INTERNATIONAL MARITIME ORGANIZATION

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REPORT TO THE MARITIME SAFETY COMMITTEE AND THE MARINE ENVIRONMENT PROTECTION COMMITTEE

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LIST OF ANNEXES

1 GENERAL

Introduction

1.1 The Sub-Committee on Carriage of Cargoes and Containers (CCC), chaired by Ms. M. Adams (Marshall Islands), held its ninth session from 20 to 29 September 2023. The Vice-Chair, Mr. D. Anderson (Australia), was also present.

1.2 The session was attended by delegations from Member States and Associate Members of IMO; and by observers from intergovernmental organizations and non-governmental organizations in consultative status, as listed in document CCC 9/INF.1.

Secretary-General's opening address

1.3 The Director of the Maritime Safety Division, on behalf of the Secretary-General, welcomed participants and delivered the opening address. The Director also expressed condolences to the Libyan Authorities and the families of those who had lost their lives in the massive flooding in eastern Libya following storm Daniel, as well as the Government of Morocco and to all those impacted by the devasting earthquake, with thousands of lives lost and many missing. The full text of the opening address can be downloaded from the IMO website at the following address:
http://www.imo.org/MediaCentre/SecretaryGeneral/Secretary/GeneralsSpeechesToMeetings

Chair's remarks

1.4 In response, the Chair thanked the Director of the Maritime Safety Division for delivering the opening address and assured her that the advice and requests would be given every consideration in the deliberations of the Sub-Committee. On behalf of the Sub-Committee, the Chair also expressed condolences to the Libyan Authorities and Government of Morocco and to all those impacted by the recent devastating events.

Adoption of the agenda and related matters

1.5 The Sub-Committee adopted the agenda (CCC 9/1) and agreed to be guided in its work, in general, by the annotations contained in document CCC 9/1/1 (Secretariat) and the working arrangements in document CCC 9/1/2 (Chair).

Use of hybrid meeting capabilities

1.6 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 and C 128 (C 127/D, paragraph 17.3; and C 128/D, paragraph 16.2.2), in particular 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.5)

1.7 The Sub-Committee noted that, in accordance with paragraphs 4.37 and 4.38 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.5), after consideration of the draft report of the Sub-Committee, the Secretariat would prepare the

final draft report for publication on IMODOCS. Delegations would be given five working days from publication of the final draft report to comment by correspondence. Comments should only address editorial corrections and improvements, including finalizing individual statements, and should not reopen discussion on decisions taken during the session. The Chair, supported by the Secretariat, would facilitate resolution of any comments received, as necessary. After the conclusion of the five-day correspondence period, the Secretariat, in consultation with the Chair, would publish a document on IMODOCS containing the comments received, together with an explanation of how they had been addressed. After the above document had been published, the final report would be prepared in due course for publication on IMODOCS.

1.8 The Sub-Committee noted also that, in addition to the above, a revised paragraph 6.3 was included in MSC-MEPC.1/Circ.5/Rev.5, stating that documents should not be introduced in plenary unless the Chair decided that this was essential for the proper consideration of the matter concerned. However, submitters of documents could indicate if they had additional information or context required for the discussions, in order for the Chair to prioritize interventions.

2 DECISIONS OF OTHER IMO BODIES

General

2.1 The Sub-Committee noted the outcomes of MSC 106, MSC 107, C 128, MEPC 79 and MEPC 80 relevant to the work of the Sub-Committee, as reported in documents CCC 9/2 and CCC 9/2/1 (Secretariat) and took them into account in their deliberations when dealing with the relevant agenda items.

Application statements of resolutions concerning new mandatory or non-mandatory instruments, or amendments to existing ones

2.2 In regard to the outcome of MSC 106, the Sub-Committee noted that the Committee had confirmed that application statements of future resolutions concerning new mandatory or non-mandatory instruments, or amendments to existing ones which used the terms "fitted", "provided", "installed" or "installation", should provide a clear understanding of the intended meaning of such terms, and invited all Sub-Committees to take action accordingly (MSC 106/19, paragraph 3.37.1).

Status of footnotes in SOLAS amendments

2.3 The Sub-Committee also noted the request by MSC 107 to give due consideration to paragraph 5.4 (Status of footnotes) of the *Guidance on drafting of amendments to the 1974 SOLAS Convention and related mandatory instruments* (MSC.1/Circ.1500/Rev.2) when drafting footnotes for inclusion in mandatory instruments (MSC 107/20, paragraph 3.65).

Document submission portal and taking decisions by correspondence

2.4 The Sub-Committee noted the approval of amendments to 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.5) (see also paragraphs 1.7 and 1.8), in particular the inclusion of a new provision on the meeting document submission portal (MSC 106/19, paragraph 15.13; and MSC 107/20, paragraphs 16.5 to 16.7). The Sub-Committee also noted decisions taken by MSC 107 to discontinue the practice of taking decisions by correspondence (MSC 107/20, paragraph 16.4).

Maritime transport of plastic pellets

2.5 The Sub-Committee noted that PPR 10 (PPR 10/18, paragraph 13.55), in considering the reduction of the environmental risk associated with the maritime transport of plastic pellets, had agreed to request input by the CCC Sub-Committee, as follows:

.1 note the text of the draft circular (PPR 10/18, annex 9) 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 (PPR 10/WP.1/Rev.1, paragraph 13.52), 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 might 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.

2.6 In this context, the Sub-Committee also had for its consideration the following documents:

.1 CCC 9/2/2 (DGAC and CEFIC), providing comments and draft text for the CCC Sub-Committee to consider as it developed its input to the PPR Sub-Committee;

.2 CCC 9/2/3 (France), containing recommendations for packaging measures with a view to finalizing the MEPC circular and responding to the terms of reference of the Working Group on Marine Plastic Litter from Ships; presenting the state of knowledge on current practices in the packaging of plastic pellets, the issues involved and existing technical solutions; and proposing an amendment to the draft circular; and

.3 CCC 9/2/4 (Germany and Kingdom of the Netherlands), referring to the discussion in the PPR Sub-Committee on potential mandatory measures to reduce marine pollution caused by the loss at sea of containers with plastic pellets and providing comments on the options discussed in that Sub-Committee.

2.7 Following the discussion, the Sub-Committee noted the following general views on this matter:

.1 the current draft text in paragraph 1.1 was sufficient for the purposes of the circular, noting that it was an interim measure and the text provided was based on, but did not refer to, the general provisions for packaging provided in 4.1.1 of the IMDG Code. Further consideration of any additional packaging advice could be undertaken when further considering potential mandatory instruments which might be used to regulate the carriage of plastic pellets by ships in freight containers. Elements of the submissions providing information beyond packaging measures in the draft circular or that address the mandatory measures for plastic pellets should be provided to the PPR Sub-Committee for consideration;

.2 the draft circular could be supported as it was, and a reference to the IMDG Code should not be included. PPR 10 requested advice only on possible recommendations concerning packaging and referencing the IMDG Code. With regard to consideration of possible mandatory measures, according to a two-step approach agreed by the PPR Sub-Committee, this consideration should take place only after experience had been gained from the application of the circular;

.3 the issue of plastic pellets leakage into the ocean must be addressed at its root causes, such as accidental loss during the transport. Therefore, collective efforts should be made to make sea transport of plastic pellets safer and more effective to prevent avoidable losses. Ocean carriers should be made aware of the presence of plastic pellets in shipments to properly stow them in a safe area of the ship to prevent losses at sea throughout the transport. Producers should be required to declare when freight containers contained plastic pellets. Ship operators would then be guided to ensure proper and safe stowage on the ship. This should address more directly the problem of plastic pellet loss at sea as opposed to reclassifying or regulating pellets in the IMDG Code. With regard to the draft circular, it could be supported as a short-term voluntary solution and for rapid implementation, with detailed guidelines for packagings and packing of freight containers. The IMDG Code should not be referenced in the circular;

.4 the draft circular should contain text on accidental conditions, as evidenced by recent accidents;

.5 the draft circular could be supported. However, at the end of paragraph 1, there was no need for the text "pending the Committee's consideration of future mandatory measures for the carriage of plastic pellets in freight containers", as all IMO instruments, whether mandatory or non-mandatory, were subject to review and amendments, if necessary. Regarding the definition and size of plastic pellets, the current definition in the draft circular could be supported. However, if this matter was not agreed at this session, it would be advisable to keep it in square brackets;

.6 it would be advisable to refer all documents to a drafting or working group for further consideration;

.7 the current text in paragraph 1.1 of the draft circular was too weak and would not prevent accidental spillage and further amendments to the draft circular would be needed. Plastic pellets transported at sea in larger amounts should be packaged using flexi-tanks, silo tanks or conventional tank containers. The manufacturer of the plastic pellets, the shipper or the designated responsible party would be responsible for providing the necessary tank. Regarding plastic pellets transported at sea in smaller amounts, the proposal in document CCC 9/2/3 regarding certified drums and any other equivalent packaging possibilities should be supported. It would not be necessary to refer to the IMDG Code in the circular;

.8 requirements concerning carriage of plastic pellets should be improved in terms of classification, packaging, stowage and pollution preparedness. Accidental conditions should be mentioned in the circular. Packaging provisions could be further deliberated in the drafting group;

.9 the text of the draft circular could be supported, with the understanding that the issue of pellet size needed further consideration; developing mandatory requirements at a later stage could also be supported;

.10 involvement of both the shipper and the carrier needed to be taken into account, and this issue could be further considered at a drafting group;

.11 there was no need to refer any documents to a drafting group at this stage; and

.12 the issue on definition of plastic pellets should not be overlooked.

2.8 Following the discussion, the Sub-Committee noted the following views regarding document CCC 9/2/3:

.1 limitation of the types of containers to be used raised concerns. Mandatory use of silo tank containers for maritime transport would have major implications, including that there were not enough of these types of containers available. Instead, other ad hoc measures could be considered, such as concerning identification of packagings and containers;

.2 the table in paragraph 9 of document CCC 9/2/3 was not clear concerning suitable characteristics, in terms of what was satisfactory and what was not; and concerning risk of operational spill, in terms of when the risk was deemed to be high or low. The diverse nature of transport of plastic pellets needed to be taken into account;

.3 the proposed amendment to the draft MEPC circular could not be supported. ISO-certified drums and silo tank type-approved containers were rarely used in international plastic pellet transport at this moment. If the proposal would need to be implemented, a substantial period of time would be needed for both suppliers and consumers to renovate their cargo handling facilities. This would prevent the immediate implementation of the circular. Although the drums and the silo containers were considered as providing for transportation with a low risk of plastic pellets discharge, those packagings might not be practical examples for a short-term measure. As a voluntary measure, it would be possible and more feasible to prevent potential damage to packagings in current use, rather than assuming the damages under accidental conditions. The proposed situation, such as torn bags and damaged octabins, has been appropriately considered in the draft circular and reflected as "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". There were good practices available today, which could appropriately prevent an inner cargo from such damage as well, without introducing containers which were not used today. Therefore, the draft text developed at the PPR Sub-Committee should be retained as it was;

.4 naming specific packaging types in the draft circular was not supported. Instead, using performance criteria was supported;

.5 the proposed text in document CCC 9/2/3 could be supported, in general. The details could be further considered by a drafting group;

.6 the specified measures proposed in document CCC 9/2/3 could possibly be introduced in paragraph 1.1 of the draft circular, but as examples. Adding the underlined text in paragraph 16 of document CCC 9/2/3 on accidental leaks, "or under accidental conditions (torn bags, damaged octabins, etc.)", could be supported;

.7 document CCC 9/2/3 aimed to reflect packagings that were available on the market. It should be noted that the draft circular was recommendatory in nature;

.8 with regard to ICS 55.140-certified drums, it was not clear what these were. With regard to silo containers, there was no reference to an ISO standard in document CCC 9/2/3. It was also not clear, in terms of size required, when a silo container would have to be used;

.9 it should be noted that plastic pellets were not dangerous goods according to the IMDG Code. Therefore, packaging requirements were not applicable. Using type-approved packagings for plastic pellets would be a too stringent requirement. Normal transport conditions should be taken into account, but it would not be appropriate to take into account accidental conditions. Certified drums and silo containers were not commonly used for transporting plastic pellets. Silo containers would not be suitable. Requirement to use these types of packagings would lead to higher carbon emissions and increased weight of shipments;

.10 regarding plastic pellets transported in smaller amounts, the proposal in document CCC 9/2/3 could be supported, along with any other equivalent packaging possibilities;

.11 the requirement to prevent loss of contents in accidental conditions did not exist even concerning high-hazard dangerous goods. The proposal in document CCC 9/2/3 was not a correct way forward for plastic pellets. Type approval for the mentioned two packaging types would need further clarification; and

.12 the proposals in paragraphs 15 and 16 of document CCC 9/2/3 should be further examined in conjunction with consideration on other measures, such as stowage and securing on board.

