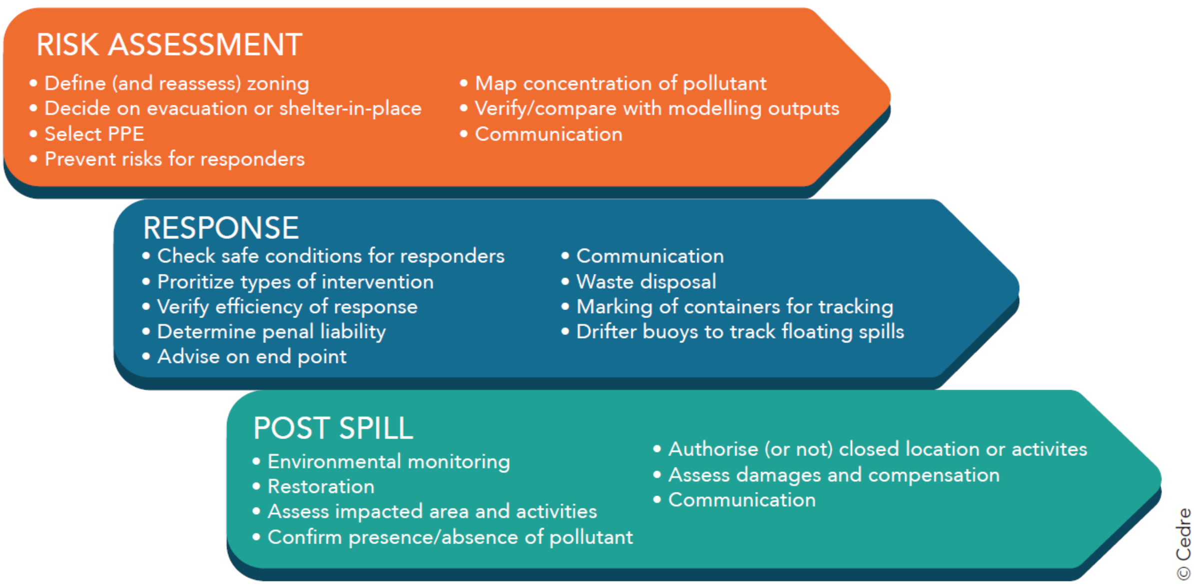


Figure 35: Objectives of monitoring for different phases of the response

6.2.4.2 Who is responsible for monitoring?

The objectives of monitoring mentioned earlier must be prioritised and integrated in a coordinated monitoring programme to avoid duplication of work, as well as to avoid missing chances of important measurements. The strategy must be led by a Monitoring Coordinator and should be built in a collaborative effort between experts and with the advisory opinion of possible third parties. It must be accepted that the survey strategy may continue after the response phase and will cover long-term clean-up or environmental follow-up. The Environmental Monitoring Coordinator should continue their activity during the whole period, including post-spill. The objective is to gather information potentially from multiple sources or various locations over a period of time to obtain a better/more accurate overview of the situation.

To implement the monitoring strategy, different duties fall under the responsibility of the Environmental Monitoring Coordinator, among them:

- establish a plan for documentation of the work and introduce a "chain of custody";
- make arrangements for appropriate monitoring if health risks are liable to occur;
- make sure that necessary measurements can be taken concerning the extent, severity and accuracy of both the spill and contaminated items as well as suspected sources;
- judge whether special examinations of the spill are needed to facilitate spill response measures;
- judge if short-term and/or long-term environmental impact may be expected. If so, contact the appropriate agencies;
- judge whether special examinations and analyses are needed when providing for general and specific needs for information;
- contact responsible bodies for transport and disposal. Check what special information is needed in this context and make arrangements for relevant analyses.

6.2.4.3 Where should monitoring be performed?

As explained in **Chapter 3**, HNS can exhibit one or several behaviours that result in them distributing to different environmental compartments e.g. the atmosphere, water surface, water column, seabed or shoreline. In addition to the behaviour of the chemical and its toxicological data, the location of the incident and the corresponding ecosystem can specifically affect biota (flora or fauna).

From the location of the incident, the short-term behaviour of the chemical (SEBC), the forecast modelling outputs or the expected fate, a sampling strategy may be established. It will detail the number and location of analyses to be performed for each parameter to monitor (chemical, temperature, etc.) making it possible to compare values, interpret and achieve the set objectives. It allows the creation of iso-concentration curves (isoclines) that will indicate the fluctuation of a pollutant in space and time.

6.2.4.4 Preparation of a monitoring strategy

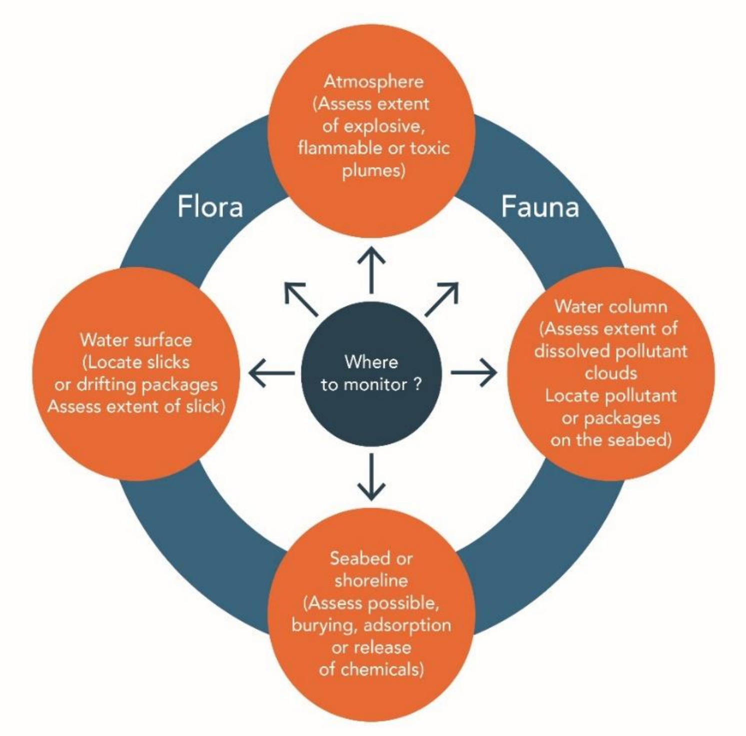


Figure 36: Environmental compartments and corresponding measurement objectives

Depending on the objective and behaviour of the chemical, the proper method for sampling or analysing will need to be selected.

Monitoring can occur at different stages of the incident management, from the very beginning after the HNS spill up to Post-spill stage, and can be implemented under various ways. It is essential to select the type of measurement: what must be monitored with what type of detection device? The target product should be the chemical spilled or, when not possible or more relevant, any other chemical or biological indicators and reflecting the level of pollution. The analytical method used should reflect the presence of pollutant. A critical analysis must be done on the results to determine whether they accurately reflect reality. For example, interfering compounds or parameters may cause the output to vary. Field data can be collected either by in situ analysis or by sampling followed by analysis in the laboratory. During the response phase it is important, possibly urgent depending especially on the spilled substance, to perform measurements to assess the situation and decide on suitable counter-measures.

Beforehand, it is important to have identified, within the contingency plan or at least during the planning stage, procedures and resources able to perform analysis, for instance with sampling protocols, guidelines or expert input. Three main types of strategy, if possible combined, can be used to establish an impact assessment following an HNS spill:
comparison of post-incident data with pre-incident data;
comparison of data from impacted sites with data from reference sites;
analysis of post-incident data monitored over a period of time to describe the recovery process.

Once the monitoring strategy has been decided, sampling should be performed as soon as possible as preserving sample may be possible (for instance by freezing them) before determining a parameter to be measured at a later stage.

Selection of type of detection
5.22 Remote sensing technologies
5.25 Portable gas detectors for first responders
5.26 Sampling techniques and protocols
5.27 HNS detection and analysis methods

6.3 Response techniques

When intervention is possible, different response techniques can be used depending on the behaviour(s) and the hazard(s) of the substances released. The range of counter pollution measures to be applied depends on the type and characteristics of the pollutant, the form in which it is transported, as well as the overall situation (vessel status, weather conditions, environmental sensitivities). Nevertheless, in all cases, their main goals are to minimise the risks created by the incident, to protect people, the environment and human activities, and to restore the affected zone to as close as possible to its pre-emergency conditions.
6.2 Environmental restoration and recovery
If the risk for operators is high, the option of leaving the pollutant in the environment must always be given consideration and, if safe, a monitoring plan could be put in place (See **5.6.2 Monitoring**).
5.36 Maintain in the environment and monitoring
If intervention is considered feasible, response techniques could be divided in two categories:

- vessel-oriented actions, namely interventions on the stricken vessel;
- pollutant-oriented actions, control dispersion, spreading/diffusion and recovery of the pollutant.

6.3.1 Vessel-oriented actions

These are generally among the first actions to be considered. The suggested techniques can generally be applied regardless of the behaviour of the substances involved. The status of the ship, the hazards of the substance(s), the environmental and weather conditions and the availability of the means and the necessary equipment are key considerations in this phase.
5.28 Emergency boarding
5.29 Emergency towing
5.30 Places of refuge
5.31 Cargo transfer
5.32 Sealing and plugging
5.33 Wreck response

6.3.2 Pollutant-oriented actions

Techniques to control the pollutant, its dispersion, spread and diffusion will depend on the location of the incident: open sea, harbour or coastal area. Controlled release tends to be applicable in the open sea, far from populated or sensitive areas, and can be applied regardless of the behaviour of the substance involved. Techniques for the reduction and control of vapours (water curtains and use of foams) can be applied both in port areas and in coastal areas, especially to protect the nearby population, as well as in the open sea, to allow intervention by the response team.
5.34 Using water curtain
5.35 Using foam
5.36 Maintain in the environment and monitoring
Response actions to contain and recover pollutants spilled in marine environment are highly dependent on the behaviour and the hazards of the substance(s) involved. In general terms, containment and recovery are possible especially in the case of substances that float or sink as their

main behaviour. In general terms, containment and recovery can be effective if the substance remains at sea for more than a few days, otherwise it is useless to plan such operations, considering the time needed to reach the area with the necessary equipment.

5.37 Using sorbents

5.38 HNS response in the water column

5.39 HNS response on the seabed

5.40 HNS response on the shore

5.41 Packaged goods response

5.42 Containment techniques: Booms

5.43 Recovery techniques: Pumps and skimmers

Above all, response actions involving the recovery of products on board the ship or spilled at sea will determine the production of waste, whose management must be taken into consideration well before the response techniques are put in place. It is important that waste management is included in the contingency plan with consideration of all the phases of the waste cycle: recovery, storage, transport, treatment, and disposal of waste.

4.4 Waste management

Intervention on marine wildlife should always be taken into consideration; marine wildlife can be affected by a spill of HNS. The intervention protocols are in many cases similar to those followed during an oil spill emergency (Cedre, 2013c)

5.44 Wildlife response

FACT SHEETS

List of fact sheets

FACT SHEET 2.1

GESAMP hazard profiles

The Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP) is an advisory body, established in 1969, that advises United Nations (UN) bodies on the scientific aspects of marine environmental protect.

GESAMP evaluates Environmental Hazards of Harmful Substances (EHS) and aims to:

- provide human health and safety criteria to assist in the assignment of transport requirements for each substance, in accordance with the IBC Code;
- contribute to protecting the marine environment from the impacts of operational discharges or accidental spills from ships;
- establish hazard end-points which assist IMO in regulating the transport of bulk chemical cargoes.

To achieve this, each substance listed in the IBC Code has a "Hazard Profile" addressing 14 human health or environmental effects (Table 10). The GESAMP hazard evaluation procedure was specifically developed for the maritime transport of bulk liquid chemicals, but it is in line with the Globally Harmonized System of Classification and Labelling of Chemicals (GHS).

	Hazard criterion	**Comment**
A- Bioaccumulation and Biodegradation		
A1	Bioaccumulation	Measures the tendency of a substance to bioaccumulate in aquatic organisms.
A2	Biodegradation	Used to identify substances with biodegradation characteris- tics (readily biodegradable ("RN") and not readily biodegra- dable ("NR"))
B- Aquatic toxicity		
B1	Acute aquatic toxicity	Toxicity to fish, crustaceans and microalgae, generally mea- sured in appropriate laboratory tests.
B2	Chronic aquatic toxicity	Reliable data on chronic aquatic toxicity, based on fish, crus- taceans and microalgae.
C- Acute mammalian toxicity		
Distinguishes lethal toxicity as a result of exposure through the following routes:		
C1	Oral toxicity	Measured in appropriate tests with laboratory animals, based on human experience or on other reliable evidence.
C2	Dermal toxicity (skin contact)	
C3	Inhalation toxicity	
D- Irritation, corrosion and long-term mammalian health effects		
Distinguishes toxicity as a result of the following:		
D1	Skin irritation/corrosion	Measured in appropriate tests with laboratory animals, based on human experience or on other reliable evidence
D2	Eye irritation	
D3	Long-term health effects	Carcinogenicity (C), Mutagenicity (M), Reprotoxicity (R), Skin Sensitization to skin (Ss)/Rrespiratory Sensitization system (Sr) , Aspiration hazard (A), Specific Target Organ Toxicity (T), Neurotoxicity (N) and Immunotoxicity (I).
E- Interference with other uses of the sea		
E1	Flammability	Rated according to a measured flash point with subsequent risk of flammability.

E2	Behaviour of chemicals in the marine environment and physical effects on wildlife and on benthic habitats	Behaviour in seawater, i.e. the tendency to form slicks or blanket the seabed, evaluated on the basis of solubility, mel- ting point, vapour pressure, specific gravity and viscosity.

Table 10: Hazard criteria/End-points used in the GESAMP Hazard Evaluation Procedure (Source: IMO, 2020)

Each substance's properties are listed on quantitative rating scales per category and often displayed in a single figure. The scales range from 0 ("practically non-hazardous" or "negligible hazard") to a maximum of 3 to 6, indicating an increasingly severe hazard.

The "GESAMP Composite List" (GESAMP, 2019) is issued annually. All substances are listed alphabetically by their assigned EHS name (and number) in concordance with the IBC Code. A Transport Reference Name and Number (TRN) are also given, as well as a CAS Number, if available. Details on rating criteria and information required to decipher abbreviations found in the GESAMP Composite List can be found in the "GESAMP Hazard Evaluation Procedure for Chemicals carried by Ships" (GESAMP, 2020).

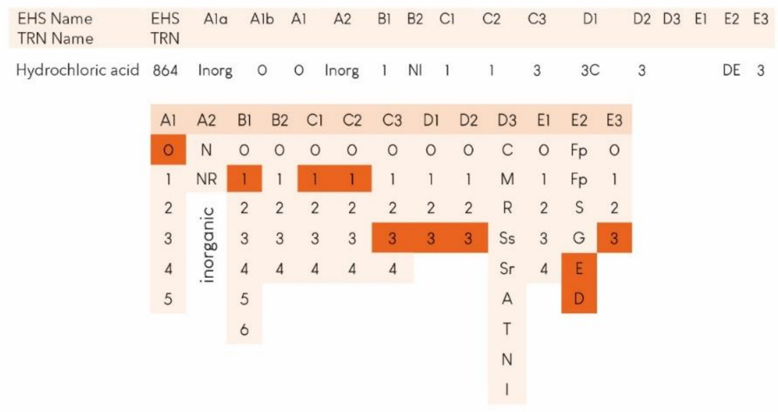


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Figure 39: Illustration of a GESAMP hazard profile for hydrochloric acid (CAS Number 7647-01-0)

Hydrochloric acid (CAS Number 7647-01-0) is an inorganic substance (A2), which is likely to dissolve and evaporate in seawater (E2 = D and E). It does not bioaccumulate (A1 = 0) and has "practically no acute aquatic toxicity" (B1 = 1), therefore there is no information listed on chronic aquatic toxicity (B2 = NI). Hydrochloric acid has slight oral (C1 = 1) and dermal (C2 = 1) toxicity but moderately high inhalation toxicity (C3 =3). It causes skin corrosion (D1 = 3C ("full-thickness skin necrosis following exposure up to 3 min")) and is severely irritating to the eyes with irreversible corneal injury (D2 = 3). Hydrochloric acid has a high potential to interfere with coastal amenities (E3 = 3).