2.9 Following the discussion, the Sub-Committee noted the following views regarding documents CCC 9/2/2 and CCC 9/2/4:

.1 the draft circular could be complemented by the proposed minimum requirements for sea bulk containers, as suggested in document CCC 9/2/2. This would keep the solution clear and pragmatic for all stakeholders involved in the logistics operation while being able to achieve the ultimate objective of preventing leakages into the environment without distorting the global plastics supply chain. The detailed guidelines in document CCC 9/2/2 could be effective for the two-stage approach; first acting as a guide for voluntary implementation, and later to be developed into mandatory standards;

.2 document CCC 9/2/2 could be generally supported in terms of notification, packaging and stowage of plastic pellets. The requirements should be based on industry practice;

.3 the text in the annex to document CCC 9/2/2 could not be supported for inclusion in the draft circular. Concrete proposals for potential mandatory measures were to be submitted to a future session of the PPR Sub-Committee for further consideration, and not to this CCC session. Therefore, document CCC 9/2/4 should be deferred to PPR 11;

.4 it should be noted that document CCC 9/2/2 was not proposing substantive amendments;

.5 with regard to document CCC 9/2/2, the packaging measures proposed in the annex to the document could be supported for inclusion in paragraph 1.1 of the draft circular. Some of the proposed wordings should be part of this Sub-Committee's recommendation to PPR 11, e.g. concerning paragraph 44 of the document: "Clear, unambiguous defining criteria, including cut-off values are used in virtually all classification criteria and definitions of the GHS, UN Model Regulations, the IMDG Code, and other regulatory codes…". Paragraph 40 of the document could also be supported, i.e. that part 6 of the IMDG Code could not be invoked as a stand-alone provision and that packaging for plastic pellets should not be subjected to performance testing or competent authority approval requirements. However, the statement in paragraph 37 could not be supported, where it was stated that the IMDG Code, including its packaging requirements, was not intended to, and could not, provide the types of protections envisaged by the proponents of classification of plastic pellets as dangerous goods. Concerning document CCC 9/2/4, option 3 would be the best way forward;

.6 definition for plastic pellets was needed, as also acknowledged in document CCC 9/2/2, particularly when possible mandatory requirements were considered. With regard to size of the pellets, it should be noted that GESAMP Reports & Studies No.93 had included plastic pellets in the range of 5 to 25 mm. Concerning mandatory requirements, regulating through MARPOL Annex III was not supported as an option. The statement in paragraph 15 of document CCC 9/2/2, stating that subjecting plastic pellets to the provisions of the IMDG Code would not prevent their release into the ocean, could not be supported. The statement in paragraph 27, stating that plastic pellets did not fall within the dangerous goods transport classification scheme and therefore were not dangerous goods, was not correct in terms of classification under class 9. Option 3 in document CCC 9/2/4 was supported in this regard;

.7 document CCC 9/2/2 could generally be supported, in particular paragraphs 38 to 44, and paragraphs 18 and 39 in that the IMDG Code was not intended to, and could not, provide the types of protections envisaged by the proponents of classification of plastic pellets as dangerous goods. Option 2 in document CCC 9/2/4 could be supported;

.8 the view in document CCC 9/2/2 on regulating plastic pellets was not correct. Further exploration of a new UN number for plastic pellets in class 9, applicable to sea mode only, as highlighted in document CCC 9/2/4, could be supported;

.9 with regard to document CCC 9/2/4, it should be noted that according to the classification criteria in the UN Manual of Tests and Criteria and the UN Model Regulations, it was not possible to classify plastic pellets to any existing UN number, nor to develop a new UN number. However, if this were to be the way forward, this issue would have to be discussed and decided first at the Committee of Experts on the Transport of Dangerous Goods and on the Globally Harmonized System of Classification and Labelling of Chemicals (GHS), because classification of the substance as a dangerous good in transport was multimodal in nature;

.10 option 3 in document CCC 9/2/4 would allow for tailor-made requirements to be developed for maritime transport of plastic pellets, and this would be in line with the IMDG Code. As a minimum, CCC 9 should advise PPR 11 on the possibility of developing such mandatory requirements;

.11 as indicated in document CCC 9/2/4, seeking a new UN number for plastic pellets would be the right way forward. However, such a proposal would require appropriate rationale on why transport provisions necessitated the development of a new UN number. This would entail detailed consideration on transport provisions at the CCC Sub-Committee;

.12 with regard to document CCC 9/2/4, submitting a proposal to UNTDG for a new UN number should not be encouraged, neither from a technical nor from a procedural point of view. With regard to document CCC 9/2/2, clarifications therein could be useful information for the PPR Sub-Committee; and

.13 introduction of mandatory measures as soon as possible was supported. Therefore, option 2 in document CCC 9/2/4 on creating a new chapter in MARPOL Annex III was supported.

2.10 After consideration, the Sub-Committee agreed that the draft MEPC circular should be retained as set out in annex 9 to document PPR 10/18, in particular that the draft text in paragraph 1.1 should not be amended and that a reference to the IMDG Code should not be included.

2.11 Subsequently, the Sub-Committee invited PPR 11 to note the decision taken (see paragraph 2.10 above) and the deliberations, as set out in paragraphs 2.7 to 2.9 above, in particular that paragraphs 39 to 44 of document CCC 9/2/2 could be further considered, with a view to providing further clarifications in the draft MEPC circular, if appropriate.

2.12 The Sub-Committee, having recognized the different scope and mandate of the Sub-Committees and varying compositions of the delegations, further invited PPR 11 to note that the information contained in documents CCC 9/2/2, CCC 9/2/3 and CCC 9/2/4 could be taken into account in the further development concerning the reduction of the environmental risk associated with maritime transport of plastic pellets.

Current situation after the Russian Federation's withdrawal from the Black Sea Initiative

2.13 The Sub-Committee noted a statement made by the delegation of Ukraine, as set out in annex 11, pointing out that the Russian Federation had deliberately blackmailed the world with the threat of a food crisis, whilst simultaneously continuing the illicit trafficking of Ukrainian agricultural products looted by the Russian Federation's military from the temporarily occupied territories in Luhansk, Donetsk, Kherson and Zaporizhzhia regions, and systematically attacking Ukrainian ports of Big Odesa and those on the Danube River to prevent the export

of Ukrainian grain by sea. The delegation also outlined its efforts to restore free shipping in the Black Sea region and minimize the impacts of a possible world food crisis, in particular the following actions: under the special maritime corridor which was announced at the 129th session of the IMO Council, five vessels had used this corridor to exit Ukraine's territorial waters since 15 August; two bulkers had arrived recently at the port of Chornomorsk to load about 20,000 tons of wheat; Ukraine was strengthening and broadening its military presence in the Black Sea to increase the security for ships; and it had established a compensation scheme (with a budget of US$540 million) that was intended to support commercial shipping to and from Ukraine and underpin liability arising from an attack on merchant ships that entered the Black Sea with the intention of loading and/or unloading goods in Ukraine's territory. The delegation also stated the obvious failure of the Russian naval blockade of Ukrainian ports in the light of the resumption of the movement of ships through the new maritime corridor; that any attempts to revive the defective Grain Initiative by proposing concessions to the Russian Federation and loosening the sanctions regimes were counterproductive; and called upon the international community and reputable international organizations like the UN, IMO, FAO, UNCTAD to focus their efforts on restoring the free shipping in the Black Sea region and minimizing the impacts of a possible world food crisis.

2.14 The delegations of Australia, Canada, Spain (supported by Belgium, Cyprus, Denmark, France, Finland, Germany, Greece, Ireland, Italy, the Kingdom of the Netherlands, Norway, Poland, Portugal, Sweden and the European Commission), Japan, the United Kingdom and the United States also made statements as set out in annex 11 expressing their solidarity with Ukraine and the Ukrainian people. The majority of delegations that spoke condemned the Russian Federation's systematic attacks against the Ukrainian port infrastructures and grain storage facilities in Odesa region and the attempts to destroy the Odesa port and those on the Danube River since the Russian Federation had withdrawn from the Black Sea Grain Initiative last July. They welcomed the efforts made by Ukraine aimed at safeguarding the safety, stability and freedom of international navigation in the Black Sea and preventing a global food crisis and called on the Russian Federation to refrain from threatening international supply chains that supported other countries and provided food by targeting civilian cargo ships.

2.15 The Sub-Committee noted a statement made by the delegation of the Russian Federation, as set out in annex 11, underlining that previous delegations yet again had produced a series of unfounded facts in order to mislead the IMO Member States, inter alia, with regard to the alleged attacks on civilian cargo ships. The delegation yet again stressed that the matters raised lay outside of the mandate of this technical Sub-Committee. In respect of the Black Sea Grain Initiative, it was stated that on many occasions its routes had been used to commit terrorist attacks by the Ukrainian forces. Apart from this, the second part of the Black Sea Grain Initiative package of providing Russian grain and fertilizers to alleviate a food crisis had never worked. The NATO countries directly blocked this humanitarian effort and instead of contributing to it preferred to further supply arms and munitions to Ukraine. It was confirmed that for any such initiative to be effective and successful the interests of all the parties involved should be respected and acted upon.

3 AMENDMENTS TO THE IGF CODE AND DEVELOPMENT OF GUIDELINES FOR ALTERNATIVE FUELS AND RELATED TECHNOLOGIES

Background

3.1 The Sub-Committee recalled that CCC 8 had re-established the Correspondence Group on Development of Technical Provisions for the Safety of Ships using Low-flashpoint Fuels, with the terms of reference set out in paragraph 3.24 of document CCC 8/18 (Secretariat), to continue the work on the draft safety provisions for ships using alternative fuels.

Report of the Correspondence Group

3.2 The Sub-Committee had for its consideration the report of the Correspondence Group on Development of Technical Provisions for the Safety of Ships Using Alternative Fuels (CCC 9/3 and Add.1) and took action as set out in the following paragraphs.

Interim guidelines for ships using hydrogen as fuel

3.3 The Sub-Committee, having noted the discussions and progress made by the Group on the development of interim guidelines for ships using hydrogen as fuel (CCC 9/3, paragraphs 4 to 12 and annex 1), also had for its consideration the following documents:

.1 CCC 9/3/11 (Japan), commenting on document CCC 9/3 and providing key elements for the development of the draft interim guidelines for the safety of ships using hydrogen as fuel;

.2 CCC 9/3/12 (Japan), providing specific text proposals for the development of the interim guidelines for ships using hydrogen based on the analysis and proposals contained in document CCC 9/3/11;

.3 CCC 9/3/15 (IACS), providing comments on document CCC 9/3 proposing to develop the interim guidelines for ships using hydrogen as fuel;

.4 CCC 9/INF.17 (IACS), providing the outcome of an analysis performed to identify the applicability and gaps in the requirements of the IGF Code in respect of the use of hydrogen as fuel; and

.5 CCC 9/INF.18 (Republic of Korea), providing information on the development of novel designs for liquid hydrogen fuel storage tanks for ships, as well as plans for a demonstration plan utilizing K-GTB.

3.4 In this regard, the Sub-Committee instructed the Working Group on Development of Technical Provisions for Safety of Ships Using Alternative Fuels, if established, to further develop the draft interim guidelines for ships using hydrogen as fuel, towards finalization, based on annex 1 to document CCC 9/3 and taking into account documents CCC 9/3/11, CCC 9/3/12, CCC 9/3/15, CCC 9/INF.17 and CCC 9/INF.18.

Safety provisions for ships using low-flashpoint oil fuels

3.5 The Sub-Committee noted the Group's discussion on the development of safety provisions for ships using low-flashpoint oil fuels. Having considered document CCC 9/3/10 (Russian Federation), commenting on document CCC 9/3 with a proposal to use an approach to provide safety by means of controlling air temperature in engine-rooms, as well as relevant specific proposals to the text of draft interim guidelines for the safety of ships using low-flashpoint oil fuels prepared by the Correspondence Group, the Sub-Committee also noted the following views on the development of safety provisions for ships using low-flashpoint oil fuels:

.1 leakage of low-flashpoint diesel fuels into conventional engine-rooms would result in potentially dangerous increased concentrations of ignitable fuel vapour and in this regard, the multi-walled fuel pipes concept provided the best protection in all situations, regardless of the ambient engine-room temperature;

.2 a temperature-controlled machinery space concept could be further considered as an equivalent measure provided the temperature was always kept at least 15°C below the lowest allowable flashpoint of the fuel;

.3 the provisions for a potential temperature-controlled machinery space concept should be complemented by proactive mitigating mechanisms such as automatic changeover to fuels meeting the 60°C flashpoint requirement, if the temperature limit was exceeded;

.4 the Sub-Committee should further develop the draft interim guidelines for the safety of ships using low-flashpoint oil fuels, which would allow the shipping industry to extend its fuel options that had already been used safely in the marine applications;

.5 studies provided to previous sessions, e.g. CCC 6/INF.6 on the FSA Study on the use of low-flashpoint oil fuels, should be taken into account in the further development of the draft interim guidelines; and

.6 document CCC 6/INF.6 should be taken into account in the course of further development of the guidelines.

3.6 Consequently, the Sub-Committee instructed the Working Group on Development of Technical Provisions for Safety of Ships Using Alternative Fuels, if established and if time permitted, to further develop the draft interim guidelines for ships using low-flashpoint oil fuels, based on annex 2 to document CCC 9/3/Add.1 and taking into account annex 3 to document CCC 9/3/Add.1 and document CCC 9/3/10.

Interim guidelines for ships using ammonia as fuel

3.7 The Sub-Committee, having noted the discussions and progress made by the Group on the development of interim guidelines for ships using ammonia as fuel (CCC 9/3, 18 to 27 and annexes 4 to 7), had for its consideration the following documents:

.1 CCC 9/3/1 (Republic of Korea and ITF), suggesting the safety principle and the draft proposals for the safety requirements of preventing exposure to toxicity, to be considered in further development of the interim guidelines for ships using ammonia as fuel;

.2 CCC 9/3/2 (Republic of Korea), providing relevant research results by comparing the characteristics of ammonia toxicity factors and exposure criteria for the efficient development of safety guidelines for vessels using ammonia as fuel, and considering the necessity of setting standards for crew members in terms of health aspects;

.3 CCC 9/3/13 (Japan), commenting on document CCC 9/3 and providing key elements for the development of the draft interim guidelines for ships using ammonia as fuel;

.4 CCC 9/3/14 (IACS), providing comments on document CCC 9/3, in particular specific technical comments on the draft guidelines contained in annex 4 of document CCC 9/3;

.5 CCC 9/INF.7 (Denmark et al.), providing supporting information to ease the review of the draft interim guidelines for the safety of ships using ammonia as fuel, as set out in annex 5 to the report of the Correspondence Group;

.6 CCC 9/INF.16 (IACS), providing information on gap analysis between ammonia as fuel and the IGF Code for LNG, taking into account the different properties, behaviours and hazards/risks; and

.7 CCC 9/INF.27 (Environmental Defense Fund), containing a study on the impacts of an ammonia spill from a ship utilizing ammonia as a marine fuel, resulting from a collision, sinking or bunkering incident.

3.8 In the ensuing discussion, the Sub-Committee noted the following views:

.1 amidst the intense discussion on toxicity, it was imperative to allocate further consideration to the flammability of ammonia;

.2 spaces should be protected with fixed gas detection systems sending a separate alarm when the ammonia concentration exceeded a certain level to avoid explosive situations and onboard personnel should be provided with portable ammonia gas detection equipment;

.3 document CCC 9/3/1 should be forwarded to the Working Group to be taken into account when further developing the draft interim guidelines on the use of ammonia as a fuel;

.4 the draft interim guidelines should consider all potential sources of ammonia when a ship was in operation to cover all in-service and maintenance activities;

.5 for the further development of the draft interim guidelines, safety principles for toxic fuels should be agreed upon, though for conventional fuel such as LNG fuel under the IGF Code was developed by focusing on lower explosive limit related to fire and explosions;

.6 the study should continue on the toxicity and corrosivity of ammonia as a marine fuel, in particular that the safe use of mechanical ventilation on board should be carefully considered;

.7 a number of important areas still needed further consideration, e.g. toxicity criteria, impact of ammonia vapours and location of gas detectors, and a comprehensive review of the existing instruments was needed; and

.8 the use of toxic fuel was unprecedented and health risk for crew should be highlighted; therefore, a conservative approach for the development of safety provisions in relation to ammonia should be taken.

3.9 Consequently, the Sub-Committee instructed the Working Group on Development of Technical Provisions for Safety of Ships Using Alternative Fuels, if established, to further develop the draft interim guidelines for ships using ammonia as fuel, towards finalization, based on annex 4 to document CCC 9/3 and taking into account annexes 5 to 7 to document CCC 9/3/Add.1 and documents CCC 9/3/1, CCC 9/3/2, CCC 9/3/13, CCC 9/3/14, CCC 9/INF.7, CCC 9/INF.16 and CCC 9/INF.27.

Work plan for the development of the IGF Code and safety provisions for alternative fuels

3.10 The Sub-Committee recalled that CCC 8 had updated the work plan for the development of the IGF Code and safety provisions for alternative fuels, as set out in annex 2 to document CCC 8/18.

3.11 The Sub-Committee also noted that MSC 106 had agreed to expand the scope and amend the title of the existing output 2.3 to read "Amendments to the IGF Code and development of guidelines for alternative fuels and related technologies" (resulting in the deletion of output 2.24 on "Development of guidelines for the safety of ships using ammonia as fuel" to avoid duplication), in order to accommodate the consideration of alternative fuels not having a low flashpoint, and endorsed the updated work plan for the development of the IGF Code and safety provisions on alternative fuels. In this regard, MSC 106 had instructed the CCC Sub-Committee to coordinate directly with other relevant IMO bodies, as necessary, in order to progress the output in an expeditious manner (MSC 106/19, paragraph 16.42).

3.12 The Sub-Committee further noted that MSC 107 had agreed to include, in the biennial agenda of the Committee for 2024-2025, a continuous output on "Development of a safety regulatory framework to support the reduction of GHG emissions from ships using new technologies and alternative fuels"; and agreed that the goal of this output was to develop a regulatory framework (to include regulations and/or guidelines) to address new alternative fuels and new technologies for the safe reduction of ships' GHG emissions. MSC 107 had also agreed that the work under this output should start with the effort already completed by the CCC Sub-Committee, which should continue its work in accordance with its work plan for the development of alternative fuels and related technologies (MSC 107/20, paragraphs 17.4 to 17.6).

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

.1 CCC 9/3/4 (IACS), summarizing the experience gained in the use of the *Interim guidelines for the safety of ships using fuel cell power installations* (MSC.1/Circ.1647) and providing suggestions for improvement;

.2 CCC 9/3/6 (Singapore), highlighting the technical considerations when transposing the *Interim guidelines for the safety of ships using methyl/ethyl alcohol as fuel* (MSC.1/Circ.1621) into mandatory instruments under the IGF Code;

.3 CCC 9/3/7 (China), proposing some revisions to regulations 9.4.2, 13.4.1, and 13.6.1 of the *Interim guidelines for the safety of ships using methyl/ethyl alcohol as fuel* (MSC.1/Circ.1621); and

.4 CCC 9/INF.23 (China), presenting the full report of an experimental study of ventilation effect and arrangement for onboard enclosed spaces containing methanol.

3.14 The Sub-Committee noted a statement by the delegation of Singapore, as set out in annex 11, highlighting a methodology it had developed for trials of vessels using new and alternative fuels, which it had successfully applied for a ship-to-containership methanol bunkering operation. The delegation also suggested that this could help Member States and industry to adopt such fuels more quickly.

3.15 In the ensuing discussion, the Sub-Committee noted the following views:

.1 document CCC 9/3/4 should be considered at CCC 10, which was in line with the work plan for the development of the IGF Code and safety provisions on alternative fuels;

.2 document CCC 9/3/6 was supported in general, and it should be forwarded to the Working Group for further consideration;

.3 CCC 9 should not carry out amendments to MSC.1/Circ.1621 and the proposed changes to the ventilation requirements needed further verification, in particular that all possible hazards needed to be considered, e.g. toxicity and types of ethyl/methyl alcohols. Therefore, documents CCC 9/3/7 and CCC 9/INF.23 should be considered at a future session when developing mandatory regulations;

.4 the proposed scenario-based ventilation flow rate in document CCC 9/3/7 was supported and the document should be considered in the development of mandatory instruments for use of methyl/ethyl alcohols as fuel;

.5 concerns on ventilation for fuel preparation spaces, venting arrangement for fuel tanks, fire detection system and additional measures in preparation of methanol bunkering should be further considered by the Sub-Committee;

.6 documents CCC 9/3/4 and CCC 9/3/6 provided usual experience and should be further considered by the Working Group;

.7 document CCC 9/3/7 should only be considered in the context of the future work plan, noting that the proposal could be further elaborated at a future stage, together with the objective evidence submitted to support the changes to the ventilation requirements;

.8 the proposed modifications in relation to the ventilation requirements in document CCC 9/3/7 could reduce the cost of ship building and operation, without lowering the current safety level;

.9 the scope of study presented in document CCC 9/3/7 was severely limited and the real-world conditions, e.g. including equipment inside the test room, should be replicated as much as possible in order to assess their impacts on methanol vapour behaviour; and

.10 documents CCC 9/3/7 and CCC 9/INF.23 should be considered when developing mandatory standards, noting that these documents proposed a reduction in ventilation requirements without taking into account the risk of inhalation exposure due to the toxicity of methanol or other specific risks such as ignition, explosion and toxicity of alcohols other than methanol which might lead to a reduction in the safety level. These essential factors should be taken into account during the discussion on amendments to the requirements for ventilation systems, in particular for fuel preparation spaces, as indicated in provision 13.4 of the Interim Guidelines (MSC.1/Circ.1621).

3.16 Consequently, the Sub-Committee instructed the Working Group on Development of Technical Provisions for Safety of Ships Using Alternative Fuels, if established, to update the work plan for developing the IGF Code and safety provisions on alternative fuels, based on annex 2 to document CCC 8/18, and taking into account documents CCC 9/3/4, CCC 9/3/6, CCC 9/3/7 and CCC 9/INF.23.

Establishment of the Working Group

3.17 The Sub-Committee agreed to establish the Working Group on Development of Technical Provisions for Safety of Ships Using Alternative Fuels and instructed it, taking into account the comments made and decisions taken in plenary, to:

.1 further develop the draft interim guidelines for ships using hydrogen as fuel, towards finalization, based on annex 1 to document CCC 9/3 and taking into account documents CCC 9/3/11, CCC 9/3/12, CCC 9/3/15, CCC 9/INF.17 and CCC 9/INF.18;

.2 further develop the draft interim guidelines for ships using ammonia as fuel, towards finalization, based on annex 4 to document CCC 9/3 and taking into account annexes 5 to 7 to document CCC 9/3/Add.1 and documents CCC 9/3/1, CCC 9/3/2, CCC 9/3/13, CCC 9/3/14, CCC 9/INF.7, CCC 9/INF.16 and CCC 9/INF.27;

.3 if time permits, further develop the draft interim guidelines for ships using low-flashpoint oil fuels, based on annex 2 to document CCC 9/3/Add.1 and taking into account annex 3 to document CCC 9/3/Add.1 and document CCC 9/3/10;

.4 update the work plan for developing the IGF Code and safety provisions on alternative fuels, based on annex 2 to document CCC 8/18, and taking into account documents CCC 9/3/4, CCC 9/3/6, CCC 9/3/7 and CCC 9/INF.23; and

.5 consider whether it was necessary for the Correspondence Group to be re-established and, if so, prepare terms of reference for consideration by the Sub-Committee.

Report of the Working Group

3.18 Having considered the report of the Working Group on Development of Technical Provisions for Safety of Ships Using Alternative Fuels (CCC 9/WP.3), the Sub-Committee approved it in general and took action as described below.

Draft interim guidelines for the safety of ships using hydrogen as fuel

3.19 The Sub-Committee noted the progress made on the draft interim guidelines for the safety of ships using hydrogen as fuel (CCC 9/WP.3, paragraphs 6 to 35 and annex 1).

3.20 The Sub-Committee agreed to the use of the term "side shell" instead of the term "ship's side", as contained in the IGF Code, to align with SOLAS chapter II-1 (CCC 9/WP.3, paragraph 15 and annex 1, paragraph 5.6.1).

Clerical error in the IGF Code

3.21 The Sub-Committee agreed that there was a clerical error in the IGF Code and to rectify it by including relevant provisions in the draft IGF Code amendments developed under agenda item 3 (CCC 9/WP.4, annex 1), for consideration and approval by the Committee (CCC 9/WP.3, paragraph 34).

Draft interim guidelines for the safety of ships using ammonia as fuel

3.22 The Sub-Committee noted the progress made on the draft interim guidelines for the safety of ships using ammonia as fuel, as well as the matters to be considered by correspondence (CCC 9/WP.3, paragraphs 36 to 42 and annex 2).

Draft interim guidelines for the use of fuel oils with a flashpoint between 52°C and 60°C

3.23 The Sub-Committee noted that, due to time constraints, the Group did not consider the draft guidelines for the use of oil fuels with a flashpoint between 52°C and 60°C (CCC 9/WP.3, paragraph 43).

Updated work plan

3.24 The Sub-Committee agreed to the updated work plan for developing new alternative fuels under the IGF Code, as set out in annex 1 (CCC 9/WP.3, paragraph 44 and annex 3).

Establishment of an intersessional working group

3.25 The Sub-Committee agreed to the convening of an intersessional Working Group on Development of Technical Provisions for Safety of Ships Using Alternative Fuels, with draft terms of references as set out in annex 2, from 9 to 13 September 2024, immediately prior to CCC 10 (see also paragraph 11.7), subject to approval by MSC 108 and endorsement by the Council, taking into account the urgency of providing guidance to Administrations, shipowners and the industry at large on the safe use of hydrogen and ammonia as fuel, and in support of the Organization's emission targets (CCC 9/WP.3, paragraphs 45 and 46 and annex 4).

Re-establishment of the Correspondence Group

3.26 The Sub-Committee agreed to re-establish the Correspondence Group on Development of Technical Provisions for Safety of Ships Using Alternative Fuels, under the coordination of Germany,[11]and instructed it to:

.1 further develop the draft interim guidelines for ships using hydrogen as fuel, towards finalization, based on annex 1 to document CCC 9/WP.3 and taking into account documents CCC 9/3, CCC 9/3/11, CCC 9/3/12, CCC 9/3/15, CCC 9/INF.17 and CCC 9/INF.18;

.2 further develop the draft interim guidelines for ships using ammonia as fuel, towards finalization, based on annex 2 to document CCC 9/WP.3 and taking into account matters to be considered by correspondence

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(CCC 9/WP.3, paragraph 42), as well as annexes 5 to 7 to document CCC 9/3/Add.1 and documents CCC 9/3, CCC 9/3/1, CCC 9/3/2, CCC 9/3/13, CCC 9/3/14, CCC 9/INF.7, CCC 9/INF.16 and CCC 9/INF.27;

.3 if time permitted, further develop the draft interim guidelines for ships using low-flashpoint oil fuels, based on annex 2 to document CCC 9/3/Add.1 and taking into account annex 3 to document CCC 9/3/Add.1 and document CCC 9/3/10;

.4 inform the intersessional working group, if established, on the progress made in the development of the draft guidelines under .1, .2 and .3 above;

.5 convene remote meetings using a suitable platform in order to consider any of the terms of reference, as necessary, for the further development of the aforementioned draft guidelines; and

.6 submit a written report to CCC 10.

3.27 The Sub-Committee authorized the Correspondence Group to convene remote meetings using a suitable platform in order to consider any of the terms of reference, as necessary, for the further development of the three sets of draft guidelines mentioned in the draft terms of reference (CCC 9/WP.3, paragraph 47.5).