FACT SHEET 3.1

Safety data sheet content

A Safety Data Sheet (SDS) is a compulsory document issued by the chemical supplier which provides information on chemical products that ensure their safe supply, handling and use. SDS is required to follow a 16-section format and includes information such as the properties of each chemical; the physical toxicity and ecotoxicity, hazards; protective measures; and safety precautions for handling, storing, and transporting the chemical.

This document facilitates the risk assessment for the use of the substance.

Section	Title	Description
Section 1	Identification of the subs-tance/mixture and of the company/ undertaking	1. GHS Product Identifier 2. Other means of identification 3. Recommended use of the chemical and restrictions on use 4. Supplier's details (name, address, phone number, etc.) 5. Emergency phone number
Section 2	Hazard identification	1. GHS classification of the substance/mixture and any national or regional information 2. GHS label elements, including precautionary statements. Hazard sym- bols may be provided as a graphical reproduction of the symbols in black and white or the name of the symbol (e.g. "flame", "skull and crossbones") 3. Other hazards which do not result in classification (e.g. "dust explosion hazard") or are not covered by the GHS
Section 3	Composition/ information on ingredients	1. Substance 2. Chemical identity 3. Common name, synonyms, etc. 4. CAS number, EC number, and other unique identifiers 5. Impurities and stabilising additives which are themselves classified and which contribute to the classification of a substance 6. Mixture 7. The chemical identity and concentration or concentration ranges of all ingredients which are hazardous within the meaning of the GHS and are present above their cut-off levels. 8. Cut-off level for reproductive toxicity, carcinogenicity, and category 1 mutagenicity is ≥ 0.1% 9. Cut-off level for all other hazard classes is ≥ 1%
Section 4	First aid measures	1. Description of necessary measures, subdivided according to the diffe- rent routes of exposure (i.e. inhalation, skin and eye contact, and inges- tion) 2. Most important symptoms/effects, acute and delayed 3. Indication of immediate medical attention and special treatment nee- ded, if necessary
Section 5	Fire fighting measures	1. Suitable (and unsuitable) extinguishing media 2. Specific hazards arising from the chemical (e.g. nature of any hazardous combustion products) 3. Special protective equipment and precautions for fire-fighters
Section 6	Accident Release measures	1. Personal precautions, protective equipment, and emergency procedures 2. Environmental precautions 3. Methods and materials for containment and cleaning up
Section 7	Handling and storage	1. Precautions for safe handling 2. Conditions for safe storage, including any incompatibilities

Section 8	Exposure controls/ personal protection	1. Control parameters (e.g. occupational exposure limit values or biological limit values) 2. Appropriate engineering controls 3. Individual protection measures, such as personal protective equipment
Section 9	Physical and chemical properties	1. Appearance (physical state, color, etc) 2. Odor 3. Odor threshold 4. pH 5. Melting point/freezing point 6. Initial boiling point and boiling range 7. Flash point 8. Evaporation rate 9. Flammability (solid, gas) 10. Upper/lower flammability or explosive limits 11. Vapor pressure 12. Vapor density 13. Relative density 14. Solubility 15. Partition coefficient: n-octanol/water 16. Auto-ignition temperature 17. Decomposition temperature
Section 10	Stability and Reactivity	1. Chemical stability 2. Possibility of hazardous reactions 3. Conditions to avoid (e.g. static discharge, shock, or vibration) 4. Incompatible materials 5. Hazardous decomposition products
Section 11	Toxicological information	1. Chemical stability 2. Possibility of hazardous reactions 3. Conditions to avoid (e.g. static discharge, shock, or vibration) 4. Incompatible materials 5. Hazardous decomposition products
Section 12	Ecological information	1. Ecotoxicity (aquatic and terrestrial, where available) 2. Persistence and degradability 3. Bioaccumulative potential 4. Mobility in the soil 5. Other adverse effects
Section 13	Disposal considerations	Description of waste residues and information on their safe handling and methods of disposal, including the disposal of any contaminated packa- ging
Section 14	Transport Information	1. UN number 2. UN proper shipping name 3. Transport hazard class(es) 4. Packing group, if applicable 5. Environmental hazards (e.g. marine pollutant (yes/no)) 6. Transport in bulk 7. Special precautions which a user needs to be aware of, or needs to comply with, in connection with the transport or conveyance within or out- side their premises
Section 15	Regulatory information	Safety, health, and environmental regulations specific for the product in question
Section 16	Other information	including information on preparation and revision of the SDS

Table 11: Risk assessment for the use of the substance

FACT SHEET 3.2

GHS vs UN TDG

The Globally Harmonized System of Classification and Labelling of Chemicals (GHS) and the UN Recommendations on the Transport of Dangerous Goods – Model Regulations (TDG) are the most important guidance documents on chemical hazard communication. Neither document is legally binding in any country.

The UN GHS Purple Book is a guidance document on the Globally Harmonized System of Classification and Labelling of Chemicals. It defines physical, health and environmental hazards of chemicals, harmonises classification criteria and standardises the content and format of chemical labels and Safety Data Sheets.

Figure 40: GHS pictograms

The UN Orange Book is the UN Recommendations on the Transport of Dangerous Goods – Model Regulations, a guidance document developed to standardise dangerous goods transport regulations. It forms the basis for most dangerous goods regulations such as the IMDG Code and IATA.

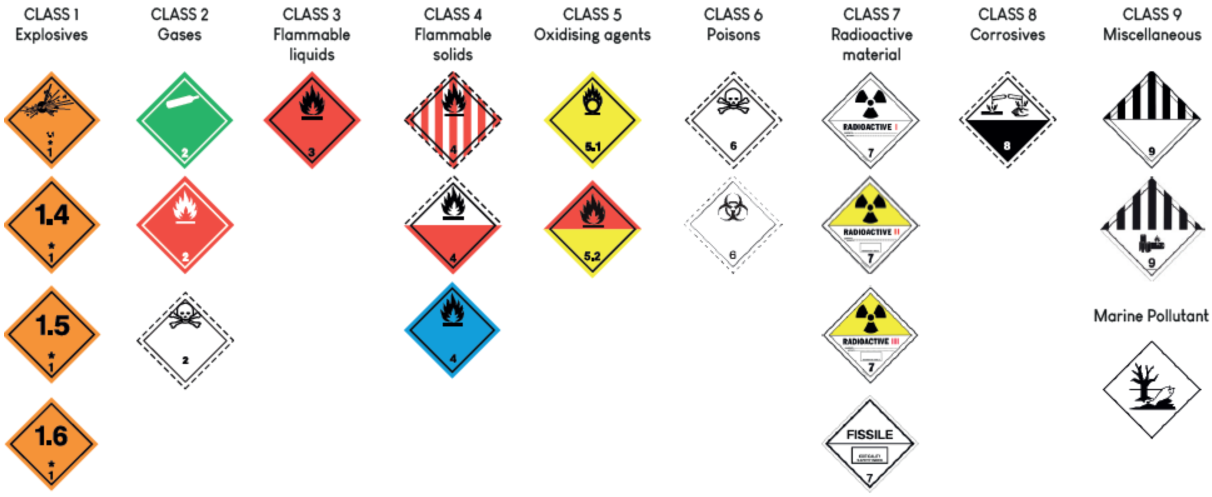


Figure 41: Classification of dangerous goods according to UN Recommendation

Hazardous chemicals vs dangerous goods

- **Hazardous chemicals** are chemicals meeting GHS classification criteria (GHS);
- **Dangerous goods** are chemicals and articles on the Dangerous Goods List or meeting dangerous goods classification criteria (TDG).

Most chemicals that are listed as dangerous goods are usually GHS-classified (and therefore hazardous chemicals) but not all dangerous goods are chemicals or GHS-classified (such as batteries or airbags).

	Transport of Dangerous Goods Model Regulation	**Globally Harmonized System of Classification and Labelling of Chemicals**
Alternative name	UN Orange Book	UN Purple Book
Purpose	Safe transport	Communicate chemical hazards to workers or recipients (occupational health and safety)
Scope	Dangerous, hazardous, and harmful substances, materials and articles	Chemical substances and mixtures
Classes	9 hazard classes	27 hazard classes
Hazard communication	• Hazard labels • Markings	• Pictograms • Signal words • Hazard and precautionary statements
Multi-layer packaging labelling placement	Outer package/ cargo transport unit	Inner package
Documentation	Dangerous Goods Manifest/ Declaration, Safety Data Sheet	Safety Data Sheet

Table 12: Hazardous chemicals vs dangerous goods

FACT SHEET 4.1

External communication

Information management is crucial to keep all external stakeholders and the general public informed and updated on the progress of the response and related matters. The communications team should be aware that different types of media will convey messages to different audiences. It is important to review the type of media utilised in order to ensure the best outreach for the target audience for every communication. This can include website updates, official press release statements and social media status updates, including photos.

Having an appropriate communication plan prior to an event improves the dissemination and quality of the response by the communication team. It is essential to have a set of engagement rules and pre-prepared statement templates. Therefore, the contingency plan should include a list of external outlets with which to communicate, such as local government, journalists, environmental groups, etc. This list should be kept updated by the communications team. Having a reliable online presence on social media prior to a crisis can help successfully share information during an event.

Figure 42: Communication plan

Important rules to note:

Appoint spokesperson

A communication plan should appoint a single person to be the spokesperson during a response. This person should ideally undergo media training prior to an incident and be experienced in public speaking.

All official enquiries should be directed to the spokesperson.

Communicate early and often

Rumours or fake news can spread fast in the absence of readily available, accurate infor- mation. Therefore, com- municating early on in a response can reduce the spread of false informa- tion. Keeping all external stakeholders and the general public updated on the progress of the response will affect how response efforts are per- ceived.

Keep it concise

Information must be concise. This is particu- larly important in the age of social media where short snapshots of infor- mation are favoured. Indeed, most social media platforms encou- rage succinctness, limi- ting the lengths of state- ments or allowing only short videos. The key points of the message should be conveyed in easy to understand, non-specialist language as efficiently as possible.

Stick to the facts

Only true and verified information should be shared. However, it is important to keep in mind that whenever limited information is available, communi- cation might still be necessary, to inform the public of the actions taken so far. Partial or incomplete information from verified sources can sometimes be preferable to no information at all. However, unverified information should never be released.

Figure 43: Key issues relating to external communication - © ITOPF

4.2 Press conferences

The relationship between the media and the response effort

Different types of media, and their various sources, can influence numerous aspects of a response. Irrespective of whether a well-defined or poor media strategy was in place, media can have a huge impact throughout the incident, influencing many facets of a response. At the beginning of a response, the impact is more direct and immediate on strategy and operational aspects and the media has a duty to communicate facts and highlight societal issues. Furthermore, increased accountability of the stakeholders involved in the response will have a major positive impact on the effectiveness of the response. As the response moves into the project management phase, the media interest usually starts to decrease. However, reporting of the potentially negative impacts of a spill on human health, the environment and socio-economic resources means that it is often too late to counteract certain perceptions of damage which may lead to non-genuine claims.

This balance is difficult to achieve, and the communications team needs to be well trained to address these types of issues when they arise.

FACT SHEET 4.2

Press conferences

Drafting a press release and organising a press conference
Aim of organising a press conference: deliver a clear and managed message to a target audience.

Press statement
A press release statement is a tool that must be included in a contingency plan; it allows a pre-determined, concise message to be delivered to a wide range of media outlets to quickly and efficiently disseminate information. As with all external communication, any press statement should be approved by the On-Scene Commander (OSC) and the communications team.
→ **4.1 External communication**

Things to consider when drafting a press statement:
- answer the questions relating to the event: Who? What? Where? How?
- be concise, stick to the facts;
- use simple, straight-forward and non-specialist language;
- use a tone that reassures the end-user;
- provide contact details for all media and public enquires to allow your organisation to manage the incoming information efficiently.

Don't forget: the time, date and reference number of the statement release

Press conferences
Press conferences should be organised by the communications team with the approval of the OSC.

- Media outlets need to be invited and a presentation or statement should be prepared ahead of time to provide an update on the situation and as many facts as is appropriate to give a clear understanding of the situation.

- A spokesperson, who has adequate media training, should be appointed to deliver the press conference. However, questions may arise that are best answered by experts/specialists, who should therefore be part of the speaker panel. If this is the case, a moderator for the panel should be appointed.

- As with all external communication, all parties must be briefed on the key points and on the facts that have been checked to be released to external parties.

- Keep the communication channels open with the public and the media but direct them through your approved channels to ensure your organisation has as much control as possible to sort and prioritise queries.

- Try to provide regular press conferences to give updates throughout the response and provide a platform for the public and the media to ask questions.

→ **4.1 External communication**

Things to consider when planning a press conference:

- make a clear and planned opening statement summarising the key facts;
- be clear and concise;
- direct any questions requiring expert knowledge to the appropriate person on the panel;
- allow a fixed number of questions or set a specific time frame for questions (e.g. 5 questions/20 min);
- prepare for challenging questions from the media, and keep answers factual;
- anticipate questions and prepare answers;
- do not speculate, or answer questions outside your competence;
- limit the whole conference to an hour/hour and a half at the most to ensure key messages are not lost.

Questions to consider before the conference:

What happened? What has been affected?	Has anyone been injured? Who is going to pay for the response?	What caused the incident? What is being done to solve the situation?	Who is responsible for the incident? What are the risks for the local population?
What are the risks for the environment/ socio-economic factors?	What are the long-term risks of the substance spilled?	Could the accident have been avoided?	Who is involved?

Social media

Social media can intensify the pressure for official outlets to provide information and to keep up with information shared online. It is important to be proactive in the world of social media and act as a reliable and consistent source of information during an event. In relation to press conferences, the communications team should use social media to advertise the details of the press conference and distribute highlights from the press conference in a clear and concise manner. This will encourage the public to seek information from official rather than alternative sources.

FACT SHEET 4.3

Internal communication

During the emergency phase of a crisis, internal and external communication can be very challenging. Below are some common issues that arise, and ways to reduce their impacts on internal communication.

Lack of awareness of responsabilities	**Overwhelming incoming requests for information**
Having a developed and up-to-date communication plan prior to any crisis is essential to ensure roles and	Having a dedicated communication team is essential to prioritise key information received from various

responsibilities are already defined. Each assigned team member should be aware of their role and have received adequate training prior to an event to allow them to fulfil the role competently.	stakeholders. Information should be delivered to all parties simultaneously in a controlled manner, and not delivered piecemeal with each request.
Getting information to where it needs to go A clear communication path is required to allow information to be delivered where needed across all internal teams efficiently. The communication plan should outline how updates and essential information is delivered to different teams so that a clear path of internal information transfer is outlined.	**Lack of meetings/openness with information** Regular and consistent updates across the internal team is crucial to ensure the response is well coordinated and informed. Meetings and briefings provide good opportunities for the communication team to deliver key messages which ensure a high level of understanding across the team. Liaison officers might ensure that rapidly changing developments are communicated effectively.

Figure 44: Main issues relating to internal communication

On-site communication

The transmission of information between responders and transmission to the On-Scene Commander (OSC) must be considered and prepared. Communication plays a key role in safety issues in the field throughout the various steps of the response.

Indeed, clear transmission of information is required, especially in the case of HNS for which a single letter in the name of a chemical can change everything. The use of the international alphabet for transmission of key words is recommended as well as asking the receptor to repeat information to ensure it has been received correctly.

During the response, responders should be able to communicate with team members. This might be possible for instance with type 1A suits equipped with bluetooth communication or by using agreed hand signals.

On site communication, SCOPE exercise 2017

Incident management team communication

The Incident Commander is responsible for implementing a communication plan that keeps all stakeholders informed. All information needs to be prioritised and filtered across the response team by a team dedicated to communication, ensuring that adapted, standardised and factual information is provided to all relevant parties in a timely and clearly transmitted manner. This communication can use a variety of means and tools including Very High Frequency (VHF) radios, emails, phone calls, text messages or any other applicable methods. It also includes Pollution Reports (POLREPs) to convey updates about the observed pollution.