Draft amendments to the IGF Code

3.28 The Sub-Committee had for its consideration documents:

.1 CCC 9/4/Add.1 (Marshall Islands), containing the part of the report of the Correspondence Group on Amendments to the IGF Code and Review of the IGC Code concerning draft amendments to the IGF Code;

.2 CCC 9/3/3 (Liberia et al.), proposing amendments to paragraphs 7.3.1.3 and 9.4.1 of part A-1 of the IGF Code;

.3 CCC 9/3/5 (Republic of Korea et al.), proposing to amend the IGF Code Part A-1 to clarify the allowable depth of LNG fuel tank's suction wells intruding into ship's double bottom space, with a view towards global, uniform and safe implementation;

.4 CCC 9/3/8 (CESA), complementing the proposal in document CCC 9/3/5 to amend the IGF Code Part A-1 regarding the allowable depth of LNG fuel tank's suction wells intruding into ship's double bottom space; and

.5 CCC 9/3/9 (CESA), providing important considerations regarding the fire protection of type C tanks with vacuum insulation and those with conventional foam insulation. It concluded that proposed new wording for part A-1 of the IGF Code be rejected and the existing wording be retained.

3.29 In the ensuing discussion, the Sub-Committee noted the following views:

.1 the proposed amendments to paragraphs 7.3.1.3 and 9.4.1 of part A-1 of the IGF Code contained in document CCC 9/3/3 were supported, noting that check valves provided an equivalent level of protection of the piping system and the tank inlet from the relief valve discharge lines, both during normal operation and in the case of activation of the gas safety system in case of emergency;

.2 document CCC 9/3/5 should be considered in the Working Group, noting the proposed clarification was necessary and that the existence of small wells in LNG tanks should be recognized in the IGF Code;

.3 the proposed text contained in paragraph 14 of document CCC 9/3/5 was supported in principle, noting that it was necessary to clarify in the Working Group if the protection/isolation distance of the suction wells could be reduced/be lower than the rest of the tank;

.4 both documents CCC 9/3/3 and CCC 9/3/8 should be further considered in the Working Group;

.5 the outcomes of the Correspondence Group on draft amendments on paragraph 11.3.1 should be carefully considered, in particular the terms "regarded as a machinery space of category A and may be located in the cargo area", which could be contradictory to SOLAS regulation II-2/5.1.1;

.6 the proposal in paragraph 14 of document CCC 9/3/9 was not supported and the proposal in document CCC 8/3/2 was preferred;

.7 the draft amendments to paragraph 11.3.1 as contained in document CCC 9/4/Add.1 should be further discussed in the Working Group and the harmonization between IGF Code, IGC Code and SOLAS requirements should be taken into account;

.8 amendments to SOLAS Convention would be a better way forward to address the issued identified in document CCC 8/17/2 the application of paragraphs 11.3.1 and 11.3.2 of the IGF Code;

.9 the proposal in document CCC 9/3/9 was not supported, taking into account that, for single wall type C tank with conventional foam insulation in the event of long-term fire, damage to the insulation layer would also impact the safety of fuel tank; and the 900 mm distance to the insulation surface was a crucial safety factor, noting that when exposed to excessive heat the foam insulation used in many conventional single-walled type C fuel tanks might deteriorate very fast;

.10 the proposal in paragraph 11 of document CCC 9/3/8 and the proposal in paragraph 17 of the document CCC 9/3/9 were not supported; and

.11 with regard to the proposal in paragraph 14 in document CCC 9/3/5, the provisions in the IGF Code around tank minimum protection distances were based on the most restrictive requirements in the IGC Code – those for type 1G ships – even though LNG as a cargo only required a type 2G ship. The allowance for tank suction wells in the IGC Code did not apply to type 1G ships. Therefore, the difference was deliberate, and the document should be forwarded to the Working Group for further discussions as to why the provision for suction wells was not included.

3.30 Subsequently, the Sub-Committee instructed the Working Group on Amendments to the IGF Code and Review of the IGC Code to prepare a draft set of amendments to the IGF Code, based on annex to document CCC 9/4/Add.1 and taking into account documents CCC 9/3/3, CCC 9/3/5, CCC 9/3/8 and CCC 9/3/9.

Establishment of a Working Group

3.31 The Sub-Committee agreed to establish a Working Group on Amendments to the IGF Code and Review of the IGC Code and instructed it, taking into account the comments made and decisions taken in plenary, to:

.1 prepare a draft set of amendments to the IGF Code, based on the annex to document CCC 9/4/Add.1 and taking into account documents CCC 9/3/3, CCC 9/3/5, CCC 9/3/8 and CCC 9/3/9; and

.2 consider whether it was necessary for the Correspondence Group to be re-established and, if so, prepare terms of reference for consideration by the Sub-Committee.

Report of the Working Group

3.32 Having considered the relevant part of the report of the Working Group on Amendments to the IGF Code and Review of the IGC Code (CCC 9/WP.4), the Sub-Committee approved it in general and took action as described below.

Amendments to the IGF Code

3.33 The Sub-Committee noted the Group's discussion on the draft amendments to the IGF Code and that the Group had finalized them (CCC 9/WP.4, paragraphs 3.1 to 3.4 and annex 1).

3.34 The Sub-Committee invited interested Member States and international organizations to further develop the requirements on methodology and boundary conditions to be used in dispersion analysis stipulated in the draft new sub-paragraph 12.5.2.4 of the IGF Code to ensure that uniform and acceptable results were obtained throughout the application of this requirement (CCC 9/WP.4, paragraph 3.3);

3.35 The Sub-Committee agreed to the draft amendments to the IGF Code, together with the associated check/monitoring sheet and record, as set out in annex 3, with a view to approval at MSC 108 and subsequent adoption at MSC 109, for entry into force on 1 January 2028 (CCC 9/WP.4, paragraph 3.4 and annex 1).

Re-establishment of the Correspondence Group

3.36 The Sub-Committee agreed to re-establish the Correspondence Group on Amendments to the IGF Code and Review of the IGC Code, under the coordination of the Marshall Islands,[22] and instructed it to:

.1 consider relevant amendments to the IGF Code with respect to allowing the use of finite element analysis in meeting the requirements of 4.23.3.1 of the IGC Code, as a supplement to a prescriptive analysis; and

.2 submit a written report to CCC 10.

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4 REVIEW OF THE IGC CODE

Background

4.1 The Sub-Committee recalled that MSC 103 had agreed to include in its post-biennial agenda an output on "Review of the IGC Code", with two sessions needed to complete the item, assigning the CCC Sub-Committee as the associated organ. Having agreed that the scope of the review should not be limited to specific paragraphs of the Code, the Committee also agreed, in accordance with MSC.1/Circ.1481 and MSC.1/Circ.1500/Rev.1, that:

.1 the amendments to be developed should apply to all new ships to which the IGC Code applied on or after the date of entry into force;

.2 the instrument to be amended was the IGC Code; and

.3 the amendments to be developed should enter into force on 1 January 2028, provided that they were adopted before 1 July 2026.

4.2 The Sub-Committee also recalled that CCC 8 had established the Correspondence Group on Amendments to the IGC and IGF Codes and instructed it to further progress the amendments to the IGC and IGF Codes.

Report of the Correspondence Group

4.3 The Sub-Committee considered document CCC 9/4 (Marshall Islands), providing the report of the Correspondence Group on Amendments to the IGF Code and Review of the IGC Code. The Sub-Committee approved it in general and took action, as described in the following paragraphs.

High manganese austenitic steel

4.4 The Sub-Committee noted the need for further test results to determine the suitability of high manganese austenitic steel for ammonia service (CCC 9/4, paragraph 5). In this context, the Sub-Committee had for its consideration the following documents:

.1 CCC 9/4/1 (Republic of Korea), providing a proposal for amendments to MSC.1/Circ.1599/Rev.2 and MSC.1/Circ.1622 to qualify high manganese austenitic steel for ammonia service and to revise additional compatibility test requirements for ammonia service; and

.2 CCC 9/INF.19 (Republic of Korea), providing technical information on high manganese austenitic steel for cryogenic service in relation to the acceptability of the material for ammonia service.

4.5 Following discussion, the Sub-Committee instructed the Working Group on Amendments to the IGF Code and Review of the IGC Code to further consider the acceptability of the high manganese austenitic steel for ammonia service, taking into account documents CCC 9/4/1 and CCC 9/INF.19; and depending on the outcomes of the consideration, prepare draft amendments to MSC.1/Circ.1599/Rev.2 and MSC.1Circ.1622, or advise the Sub-Committee how best to proceed.

Cargo tank filling

4.6 The Sub-Committee noted the need for additional submissions regarding the regulation of filling limits in LNG cargo tanks (CCC 9/4, paragraph 6). In this context, the Sub-Committee also noted with appreciation the information provided in document CCC 9/INF.24 (SIGTTO).

4.7 Following discussion, the Sub-Committee instructed the Working Group on Amendments to the IGF Code and Review of the IGC Code to further consider provisions related to filling limits in LNG cargo tanks, taking into account document CCC 9/INF.24.

Draft amendments to the IGF Code

4.8 The Sub-Committee recalled that the outcomes of the Correspondence Group with regard to the draft amendments to the IGF Code (CCC 9/4/Add.1) had been considered under agenda item 3 (see paragraphs 3.28 to 3.30).

Draft amendments to the IGC Code

4.9 Having noted the progress made by the Correspondence Group on finalizing draft amendments to the IGC Code, the Sub-Committee had for its consideration the following documents:

.1 document CCC 9/4/2 (SIGTTO), proposing amendments to paragraphs 8.2.9, 8.4.2, 8.4.3 and 8.4.5 of the IGC Code concerning pressure relief valves (PRVs);

.2 document CCC 9/4/3 (SIGTTO), proposing to amend the IGC Code special requirements for CO_2 transportation in paragraphs 17.21 and 17.22, and chapter 19;

.3 document CCC 9/4/6 (SIGTTO), providing comments on the report of the Correspondence Group on requirements concerning carbon dioxide;

.4 document CCC 9/4/7 (Japan), providing comments on the report of the Correspondence Group on ventilation requirements for spaces not normally entered in cargo areas;

.5 CCC 9/4/8 (Japan), providing comments on the report of the Correspondence Group concerning the ESD cause-and-effect (table 18.1); and

.6 CCC 9/4/9 (Belgium et al.), providing information to address concerns raised in the Correspondence Group and proposing amendments to paragraph 16.9.2 of the IGC Code concerning ammonia.

4.10 In the ensuing discussion, the Sub-Committee noted the general support for document CCC 9/4/9 and the following views:

.1 the proposal in document CCC 9/4/9 should be further considered in the Working Group;

.2 there was an urgent need to facilitate the industry's transition to low and zero- carbon fuels, including ammonia, and the amendments to the IGC Code would allow and support this much-needed transition;

.3 the proposal in document CCC 9/4/9 would allow a gas carrier to use its toxic cargo such as ammonia as fuel when the engines, engine and vessel design and other mitigation measures were ready; and that amendments to the IGC Code should be developed simultaneously with the development of guidelines and safety standards for the use of ammonia as a marine fuel and a footnote referring to such guidelines should be added in the draft amendments to the IGC Code;

.4 the draft amendments to paragraph 16.9.2 of the IGC Code should not be limited to ammonia only and a more open approach should be considered;

.5 the second alternative for the amendments to paragraph 16.9.2 as provided in annex 5 to document CCC 9/4 was preferred and it should be further discussed in the Working Group; and

.6 specific safety requirements and corresponding guidelines should be developed for using a toxic cargo as fuel.

4.11 Following discussion, the Sub-Committee noted the support for a more open approach and the preference to use the second alternative for the amendments to paragraph 16.9.2 as set out in annex 5 to document CCC 9/4.

4.12 In this context, the Sub-Committee instructed the Working Group on Amendments to the IGF Code and Review of the IGC Code to prepare draft amendments to the IGC Code, taking into account documents CCC 9/4/2, CCC 9/4/3, CCC 9/4/6, CCC 9/4/7, CCC 9/4/8 and CCC 9/4/9.

LPG cargo as fuel

4.13 Having noted the progress made by the Correspondence Group on finalizing safety provisions for the safe use of LPG cargo as fuel, the Sub-Committee noted the following views:

.1 a regulatory framework was urgently required owing to the number of LPG carriers under construction using their cargo as fuel and interim guidelines, which would be approved by MSC 108 in 2024, should be the better way forward;

.2 the interim guidelines would allow time for the industry to gain practical experience before making final amendments to the IGC Code and simplified the addition of ethane and other saturated hydrocarbons as fuel under the IGC Code;

.3 amendments to the IGC Code with a MSC circular for early implementation should be the way forward; and

.4 noting that the use of LPG cargo as fuel was allowed under paragraph 16.9.1 of the existing IGC Code, there was no urgent need to amend the IGC Code to specify the mandatory requirements for LPG cargo as fuel.

4.14 Following discussion, the Sub-Committee instructed the Working Group on Amendments to the IGF Code and Review of the IGC Code, to further consider the desirability of the amendments to the IGC Code in lieu of interim guidelines for the use of LPG cargo as fuel and prepare the provisions accordingly, taking into account annexes 2 and 3 to document CCC 9/4.

Risk assessment

4.15 The Sub-Committee endorsed the proposal by the Correspondence Group that a limited risk assessment could be incorporated in amendments to the otherwise prescriptive IGC Code (CCC 9/4, paragraph 21).

Additional submissions on other LPG cargoes

4.16 The Sub-Committee noted the request by the Correspondence Group for additional submissions on other LPG cargoes for use as fuel (CCC 9/4, paragraph 22).

Addition of an ESD protected machinery space safety concept

4.17 The Sub-Committee noted the request by the Correspondence Group for the addition of an ESD protected machinery space safety concept to the IGC Code.

Consequential amendments to the IGC Code

4.18 The Sub-Committee noted the progress made by the Correspondence Group on the review and consequential amendments to the IGC Code and instructed the Working Group on Amendments to the IGF Code and Review of the IGC Code to further develop the consequential amendments to the IGC Code, based on annex 5 to document CCC 9/4.