<u>→ 5.1 Incident notification</u>

These procedures need to be appropriate for team members in an office setting, as well as for those in the field on aircrafts, vessels or in remote locations. Therefore, suitable methods may be team-specific.

Internal communication will aim at:

- **informing** all stakeholders of the current situation and the process for communication channels;
- **outlining** the roles and responsibilities of each team within the response, and what is expected of them;
- **advising** by providing reliable advice on how to act in different situations regarding communications.

Communication plan

Information can be overwhelming for decision-makers during a crisis; a clear approach is required to allow information to be sifted through, organised and responded to in an appropriate and timely manner.

FACT SHEET 4.4

Waste management

Objective

The waste management strategy must be established at the start of the response. The key objectives of all provisions relating to hazardous waste management are the protection of human health and the environment against harmful effects throughout the different stages of waste management:

- recovery;
- storage;
- transport;
- treatment;
- upgrade or waste disposal.

Applicability

Waste can be generated during recovery, dredging or decontamination operations. The HNS spill itself can kill/contaminate flora and fauna and generate –sometimes huge– volumes of contaminated biological waste (animal carcasses, dead algae…).

Response strategy	Type of waste generated
Pumping, skimming and dynamic recovery	Recovered HNS Contaminated water Water-in-HNS or HNS-in-water emulsion Contaminated flotsam
Recovery with sorbents	Contaminated sorbents
Containment and recovery on the seabed	Recovered HNS Contaminated sediments
Decontamination of personnel and equipment	Contaminated water Contaminated material/PPEs Equipment that is difficult to decontaminate
Fire fighting	Fire-extinguishing water Cargo residues Burned-out containers
Recovery of damaged containers/tanks of HNS	Debris Hazardous and non-hazardous cargoes Improperly packaged HNS
Manual or mechanical recovery on the shoreline	Improperly packaged HNS Contaminated sediments Contaminated debris Contaminated sorbents Contaminated water Recovered HNS mixed with sediments

Table 13: Types of waste that may be generated in the case of a maritime HNS spill

Recovery/storage

Waste minimisation must be a permanent objective during response operations.

Waste segregation must also be emphasised as early as possible on the response sites. If waste is contaminated with one chemical/product, refer to Section 7 (Handling and storage) of the →**3.1 Safety**

data sheet content. In the case of a mixture of chemicals, expertise from industrial hazardous waste specialists is required.

Contaminated materials may be sorted into the following categories:
liquid;
solid;
non-biodegradable (contaminated plastics, contaminated clean-up equipment…);
biodegradable (contaminated seaweed, fauna).

In terms of waste storage, different options can be used depending on the location, the volumes of waste to be recovered, the chemical properties, the state of the waste (liquid, solid) and the hazard level.

When planning at-sea recovery, it is important to consider the waste storage capacity of the vessels used. If required, auxiliary tanks or containers can be installed on deck. In other cases, floating storage tanks can be towed. → **4.5 Response vessels**

Waste is then transferred to shore, to treatment units or to temporary land-based storage sites.

On the shoreline, temporary storage sites are also required in the vicinity of the clean-up worksites, for the immediate deposit of the generated/collected waste before their transfer to a treatment unit or an intermediate storage site. These sites should be equipped to contain leaks and rainwater.

Established at the start of the response, temporary storage sites should be accessible by road and should also be located as far as possible from homes, environmentally sensitive areas and watercourses.

Storage capacities on the deck

Regardless of the type of storage considered, equipment should be:

- resistant;
- composed of materials compatible with the chemicals recovered;
- impermeable and equipped with a closing device;
- equipped with a level monitoring device (or sufficiently transparent to allow visual monitoring) in order to prevent overflow and anticipate the replacement of the container;

- equipped with a base valve for decanting;
- stowable, crane-liftable and transferable.

Transport

In terms of waste transport, it is necessary to:

- take into account the characteristics and hazard level of the waste;
- ensure compliance with transportation of hazardous goods and waste legislation (ADR by road, RID by train, etc.);
- award contracts to companies that are registered waste carriers and that have appropriate equipment and trained drivers.

Waste treatment and disposal

Treatment and disposal processes include methods by which chemicals and chemical-contaminated waste are valorised, eliminated or disposed of. Such methods are normally applied after the response phase. These techniques are performed at specifically licensed facilities after transportation of the hazardous materials.

The main waste treatment options are outlined below:

Industrial use:

- If the cargo recovered during response is unspoiled, it can be transported to the industrial firms concerned for normal use, after having undergone the relevant legal procedures.

Re-use/waste upgrading:

- The possibilities of upgrading waste will depend on three factors: the type of waste, the degree of pollution and the existence of suitable upgrading solutions. Several options exist, such as distillation and refining for solvents, energy production for certain flammable wastes and recovery for metals.

Biological treatment:

- It is possible to use micro-organisms that are able to break down certain chemical products such as chlorinated compounds or nitro compounds, alcohols or organic acids.

Thermal treatment:

- collected waste can be sent to special industrial waste incineration plants. In addition to energy recovery, this option has two further advantages: it decreases the volume of waste and reduces the hazardous nature of the substances involved;
- the atmospheric and aqueous discharges generated by this activity undergo different treatments and are strictly controlled before being released into the environment. Meanwhile, incineration residues, such as mud and clinker, are sent to specialised landfill sites.

Physico-chemical treatment:

- some waste is neutralised by stabilisation. An initial solution involves incorporating it with a mineral substance such as lime, cement, clay or activated carbon. Through this process, the waste forms clusters of varying sizes. This type of treatment is cost-effective but has the drawback of increasing the volume of waste;
- there exists an alternative, known as vitrification, whereby the waste is melted at a high temperature (between 1,200°C and 4,000°C according to the process) to form a glass matrix. It is then moulded into ingots or granules. This technique requires investments in substantial equipment and involves non-negligible energy consumption. It does however considerably

reduce the volume of waste. Stabilised waste can in some cases be buried.

Burial:

- at appropriate storage centres (landfills). Waste burial is subject to increasingly tight regulations.

FACT SHEET 4.5

Response vessels

Objective

Advice on main capabilities and characteristics of response vessels to be sent to the incident area, taking into account the purposes they must fulfil in the area of the accident (monitoring, search and rescue, clean up).

Generality

The response vessel typology to use for responding to an HNS spill should be chosen carefully, and in accordance with the strategies detailed in the contingency plan; depending on political willingness, it is important to bear in mind that these dedicated vessel are quite expensive both in construction and maintenance but have high value in an HNS incident.

Many aspects need to be considered, including:

- sea state in which the vessel can navigate; therefore, if use is foreseen in open sea or in harbours;
- minimum depth for navigation (draught) (shallow or deep waters);
- minimum crew required;
- width of freeboard where required to work;
- mobilisation time and availability of vessel to arrive in involved area;
- response activities that the vessel must carry out, especially:
    - search and rescue,
    - detection & monitoring,
    - towage,
    - containment & recovery;
- consequently, equipment needed on board.

Due to the high costs of HNS response vessels, they are generally multipurpose.

Characteristics of a response vessel

If a vessel is to navigate in areas with a potentially toxic and dangerous atmosphere, its superstructure must be air-tight and at positive pressure and, most of all, clean air must be provided with filtering systems to accommodate the ship's crew during operations.

Different kinds of vessel with different designs could be used:

- **tug boats**: bollard pull is the most important measure; size and power must be sufficient for towage. There are harbour and ocean-going tugs, respectively used to tow a vessel out of a harbour or to tow it to a sheltered area →**5.30 Places of refuge**. A specific example of a tug boat is the Emergency Tow Vessel (ETV), a multi-purpose boat used by state authorities to tow disabled vessels on high seas;

→5.29 Emergency towing

- **purpose built at-sea response vessels** (with sweeping arms, dispersant spray arms, skimmers, pumps, storage tanks, etc.): some such vessels have a substantial towing capacity;
- **offshore supply vessels**: a ship specially designed to supply offshore activities (mainly oil and gas platforms);
- **vessels of opportunity (VOO)**: boats usually used for other purposes (fishing, charter, etc.) utilised during an oil or HNS emergency. In general terms VOOs are defined as "Any vessel in the vicinity of the casualty vessel which may be able to provide assistance but is not formally part of the responsible authorities official response plan".

Purpose built at-sea response vessels with oil and HNS response capabilities


Oil tanker equipped by EMSA with oil response equipment

The characteristics of a HNS response vessel will depend on the activities that it must carry out. Vessels might need to be equipped to:

- provide medical care;
- detect and monitor pollutants, see **Chapter 5.6.2**;
- fight various types of fires (water/mist/foam);

→5.34 Using water curtain
→5.35 Using Foam

- contain and recover floating pollutants using booms and skimmers and suitable storage tanks, possibly with a heating (or cooling) system;

→5.42 Containment techniques: Booms
→5.43 Recovery techniques: Pumps and skimmers
→5.37 Using sorbents

- recover containers and other goods lost at sea (using cranes, cradles, etc.) and provide sufficient deck storage capacity for such debris.

→5.41 Packaged goods response

- perform underwater operations using divers or ROV in case of sunken chemicals or containers

→5.39 HNS response on the seabed

- decontaminate personnel and equipment at the end of operations

→5.21 Decontamination

- store large amounts of solid/liquid waste from clean-up operations and decontamination

→4.4 Waste management

- launch small craft to transfer personnel from/to the casualty

EMSA (European Maritime Safety Agency) conducted a study aimed to propose vessel design and equipment requirements to operate in a range of scenarios in order to provide a safe platform for responders and any crew from the vessel involved in an HNS incident. Study proposes criteria for adaptation of different ship typologies in case of an HNS incident.

The level of design requirements needed for the vessels responding to HNS incidents in a safe manner is established on the basis of the potential hazards of the chemical substances and the consequent scenario as well as safety zones in which vessel is to navigate (H= High risk; M= Medium risk; L= Low risk) 5.19 Safety zones. The hazards taken into consideration are:

- flammable/explosive leak;
- fire;
- health hazard/toxic;
- cryogenic/gas under pressure;
- corrosive

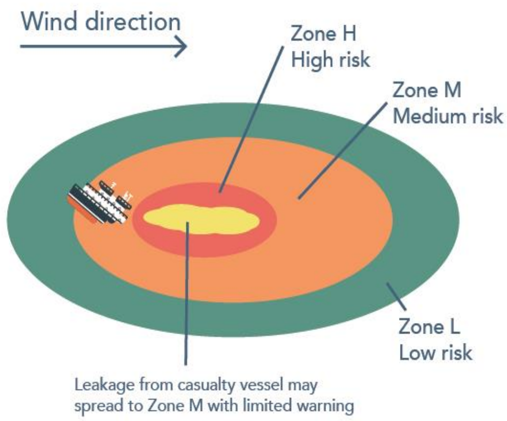


Figure 45: Zoning of incident area

Vessel response			Zone applicability
Type	Description	Requirements	
1	Vessel to approach (not to enter zone M or H). Main functions are: monito- ring of situation and on-site control	Vessel will not require protective or spe- cialist equipment, remaining at a safe distance from the hazards	L (low risk)
2	Vessel to approach (not to enter zone H) and deliver and recover response teams and rescue crew members by deployment of boats into zone M	Vessel will need to have some level of decontamination and medical facilities	L&M (low/medium risk)
3	Vessel to enter in hazardous environ- ments, deliver response teams and rescue crew members	Vessel will have limited additional pro- tection to allow it to operate in zone M and in exceptional circumstances also in zone H	M & limited H (Medium/high risk)

4	Vessel to enter in hazardous environ- ment, deliver response teams and rescue crew members and recover hazardous substances	Vessel will have highest level of protec- tion to operate for long periods in the high risk zone H. It should be specifically designed for this role	H (high risk)

Table 14: Vessel response according to zone mapping (source EMSA, 2012)

FACT SHEET 4.6

Acquisition and maintenance

Objective
To provide guidance on the acquisition and maintenance of pollution response equipment

Determining the risks for which equipment is purchased
Any procurement process for pollution control equipment must begin with the identification of the specific pollution risks: what type of pollution is likely to occur? Where are the potential pollution hotspots and what circumstances might lead to such pollution incidents? This type of risk assessment forms the basis of an HNS contingency plan. The pollution response equipment purchased should be part of the mitigation measures addressing the identified risk.

When choosing pollution response equipment, it is important to ensure that the equipment is suitable for the anticipated environmental conditions, meets chemical compatibility criteria and fulfils the specific conditions of use (for instance explosive atmosphere). It is interesting to look into past experience on the use of specific equipment intended to be purchased and to check whether tests conducted by the manufacturer were performed under near-real conditions.

Conditions of use
When choosing equipment, in general terms, it must be suitable for use in the specific conditions reported in the contingency plan. It is then important to evaluate where the equipment could be employed:

- **exposed areas** (open ocean): heavy-duty equipment suitable for rough weather conditions (swell, wind) and capable of collecting and storing large quantities of pollutant;
- **sheltered areas** (coastal, harbour): intermediate-sized equipment;
- **shoreline**: portable equipment.

Adaptation to the type of pollution

- **fire/explosion hazard**: if the flash point of the product is close to ambient temperature, it is advisable to use equipment that does not cause the substance to ignite (ATEX or Ex-proof certification);
- **compatibility of materials**: the pollution response equipment must be compatible with the spilled/recovered substances;
- **behaviour of the pollutant**: the equipment must be suited to the expected behaviour of the pollutant:
  - gas or evaporator: vapour reduction equipment;

→5.34 Using water curtains
→5.35 Using foam

  - floater: containment, skimming, transfer, storage equipment;

→5.37 Using sorbents
→5.42 Containment techniques: Booms
→5.43 Recovery techniques: Pumps and skimmers

  - dissolver: pumping of the water body and in situ treatment unit or equipment (in very confined environment);

→5.38 HNS response in the water column

- sinker: containment on the bottom, pumping on the bottom;

→**5.31 Cargo transfer**
→**5.33 Wreck response**
→**5.39 HNS response on the seabed**

- **sampling and detectors**: choose on the basis of chemical and physical properties of pollutants and depending on environmental matrices to be collected.

→**5.25 Portable gas detectors for first response**
→**5.26 Sampling techniques and protocols**

Indirect costs

In addition to the purchase cost of equipment, the following indirect costs must be considered:

- use of the equipment: complete list of all the necessary tools (e.g. crane to place it in the water; system for its towage, etc.);
- training of personnel to ensure the safe and effective use of the equipment;
- regular operational maintenance (qualified personnel, consumable and replacement parts, preventive/corrective maintenance, etc.);
- appropriate storage facility;
- shipment to and deployment of the equipment on site (during an incident or for exercises);
- disposal of contaminated materials →**4.4 Waste management**.

Sharing of equipment

Given the high direct and indirect costs of pollution response equipment, sharing of assets might be considered via an agreement for rapid provision of all or part of the necessary equipment by a storage cooperative, response company or equipment storage centre.

When stockpiles are placed in strategic locations accessible by multiple regions/countries it is important to ensure, for their common use, that:

- regional/bilateral/multilateral agreements are in place;
- transfer/shipping of equipment is pre-arranged (customs clearance, etc.);
- equipment is maintained and personnel are trained.

Equipment maintenance

Equipment to respond to an HNS spill is very delicate and expensive and, when required, it must be ready for use. Equipment maintenance is often overlooked but plays a fundamental role for two reasons:

- it guarantees operational readiness for the rare occasions on which it is required;
- it ensures economic savings by extending the lifetime of expensive equipment.

The use of such equipment can be sporadic and it can remain stored in the warehouse for long periods of time. Therefore, it is recommended to plan regular operational maintenance, conducted by qualified personnel, which also includes the implementation of tests. Equipment should be stored in suitable places, in accordance with the manufacturer's recommendations.

It is important to keep the response equipment maintenance log up-to-date. This log should include information on the use of the equipment (reason, dates, number of hours of use, etc.), and its maintenance (dates of maintenance actions, references of parts replaced, etc.).

FACT SHEET 5.1

Incident notification

Ship reporting systems and requirements (vessel to nearest coastal state)
Under MARPOL 73/78 as amended, it is the master's (or shipowner's) duty to report incidents involving a discharge or probable discharge of oil and/or HNS to the nearest coastal state. Incident reports can also be produced by responding or passing vessels. The standard reporting format is described in IMO Resolution A.851(20) (1997), as amended by Resolution MEPC.138(53) (2005), which differentiates between:

- Harmful Substances report (HS) for spills of oil and noxious liquid substances in bulk
- Packaged dangerous goods report (DG)
- Marine Pollutants report (MP)

Such reports should include information about the vessel (name, location, etc.) but also the type of oil or correct technical name of HNS on board/discharged/lost, UN number/IMO hazard classes, pollution category, type of packages, names of manufacturers where known, quantity on board/lost, whether substances are floating or have sunk, cause of loss, estimation of the surface area of the spill, name and number of the ship's owner and representative, measures taken so far.

International reporting between coastal states
Pre-agreed emergency communication channels (such as SafeSeaNet and CECIS Marine Pollution (EC, 2020) in Europe) might be used between Contracting Parties to alert –and request assistance from– other countries when a maritime pollution incident has occurred or when a threat of such is present (also see REMPEC (2018)). The standard POLREP used for this purpose is divided into three parts:

- **Part I or POLWARN** (POLlution WARNing): gives first information or warning of the pollution or the threat;
- **Part II or POLINF** (POLlution INFormation): gives detailed supplementary information as well as situation reports;
- **Part III or POLFAC** (POLlution FACilities): is used for requesting assistance from other Contracting Parties and for defining operational matters related to the assistance.

Pollution observation report
If a pollution report does not originate from the polluting vessel, but for instance from a surveillance aircraft, the message format will comply with the country's national or regional reporting standard for aerial surveillance (such as Bonn Agreement (2017) for oil).
Such observation reports are unlikely to include exact information on the type and volume of the substance(s) spilled (e.g. UN number) and/or the vessel/cargo owner. Further investigation is therefore required to complete a →**5.5 Situation assessment**. Pollution observation reports play an important role in gathering photographic evidence (if possible) of the pollution and obtaining a better understanding of the fate/behaviour, extent and trajectory of a pollutant; therefore, it is crucial that aerial surveillance is conducted by trained and experienced observers.

FACT SHEET 5.2

Incident data gathering

It is essential that the following information be obtained as soon as possible in order to assess the situation.

Table 15: Information gathering

Information	Source
BASIC INFORMATION	
Name of vessel, IMO Number, MMSI (Maritime Mobile Service Identity), GT (Gross Tonnage), DWT (Dead Weight Tonnage), vessel owner	Ship Captain, Coast Guard, Mari- time Rescue Coordination Centre (MRCC), Navy, Salvors, Harbour master's office
Date and time of incident (LT/UTC)	
Position (latitude/longitude)	
Number of crew (including health status)	
Cause of the incident (e.g. collisions, grounding, explosion, fire, etc.)	
Nature of damage	
Status of vessel and response operations as well as actions taken so far	
Cargo on board and description of pollution or dangerous car- go lost overboard/spilled	
CARGO - HNS	
Cargo Certificate/Shipper's Declaration/Dangerous Goods Declaration, SDS →3.1 Safety data sheet content	Ship owner, cargo owner, P&I Club and correspondents, manufacturer, port authorities from last port of call
UN or CAS number, state of chemicals: solid, liquid, gas, bulk, packaged	
BUNKERS	
Bunkering Certificate	Ship owner, cargo owner, P&I Club and correspondents, manufacturer
Main characteristics: density, viscosity, pour point, distillation characteristics, wax & asphaltene content and volume	
Distribution of cargo/bunkers/location relative to damage using the ship's General Arrangement Plan	
POLLUTION OBSERVATION REPORT	
Pollution observation: pollution incident report by the vessel, pollution observation report by authorities/general public	→5.1 Incident notification

During an HNS incident it is crucial to obtain verified details about the spilled substance's correct name and its properties. Shipping documents such as Cargo Certificate/ Shipper's Declaration/Bill of Lading/Dangerous Goods Declaration and the appropriate SDS are the best initial sources of information for substance-specific information. However, other resources might be needed to supplement the official documents available →**5.3 Information resources**. This type of documents is available from the ship/ship owner/cargo vary and might be dependent on the legal documentation requirements associated with the cargo itself and its mode of transport.

One crucial piece of information to find is the manufacturer's contact details, which might be needed to obtain the most recent and up-to-date SDS (or other substance-specific information).

The information available for a cargo is dependent on the type of vessel they are transported in (**Chapter 2**). Figure 46 below specifically highlights the sources for each key piece of information for each vessel type.

Figure 46: Summary of applicable sources of information available by cargo type

Key information	Containerised Cargo	Tanker	Bulk Carrier	Source
Exact Cargo Name	Bill of Lading	Bill of Lading	Bill of Lading	Shipper/Consignee
Exact Cargo Properties	Safety Data Sheet	Safety Data Sheet	Safety Data Sheet	Manufacturer
Summary	Dangerous Goods Declaration/ Cargo Manifest	Cargo Certificate/ Certificate of Origin	Shipper's Declaration	Shipper/Consignee
Location on board	Stowage Plan	Tank Arrangement Plan	Cargo Stowage Plan	Ship

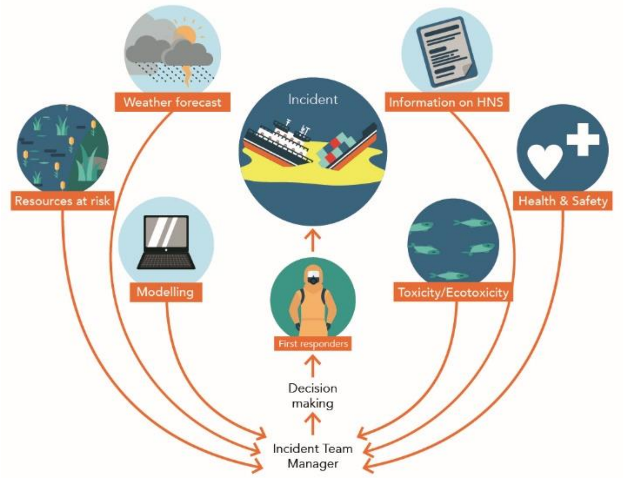
The **Bill of Lading** is a legal document acting as proof of receipt for the cargo on board, proof of transport agreement and title of ownership. It is issued by the carrier to the shipper and specifies the **original and specific cargo name**, type, quantity, and destination of the goods being transported.

FACT SHEET 5.3

Information resources

Shipping documents such as the Cargo Certificate/Shipper's Declaration/Dangerous Goods Declaration and the appropriate SDS and IMO code are the best initial sources to obtain substance-specific information. However, other resources might be needed to supplement the official documents available. Some information resources are listed below.

Figure 47: Information resources



Detailed information on HNS

- eChemPortal provides information on the properties of chemicals, biocides and pesticides including links to information prepared for government chemical programmes at national, regional, and international levels (including ECHA, 2020) (OECD, 2020);
- HNS-MS is a web-based decision support tool, composed of an HNS database, vulnerability maps and a 3D model to forecast the drift, fate and behaviour of acute marine pollution by HNS (DG ECHO, 2017);
- MARine Chemical Information Sheets (MAR-CIS) provide substance-specific and maritime-relevant information on chemicals, aimed at assisting the competent authorities during the initial stage of the response to maritime incidents involving such substances. They are available to EU Member States via log-in;

- Chemical Reactivity Worksheet (CRW) is software by EPA and NOAA that indicates the possible hazards due to mixtures of chemicals (CCPS, 2019).

Web-based response guides

- MIDSIS TROCS developed by REMPEC (2020);
- CAMEO Chemicals developed by NOAA (2018).

Modelling →**5.11 HNS spill modelling**

- CHEMMAP: fate and behaviour modelling (aquatic and atmospheric) (RPS, 2020);
- ALOHA: atmospheric dispersion model by NOAA (2020).

Occupational health and safety →5.20 Personal protective equipment

- International Chemical Safety Cards (ICSCs) provide essential safety and health information on chemicals (ILO, 2020);
- GESTIS is the Information system on hazardous substances of the German Social Accident Insurance with a strong focus on Personal protective equipment (IFA, 2020).

Toxicity/ecotoxicology →5.7 Response considerations: Toxic substances

- GESAMP provides a composite list of hazard profiles for substances transported in bulk by sea in accordance with MARPOL Annex II;
- PubChem is a large collection of freely accessible chemical information including chemical and physical properties, toxicity and ecotoxicity, health and safety, patents and further literature citations (NIH, 2020);
- CAFE (the Chemical Aquatic Fate and Effects database) summarises information on the fate and effects of chemicals, oils, and dispersants and aims to assist in assessing environmental impacts on aquatic species (developed by NOAA);
- Cedre Chemical Response Guides (Cedre, 2020).

First responders

- Fire brigade, Civil Protection;
- The CEFIC Emergency Response Intervention Cards (ERICards or ERIC's) provide guidance on initial actions for fire crews when they first arrive at the scene of a chemical transport accident without having appropriate and reliable product-specific emergency information at hand (CEFIC, 2020);
- PHMSA's Emergency Response Guidebook (ERG) provides first responders with a go-to manual to help deal with hazmat transportation accidents during the critical first 30 minutes (USDOT, 2020).

Resources at risk

- Contingency plans, ESI maps;
- Environmental resources:
    - Conservation tools such as:
        - Protected Planet, an up-to-date and complete source of information on protected areas, updated monthly. It is managed by the United Nations Environment World Conservation Monitoring Centre with support from IUCN and its World Commission on Protected Areas (Protected Planet, 2020).
        - IUCN Red List of Threatened Species (IUCN Red List, 2020a)
        - IUCN Red List of Ecosystems (IUCN Red List of Ecosystems, 2020b)
    - Digital Observatory for Protected Areas, which can be used to assess, monitor, report and possibly forecast the state of and the pressure on protected areas at multiple scales (Joint Research Center, 2020);
- Socio-economic resources (aquaculture, amenities, etc.).

Weather forecast

- National meteorological services, national hydrographic office;

- Current and predicted weather and sea conditions, wind speed and direction, water and air temperature.

International assistance

- Requests for assistance via HELCOM, REMPEC, Bonn Agreement and CECIS Marine Pollution;

- EMSA (activated by member state's maritime administrations)
    - MAR-ICE Network (providing remote as well as on-site advice for member states in case of a chemical spill);
- IMO "Guidelines on International Offers of Assistance in Response to a Marine Oil Pollution Incident". Developed for incidents that exceed a country's capacity for oil spill response and may be used as a non-binding supplement to existing bilateral and multilateral agreements for support (IMO, 2016);
- Mediterranean Guide on Cooperation and Mutual Assistance in Responding to Marine Pollution Incidents (REMPEC, 2018);
- Neighbouring countries: "Manual of the national mechanism for the mobilisation of response equipment and experts in case of emergency" (West MOPoCo, 2020).

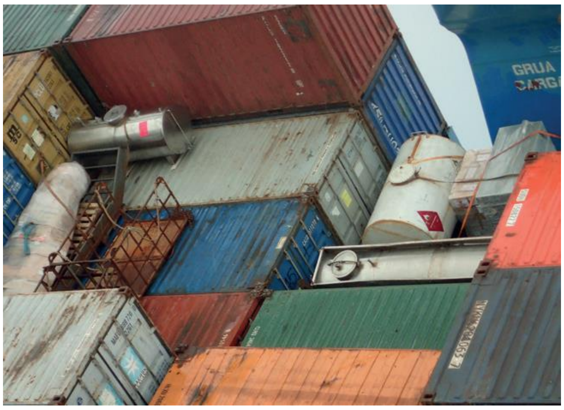
FACT SHEET 5.4

Packaged goods identification

Packaged goods may be accidentally lost overboard, jettisoned in an emergency situation or contained in sunken or grounded vessels. They may be carried over considerable distances by the effects of currents, wind, or tides.

To aid the identification of hazards, all dangerous goods packages and their cargo transport unit must be appropriately marked (Proper Shipping Name, UN number and MP mark) and labelled (primary and secondary hazard labels) before transport (as per IMDG Code (**Chapter 2**). However, when packages remain in the marine environment for a certain time, their markings and labels may no longer be legible (e.g. covered by marine flora and fauna, partial destruction of label, ink washed off).

Dangerous goods containers washed up on the shore following a shipping incident



Dangerous goods containers on board

Freight container identification

While the most common types of freight containers are 20-foot or 40-foot dry storage containers, there are also flat rack (open sides and top), open top, refrigerated, tank and many other types of containers. As per the IMDG Code, all containers carrying dangerous goods must display the following (see example in Figure 48):

- main and subsidiary hazard placards (250 x 250 mm) of all dangerous goods inside the container;
- UN number if the DG are in excess of 4,000 kg gross mass (either separate placard of 300 x 120 mm or jointly with the main hazard placard).

Figure 48: Container carrying DG of different UN numbers or one DG with a subsidiary risk (left); Container carrying DG of UN3082 in excess of 4,000 kg gross mass (right)

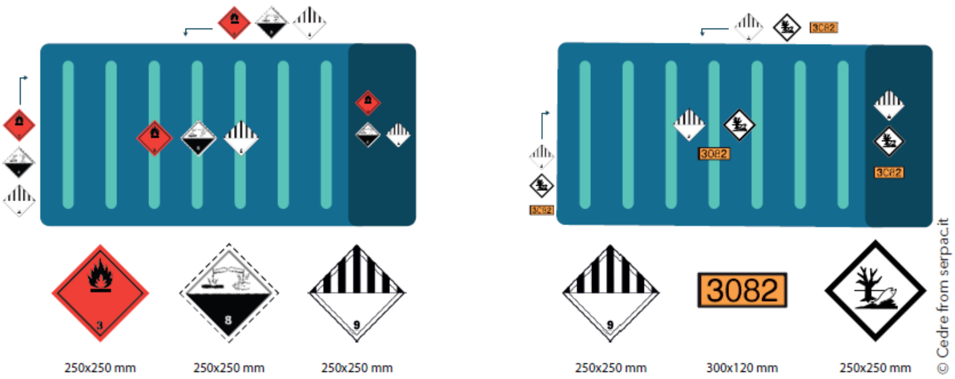


Figure 48: Container carrying DG of different UN numbers or one DG with a subsidiary risk (left); Container carrying DG of UN3082 in excess of 4,000 kg gross mass (right)

Package identification

Inside a container, the cargo may be shipped "loose" (such as fish, paper rolls, cars, etc.) or in various receptacles (Table 16).

Table 16: Packaging types and materials as per IMDG Code Chapter 6

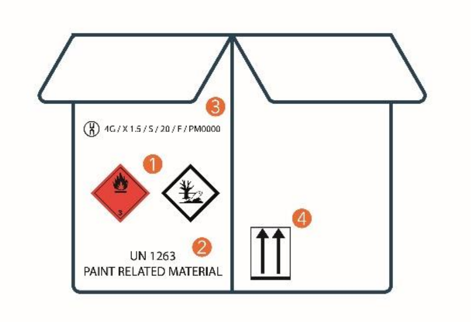
Type	Material	Picture

Drums	Steel, aluminium, plywood, fibre, plastics, other metal	
Jerricans	Steel, aluminium, plastics	
Boxes	Steel, aluminium, natural wood, plywood, reconstituted wood, fibreboard, plastics, other metal	
Bags	Woven plastics, plastic film, textile, paper	
Composite packaging	Plastic/glass/porcelain/stoneware receptacle in drum/box/other packaging	
Intermediate Bulk Containers (IBC)	Metal (steel, aluminium, other), flexible material (plastics, textile, paper, rigid plastics, composite, fibreboard), wooden (natural, plywood, reconstituted wood)	

All packages or outer packages (if composite packaging) should display the following (Figure 49):
Main and subsidiary hazard label (**Chapter 2.3.4**);
PSN and UN number (**Chapter 2**);
UN packing markings (see below);
Orientational label (optional).

Figure 49: Example of box identification

Content: UN 1263, Paint; Hazards: Flammable liquid, marine pollutant; Packaging: UN certified fibreboard box, tested for PG X, maximum gross weight 15 kg, manufactured by PM0000 in the Netherlands in 2020



All package markings should be readily visible and legible, displayed on a background of contrasting colour on the external surface of the package and should not be located with other package markings that could substantially reduce their effectiveness. Also, the information should be identifiable on packages surviving at least three months' immersion in the sea.