Draft check/monitoring sheet for amendments to the IGC Code

4.19 Having noted the progress made by the Correspondence Group on the draft check/monitoring sheet for amendments to the IGC Code, the Sub-Committee had for its consideration the following documents:

.1 CCC 9/4/4 (Liberia), providing comments on the work of the Correspondence Group with regard to the scope of application to the existing ships and proposing that consideration could be given to adopt three separate IGC Codes (1983 IGC Code, 2014 IGC Code and 2026 IGC Code) and keep all of them valid and in force (and updating); and

.2 CCC 9/4/5 (Liberia), providing comments on the work of the Correspondence Group with regard to the incorporation of the existing MSC circulars on the interpretations of the IGC Code.

4.20 In the ensuing discussion, the Sub-Committee noted the following views:

.1 the proposal in document CCC 9/4/4 was supported and three different generations should all be kept valid and in force;

.2 the proposal in document CCC 9/4/4 should be further clarified and the outcomes of discussion of document BLG 17/9/6, i.e. the agreement to the option to have the revised Code as an amendment to the existing Code, should be taken into account;

.3 it was possible to amend the requirements for ships constructed on or after 1 July 1986 but before 1 July 2016, by clarifying that such amendments were effective notwithstanding paragraph 1.1.2.3 of the Code, which was the general requirement for those ships; and

.4 there was a need to further clarify the application of the revised IGC Code to the existing ships and the Secretariat might be requested to provide advice on the way forward.

4.21 Following discussion, the Sub-Committee instructed the Working Group on Amendments to the IGF Code and Review of the IGC Code, based on the progress made by this session and taking into account annex 6 to document CCC 9/4 and documents CCC 9/4/4 and CCC 9/4/5, to prepare the check/monitoring sheet for amendments to the IGC Code. In this context, the Sub-Committee invited the Secretariat to provide advice in the Working Group on the application of the revised IGC Code, taking into account the proposals in document CCC 9/4/4.

Instructions to the Working Group

4.22 Having considered the above matters, the Sub-Committee instructed the Working Group on Amendments to the IGF Code and Review of the IGC Code, established under agenda item 3 (see also paragraph 3.31), taking into account the comments made and decisions taken in plenary, to:

.1 further consider the acceptability of the high manganese austenitic steel for ammonia service, taking into account documents CCC 9/4/1 and CCC 9/INF.19; depending on the outcomes of the consideration, prepare draft amendments to MSC.1/Circ.1599/Rev.2 and MSC.1Circ.1622, or advise the Sub-Committee how best to proceed;

.2 further consider provisions related to filling limits in LNG cargo tanks, taking into account document CCC 9/INF.24;

.3 further develop the draft amendments to the IGC Code, based on annexes 1 and 5 to document CCC 9/4 and taking into account documents CCC 9/4/2, CCC 9/4/3, CCC 9/4/6, CCC 9/4/7, CCC 9/4/8 and CCC 9/4/9;

.4 further consider the desirability of the amendments to the IGC Code in lieu of interim guidelines for the use of LPG cargo as fuel and prepare provisions accordingly, taking into account annexes 2 and 3 to document CCC 9/4;

.5 based on the progress made by this session and taking into account annex 6 to document CCC 9/4 and documents CCC 9/4/4 and CCC 9/4/5, prepare the check/monitoring sheet for amendments to the IGC Code; and

.6 consider whether it was necessary for the Correspondence Group to be re-established and, if so, prepare terms of reference for consideration by the Sub-Committee.

Report of the Working Group

4.23 Having considered the part of the report of the Working Group on Amendments to the IGF Code and Review of the IGC Code (CCC 9/WP.4) related to this agenda item, the Sub-Committee approved it in general and took action as described in paragraphs 4.24 to 4.32).

Amendments to the IGC Code

4.24 The Sub-Committee noted the Group's discussion and progress made on the draft amendments to the IGC Code for finalization at CCC 10, with a view to approval at MSC 109, and subsequent adoption at MSC 110, with a view to entry into force on 1 January 2028 (CCC 9/WP.4, paragraphs 4.1 to 4.12 and annex 2).

Toxic products as fuel

4.25 The Sub-Committee noted the Group's consideration on the need to develop guidelines for the use of cargoes identified as toxic products which were required to be carried in type 2G/2PG ships as fuel (CCC 9/WP.4, paragraph 4.11).

Suitability of high manganese austenitic steel for ammonia service

4.26 The Sub-Committee endorsed the Group's confirmation that high manganese austenitic steel was considered resistant to ammonia stress corrosion cracking and, therefore, suitable for ammonia cargo and/or fuel tanks containing ammonia (CCC 9/WP.4, paragraph 5.1).

Revision of MSC.1/Circ.1599/Rev.2

4.27 The Sub-Committee agreed to the draft MSC circular on *Revised guidelines on the application of high manganese austenitic steel for cryogenic service* (MSC.1/Circ.1599/Rev.2), as set out in annex 4, with a view to approval by MSC 108 and circulation as MSC.1/Circ.1599/Rev.3 (CCC 9/WP.4, paragraph 5.4 and annex 3).

Revision of MSC.1/Circ.1622

4.28 The Sub-Committee agreed to the draft MSC circular on *Guidelines for the acceptance of alternative metallic materials for cryogenic service in ships carrying liquefied gases in bulk and ships using gases or other low-flashpoint fuels* (MSC.1/Circ.1622), as set out in annex 5, with a view to approval by MSC 108 and circulation as MSC.1/Circ.1622/Rev.1 (CCC 9/WP.4, paragraph 5.6 and annex 4).

Cargo tank filling limits

4.29 The Sub-Committee endorsed the Group's view that safety risks should be addressed by a set of amendments to the IGC Code (CCC 9/WP.4, paragraphs 6.1 and 6.2).

LPG cargo as fuel

4.30 The Sub-Committee agreed to the draft MSC circular on *Interim guidelines for use of LPG cargo as fuel*, as set out in annex 6, for approval by MSC 108 (CCC 9/WP.4, paragraphs 7.1 and 7.2, and annex 5).

4.31 The Sub-Committee noted the Group's consideration on the need to develop draft amendments to the IGC Code with respect to the safe use of LPG as fuel based on the interim guidelines, if agreed, as well as such provisions for safe use of LPG as fuel for gas carriers carrying cargoes listed in chapter 19 of the IGC Code other than LPG (CCC 9/WP.4, paragraphs 7.3 to 7.5).

Application issues related to the amendments

4.32 The Sub-Committee, regarding the application of the new IGC Code amendments to new and/or existing ships:

.1 endorsed the Group's agreement that under the current scope of the output, the revision work of the IGC Code should be done as an amendment and not as a new code replacing the 2014 Code; and that the output's scope should be expanded by the Committee if a different approach were to be taken (CCC 9/WP.4, paragraphs 9.1 to 9.5); and

.2 invited MSC 108 to note the discussion held in that respect and that the current scope of the output might need to be revisited subject to the outcome of the investigation on the matter (CCC 9/WP.4, paragraph 9.6).

Instructions to the Correspondence Group

4.33 The Sub-Committee instructed the Correspondence Group on Amendments to the IGF Code and Review of the IGC Code established under agenda item 3 (see paragraph 3.36) to:

.1 prepare draft amendments to the IGC Code in relation to filling limits for cargo tanks to minimize safety risks, taking into account document CCC 9/INF.24, and consider if such amendments would be required for the IGF Code;

.2 prepare draft amendments to the IGC Code containing safety provisions for gas carriers using LPG cargo as fuel, based on annex 5 to the report (CCC 9/WP.4);

.3 prepare draft amendments to the IGC Code containing safety provisions for gas carriers using LPG as fuel and carrying cargoes listed in chapter 19 of the IGC Code other than LPG;

.4 further progress the draft amendments to the IGC Code left in square brackets at CCC 9, based on annex 2 to the report (CCC 9/WP.4);

.5 identify the draft amendments to the IGC Code (CCC 9/WP.4, annex 2) applicable to new and/or existing ships, with a view to advising on the need for the expansion of the scope, generation of multiple versions of the IGC Code, and finalizing the draft cover MSC resolution, as well as the associated check/monitoring sheet and record format; and

.6 finalize the draft check monitoring sheet and record format for the draft amendments to the IGC Code, based on annex 6 to document CCC 9/4 and taking into account annex 2 to the report (CCC 9/WP.4).

5 AMENDMENTS TO THE IMSBC CODE AND SUPPLEMENTS

Background

5.1 The Sub-Committee recalled that MSC 107 had adopted amendments (07-23) to the IMSBC Code by resolution MSC.539(107), in the form of a consolidated edition, which was expected to enter into force on 1 January 2025.

5.2 The Sub-Committee noted that, after consideration of the submissions under this agenda item, it would provide clear advice and instruction to E&T 40, in order to prepare draft amendments (08-25) to the IMSBC Code, for consideration at CCC 10.

Report of E&T 37

5.3 The Sub-Committee considered document CCC 9/5 (Secretariat), containing the report of E&T 37, together with the related documents submitted to the session, and took action as indicated in the following paragraphs.

Amendment 07-23 to the IMSBC Code

5.4 The Sub-Committee noted that E&T 37 had finalized the draft amendments (07-23) to the IMSBC Code and had agreed to request the Secretary-General to circulate them in accordance with SOLAS article VIII, for consideration and subsequent adoption by MSC 107 (CCC 9/5, paragraphs 3.1 to 3.14; 3.18 to 3.26; 3.60 and 3.61, and annex 1). MSC 107 had adopted amendments (07-23) to the IMSBC Code by resolution MSC.539(107).

Fish meal

5.5 The Sub-Committee recalled that CCC 8 had agreed, in principle, and E&T 37 had incorporated the proposals in document CCC 8/5/12 (Germany) to replace the existing individual schedule for "FISH MEAL (FISH SCRAP), STABILIZED UN 2216 Anti-oxidant treated" with the new individual schedule for "FISH MEAL (FISH SCRAP), STABILIZED Anti-oxidant treated"; and that the new individual schedule had been included in amendment 07-23 to the IMSBC Code (resolution MSC.539(107)).

5.6 In this context, the Sub-Committee had for its consideration the following documents:

.1 CCC 9/5/1 (Peru), presenting information on the performance of a tocopherol-based antioxidant, when fish meal was shipped in bulk; and proposing to introduce amended text to the IMSBC Code to cover these aspects for the stabilization of fish meals; and

.2 CCC 9/5/14 (Peru and Chile), commenting on and expressing opposition to the proposal to change the hazard classification of fish meal in bulk from class 9 to MHB (SH), as well as other modifications, as set out in document CCC 9/5, taking as its basis document CCC 8/5/12 (Germany).

5.7 Following the discussion, the Sub-Committee noted the following views:

.1 Provisions on tocopherol had already been included in the new individual schedule, as contained in amendment 07-23 to the IMSBC Code; therefore, there might be a need to refer only document CCC 9/5/14 to E&T 40, to further consider classification of this cargo in terms of the possibility for a future amendment, if appropriate; and it would be preferable to invite the submission of a new proposal to E&T 40.

.2 Document CCC 9/5/1 showed that, based on recent studies, tocopherol was an effective antioxidant and therefore provided for safe maritime transport of fish meal; and that classification of stabilized fish meal as MHB was incorrect and therefore the classification should be reinstated as class 9.

.3 Test results indicated in document CCC 9/5/1 concerned three samples that contained tocopherol in quantities that exceeded the amount required in the IMSBC and IMDG Codes; therefore, a precautionary approach would be to retain the cargo as group B, MHB, at this stage. Concerning document CCC 9/5/14, CCC 4 concluded that the tocopherol content of 250 ppm at the time of shipment was sufficient, and SP308 of the IMDG Code was amended accordingly. A similar amendment was necessary for the IMSBC Code, as included in amendment 07-23, assigning the cargo as MHB according to the relevant provisions of the IMSBC Code.

.4 The amendments included in amendment 07-23 to the IMSBC Code could be supported.

.5 As amendment 07-23 to the IMSBC Code was adopted recently, any proposals for new amendments should be considered carefully.

.6 The amendments proposed in document CCC 9/5/1 would ensure an alignment of the IMSBC Code with the IMDG Code; therefore, the document should be referred to E&T 40 for further consideration.

.7 Document CCC 9/5/14 should be referred to E&T 40 for further consideration, with a view to a holistic review of this issue, based on scientific evidence.

.8 Further scientific studies should be encouraged.

.9 Documents CCC 9/5/1 and CCC 9/5/14 should be referred to E&T 40 for further consideration, taking into account possible negative economic repercussions of decisions that were based on assumptions, as opposed to scientific evidence.

.10 New proposals for amendments should be accompanied by new relevant supporting information.

.11 The E&T Group did not incorporate amendments solely by the Group's own decision.

5.8 After consideration, the Sub-Committee agreed to:

.1 refer documents CCC 9/5/1 and CCC 9/5/14 to E&T 40 for further consideration; and invite interested Member States and international organizations to submit further scientific and technical studies to that session, as well as new proposals for amendments; and

.2 depending on the outcomes of consideration on documents CCC 9/5/1 and CCC 9/5/14 and new submissions, if any, as indicated in sub-paragraph .1 above, invite E&T 40 to consider how best to proceed, e.g. if new amendments to the IMSBC Code were needed and/or a CCC circular on possible additional information/guidance could be prepared.

CELESTINE

5.9 The Sub-Committee noted the deliberations of E&T 37 on CELESTINE and that the Group had agreed not to incorporate the draft individual schedule for CELESTINE in amendment 07-23 (CCC 9/5, paragraphs 3.2 to 3.3).