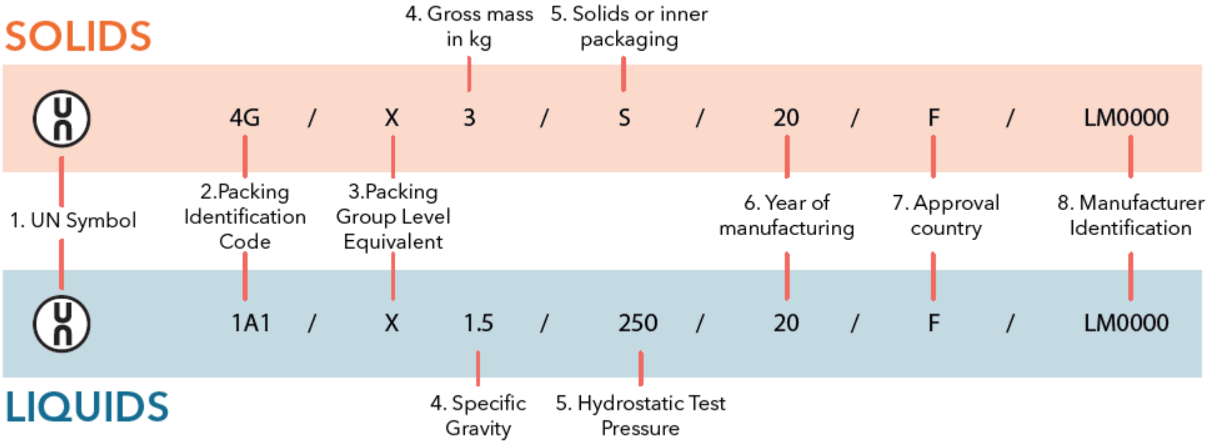
UN packaging markings

The packing specifications of the outer package are standardised (included in the IMDG Code, Volume 1 Chapter 6). Package markings only describe the specifications of the package itself, rather than what it carries; therefore, a package certified to carry dangerous goods of the highest degree of hazard might be carrying innocuous substances.

1. The **United Nations symbol** indicates that the packaging has been tested and certified according to the UN standard.
2. The **Packing Identification Code** specifies the type of container, the material used and packaging head or material wall type.
3. The **letters X** (Packing Group I – highest degree of danger), **Y** (Packing Group II – medium degree of danger) or **Z** (Packing Group III – lowest degree of danger) indicate for which packing group the package was tested.
4. The **gross mass for solids** indicates the maximum gross mass in kg that the package is allowed to carry (packing including content). The **specific gravity for liquids** indicates the maximum specific gravity allowable for that package.
5. **For solids "S"**; for liquids the marking indicates the **maximum hydrostatic pressure** the container was tested at in kPa.
6. Two last digits of the **year of manufacture**.
7. **Abbreviation of the manufacturing country**.
8. **Code, name and address or symbol** identifying the approval agency or the manufacturer.

However, operationally, during the response, seeing the parcel/package/box is often more useful than knowing what all the codes stand for.

Figure 50: UN package identification for liquids and solids



Example for solids: UN certified fibreboard box capable of carrying solid goods of Packing Group I (highest degree of danger) with a gross mass maximum weight of 3 kg. The box was manufactured by LM0000 in France in 2020.

Example for liquids: UN certified steel drum with non-removable head capable of carrying liquids of Packing Group I (highest degree of danger) with a maximum specific gravity of 1.5. The maximum hydrostatic pressure the drum was tested at is 250 kPa. The drum was manufactured by LM0000 in France in 2020.

FACT SHEET 5.5

Situation assessment

Response

Objective

Following the reporting of an incident, situation assessment is the starting point of the decision-making process and should help to define the strategy for protecting the population, environment and/or amenities. Therefore, the situation assessment should take into account existing or potential risks, directly related to the conditions of the accident. When the strategy is defined, it can be translated into tactics and techniques to be deployed in the field. This is an on-going process that should be regularly updated.

Applicability

Situation assessment is required for any intervention. Depending on the size and conditions of the incident, the risk assessment may be different and the risk assessment procedures should be detailed in the contingency plan (see **Chapter 4**):

- for a small leakage, proficient personnel trained in chemical hazards can assess the situation and, on the basis of procedures indicated in the emergency plan, can implement first measures to stop or mitigate the HNS release.
- for more complex situations involving HNS, such as a large spill, a high potential impact, a high level of hazard, difficult salvage or response operations, a more robust assessment of the situation is required before response implementation. In this case, the situation assessment is performed according to the planning section of the structural organisation.

Method description

The situation assessment process uses information gathered on the incident →**5.2 Incident data gathering**, especially to identify hazards related to the HNS involved. Thanks to information included in the contingency plan (see **Chapter 4**), collected during the preparatory phase, it can be cross-linked with identified hazards to estimate risk and vulnerability.

Risk can be estimated by combining the probability of a hazard occurrence and the potential scale of consequences such as injury, damage or loss (socio-economic, environmental, etc.).

The risk assessment approach in case of an incident is different from that during the preparatory phase to develop contingency planning. In the first case, specific information related to hazards should be collected (→**5.2 Incident data gathering**) on the HNS involved and the exact conditions of the incident. The risks and their probability of occurrence are assessed to anticipate the potential worsening of the situation. In the second case, risks and their probabilities are based on statistics for vessel traffic, HNS transported, as well as frequency and type of past incidents in the area considered.

From the probability of risk occurrence, potential **consequences can be evaluated** and will correspond to worsening conditions. For example in the case of an explosive or flammable chemical, the risk of the vapour cloud igniting should be assessed.

Figure 51: The 3 main steps in the situation assessment

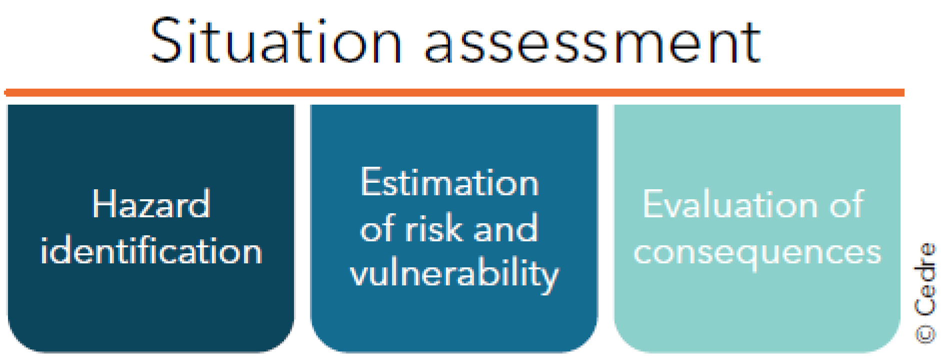


Table 17: Description of the three main steps of situation assessment

Possible impact on:	**Hazard identification**	**Estimation of risk and vulnerability. Need to refer to similar past incidents (similar conditions or hazards)**	**Evaluation of consequences**
Humans	- Physical hazards of HNS: danger class(es), sub class(es) of danger - Toxicological levels - Hazards related to the vessel	Probability of population being exposed to HNS	- Number of proven or potentially injured people - Health impact on population, responders

	- Environmental conditions		
Environment	- Consider hazards of HNS on for the environment - Ecotoxicological effects - Environmental conditions	Probability of the pollutant reaching environmentally sensitive areas identified in the contingency plan	Proven or potential impacts on the environment (value, structure, function or ecosystem)
Socio-economic activities and amenities	Hazards for areas or entities, for instance: aquaculture, water intakes, tourism, etc.	Probability of the pollutant to reaching socio-economically sensitive areas identified in the contingency plan	Losses: proven or potential costs, loss of activity, etc.

As far as possible, relevant data to assess hazards, risk/vulnerability, as well as consequences, should be quantitative. All these data can subsequently be gathered in a table, dated and recorded for further archiving.

To anticipate possible changes in the situation, some input data should be considered as they worsen or become increasingly favourable. These can be for instance:

- environmental conditions (change of weather, tide, etc.);
- sensitive period (forthcoming peak period, for instance during holidays, political elections, etc.) or location (remote area, difficult access, etc.).

Special care for incidents involving containers

Searching for information in cargo manifest is drastically time-consuming when faced with several hundreds or even thousands of containers. This task should be performed through a collaborative effort and by people familiar with (or at least with sufficient knowledge of) the use of the IMDG Ccode and information resources related to containers.

Tips: use a spread sheet obtained from an expert organisation to identify containers, danger classes, UN number, etc. It is useful to rank and highlight more problematic containers. If the situation were to evolve, this would allow the response team to modify the ranking (for instance initial ranking for a vessel on fire will be modified in case of shipwreck).

Required personnel/equipment

Personnel involved in the Incident Team should include:
experts in different fields involved: naval officer, chemical engineer, environmental engineer (biologist, ecologist, etc.);
local experts on potentially impacted sensitive areas.

Considerations

• A situation assessment may be time-consuming due to a lack of available data (on HNS, vessel, contingency plan).

• In case of a mixture of chemicals: possible hazards due to the mixing of chemicals should be considered and a medical expert should be consulted to assess the possible effects of combined exposure to multiple chemicals.

• The reliability level of the situation assessment is directly correlated to the quantity and reliability of information gathered from the incident.

→**5.2 Incident data gathering**

FACT SHEET 5.6

Response considerations: Flammable and explosive

Response

Related GHS pictograms and UN Regulation

Examples of related case studies:

- ***Cason*, 1987**, Cape Finisterre, Galicia, Spain; Sodium (1,400 barrels) and other hazardous chemicals (flammable/toxic/corrosive products in 5,000 different package forms; 1100 tonnes transported and spilled). Cause of spill: fire on board (reaction of sodium with seawater) and subsequent grounding.
- ***Val Rosandra*, 1990**, Port of Brindisi, Italy; Propylene (1,800 tonnes in bulk, controlled burning, quantity spilled: 0). Cause: fire.
- ***Alessandro Primo*, 1991**, 30 km off Molfetta, Adriatic Sea, Italy. Acrylonitrile (549 tonnes in 594 barrels) and of Dichloroethane (3, 013 tonnes); recovery from sunken wreck. Cause: structural damage subsequent due to a storm.
- ***Igloo Moon*, 1996**, outside Key Biscayne in South, Florida; Butadiene (6,589 tonnes, recovery of the cargo, quantity spilled: 0). Cause: grounding.
- ***MF Ytterøyningen*, 2019**, Norwegian; Ethylene Glycol leak (coolant components). Cause: fire and subsequent explosion (failure communication failure between the EMX –Energy management system– and the battery packs).

Alert and notification in case of a potential leak:
Depending on the location of the incident, the MRCC, site emergency services and public emergency services must be alerted. Ships (crew) and the population downwind (vapour cloud) and downstream (spill) must also be warned in order to prevent complications arising.

Applicability and main risks:
For more information and a description of the flammability and explosivity of substances, refer to **Chapter 3** on hazardous substances.

Table 18: Flammable and explosive substances: applicability and main risks

Applicability[1]	Risks for humans/ responders	Risks for the environment	Risks for amenities

- Leakage of gas from a sealine (subseapipeline) - Leakage of liquefied gas - Mixing of reactivechemicals forming gas - Evaporation from slicks - Gas cloud formed after reaction of chemicals	- Direct injuries due tofire or explosion - Anoxia, asphyxia, especially in confined space - Depending on chemicals: toxicity or corrosivity	- No major expected chronic impact expected - Possible indirect impact (e.g. fire residues)	- Window-shattering explosion, - Building destruction

[1] Events leading to a flammable/explosive situation

Risk assessment

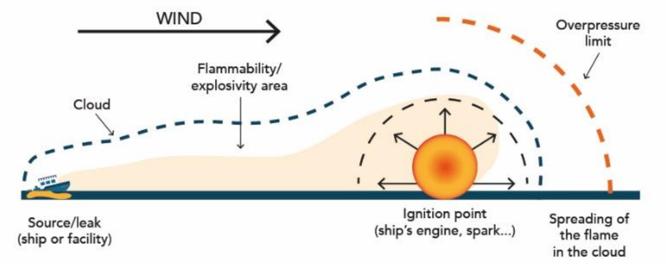
- Risks of flammability or explosion must be assessed by monitoring the LEL/LFL and UEL/UFL values and the evolution of concentrations over time.

→5.25 Portable gas detectors for first responders
→5.26 Sampling techniques and protocols

- Forecast of the gas cloud drift must be requested from experts.
- If applicable (regarding the characteristics of the chemical and the situation), the toxicity risk should be assessed, as well as corrosivity.

→5.7 Response considerations: Toxic substances
→5.8 Response considerations: Corrosive substances

Figure 52: Risk assessment



- Areas to consider for intervention:
- Consider (and control) aggravating factors:
  - in the event of fire, prevent the risk of BLEVE by cooling tanks in direct contact with heat radiation; risk of toxic gas production.

Protective measures (human health, environment and amenities)

- Evacuation:
  - the distressed vessel's crew: the helicopter/rescue ship must approach from downwind;
  - the population: modelling should be carried out to determine the specific area to evacuate or the containment measures to be implemented.
- Protection:
  - ventilation of the explosive atmosphere in order to lower the LEL/LFL;
  - activation of the existing firefighting systems;
  - gas or vapour cloud should be prevented from entering confined or closed areas and obstacles must be removed (if possible) to reduce turbulence;
  - protection of responders against inhalation of vapours or mist.

→5.20 Personal protective equipment

Reminder: a flammable cloud may **become explosive** when the speed of the front flame exceeds several meters per second (due to HNS nature, atmosphere turbulence and obstacles) or in a confined space. Continue to monitor the LEL/LFL throughout the response.

Response measures

- Stopping the leakage;

→5.32 Sealing and plugging

- Elimination of sources of ignition.
  - Behaviour:

→5.13 Response considerations: Gases and evaporators
→5.14 Response considerations: Floaters

  - Techniques:

→5.19 Safety zones
→5.34 Using water curtains
→5.35 Using foam
→5.36 Natural attenuation and monitoring

FACT SHEET 5.7

Response considerations: Toxic substances

Related GHS pictograms and UN Regulation

Examples of related case studies:

- ***Cavtat*, 1974**, southern Italy, Tetraethyl lead and tetramethyl lead;
- ***Burgenstein*,1977**, port of Bremerhaven, Germany, Sodium Cyanide, Potassium Cyanide;
- ***Sindbad*, 1979**, North Sea, Chlorine;
- ***Testbank*, 1980**, Louisiana, USA, Hydrogen Bromide
- ***Rio Neuquen*, 1984**, Port of Houston, USA, Aluminium Phosphide;
- ***Santa Claira*, 1991**, New Jersey, USA, Arsenic Trioxide

Alert and notification in case of a potential leak:

Depending on the location of the accident, the Munster Regional Communications Centre (MRCC), site emergency services and public emergency services must be alerted. Ships (crew) and the population downwind (vapour cloud) and downstream (spill) must also be warned in order to prevent complications arising.

Applicability and main risks:

For more information and description of toxic substances, refer to **Chapter 3** on hazardous substances.

Table 19: Toxic substances: applicability and main risks

Applicability[1]	Risks for humans/responders	Risks for the environment
- Leakage of toxic gas from drum or tank - Leakage of toxic chemicals - Mixing of reactive chemicals for-ming gas - Evaporation from slicks - Gas cloud formed after reaction of chemicals	- Injuries due to direct contact with substance (skin/mucosa contact, ingestion, inhalation) - Carcinogenetic issues	- Direct impact on animals and the environment - Chronic impact - Possible indirect impact (e.g. extinguishing water, dissol- ver in water curtain)

1 Events that may lead to a toxic atmosphere

Risk assessment

- Assess the risks of atmospheric and marine toxicity by gathering data on the substances.
- Consider toxic exposure limits (see **Chapter 3**) to assess the risk for the population;

- Model the behaviour and movements of the toxic cloud;
- Evaluate the environmental compartment(s) (atmosphere, water column…) liable to be impacted by the toxic substance or any by-products that may be formed in the scenarios;
- Assess route of entry of the toxic substances (dermal contact, ingestion, inhalation…);
- Consider (and control) aggravating factors:
  - weather conditions: wind, current, temperature, rain and fog, atmospheric stability, etc.
  - reactions between chemicals, reactions due to the increase in temperature, time of exposure…

Protective measures (human health, environment and amenities)
Protective measures must be tailored to the penetration process of the substance involved and its characteristics. Toxicity is not only related to airborne substances; the population and responders can also be affected through contact, ingestion, etc.