Alignment of the IMSBC Code with SOLAS on declaration of solid bulk density

5.10 The Sub-Committee noted that E&T 37 had agreed to the draft MSC circular on "The revised form for cargo information for solid bulk cargoes" and had requested the Secretariat to submit it to MSC 107 for approval (CCC 9/5, paragraphs 3.11 to 3.14, and annex 2). MSC 107 had approved the circular as MSC.1/Circ.1664.

Amendments to MSC.1/Circ.1453/Rev.1 and MSC.1/Circ.1454/Rev.1

5.11 The Sub-Committee noted that E&T 37 had agreed to draft revisions of the MSC circulars on *Guidelines for the submission of information and completion of the format for the properties of cargoes not listed in the IMSBC Code and their conditions of carriage* (MSC.1/Circ.1453/Rev.1) and *Guidelines for developing and approving procedures for sampling, testing and controlling the moisture content for solid bulk cargoes which may liquefy* (MSC.1/Circ.1454/Rev.1), and had requested the Secretariat to submit them to MSC 107 for approval (CCC 9/5, paragraphs 3.15 to 3.17, and annexes 3 and 4). MSC 107 had approved the revisions, to be disseminated as MSC.1/Circ.1453/Rev.2 and MSC.1/Circ.1454/Rev.2.

Substance identification number for solid bulk cargoes

5.12 The Sub-Committee noted the deliberations of E&T 37 on substance identification number for solid bulk cargoes and agreed to invite interested Member States and international organizations to submit further proposals to a future session (CCC 9/5, paragraphs 3.27 to 3.29).

Proposed amendments to the individual schedule for COAL

5.13 The Sub-Committee noted the deliberations of E&T 37 on proposed amendments to the individual schedule for COAL and the invitation to interested Member States and international organizations to informally cooperate with Australia to submit a proposal for a new output to MSC 107 (CCC 9/5, paragraphs 3.30 to 3.32).

5.14 In this context, the Sub-Committee had for its consideration document CCC 9/5/13 (Australia), providing an update on informal discussions arising from the proposed amendments to the individual schedule for COAL; and inviting interested Member States and international organizations to cooperate with Australia to continue informal discussions to develop draft amendments to the IMSBC Code for COAL to be classified as MHB (SH).

5.15 Following the discussion, the Sub-Committee noted a view that amending 9.2.3 of the IMSBC Code could not be supported, taking into account that any exclusion from class 4.2 classification must be dealt with under 9.2.2 of the IMSBC Code.

5.16 After consideration, the Sub-Committee invited interested Member States and international organizations to cooperate with Australia[33]to submit further proposals on this matter to a future session.

Possible consequences for individual schedule for CHARCOAL in IMSBC Code

5.17 The Sub-Committee noted the opinion of E&T 37 on the possible consequences for the individual schedule for CHARCOAL in the IMSBC Code if UN 1361 was considered as dangerous goods regardless of the result of the UN N.4 test (CCC 9/5, paragraphs 3.33 to 3.38).

Proposed amendments to IMSBC Code concerning carriage of spare charges for SCBAs

5.18 The Sub-Committee noted the deliberations of E&T 37 regarding amendments to the IMSBC Code in connection with the carriage requirement for spare charges for self-contained breathing apparatuses (SCBAs) and agreed to the invitation to interested Member States and international organizations to submit further proposals to this session (CCC 9/5, paragraphs 3.39 to 3.44).

5.19 In this regard, the Sub-Committee considered document CCC 9/5/6 (IACS), proposing amendments to the individual cargo schedules in appendix 1 to the IMSBC Code to delete superfluous requirements for additional SCBAs.

5.20 Following the discussion, the Sub-Committee noted the following views:

.1 The outcome of E&T 37 could be supported. Therefore, the proposals in paragraphs 7 and 9 and in the annex to document CCC 9/5/6 could be supported, in general. With regard to FERROSILICON, as this schedule was MHB, the requirement for additional two sets of SCBAs in paragraph 1 of the general requirements for carriage of FERROSILICON in the appendix to the individual schedule was not related to the additional sets required in SOLAS chapter II-2 for dangerous goods in solid bulk form. Therefore, the proposed amendment concerning the FERROSILICON schedule could not be supported. The individual schedule for FERROUS METAL BORINGS, SHAVINGS, TURNINGS OR CUTTINGS UN 2793 did not include the requirement for additional two sets of SCBAs in the section for "Precautions", even though it was a class 4.2 dangerous good. Therefore, the proposed new text for the sections for "Precautions" of the other schedules should also be added to this schedule's section for "Precautions", as a consequential amendment. The section for "Carriage" of this schedule did include the requirement for two sets of SCBAs in addition to those required by SOLAS regulation II-2/10.10; however, this was to allow entry into cargo spaces for the purpose of taking the required daily temperature readings. This was an alternative to the stated requirement that "Temperature readings shall be taken in such a way as not to require entry into the cargo space". Similarly, it was observed that the section "Discharge" of the schedule included that entry was permitted for personnel provided that they were using appropriate breathing apparatus. For quite some time, it had been agreed that a cargo

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space was an enclosed space, and that wearing and using a breathing apparatus set to enter an enclosed space could not be an alternative to ensuring the atmosphere in the space was safe. It was acknowledged that, although these observations arose as a result of considering the proposals in document CCC 9/5/6, the Sub-Committee might not be able to agree that they were consequential in nature. If so, submitting suitable proposals to E&T 40 to address these concerns could be considered.

.2 The proposals in document CCC 9/5/6 could be supported.

.3 SOLAS regulation II-2/19.3.6.2 referred only to dangerous goods in solid form in bulk, as defined in regulation 7 of part A-1 of SOLAS chapter VII, i.e. solid bulk goods to which a UN number was assigned. That being the case, self-contained breathing apparatus additional to those required by SOLAS regulation II-2/10.2.1 remained relevant when transporting group B cargoes that did not have a UN number assigned. This issue should be referred to E&T 40 for further consideration.

5.21 After consideration, the Sub-Committee agreed, in principle, to the proposed deletions proposed in document CCC 9/5/6, except for FERROSILICON; and referred the document to E&T 40 for further consideration and incorporation, as appropriate, into draft amendment 08-25 to the IMSBC Code. With regard to FERROSILICON, the Sub-Committee invited interested Member States and international organizations to submit further information to E&T 40.

IMSBC Code schedules for iron ore pellets

5.22 The Sub-Committee noted the deliberations of E&T 37 on the IMSBC Code schedules for iron ore pellets and considered the draft amendments to the individual schedule for IRON ORE PELLETS recommended by the Group (CCC 9/5, paragraph 3.49).

5.23 After consideration, the Sub-Committee agreed to the draft amendments, in principle, and referred them to E&T 40 for consideration and incorporation, as appropriate, in draft amendment 08-25 to the IMSBC Code.

Chemical gypsum powder

5.24 The Sub-Committee noted the deliberations of E&T 37 on the draft new individual schedule for chemical gypsum powder and the invitation to Finland to submit a new proposal to CCC 9 (CCC 9/5, paragraphs 3.50 to 3.54).

Contaminated soil

5.25 The Sub-Committee noted the deliberations of E&T 37 on the draft new individual schedule for contaminated soil and the invitation to interested Member States and international organizations to submit further proposals to this session (CCC 9/5, paragraphs 3.55 to 3.59).

Consequential amendments to MSC.1/Circ.1395/Rev.5

5.26 The Sub-Committee noted that E&T 37 had agreed to some consequential amendments to MSC.1/Circ.1395/Rev.5 on *Lists of solid bulk cargoes for which a fixed gas fire-extinguishing system may be exempted or for which a fixed gas fire-extinguishing system is ineffective* and had prepared the draft MSC.1/Circ.1395/Rev.6 for submission to MSC 107 for approval (CCC 9/5, paragraph 3.62 and annex 5). MSC 107 had approved MSC.1/Circ.1395/Rev.6.

Proposals for amendments to the existing individual schedules and provisions in the IMSBC Code and related instruments

Recommendations on the safe use of pesticides in ships applicable to the fumigation of cargo holds (MSC.1/Circ.1264)

5.27 The Sub-Committee noted that MSC 107 (MSC 107/20, paragraphs 17.8 to 17.10) had considered document MSC 107/17/1 (Luxembourg and the Kingdom of the Netherlands), proposing a new output to amend the *Recommendations on the safe use of pesticides in ships applicable to the fumigation of cargo holds* (MSC.1/Circ.1264), together with commenting document MSC 107/17/30 (China), proposing that amendments to SOLAS regulation VI/4 also be considered as part of this work; and that following discussion, having agreed that amendments to SOLAS should not be addressed at this stage and taking into account that there was a continuous output to address amendments to the IMSBC Code and supplements (including MSC.1/Circ.1264) on the 2022-2023 biennial agenda of the CCC Sub-Committee, the Committee had instructed CCC 9 to consider this proposal under the existing agenda item on "Amendments to the IMSBC Code and supplements".

5.28 After consideration, the Sub-Committee agreed to the proposal in document MSC 107/17/1 to amend MSC.1/Circ.1264, in principle, and decided to refer the document to E&T 40 for further consideration.

Proposal for annual listing and real-time updating of solid bulk cargoes not listed in the IMSBC Code but shipped based on provisional assessments (tripartite agreements)

5.29 The Sub-Committee noted that MSC 107 (MSC 107/20, paragraphs 17.11 to 17.12) had considered document MSC 107/17/2 (Finland et al.), proposing a new output on "Annual listing and real-time updating of solid bulk cargoes not listed in the IMSBC Code but shipped based on provisional assessments (tripartite agreements)" and that following discussion and taking into account that there was a continuous output to address amendments to the IMSBC Code and supplements on the 2022-2023 biennial agenda of the CCC Sub-Committee, the Committee had instructed CCC 9 to consider this proposal under the existing agenda item on "Amendments to the IMSBC Code and supplements".

5.30 After consideration, the Sub-Committee agreed, in principle, to the proposal in document MSC 107/17/2 to start issuing an annual CCC circular and a dedicated website, listing all current tripartite agreements, and decided to refer the document to E&T 40 for further consideration.

Reclassification of CASTOR BEANS or CASTOR MEAL or CASTOR POMACE or CASTOR FLAKE UN 2969 as MHB (TX and/or CR) and amendment of Bulk Cargo Shipping Name

5.31 The Sub-Committee had for its consideration document CCC 9/5/9 (Germany), proposing the classification of CASTOR BEANS or CASTOR MEAL or CASTOR POMACE or CASTOR FLAKE UN 2969 as MHB (TX and/or CR) according to its inherent toxicological properties and to delete hazard class 9; and also proposing to amend the Bulk Cargo Shipping Name (BCSN) for CASTOR BEANS or CASTOR MEAL or CASTOR POMACE or CASTOR FLAKE UN 2969 to CASTOR BEANS solely, because the IMSBC Code permitted the transport of unprocessed castor beans in bulk only.

5.32 The Sub-Committee noted the following views on this matter:

.1 Mandatory text excluding cargoes other than beans could be supported. The BCSN should be CASTOR BEANS UN 2969. Amending the schedule as MHB could not be supported because castor beans remained a dangerous good in accordance with the IMDG Code. If a proposal were to be made to and agreed at the UN Sub-Committee of Experts on the Transport of Dangerous Goods to remove castor beans from the Dangerous Goods List in the UN Model Regulations, there would be no opposition to a consequential amendment being made to the IMDG Code, and consequently, appropriate amendments being proposed for the individual schedule for CASTOR BEANS in the IMSBC Code.

.2 The BCSN should be CASTOR BEANS UN 2969; however, references to other castor cargoes should be retained in the IMSBC Code; class 9 classification should be retained, and in addition, notational MHB references TX and/or CR should be added.

5.33 After consideration, the Sub-Committee agreed to refer the document to E&T 40 for further consideration with a view to providing advice to CCC 10.

Amendment of 4.2 of the IMSBC Code regarding the cargo information to be provided by the shipper and the sample cargo declaration form

5.34 The Sub-Committee had for its consideration document CCC 9/5/10 (China), proposing, in order to assist shippers in providing full and clear information on consignments, to amend 4.2 of the IMSBC Code regarding the cargo information to be provided by the shipper and sample cargo declaration form in order to clarify the requirements for the provision of information on subsidiary hazard characteristics and to introduce notational references of MHB hazards.

5.35 After consideration and having noted general support for the proposal, the Sub-Committee invited interested Member States and international organizations to submit a proposal to MSC for a new output.

Proposal for an amendment to the individual schedule for DIRECT REDUCED IRON (A) Briquettes, hot-moulded

5.36 The Sub-Committee had for its consideration document CCC 9/5/15 (IIMA), containing a proposal for an amendment to the individual schedule for DIRECT REDUCED IRON (A) Briquettes, hot-moulded.

5.37 Following the discussion, the Sub-Committee noted a view that, as the density was not mandatory in the description, it would be unusual and confusing to have a mandatory figure in a mandatory part of one schedule; the word "apparent" did not appear to be helpful and the revised paragraph 3 in the schedule did not add to the existing criteria, and this had not been evidenced as a safety issue; therefore, none of the proposed amendments to the schedule could be supported.

5.38 After consideration, the Sub-Committee agreed to refer the document to E&T 40 for further consideration with a view to providing advice to CCC 10.

Proposals for new individual schedules

Phosphate rock fines (uncalcined)

5.39 The Sub-Committee had for its consideration documents CCC 9/5/2, CCC 9/INF.11 and CCC 9/INF.12 (Australia), proposing a new individual schedule for phosphate rock fines (uncalcined) for inclusion in the IMSBC Code and containing the cargo information to support the proposal for a new individual schedule.

5.40 Following discussion, the Sub-Committee noted a view that, while group A classification of this cargo could be supported, distinguishing the proposed new individual schedule from the existing group C schedule was difficult.

5.41 After consideration, the Sub-Committee agreed to refer the documents to E&T 40 for further consideration with a view to providing advice to CCC 10.

Zinc slag (coarse)

5.42 The Sub-Committee had for its consideration documents CCC 9/5/3, CCC 9/INF.13 and CCC 9/INF.14 (Australia), proposing a new individual schedule for zinc slag (coarse) for inclusion in the IMSBC Code and containing the cargo information to support the proposed new individual schedule.

5.43 After consideration, the Sub-Committee agreed to the proposal, in principle, and referred the above documents to E&T 40 for consideration and incorporation, as appropriate, in draft amendment 08-25 to the IMSBC Code.

Untreated incinerator bottom ash (U-IBA)

5.44 The Sub-Committee had for its consideration documents CCC 9/5/4 and CCC 9/INF.6 (Ireland), proposing a new individual schedule for untreated incinerator bottom ash (U-IBA) for inclusion in the IMSBC Code and containing the cargo information to support the proposed new individual schedule.

5.45 The Sub-Committee noted the following views on this matter:

.1 The incinerated material was waste. In transport, it invariably meant that a substance was included in the waste material that was covered by the Basel Convention. In that case, the cargo would be a waste that was subject to restrictions on transboundary movements under that Convention. The carriage of such solid wastes in bulk must be in accordance with section 10 of the IMSBC Code. If the cargo included a substance that was subject to the Basel Convention, it would contain or be contaminated with one or more constituents that were subject to the provisions of the IMSBC Code applicable to cargoes of classes 4.1, 4.2, 4.3, 5.1, 6.1, 8 or 9, in accordance with the definition of "wastes" in 10.2.1 of the Code. Even without constituents subject to the Basel Convention, the cargo might include substances that were dangerous goods. It should be noted that many requirements in the proposed schedule were appropriate for cargoes that were classified as dangerous goods. It appeared that the draft schedule was amended to add these more stringent provisions after the explosion mentioned in section 4.5 of the annex to document CCC 9/INF.6. This indicated that the cargo involved in the incident would have been classified as a dangerous good if it had been tested as required in

accordance with 9.2.2 of the Code. Once a cargo was classified as a dangerous good, an MHB schedule was not suitable for its safe carriage. Using a range of mitigations for dangerous goods hazards in a schedule that was for cargoes that were MHB could not be supported. This principle was such that it would require a clear decision by the Sub-Committee to introduce it in the IMSBC Code after careful consideration of the consequences for existing and future MHB schedules for cargoes that were waste products. Therefore, it was suggested that the schedule should include text under the BCSN that it was "not to be used for cargoes that are dangerous goods when tested in accordance with 9.2.2 of this Code". Once there was clear mandatory text that the schedule was not to be used for such cargoes, it would be preferable not to include these more stringent provisions that were appropriate only for cargoes that were dangerous goods.

.2 The proposal could be further developed at E&T 40.

.3 The proposal could be supported, in general. However, standard texts concerning weather precautions for group A cargoes and loading of high-density solid bulk cargoes should be added.

5.46 After consideration, the Sub-Committee, with a view to providing advice to CCC 10, agreed to:

.1 refer the documents to E&T 40 for further consideration; and

.2 invite interested Member States and international organizations to submit further information to E&T 40, taking into account the views indicated in paragraph 5.45 above.

Iron ore briquettes

5.47 The Sub-Committee had for its consideration documents CCC 9/5/5 and CCC 9/INF.15 (Brazil), proposing a new individual schedule for iron ore briquettes for inclusion in the IMSBC Code and containing the cargo information to support the proposed new individual schedule.

5.48 The Sub-Committee noted the following views on this matter:

.1 Consideration should be given to amending the existing group C schedule for IRON ORE PELLETS, noting that apart from the sizing and description, which were not mandatory, the requirements for safe carriage of the cargoes were identical. The briquettes are 10 to 40 mm, whereas the pellets were up to 20 mm. Briquettes that were 15 mm could be identified as pellets and carried safely in accordance with the IRON ORE PELLETS schedule, or pellets that were 15 mm could similarly be identified and carried safely as briquettes. Both cargoes were formed by an agglomeration of iron ore that was the result of either a hot or cold agglomeration process, with or without binders. The BCSN could be IRON ORE (agglomerate) or similar, with the description adjusted to include any agglomeration process and any shape, such as pellets or briquettes. Sizing of "up to" should be avoided, since a cargo could include a high proportion of fines with the remaining cargo lumps up to the stated number. Since sizing was not mandatory, but shippers and industry generally tended to apply the numbers as if that were the case, for these types of shaped, lump cargoes, the lower size was given as 6.3 mm

with a reasonable upper limit. For this specific cargo, the process was to produce briquettes around 40 mm. Larger sizes would not need a new schedule; therefore, there seemed to be no reason why a larger size should not be provided when the schedule was introduced in the IMSBC Code.

.2 There was a need for a new schedule. Therefore, the proposal could be supported.

.3 Further information would be needed concerning possible group A properties of this cargo.

.4 Introducing a new schedule would be in line with the efforts to combat climate change. The cargo went through a new agglomeration process and did not fit into any existing schedule in the IMSBC Code. A new schedule would benefit safety of maritime transport. The conducted tests showed that this cargo belonged to group C.

5.49 After consideration and having noted the overwhelming support for incorporation of the proposal in draft amendment 08-25 to the IMSBC Code, the Sub-Committee referred the documents to E&T 40 for further consideration and incorporation, as appropriate, in draft amendment 08-25 to the IMSBC Code, taking into account the views indicated in paragraph 5.48 above.

Asphalt granulates (non-hazardous)

5.50 The Sub-Committee had for its consideration documents CCC 9/5/7 and CCC 9/INF.20 (Kingdom of the Netherlands), proposing a new individual schedule for asphalt granulates (non-hazardous) for inclusion in the IMSBC Code and containing the cargo information to support the proposed new individual schedule.

5.51 The Sub-Committee noted a view that the proposed new individual schedule could be supported, in general, and could be referred to E&T 40 for further consideration, specifically to consider the following: the use of the wording "non-hazardous" in the BCSN; the synonym appearing under the BCSN which was mandatory text; the size starting from zero millimetres, which although not mandatory criteria, might lead to cargoes with high proportions of fines being carried without testing for group A properties; whether an angle of repose of 30° required some specific text around it, being a non-cohesive cargo; why specific stowage and segregation requirements were included; and why precautions included personal protective equipment seemingly beyond what was required for dust of a cargo with no MHB or dangerous goods hazards.

5.52 After consideration, the Sub-Committee, with a view to providing advice to CCC 10, agreed to:

.1 refer the documents to E&T 40 for further consideration; and

.2 invite the Kingdom of the Netherlands to submit further information to E&T 40, taking into account the view indicated in paragraph 5.51 above.

Pea protein concentrate pellets (non-hazardous)

5.53 The Sub-Committee had for its consideration documents CCC 9/5/8 and CCC 9/INF.21 (Kingdom of the Netherlands), proposing a new individual schedule for pea protein concentrate pellets (non-hazardous) for inclusion in the IMSBC Code and containing the cargo information to support the proposed new individual schedule.

5.54 The Sub-Committee noted the following views on this matter:

.1 The proposal could not be supported. Further information would be needed on how this cargo should be handled on board a ship in case the stated maximum values on moisture, fat, ash and crude fibre were exceeded. It should also be further considered whether this cargo could be regarded as "non-hazardous", taking into account that the proposed schedule stated that all electrical equipment in the cargo spaces to be used for this cargo must be electrically disconnected from the power source.

.2 The proposed new individual schedule could be supported, in general, for forwarding to E&T 40 for further consideration, specifically to consider the use of the wording "non-hazardous" in the BCSN; whether an angle of repose of less than 30° required some specific text around it, being a non-cohesive cargo and/or a cargo that flowed freely like grain, thereby requiring compliance with the Grain Code; and why specific stowage and segregation requirements were included for sources of heat.

5.55 After consideration, the Sub-Committee, with a view to providing advice to CCC 10, agreed to:

.1 refer the documents to E&T 40 for further consideration; and

.2 invite the Kingdom of the Netherlands to submit further information to E&T 40, taking into account the views indicated in paragraph 5.54 above.

Petroleum coke (calcined or uncalcined)

5.56 The Sub-Committee had for its consideration document CCC 9/5/11 (China), proposing a new individual schedule for petroleum coke (calcined or uncalcined) as a group C cargo, in order to clarify the provision for the cargo with a temperature below 55°C when loaded.

5.57 The Sub-Committee noted the following views on this matter:

.1 The existing schedule "should not apply to materials having a temperature below 55°C when loaded" according to the non-mandatory text in the section for "Description". There might be a discussion to be had with regard to amending the existing schedule to clearly deal with the cargo when loaded below 55°C, as well as above that temperature. Noting the current work around CARBON and that SP925 was likely to be deleted, it would be preferable not to change the schedule to be group C.

.2 The proposal could be supported, in principle. However, the IMO Solid Bulk Cargo Information Reporting Questionnaire should be submitted.

5.58 After consideration, the Sub-Committee, with a view to providing advice to CCC 10, agreed to:

.1 refer the document to E&T 40 for further consideration; and

.2 invite China to submit further information to E&T 40, taking into account the views indicated in paragraph 5.57 above.

Wheat gluten pellets

5.59 The Sub-Committee had for its consideration documents CCC 9/5/12 and CCC 9/INF.22 (China), proposing a new individual schedule for wheat gluten pellets for inclusion in the IMSBC Code and containing the cargo information to support the proposed new individual schedule.

5.60 The Sub-Committee noted a view that the proposed new individual schedule could be supported, in general, to be referred to E&T 40 for further consideration, specifically to consider whether an angle of repose of less than 30 degrees required some specific text around it, being a non-cohesive cargo and/or a cargo that flowed freely like grain, thereby requiring compliance with the Grain Code.

5.61 After consideration, the Sub-Committee, with a view to providing advice to CCC 10, agreed to:

.1 refer the documents to E&T 40 for further consideration; and

.2 invite China to submit further information to E&T 40, taking into account the view indicated in paragraph 5.60 above.

Proposed draft unified interpretations of appendix 1 – individual schedules of solid bulk cargoes of the IMSBC Code

5.62 The Sub-Committee had for its consideration document CCC 9/10 (IACS), proposing draft unified interpretations of appendix 1 – individual schedules of solid bulk cargoes of the IMSBC Code concerning certified safe type electrical equipment for ships carrying materials hazardous only in bulk (MHB).

5.63 The Sub-Committee noted the following views on this matter:

.1 In paragraph 9 of document CCC 9/10, the reference to paragraph 4.3.2 of the IEC standard should be read as a reference to paragraph 4.3.1. With regard to the substance of the proposal, the proposed unified interpretation could not be supported for the following reasons: Firstly, paragraph 4.3.2 of the IEC standard applied to class 4.3 dangerous goods, as mentioned in the standard itself. If this IEC standard were applied to MHB cargoes without detailed instruction, it would create confusion and would not contribute to safety. Secondly, in the IEC standard, table 1 specified the required level of protection against explosive gas atmosphere, as well as IP standard, which was a degree of protection against explosive dust atmosphere, for respective cargoes. The cargoes listed in the annex to the proposal were not covered by the table. Therefore, it would be confusing if the compliance to the IEC standard were to be required. If the Sub-Committee considered it necessary to apply this IEC standard to MHB cargoes, a proper review by IEC and update, if appropriate, would be necessary. Thirdly, in the IEC standard,

"extended areas" were limited to ventilation of the cargo space. On the other hand, the proposed interpretation referred to adjacent spaces not separated by gastight bulkheads and decks. Thus, the proposed interpretation required application of the IEC standard to wider areas than what was defined by the current IEC standard. This would cause unrealistic consequences.

.2 A unified interpretation would not be a suitable way forward; amending the IMSBC Code should be considered instead.

.3 Intrinsically safe equipment had already been a topic of lengthy discussion in the context of the IMDG Code, and SOLAS chapter II-2 already included measures for the ship to address hazards that met the criteria for classification as a dangerous good and that required the ship to have a Document of Compliance to be issued. MHB cargoes were specific to solid bulk cargoes and the IMSBC Code did include suitable specific text in appropriate individual schedules, and the text was often mandatory. The proposed unified interpretation was not a correct way forward, because it could not be regarded as an interpretation of a mandatory requirement. Proposals to introduce mandatory measures and requirements for ships carrying MHB solid bulk cargoes should be considered under mandatory parts of the IMSBC Code.

.4 Careful consideration was needed in relation to ventilation requirements and arrangements. In addition, it should be considered whether this matter could be dealt with by an interpretation or whether an amendment would be required. These issues could be further discussed at E&T 40.

.5 A footnote could be added to the mandatory part of the IMSBC Code, referring to the relevant IEC standard. In addition, the Sub-Committee could invite IEC to update the standard.

5.64 After consideration, the Sub-Committee invited IACS, taking into account the views indicated in paragraph 5.63 above, to submit a new proposal to E&T 40 for further consideration.

Draft amendment 08-25 to the IMSBC Code and instructions to the E&T Group

5.65 Having considered the above matters, the Sub-Committee instructed E&T 40 to prepare the draft amendments (08-25) to the IMSBC Code, based on the documents submitted to CCC 9 and related documents submitted to E&T 40, taking into account comments made and decisions taken by the Sub-Committee, and submit a written report to CCC 10.

5.66 The Sub-Committee also instructed E&T 40 to consider new proposals, if submitted, and to advise CCC 10 accordingly.

5.67 The Sub-Committee noted that the provisional agenda for E&T 40 would be available in due course as document E&T 40/1.

6 AMENDMENTS TO THE IMDG CODE AND SUPPLEMENTS

General

6.1 The Sub-Committee recalled that MSC 105 had adopted amendments (41-22) to the IMDG Code by resolution MSC.501(105), which was expected to enter into force on 1 January 2024.