→5.20 Personal protective equipment (e.g. Self-Contained Breathing Apparatus -SBCA for toxic gas, specific protective clothing for dermal risks…)

→5.25 Portable gas detectors for first responders

Figure 53: Toxicity to human health

- Evacuation:
  - the distressed vessel's crew: the helicopter/rescue ship must approach from downwind in case of a toxic cloud;
  - the population: modelling should be used to determine specific areas to evacuate or shelter-in-place measures to implement (in case of a toxic cloud).
- Protection:
  - in the case of marine toxic substances, resources (e.g. fisheries, water intakes…) liable to be impacted should be assessed along with measures to protect them if required;

→5.40 HNS response on the shore

  - additional contamination due to by-products resulting from the response to the incident must be avoided by containing and recovering these substances (residual water from water curtain techniques, extinguishing water…).

Response measures
- The source of the leakage must be isolated if possible (tank or drum storage) to facilitate the response;
- Protective Action Criteria (PACs, see dedicated part in Chapter 3) should be used for intervention and to select proper PPE;
- Depending on the substances:
  - behaviour:

    →5.13 Response considerations: Gases and evaporators
    →5.14 Response considerations: Floaters
    →5.15 Response considerations: Dissolvers
    →5.16 Response considerations: Sinkers
  - techniques:

    →5.34 Using water curtains
    →5.35 Using foam
    →5.36 Natural attenuation and monitoring

FACT SHEET 5.8

Response considerations: Corrosive substances

Response

Related hazard pictograms

Examples of related case studies:

- **Unknown lost packages, 1975**, Swedish West Coast about 100 km north of Gothenburg, Sweden. Propionic Acid (approximately 30 drums lost at sea). Cause: probably lost deck cargo.
- ***Puerto Rican*, 1984**, 8 miles west of Golden Gate Bridge, San Francisco Bay, California, USA. Caustic soda solution, 50% (quantity spilled 400-500 m^3). Cause of spill: explosion (reaction of caustic soda with the epoxy coating).
- ***Julie A*, 1989**, Port of Aarhus, Denmark. Hydrochloric Acid (quantity spilled: 1 to 5 tonnes of HCl 31%; quantity transported: 300 tonnes). Cause of spill: structural damage to internal tank coating (reaction of hydrochloric acid with sheet iron, with formation of hydrogen gas).
- ***Kenos Athena*, 2012**, in water adjacent to Zheland Island, southern Guangdong Province, China. Sulphuric Acid (ship loaded with 7,000 tonnes and 140 tonnes of residual fuel oil; chemical and bunker-oil removal from sunken ship). Cause: shipwreck, sunk after about a month.

Alert and notification in case of a potential leak:

Depending on the location of the accident, the Munster Regional Communications Centre (MRCC), site emergency services and public emergency services must be alerted. Ships (crew) and the population downwind (corrosive gases) and downstream (spill) must also be warned in order to prevent complications arising.

Applicability and main risks:

For more information and a description of corrosive substances, refer to **Chapter 3** on hazardous substances.

Table 20: Corrosive substances: applicability and main risks

Applicability[1]	**Risks for humans/ responders**	**Risks for the environment**	**Risks for amenities**
- Leakage of corrosive liquid or gas from drum or tank - Mixing of reactive chemicals forming corrosive gas or compound - Evaporation from slicks	- Injuries due to direct contact with substance (dermal necrosis, inhalation, ingestion)	- Direct impact on animals and the environment - Acute and chronic impact - Possible indirect impact (e.g. extinguishing water, dissolver in water cur- tain)	- Chemical corroding drums or tanks, leading to a pollution spill - Corrosion of metals (ship's deck, crane, etc.) (limitation/interference to with the legitimate uses of the sea/amenities)

[1] Events that may lead to a toxic atmosphere

Risk assessment
For the general consideration of corrosive substances, responders should focus on:
- assessing the risks of atmospheric and marine toxicity by gathering data on the substances;
- assessing the risks of exposure to corrosive substances on the basis of its physical state and behaviour, monitoring pH if applicable;
- assessing associated hazards if present and evaluate the priority for response; corrosive substances are often associated with other hazards such as flammability and/ or explosivity and/or toxicity;

→**5.6 Response considerations: Flammable and explosive substances**
→**5.7 Response considerations: Toxic substances**
→**5.9 Response considerations: Reactive substances**
- analysing weather data and detector measurements;
- modelling the behaviour and movements of the corrosive gas/vapours/fume clouds, if applicable. Consider modelling corrosive floater/dissolver/sinker if spilled in water column, if applicable;
- assessing measures to protect sensitive areas (environmental, ecological, social, industrial sites) and facilities, including through preventive shutdown, determining the hazards posed by any products that may be formed in the scenarios and assessing the associated hazard levels (smoke from fire, reaction with the environment, etc.);

→**5.2 Incident data gathering**
- evaluating the location of facilities and equipment for quick response.

Areas to consider for intervention:
evaluate/model the extent of the area affected by dangerous concentrations of corrosive substances in the water column and/or in the atmosphere to limit legitimate uses of the sea and amenities.
→**5.19 Safety zones**

Consider (and control) aggravating factors:
- Reactions between acids and bases, reactions due to the increase in temperature, time of exposure;
- Possible highly exothermic reaction when certain acids or bases are spilled in water;
- Maximum precautionary measures must be taken especially in the case of in situ response on the vessel (confined space);
- High viscosity values slow down dilution and dispersion processes at sea.

Protective measures (human health, environment & amenities)
As corrosive substances gather a large group of chemicals, protective measure must comply with the conclusions of the risk assessment:
- corrosive liquids (mineral acids, alkali solutions and some oxidisers): eyes and skin are particularly vulnerable due to splashes of the substance and effects on tissues are generally very fast;
- corrosive gases and vapours: effect is generally related to the solubility of the substances in the body fluids. Highly soluble gases like ammonia or hydrogen chloride cause severe nose and throat irritation, whereas lower solubility vapours (phosgene, sulphur dioxide, etc.) penetrate deep into the lungs;
- corrosive solids: direct contact can cause burns to the skin (phenol, sodium hydroxide…) and dust affects the respiratory system. Many corrosive solids may produce highly exothermic reactions when dissolved in water;

- in case of a water-reactive product, the substance must be prevented from reaching the water surface and the spill must be contained (construct berms, sand dikes…).

→5.20 Personal protective equipment
→5.25 Portable gas detectors for first responders

On board:

- Attention should be paid to avoiding direct contact with the skin and protecting against inhalation of vapours or mists. Check atmosphere before entering a confined space; do not operate without self-contained breathing apparatus;

→5.20 Personal protective equipment
→5.25 Portable gas detectors for first responders

- evacuation must be implemented immediately downwind (gas/evaporator/fumes);
- attention should be paid to decontaminating protective clothing: wash down with water and then remove.

Population and amenities:

- Modelling will need to be conducted to determine the specific area to decide on the implementation of evacuation or shelter-in-place measures (in case of a corrosive cloud or marine environment contamination);
- evacuation must be implemented in downwind impacted areas (in case of hazardous vapours, gas clouds, fumes);
- zoning: downstream area of the spill (targets of polluted runoff, liquid and solid spills) and evaluate any limitations on the use of the sea and amenities.

Response measures

On board:

- If possible, other chemicals or organic products must be isolated from the leaking substances until its reactive potential has been assessed;
- if the substance is not water-reactive, acids and bases may be neutralised by a dilution process in order to reduce the concentration (overboard washing with indirect water jets if possible). pH should be measured before discharging the diluted mixture in the environment;

→5.34 Using water curtains
→5.36 Natural attenuation and monitoring

- water-reactive substances may be treated by compatible sorbent or inert materials;

→5.37 Using sorbents

- in the case of an on board leak, appropriate containment and recovery methods and techniques according to the substances involved and scenarios should be used (Emergency Schedules (EmS), IMO, 2018).

In the environment:

Refer to the characteristics, behaviour and fate and of the spilled (or leaked) substances, using specific precautions for the risk of corrosivity.

Behaviour:

→5.13 Response considerations: Gases and evaporators
→5.14 Response considerations: Floaters
→5.15 Response considerations: Dissolvers
→5.16 Response considerations: Sinkers
→5.41 Packaged goods response

Techniques:
See **Chapter 5.6.3**

FACT SHEET 5.9

Response considerations: Reactive substances

Response

Related hazard pictograms (direct and indirect hazards)

Flammable/explosive: **Oxidising/peroxidising:**
GHS GHS GHS UN Regulation

Physical hazards not otherwise classified (refer to Safety Data Sheet)

Examples of related case studies:

Table 21: Related case studies of incidents involving reactive substances

Reactivity	Main Risks & Hazards - Related case studies	Examples of substances
With oxygen (air)	Ignition, explosion. ***Ocean Liberty*, 1947**, port of Brest, France; ammonium nitrate (3,160 tonnes) + oil (300 tonnes). **Cause of spill:** fire and subsequent explosion.	Some alkali metals (e.g. potassium, sodium, calcium), some metal hydrides (e.g. hydrides of sodium, hydrides of calcium), with phos- phorus, some oxidants (e.g. ace- taldehyde; diethyl ether, isopropyl ether), pyrophoric liquids (tributyl- phosphine, trimethyl aluminum)
With water ***(hydrolysis, hydration, oxidation; consider also possible reaction with moisture in the air)***	Explosion or formation of hazardous pro- ducts (corrosive, toxic or flammable). ***Adamandas*, 2003**, Réunion Island; deoxi- dised iron of ore balls (21,000 tonnes) and diesel (470 tonnes). Risk of production of hydrogen gas. **Cause of spill:** structural damage	Some alkaline metals, sodium or potassium phosphide, alkali metal cyanide salts, aluminum chloride, calcium carbide, cyanide salts
Polymerisation	Highly exothermic reaction (with violent explosion in some cases) due to self-reaction of a monomer; ***Stolt Groenland*, 2019**, Ulsan, South Korea; Styrene monomer (5,200 tonnes). **Cause of spill:** explosion, fire due to over-pressurisa- tion and ignition of styrene.	Acrylonitrile; cyclopentadiene, hydrocyanic acid; methacrylic acid; methyl acrylate; vinyl acetate
With other substances	Fire, explosion or release of toxic vapours depending on amounts, and surrounding conditions); ***Burgenstein*, 1977**, port of Bremerhaven, Germany; Sodium peroxide and other hazar- dous products including cyanide. **Cause of spill:** structural damage to a drum of sodium peroxide.	Some incompatible groups: flam- mable and toxic products; flam- mable products and oxidisers; acids and bases; oxidisers and reducers See The Chemical Reactivity Work- sheet (CRW) - NOAA

Self-reactive substances	A self-reactive substance means a thermally unstable liquid or solid substance liable to undergo strongly exothermic decomposition even without the participation of oxygen (air). This defini- tion excludes substances or mixtures classified under the GHS as explosive, organic peroxides or as oxidising agents (GHS, 2019).		
	Light-induced Mechani- cal shock Inherently unstable	Explosive reactions ***M/V Sinbad*, 1979**, 20 nautical miles west of Ijmuiden, Netherlands, offshore of Ams- terdam; Chlorine (51 steel cylinders/51 tonnes). Losst of deck cargo at depth of 30 m. **Cause of spill:** structural damage (adverse weather) Can detonate under certain pres- sure and temperature conditions.	Hydrogen and chlorine Acetylides, oxides, organic nitrates and many peroxides Acetylene

Alert and notification in case of a potential leak:
Depending on the location of the incident, the Munster Regional Communications Centre (MRCC), site emergency services and public emergency services must be alerted. Ships (crew) and the population downwind (vapour cloud) and downstream (spill) must also be warned in order to prevent complications arising.

Applicability and main risks:
Reactive substances include a wide range of potential consequences which depend heavily upon their chemical nature (see above table). For more information and a description of reactive substances, see **3.2.5 Hazard: reactivity**.

Also note:
- In the case of a fire/spillage involving self-reactive substances, non-water-reactive but flammable substances, polymerising substances:

→5.6 Response considerations: Flammable and explosive substances
- In the case of fire/spillage of chemicals which form toxic or corrosive products by reaction with other materials or other spills:

→5.7 Response considerations: Toxic substances
→5.8 Response considerations: Corrosive substances

Table 22: Reactive substances: applicability and main risks

Applicability[1]	Risks for humans/ responders	Risks for the environment	Risks for amenities
Leakage of reactive substances that cause ignition/ explosion	- Direct injuries due to fire or explosion or highly exo- thermic reactions (violent explosion) - Oxidising substances could ignite combustible material or destroy material (e.g. responder equipment) - Anoxia, asphyxia, especially in confined spaces	- No major expected chronic impact expected - Possible indirect impact (e.g. fire residues)	- Direct and indirect damages (or destruc- tions) to vessels, buil- dings, other maritime infrastructures (in some scenarios, even at a considerable distance from the incident).
Leakage of reactive substances that form cor- rosive products	- Injuries due to direct contact with substance (dermal necrosis, inhala- tion, ingestion)	- Direct impact onanimals and the environment - Chronic impact - Possible indirect impact (e.g. extinguishingwater, dissolver in water curtain)	- Chemical corroding drums or tanks, leading to a pollution spill - Corrosion of metals (ship's deck, crane,etc.) (limitation/interference with the legitimate uses of the sea/amenities)

Leakage of reactive substances that form toxic products	- Injuries due to direct contact with substance (skin/mucosa contact, ingestion, inhalation) - Carcinogenetic issues	- Direct impact on animals and the environment - Acute and chronic impact - Possible indirect impact (e.g. extinguishing water, dissolver in water curtain)	Contamination of the marine environment by toxic-persistent product may lead to a closure/ limitation/interference to with the legitimate uses of the sea

1 Events that may lead to a corrosive spill or atmosphere

Risk assessment

For the general consideration of corrosive substances, responders should focus on:

- assessing the risks of atmospheric and marine toxicity by gathering data on the substances;
- assessing the risks of exposure to corrosive substances on the basis of its physical state and behaviour, monitoring pH if applicable;
- assessing associated hazards if present and evaluate the priority for response; corrosive substances are often associated with other hazards such as flammability and/ or explosivity and/or toxicity;

→**5.6 Response considerations: Flammable and explosive substances**
→**5.7 Response considerations: Toxic substances**
→**5.9 Response considerations: Reactive substances**

- analysing weather data and detector measurements;
- modelling the behaviour and movements of the corrosive gas/vapours/fume clouds, if applicable. Consider modelling corrosive floater/dissolver/sinker if spilled in water column, if applicable;
- assessing measures to protect sensitive areas (environmental, ecological, social, industrial sites) and facilities, including through preventive shutdown, determining the hazards posed by any products that may be formed in the scenarios and assessing the associated hazard levels (smoke from fire, reaction with the environment, etc.);

→**5.2 Incident data gathering**

- evaluating the location of facilities and equipment for quick response.

Areas to consider for intervention:

- evaluate/model the extent of the area affected by dangerous concentrations of corrosive substances in the water column and/or in the atmosphere to limit legitimate uses of the sea and amenities.

→**5.19 Safety zones**

Consider (and control) aggravating factors:

- reactions between acids and bases, reactions due to the increase in temperature, time of exposure;
- possible highly exothermic reaction when certain acids or bases are spilled in water;
- maximum precautionary measures must be taken especially in the case of in situ response on the vessel (confined space);
- high viscosity values slow down dilution and dispersion processes at sea.

Protective measures (human health, environment & amenities)

As corrosive substances gather a large group of chemicals, protective measure must comply with the conclusions of the risk assessment:

- corrosive liquids (mineral acids, alkali solutions and some oxidisers): eyes and skin are particularly vulnerable due to splashes of the substance and effects on tissues are generally very fast;

- corrosive gases and vapours: effect is generally related to the solubility of the substances in the body fluids. Highly soluble gases like ammonia or hydrogen chloride cause severe nose and throat irritation, whereas lower solubility vapours (phosgene, sulphur dioxide, etc.) penetrate deep into the lungs;
- corrosive solids: direct contact can cause burns to the skin (phenol, sodium hydroxide…) and dust affects the respiratory system. Many corrosive solids may produce highly exothermic reactions when dissolved in water;
- in case of a water-reactive product, the substance must be prevented from reaching the water surface and the spill must be contained (construct berms, sand dikes…).

→5.20 Personal protective equipment
→5.25 Portable gas detectors for first responders

On board:

- attention should be paid to avoiding direct contact with the skin and protecting against inhalation of vapours or mists. Check atmosphere before entering a confined space; do not operate without self-contained breathing apparatus;

→5.20 Personal protective equipment
→5.25 Portable gas detectors for first responders

- evacuation must be implemented immediately downwind (gas/evaporator/fumes);
- attention should be paid to decontaminating protective clothing: wash down with water and then remove.

Population and amenities:

- modelling will need to be conducted to determine the specific area to decide on the implementation of evacuation or shelter-in-place measures (in case of a corrosive cloud or marine environment contamination);
- evacuation must be implemented in downwind impacted areas (in case of hazardous vapours, gas clouds, fumes);
- zoning: downstream area of the spill (targets of polluted runoff, liquid and solid spills) and evaluate any limitations on the use of the sea and amenities.

Response measures

On board:

- if possible, other chemicals or organic products must be isolated from the leaking substances until its reactive potential has been assessed;
- if the substance is not water-reactive, acids and bases may be neutralised by a dilution process in order to reduce the concentration (overboard washing with indirect water jets if possible). pH should be measured before discharging the diluted mixture in the environment;

→5.34 Using water curtain
→5.36 Natural attenuation and monitoring

- water-reactive substances may be treated by compatible sorbent or inert materials;

→5.37 Using sorbents

- in the case of an on board leak, appropriate containment and recovery methods and techniques according to the substances involved and scenarios should be used (Emergency Schedules (EmS), IMO, 2018).

In the environment:

Refer to the characteristics, behaviour and fate and of the spilled (or leaked) substances, using specific precautions for the risk of corrosivity.

Behaviour:

→5.13 Response considerations: Gases and evaporators

→5.14 Response considerations: Floaters

→5.15 Response considerations: Dissolvers

→5.16 Response considerations: Sinkers

→5.41 Packaged goods response

Techniques:
See **Chapter 5.6.3**

Hyundai Fortune *marine accident, March 2006, Gulf of Aden, at about 100 km south of Yemen; following an explosion and fire on board, 60 to 90 containers were lost at sea.*

FACT SHEET 5.10

LNG

Related GHS pictograms and UN Regulation

UN number: 1972
SEBC: G


Objective

To deliver characteristics on LNG, its properties and transport, and to provide information on potential risks in the event of a spill.

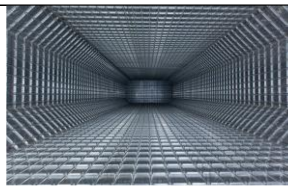
General features relating to LNG

LNG, or Liquefied Natural Gas, is increasingly used as a source of energy as its main advantages are to release significantly less carbon and lower pollutant emissions, including NOx, SOx and particulate matter. In the maritime shipping world, LNG can either be transported as cargo or used as bunkering fuel. For the latter, LNG can be used alone or with a dual fuel engine.

Table 23: Type of LNG

Type of LNG	Tank volume	Type of tank type
Cargo	10,000 - 45,000 m^3 per tank Maximum cargo 266,000 m^3 for Q-max vessel	
Bunker	20,000 m^3	Thermally insulated tank, pressure lower than 0.7 bar
	500 – 10,000 m^3	Type-C tank, pressure lower than 4 bars Temperature range: -162°C up to -121°C
	40 m^3	ISO tank (IMDG compliance), pressure lower than 10 bars


Cargo


Storage tank for seaborne transport of LNG


Jiyeh power plant after the Israeli bombing, 2006

ISO tank (IMDG compliance)

Physical and chemical properties

The main physical and chemical properties of LNG are summed up in the following table.

Table 24: Physical and chemical properties of LNG

Boiling point	-162°C	LFL-UFL	5-15%
Flash point	-188°C	Density of LNG	0.4
Auto ignition temperature	595°C	Density of methane (20°C)	0.6

Hazards and behaviour

LNG is mostly composed of methane (CH_4, CAS Number 74-82-8), representing about 90%, and a few other alkanes (such as ethane, propane and butane) with a total concentration of less than 10%. LNG is **odourless**, both in cargo or bunkers. No additive is present to detect a release by a characteristic odour. LNG is a **colourless** liquid when liquefied at -162°C. At this temperature **cryogenic effects** can be expected. Water in contact with LNG can form ice and block safety devices.

A 1 m_3 release of LNG will represent 600 m_3 after evaporation into the atmosphere. The **anoxia** or **asphyxia** hazard may also be high, especially in a confined area. When released into surface waters it can form a pool that will evaporate rapidly and create a **flammable** cloud when mixed with air with the subsequent formation of a white cloud due to the condensation of water humidity in the air. If the vapour ignites it can create a jet (pressurised gas release) or **pool fire**, a **flash fire** or even a **vapour cloud explosion** when the surrounding environment creates overpressure and blast damage. For pressurised tanks, **BLEVE** may also occur in case of fire. See **Chapter 3.**

Methane does not exhibit violent reactivity with products that are frequently used or transported on ships. However it reacts violently with liquid oxygen.

Possible impacts on people, environment and amenities are summarised in the following table.

Table 25: Effects of an incident involving LNG on people, environment and amenities, depending on the origin of incident

	Effects on:		
Type of incident	**People**	**Environment**	**Amenities**
Release of cryogenic liquid	Serious injuries due to cold burn or due projections in case of Rapid Phase Transition	Can form ice in water. In absence of fire, no damage to aquatic life because LNG is not soluble in water and it will evaporate rapidly into the atmosphere.	Brittle fracture damage to steel structures
Evaporation of methane into the atmosphere	Anoxia/asphyxia	Extremely low solubility in water	-
Ignition of LNG slick	Injuries or death	No major damage expected	Fire, temperature
Inflammation of vapour cloud	Injuries or death	No major damage expected	Fire, temperature
Explosion of gas in confined space (for instance engine room)	Injuries or death	Extremely low solubility in water	- Glass explosion - Building destruction
BLEVE following fire of tank containing LNG under pressure	Injuries or death	Possible physical damage due to explosion	- Glass explosion - Building destruction

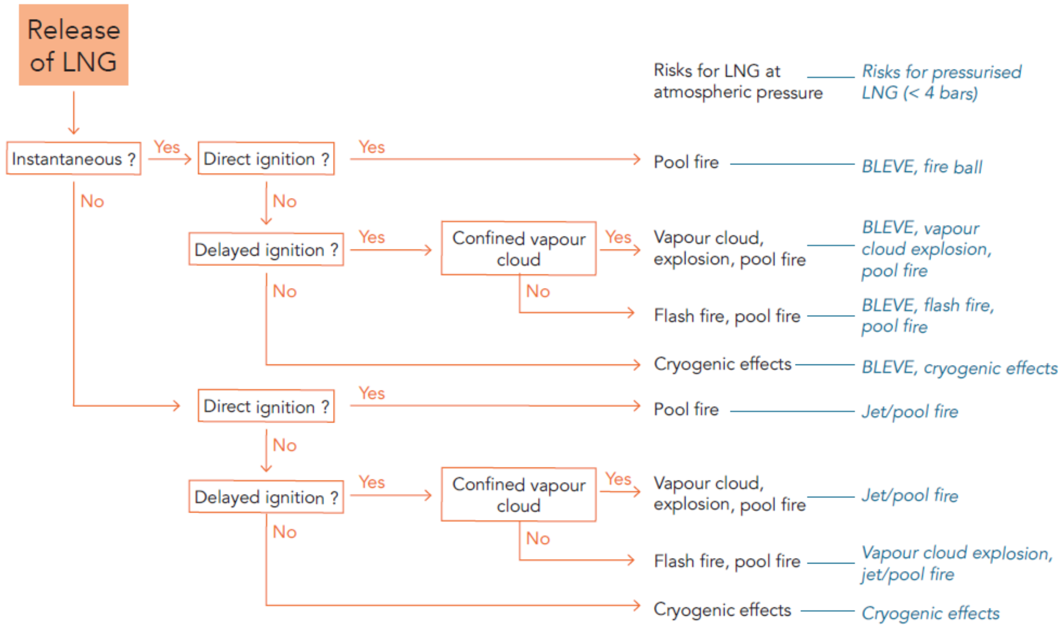
Situation assessment

As with gaseous products, LNG has fast-moving kinetics. It is important to properly assess the situation using all the tools available to effectively protect the population and stakeholders but also to initiate a response on the ground:

→5.5 Situation assessment
→5.6 Response considerations: Flammable and explosive substances
→5.11 HNS spill modelling
→5.22 Remote sensing technologies
→5.25 Portable gas detectors for first responders

Depending on the situation, especially the type of release and whether LNG is pressurised or only refrigerated, the following decision tree can support risk assessment.

Figure 54: Decision tree regarding release of LNG



Operational features relating to LNG

Response

Protective measures (human health, environment and amenities):

- zoning should be established (**5.19 Safety zones**) and monitoring performed over time to assess the risk of flammability. In case of evacuation of the crew from a distressed vessel, the helicopter/rescue ship must approach from downwind;

→5.20 Personal protective equipment
→5.11 HNS detection and analysis methods

- flammable ignition sources should be removed. Before responders plan to enter in confined space, ventilation can be carried out to lower the concentration below the LEL.

Response following a leak of LNG:

- all sources of ignition should be eliminated;
- nobody should walk on or touch the spilled LNG;

- if the LNG is likely to leak, water can be sprayed on the vessel's hull to prevent brittle fracture on the steel structure due to cryogenic effect;
- water should not be sprayed directly onto LNG to avoid Rapid Phase Transition or RPT (no spray or run-off);
- water curtains should be used, especially to reduce the concentration below the LEL;

→5.34 Using water curtains

- if leakage cannot be stopped, the substance should preferentially be released in gaseous state rather than as cryogenic liquid;
- water can form ice when in contact with LNG, which can represent an advantage to temporarily block a leak.

Response in case of fire:

- a leak of burning gas should never be extinguished, unless the source of the leak can be stopped;
- water curtains should be used, especially to reduce radiation effects;
- fire should be fought from a maximum distance or with use of water cannons;
- minor fire (bunker for instance): dry chemical powder or CO_2;
- major fire: water spray or fog;
- if possible, combustible products should be moved away from LNG on fire.

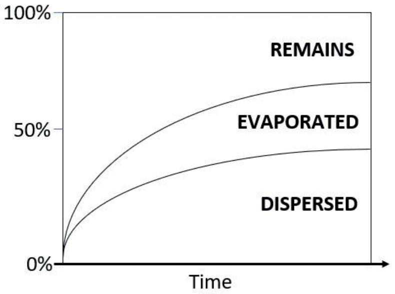
FACT SHEET 5.11

HNS spill modelling

A computer-based model can be an extremely useful tool during an HNS spill. Generally, these models are computer programmes that are designed to simulate what might (forecast) or what did happen (hindcast/backcast) in a situation. They can be created to simulate almost any scenario, however, to make a model from scratch will require expertise and a lot of testing to ensure the model is working. Many organisations and research institutes have developed models to simulate different aspects of HNS spills. Specific model capabilities include:

Predicting the fate of pollutants
Fate models predict how a pollutant changes both physically and chemically when released into the environment. Such models are used as a tool to help understand the expected characteristics and behaviour of a pollutant and prepare for an efficient response (Figure 55).

Figure 55: Fate model output

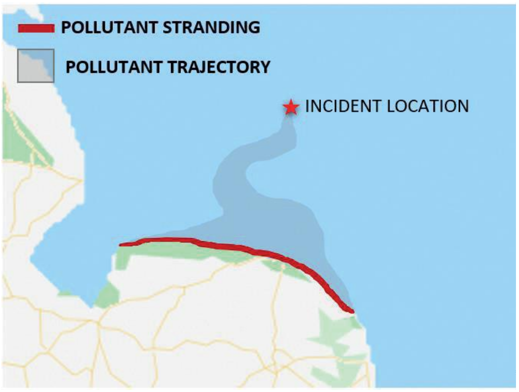


Although fate models can be stand-alone, they are usually built within a trajectory model, as physical and chemical changes can alter a pollutant's behaviour and subsequently, its trajectory.

Fate models require detailed specifications of the pollutant, such as physical and chemical properties, along with environmental data, such as temperature and wind speed.

Predicting a pollutant trajectory in water
Trajectory models can simulate the movement of a pollutant in water, using environmental data such as wind, currents, and wave information as well as the substance's physical characteristics. The simulation can be either forward-looking or backtracking. Forward modelling can help with predicting where the pollutant may strand along a shoreline or provide warning if it is heading towards a particularly sensitive area. Likewise, by using the model to backtrack a situation, it can be used to work out where the pollutant may have come from. These models can be either 2D (movement at the water surface only) or 3D (movement within the entire water column) (Figure 56).

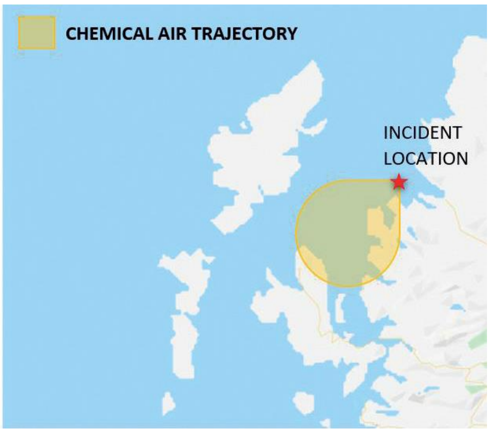
Figure 56: Pollutant trajectory on sea surface



Predicting a pollutant trajectory in the air

Trajectories of hazardous gas clouds that are a result of an HNS incident can be modelled using an atmospheric dispersion model. Generally, these models can estimate how quickly the chemical will be released into the atmosphere and how it will travel downwind (Figure 57).

Figure 57: Air pollutant trajectory



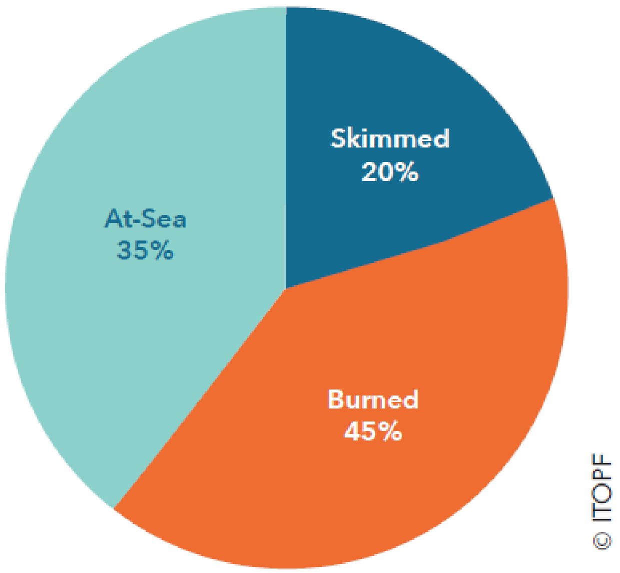
Along with the pollutants' physical and chemical properties, the models require environmental data, relating to wind and temperature.

The model results can then be used as an indication of where there may be significant threat to human life.

Analysing response methods

Models can also be used to analyse different response methods. They are used only as a guide to help manage resources, which is particularly useful in the case of a large incident with limited resources (Figure 58).

Figure 58: Response model output



Fate models are usually used in conjunction with response models as the pollutant may change physically and chemically over time, resulting in different possible recovery totals. However, they can also be combined with trajectory models, allowing for an overall prediction of how the incident will evolve and be managed.

Model limitations

To work, a model needs information regarding the incident, pollutant, and environmental conditions, for instance the incident time and location, pollutant properties, atmospheric and water temperatures, and wind speed and direction. However, for a model to produce reliable results, the input data needs to be as accurate as possible. Accurate data is not always feasibly obtainable for several reasons. Firstly, there may not be any **environmental data available** in the required area or timeframe, information may be missing regarding the incident, or the pollutant properties may be unknown.

Secondly, the **spatial and temporal resolution** in environmental datasets may be too large to represent certain physical processes. For example, turbulent eddies in water, prevalent around coastlines and in rivers, may be too small to be represented in current data. In addition to input data inaccuracies, during the construction of a model, approximations and assumptions are unavoidable, therefore no model will, unfortunately, ever be entirely exact. Also, models cannot take into consideration multiple substances and reactivity. With these points in mind, it is important that models should not be relied upon entirely but rather **used simply as a guide**, validating results through in situ observations where feasibly possible.

Models available

Specialist training to learn to use models for an HNS incident and understand their limitations is advised. Alternatively, many modelling providers or developers can carry out the modelling themselves and provide an explanation of the results, through contract-based work. Usually, modelling providers will also have access to the environmental data needed for the model, such as wind speed and direction, sea temperatures, wave heights, in addition to chemical and SDS databases. The table below lists some, but by no means all, models that have been created for use in an HNS incident. Oil spill models have been added since they might be suitable to predict the fate and behaviour of substances such as vegetable oils.

Table 26: Models available

Model	**Developer/provider**	**Capability**
ADIOS (open source)	NOAA	Oil fate
AIRMAP	RPS ASA	Chemical air trajectory and fate
ALOHA (open source)	NOAA	Chemical air trajectory and fate
CALPUFF	TetraTech	Chemical fate
CHEMMAP	RPS ASA	Chemical air and sea trajectory and fate
GNOME (open source)	NOAA	2D at-sea oil trajectory and fate
MOHID Water	MOHID	3D at-sea and air chemical trajectory
MOTHY	Meteo-France	2D at-sea oil and floating objects (such as containers) trajectory
OILMAP	RPS ASA	3D at-sea oil trajectory, fate, and response analysis
OpenDrift/OpenOil (open source)	MET Norway	Chemical/objects at sea and air trajectory and fate
OSCAR	SINTEF	3D at-sea oil trajectory and fate
SPILLCALC	TetraTech	3D at-sea oil trajectory
ROC (open source)	NOAA	Oil response method analysis

FACT SHEET 5.12

Non dangerous goods cargo

Objective

To draw the attention of decision-makers and operators to products not strictly classified as dangerous, as per international classification, but could present risks for responders or could be harmful for the environment. Some advice on approach or first elements of response are provided for some categories of products.

Applicability

All the fact sheets and the structure of this Manual are based on identified and classified hazards according to international regulations and consistent with the 2010 HNS Convention and corresponding codes (IGC, IBC, IMSBC, IMDG). Many non-dangerous products are also shipped and past incidents have shown that some non-dangerous products may be harmful and have considerable impacts on humans or the environment. The location of the incident is of high importance as it may amplify the risks for humans, or the environmental sensitivity may cause severe damages and alter or compromise the natural restoration of the environment.

Method description

Issues posed by non-dangerous goods may be related in some cases to the quantity released in the environment. A product introduced in relatively large quantities compared to the size of the area may cause issues, and possible impacts can differ depending on physical, chemical or biological effects. Physical damage can first occur through shading/smothering of the seabed and dust may impact turbidity. Additionally a change in the chemical composition of the water compartment may alter biological processes. For instance an unusual and important provision of organic products can lead to oxygen depletion, creating an anoxic medium with fish mortality. Decomposition of organic matter will result in an exothermic reaction, creating favourable conditions for the development of sulphate-reducing microflora. This microflora will degrade the organic matter on the site, with significant production of hydrogen sulphide (H_2S), a highly toxic gas for humans.

For these reasons, an effective post-incident monitoring programme should be set up to assess impacts, in particular on species/habitats of nature conservation importance (e.g. in relation to the EU Birds and Habitats Directives, OSPAR), commercial stocks of fish and shellfish, the wider ecosystem and its functionality, and the human food chain, as well as to support subsequent compensation claims.

The following table presents an overview of the main categories of products frequently transported in large quantities by sea and that may present issues when spilled at sea.

Table 27: Examples of possible incidents, potential impacts and response option depending on the nature of product and type of transport

Nature of product	Transport mode	Examples	Potential impact	Response
Organic	**Liquid bulk** Packaged goods (e.g. drums, tank, flexitank)	Glucose solution, Lecithin, orange juice, vegetable protein solution	In low renewal shallow waters, risk of oxygen depletion (low Biochemical Oxygen Demand) leading to death of flora and fauna	Depending on exact conditions: oxygenation, thanks to mechanical stirring, or creation of a current to renew the water when quantity of substance is too high compared to the environment
	Incident: pipeline, 2013; Hawaii harbour, US. Cargo: molasses			

	Solid bulk Packaged goods (e.g. bags)	Grain (wheat, rapeseed…), Rice Seed cake (soya meal/pellet, oil by-products….).	Fermentation and production of gas- es and potentially harmful by-products **Sinker**: reduction of oxygen rate due to increase in bacteria; smothering	Removal of the substances (by ROV, dredging or divers) ▶ 5.39 HNS response on the seabed ▶ 5.24 Remotely operated vehicles
	Incident: Fénès, *1996; Lavezzi islands off Corsica, France. Cargo: wheat*			
Plastic pellets	**Solid bulk** Packaged goods (e.g. bags)	Chopped rub- ber and plastic insulation, Granu- lated tyre rubber, Coarse chopped tyres, Recycled plastic resin/pellets, Nurdles	Depending on the size of pellet: - **Floater**: risk of ingestion for birds and fish; - **Suspended matter**: increase of turbid- ity, impact on spe- cies on respiratory/ digestive system; - **Sinker**: smothering of life on the seabed.	Recovery at the surface/on the sea-bed/shoreline ▶ 5.43 Recovery techniques: Pumps and skimmers Removal of the substances (by ROV, dredging or divers) ▶ 5.39 HNS response on the seabed ▶ 5.24Remotely operated vehicles Manual recovery of pellets on the shoreline ▶ 5.38 HNS response in the water column
	Incident: MSC Susanna*, 2018; South Africa. Cargo: plastic nurdles packaged in 25 kg bags.*			
Minerals and coal	**Solid bulk** Packaged goods (e.g. bags)	Chamotte, Chlorite, Limestone, Magnesite, Clay, Ores, Coal	Depending on the grain size: - Suspended matter: increase of turbid- ity, impact on spe- cies on respiratory/ digestive system; - Smothering of life on the seabed (sinkers)	When possible and if quantity of spilled product is too high com- pared to the environment, the water should be renewed or polluted water pumped and filtered ▶ 5.38 HNS response in the water column Removal of the substances (divers, dredging) ▶ 5.39HNS response on the seabed
	Incident: M/V Eurobilker IV*, 2001; Sardinia, Italy. Cargo: 17,000 tonnes of coal dispersed on seafloor causing suffucation of surrounding Posidonia oceanica meadows*			
Cement	**Solid bulk** Packaged goods (e.g. bags)	Cement, Cement clinkers	Suspended matter: increase of turbidity, impact on species on respiratory/digestive system; Sedimentation or solidification on the seabed	Dilution or filtration if quantity of sub- stance is too high compared to the environment ▶ 5.38 HNS response in the water column Removal of sunken solidified part if necessary ▶ 5.39 HNS response on the seabed

FACT SHEET 5.13

Response considerations: Gases and evaporators

Response

(applicable to all groups with "G" and "E" as SEBC behaviour)

Table 28: Behaviour of gases and evaporators

Physical State	Gaseous		Liquid	
SEBC Code	G	GD	E	ED
Density at 20°C	-		< seawater density	
Vapour pressure (kPa) at 20°C	> 101.3		> 10	
Solubility (%)	< 10	> 10	< 1	1-5

Note: for SEBC subgroups "GD" and "ED" see also →**Response considerations: Dissolvers**

Response strategies need to consider the factors affecting the behaviour and fate of the released substances, taking into account that gases and evaporators mainly undergo short-term processes when spilled at sea, due to their physic state (for G) or hight volatility (for E).

Table 29: Processes and factors affecting behaviour and fate of gases and evaporators

PROCESSES AND FACTORS AFFECTING BEHAVIOUR AND FATE OF GASES AND EVAPORATORS					
Physical state		Gaseous		Liquid	
SEBC Code		G	GD	E	ED
BEHAVIOUR and FATE	Processes when spilled at sea	Immediate evaporation/ atmospheric partitioning	Immediate evaporation/ atmospheric partitioning Dissolution	Rapid evaporation	Rapid evaporation Dissolution
	Environmental factors influencing intensity of process	Sea state /wind intensity/air and water temperature/humidity (when on board)/ solar irradiance/coastline morphology			
	Drift and spread of HNS	Atmospheric dispersion with potential production of dangerous air mixture. Potential violent reactions with smoke/gas/aerosol production, possibly toxic. Non-persistent.	Dispersion, diffusion, dilution in sea surface waters		Dispersion, diffusion, dilution in sea surface waters
	Other relevant HNS properties and hazards	Flash point, explosive range, reactivity, toxicity, corrosivity, gas/ vapour density			
	Impact on marine environment	Gas/evaporator substances tend to readily leave the water column by par- titioning first in the sea surface layer and then in the atmosphere: time- and space-limited impact (generally low) on pelagic ecosystem; risks could be more significant for avifauna and more sensitive pleuston organisms.			
For hazards and risks see also **3.2 Hazards**					

Considerations

- Main risks for safety and/or human health (crew; population if source and cloud near to the coast)

5.6 Response considerations: Flammable and explosive substances 5.7 Response considerations: Toxic substances

- Minor risks for the marine environment (non-persistent substances)
- Response actions are conducted on board the ship

Situation assessment and first actions

Information gathering:

- immediately refer to Safety Data Sheet or chemical databases. In the case of an unknown substance, act as in the case of maximum risk;

→**3.1 Safety data sheet content**

- immediately refer to data related to the location of the incident and other relevant information;
- consider sea and weather forecast.

→**5.1 Incident notification**
→**5.2 Incident data gathering**
→**5.3 Information resources**

Situation assessment:

- on the basis of the information gathered on the incident and the risks identified during contingency planning, consider conducting:
- hazard identification;

→**5.6 Response considerations: Flammable and explosive substances**
→**5.7 Response considerations: Toxic substances**
→**5.8 Response considerations: Corrosive substances**
→**5.9 Response considerations: Reactive substances**

- estimation of risk and vulnerability;
- evaluation of consequences.

5.5 Situation assessment

First actions:

- take into account the first actions to guarantee safe conditions for the responders by identifying and reducing the hazards of explosion, fire, exposure to toxic clouds, etc. and then stop or reduce the source of the HNS spill;

→**5.17 First actions (casualty)**
→**5.18 First actions (responders)**

- consider public safety;

→**5.19 Safety zones**

- equipment/logistics;

→**5.20 Personal protective equipment**
→**5.25 Portable gas detectors for first responders**

Monitoring

Modelling:

- modelling of gas cloud in air; Input to be considered: chemical and physical parameters of the substance, weather condition and forecast, type of spill source.

→**5.11 HNS spill modelling**

Monitoring using remote measuring instruments and search techniques:

- aerial surveillance: planes and helicopters (not in case of explosive or unknown gas); drones;

→**5.22 Remote sensing technologies**

- use of markers (not in case of explosive or unknown gas) for safety and operational reasons.

→**5.23 Substance marking**

Monitoring using in situ measuring instruments and search techniques:
Air sampling

- trace gas sensors: explosimeter and gas detection to detect explosion or fire risks; detectors for toxic substances (on board and in environment);
- oxygen deficiency: electrochemical oxygen sensor.

→**5.25 Portable gas detectors for first responders**

Water sampling

- water sampling by "niskin" bottles and storage of samples for laboratory analysis (for not surface spill)/bottle sampling for surface water (for substances "DE" and "ED"). For GD substances (in particular with regard for VOC and semi-VOC).

→**5.26 Sampling techniques and protocols**
→**5.27 HNS detection and analysis methods**

Response options
Vessel-oriented actions: →**5.28 Emergency boarding**

- mark out the risk area on board;
- stop the release of substance from its source;

→**5.32 Sealing and plugging**

- ventilate when possible (e.g. with ventilators) to reduce concentration but be careful if there is a very rich atmosphere (> UEL). In this case, ventilation could reduce the concentration below the UEL;

→**5.6 Response considerations: Flammable and explosive substances**

- for small spills, consider using techniques to prevent/control ignition or evaporation of the chemicals;

→**5.35 Using foam**

- recovery operation of the residual load;

→**5.31 Cargo transfer**

- towing & boarding;

→**5.29 Emergency towing 5.30 Places of refuge**

Pollutant-oriented actions:

- high pressure water spray jet;

→**5.34 Using water curtains**

- re-condensation of spilled gas in liquid state: for small spillage;
- controlled release technique;

→**5.36 Natural attenuation and monitoring**

- wildlife response focuses on toxic effects on avifauna or marine mammals (inhalation hazards).

→**5.44 Wildlife response**

Containment and recovery: None. Monitoring only**.**

Natural attenuation and monitoring:

- evaluate the non-intervention strategy in the case of: high risks for human health; no risks of cloud advection towards the coast. Set up exclusion/ban areas, until natural processes have reduced pollutant concentrations.

→**5.36 Natural attenuation and monitoring**

Post-Spill

Environmental investigation:

- generally UNNECESSARY in the case of gaseous and highly volatile substances. To be considered in the case of damages following a release of gas/evaporator (e.g. fire and/or explosion);
- for soluble substances (GD): detection of concentrations in water and evaluation of the effects on sensitive organisms;
- chemical and ecotoxicological analysis of samples of contaminated water;
- chemical analysis and studies on biomarkers of sedentary species;
- the same investigations must always be carried out in areas chosen as a reference. Not for explosive HNS.

→**5.27 HNS detection and analysis methods**

See Chapter **6.2 Post-spill monitoring**

→**6.2 Environmental restoration and recovery**

Table 30: Examples of gaseous/evaporator chemicals of marine environmental concern

EXAMPLES OF GASEOUS/EVAPORATOR CHEMICALS OF MARINE ENVIRONMENTAL CONCERN		
SEBC group	Main characteristics and impact on the marine environment	GHS pictograms
Vinyl chloride (G)	Highly flammable, shows long-term toxicity (carcinogen), ther- mal degradation with the formation of toxic/corrosive fumes. Incident: *Brigitta Montanari*, 1984; off Croatian coast. Cargo: bulk (1,300 tonnes of vinyl chloride monomer) Incident: tanker-barge	

	Pampero, 2020; at the locks in Sablons, Rhône France. Cargo: bulk (2,200 tonnes)	
Anhydrous ammonia (GD) shipped in liquid state	Corrosive, highly toxic to aquatic organisms due to formation of a highly corrosive solution with water. Incident: *René 16*, 1976; Port of Landskrona, Sweden. Cargo: bulk (533 tonnes of anhydrous ammonia)	
Benzene (E)	Toxic liquid for humans and the environment. Not persistent in the water column, tends to partition in the atmosphere. Depending on the release conditions, it could be toxic for marine organisms, in particular for pleuston due to the tendency of benzene to float. Dangerous for marine mammals and avifauna if inhaled. Vapours of benzene are heavier than air. Incident: Barge, 1997; Mississippi River, US. Cargo: bulk (pyrolysis gasoline contains 41.0% benzene)	
Methyl-t-butyl ether (ED)	It has low acute and chronic toxicity for marine species but acute effects were found at high concentrations for the grass shrimp and marine mussel. It poses limitations on uses of the sea. Vapours heavier than air. Incident: *Carla Maersk*, 2015; Houston Ship Channelgo, US. Cargo: bulk 5,600 tonnes of MTBE.	

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