6.2 The Sub-Committee also recalled that CCC 8 had instructed the Editorial and Technical Group (E&T 38) to prepare the draft amendments (42-24) to the IMDG Code and the draft editorial corrections to amendment 41-22 to the IMDG Code.

6.3 The Sub-Committee noted that, after consideration of the submissions under this agenda item, it should provide clear advice, instruction and authorization to E&T 39, in order to finalize the draft amendments (42-24) to the IMDG Code, with a view to adoption at MSC 108 in 2024.

Report of E&T 38

6.4 The Sub-Committee considered the report of E&T 38 (CCC 9/6), together with the related documents submitted to the session and, having approved it in general, took action as indicated in the following paragraphs.

Editorial corrections to the English, French and Spanish versions of amendment 41-22 to the IMDG Code

6.5 The Sub-Committee agreed, in principle, to the draft editorial corrections to the English version of amendment 41-22 to the IMDG Code, as prepared by E&T 38 (CCC 9/6, paragraphs 2.1 to 2.26 and annex 1), noting that there were remaining editorial issues in square brackets to be resolved; and referred the draft editorial corrections to E&T 39 for consideration and finalization.

6.6 The Sub-Committee agreed, in principle, to the draft editorial corrections to the French version of amendment 41-22 to the IMDG Code, as prepared by E&T 38 (CCC 9/6, paragraph 2.24 and annex 2), noting that there were remaining editorial issues in square brackets to be resolved; and referred the draft editorial corrections to E&T 39 for consideration and finalization.

6.7 The Sub-Committee agreed, in principle, to the draft editorial corrections to the Spanish version of amendment 41-22 to the IMDG Code, as prepared by E&T 38 (CCC 9/6, paragraph 2.25 and annex 3), and referred the draft editorial corrections to E&T 39 for consideration and finalization.

Issues requiring further consideration

6.8 The Sub-Committee noted the deliberations and draft amendments prepared by E&T 38 on several issues, which owing to their complexity and time constraints needed further discussion; and the invitation to interested Member States and international organizations to submit further related proposals to this session (CCC 9/6, paragraphs 3.23 to 3.26, 3.66 to 3.73, 3.80 to 3.99, and annexes 4 and 5). In so doing, the Sub-Committee took action as indicated in the following paragraphs.

CARBON

6.9 The Sub-Committee recalled that E&T 38 had reached agreement on some issues but had been unable to reach a clear agreement on some other issues concerning CARBON (CCC 9/6, paragraphs 3.66 to 3.73). Subsequently, E&T 38 had prepared draft amendments (CCC 9/6, annex 5) and had agreed to leave them in square brackets; and invited interested Member States and international organizations to submit further proposals to CCC 9 where this issue could be considered by a working group, if established at the session.

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

.1 CCC 9/6/4 (CEFIC), providing a proposal for further requirements for a new special provision (provisionally named SP9xa at CCC 8) applicable to UN 1361 CARBON, vegetable or animal origin, to replace the deleted SP925;

.2 CCC 9/6/5 (CEFIC), containing a proposal for a suitable wording of the new special provision applicable to UN 1362 CARBON, ACTIVATED, to replace the deleted SP925; and

.3 CCC 9/6/12 (WSC), summarizing the views expressed within an informal correspondence group, which was established with interested Member States and international organizations following E&T 38, to consider annex 5 to document CCC 9/6.

6.11 After consideration, the Sub-Committee instructed the Drafting Group to:

.1 further develop draft amendments to the IMDG Code concerning CARBON, taking into account documents CCC 9/6 (paragraphs 3.66 to 3.73 and annex 5), CCC 9/6/4, CCC 9/6/5 and CCC 9/6/12; and

.2 consider whether it was necessary to establish a correspondence group to progress the issue on CARBON and, if so, prepare terms of reference for consideration by the Sub-Committee.

Stabilized substances

6.12 The Sub-Committee noted that E&T 38 had noted multimodal aspects of this issue and that there might be a need to submit proposals to the UNTDG Sub-Committee for potential discussion by the Explosives Working Group, and that this issue had maritime-specific aspects. The Sub-Committee also noted that, in this context, E&T 38 had invited interested Member States and international organizations to submit further proposals to CCC 9, and had encouraged interested parties to contact DGAC and WSC, in order to be included in the ongoing discussions (CCC 9/6, paragraphs 3.96 to 3.99).

6.13 In this regard, the Sub-Committee had for its consideration document CCC 9/6/14 (United Arab Emirates et al.), containing an update on discussions on stabilized substances which had taken place between CCC 8 through E&T 38 and up to the point of submission; and proposing that, given the fact that the intermodal discussion was germane and closely connected to the issues that were raised in the original document CCC 8/6/11 (Morocco et al.), consideration of amendments to the IMDG Code by IMO, including on the point of critical information to be provided to the carrier by the shipper regarding these substances, would be best undertaken once the final outcome of the review process in the UNTDG Sub-Committee was available, so as to ensure consistency.

6.14 After consideration, the Sub-Committee invited interested Member States and international organizations to submit further proposals on this issue to a future session.

Outstanding issues from document CCC 7/6/2

6.15 The Sub-Committee noted that E&T 38 had been unable to have a thorough consideration on the outstanding issues contained in paragraph 41 of the report of the Correspondence Group, as set out in document CCC 7/6/2 (Germany). Consequently, E&T 38 had agreed to invite interested Member States and international organizations to submit further proposals to CCC 9 and that this issue could be considered by a working or drafting group, if established at the session (CCC 9/6, paragraphs 3.90 to 3.92).

6.16 Having noted that no new documents had been submitted since CCC 7, the Sub-Committee agreed that this matter was deemed concluded, with the understanding that this did not preclude interested Member States and international organizations from submitting new proposals to future sessions, as appropriate.

Remaining issues

6.17 After consideration, the Sub-Committee instructed the Drafting Group to further develop draft amendments to the IMDG Code concerning the remaining issues (CCC 9/6, paragraphs 3.23 to 3.26, 3.80 to 3.89 and 3.93 to 3.95, and annex 4).

Draft amendment 42-24 to the IMDG Code

6.18 Subsequently, the Sub-Committee agreed, in principle, to draft amendment 42-24 to the IMDG Code, as prepared by E&T 38 (CCC 9/6, paragraphs 3.1 to 3.65, 3.74 to 3.79, 3.100 to 3.109 and 3.111, and annex 4), noting that there were remaining issues in square brackets in need of further consideration; and agreed to refer the draft amendment E&T 39 for finalization, with a view to adoption at MSC 108 in 2024. In this context, the Sub-Committee noted a view concerning basic documentation requirements for goods not subject to the IMDG Code and amendments to 5.4.4 of the IMDG Code (CCC 9/6, paragraphs 3.74 to 3.79), supporting option 1 instead of option 3 agreed at E&T 38.

6.19 In this context, the Sub-Committee also had for its consideration document CCC 9/6/13 (United States), commenting on the report of E&T 38, proposing texts for column 17 of the Dangerous Goods List in the IMDG Code, and suggesting a review of the entirety of column 17.

6.20 After consideration, the Sub-Committee agreed to refer document CCC 9/6/13 to E&T 39 for further consideration in conjunction with the finalization of the draft amendment 42-24 to the IMDG Code.

Working group on IMDG Code matters

6.21 The Sub-Committee noted the Group's recommendation to establish a working group on IMDG Code matters at this session.

Amendments to the EmS Guide

6.22 The Sub-Committee agreed, in principle, to consequential amendments to the *Revised Emergency Response Procedures for Ships Carrying Dangerous Goods* (MSC.1/Circ.1588/Rev.2) (EmS Guide) emanating from draft amendment 42-24 to the IMDG Code (CCC 9/6, paragraphs 4.1 to 4.2 and annex 6), and referred them to E&T 39 for finalization, with a view to approval at MSC 108 in 2024.

Deletion of MSC/Circ.506/Rev.1

6.23 The Sub-Committee agreed that MSC/Circ.506/Rev.1 on *Container packing certificates/vehicle packing declarations* should be deleted from the IMDG Code supplement and instructed the Secretariat to effect the deletion for the next edition of the supplement.

Revision of IAEA's [SSR-6 (Rev.1)] regulations for safe transport of radioactive material

6.24 The Sub-Committee noted the deliberations of E&T 38 on a revision of IAEA's [SSR 6 (Rev.1)] regulations for the safe transport of radioactive material and the invitation to interested Member States and international organizations to submit further proposals concerning the proposed definitions and further information on the background for the draft revision; and the authorization to the Secretariat to inform IAEA of the Group's deliberations (CCC 9/6, paragraphs 5.1 and 5.2).

6.25 In this context, the Sub-Committee considered document CCC 9/6/3 (IAEA and WNTI), seeking its opinion on an additional definition for "Bay", related to maritime transport, which was intended to be included within the next version of the IAEA regulations for the safe transport of radioactive material [SSR-6].

6.26 The Sub-Committee noted the following views on this matter:

.1 The definition for "conveyance" in SSR-6 for transport by water was any ship or any cargo space or defined deck area on the ship. When a freight container or a vehicle was under exclusive use, did the transport of this unit require, in addition, the cargo space or the defined deck area to be under exclusive use by the shipper of that unit, or did the reference to ship, cargo space or defined deck area apply only when the cargo was not loaded in a freight container or vehicle but loaded as conventional cargo directly into the ship? It should also be asked who defined the "defined deck area". Was it the master of the ship or was it a competent authority? Was there only one defined deck area or were a larger number of defined areas on the same ship possible, provided a distance of minimum 6 m was observed between them? Would it be possible for the IMDG Code to provide clarity on these definitions, e.g. by defining a conveyance for the transport of radioactive material to mean on a general cargo ship, a hold, compartment or defined deck area on the weather deck; on a roll-on/roll-off ship, a vehicle; and on a containership, a large freight container? Developing precise definitions in the IMDG Code might be a way forward to clarify the intended meaning of these terms. The Secretariats of IMO and IAEA could review the feasibility of such an approach.

.2 Concerning document CCC 9/6/3, the proposed definition for a container bay was not correct. A bay was defined only by its distance from the bow of the ship, extended over the complete breadth of the ship and included stowage positions under deck and on deck. A bay was not delimited by bulkheads. Bulkheads were delimiting under-deck cargo spaces, not bays. A forty-foot bay under deck might adjoin a bulkhead either at its forward part or at its aft part but never at both ends, and a twenty-foot bay might not adjoin to any bulkhead. For stowage on a weather deck or on a vehicle deck, the SSR-6 regulations provided a maximum CSI of 50 for a group of containers in a defined deck area, provided that a distance of 6 m was observed to other groups of containers in the defined deck area. The same approach could be applied to the under-deck cargo space (i.e. hold) of a containership. The CSI

of 50 should apply to a group of containers which was separated from other groups of containers by a horizontal distance of 6 m in longitudinal and transverse direction, both vertically projected. The maximum CSI of 100 for an under-deck cargo space (hold), as proposed by IAEA and WNTI, could be maintained. The Secretariats of IMO and IAEA could be invited to consider the feasibility of providing clarity on these definitions in the IMDG Code. The Sub-Committee, including the co-sponsors of document CCC 9/6/3, were invited to consider the alternative proposal presented here.

.3 Contrary to paragraph 9 of document CCC 9/6/3, there were still divergent views expressed, and the Transport Safety Standard Committee (TRANSSC) of IAEA had not yet reached a conclusion. With regard to terminology, the proposed definition for "bay" differed from the ordinary one. Therefore, the proposed definition might cause confusion. During E&T 38, many Member States had expressed concerns over the definition. In short, "bay" simply meant the loading position of a container, and might not necessarily be delimited by bulkheads equipped with cell-guides. Furthermore, "cell-guides" were not designed to withstand accidental accelerations. Namely, cell-guides could not maintain the container's position in the event of a severe accident. Therefore, it could not be guaranteed that the cell-guides would maintain a 6-metre segregation distance between fissile packages in the event of an accident. The risk of a fissile package reaching a critical state could not be eliminated only by cell-guides. Therefore, the proposed terminology could not be supported. Furthermore, this matter should not be considered in a narrow scope of terminology, but should be considered as a matter of safety of ships, which could be ensured only if criticality was sufficiently prevented. When transporting fissile material, it was essential to prevent criticality, and managing accumulation was of paramount importance. In other words, while individual fissile packages were designed to prevent criticality, the accumulation of multiple fissile packages could potentially result in criticality. Therefore, during transportation, the accumulation was limited, and a distance of at least 6 m between accumulations was maintained, to ensure that they did not reach criticality. Relaxing the CSI limit, as set out in annex 2 to document CCC 9/6/3, could not be supported. The proposal in document CCC 9/6/3 would not guarantee a sufficient segregation distance between fissile materials and would increase the risk of criticality. Even if the limits were modified using terms other than "bay", or using the definition itself, the risk of criticality would also increase, which could not be supported. E&T 38 requested information concerning the discussions that had taken place, including the intent and background of the proposal. However, up to now, no sufficient information had been provided. To discuss relaxation of the limits, it was essential to have a comprehensive understanding of the reasons behind their establishment in the past. Therefore, given the lack of sufficient information, the relaxation of the CSI limit could not be accepted. Furthermore, should such relaxation be considered, the Sub-Committee needed to be fully involved in the work, not only in terms of terminology, but also with regard to fundamental aspect of ship safety, with sufficient information. Therefore, the Sub-Committee should duly consider the risk emanating from the proposed relaxation of CSI limits, and not limit the scope of its work to terminology only.

.4 In practice, there had been no major problems. Therefore, more information on the background of the proposal should be submitted to CCC 10.

.5 "Bay" already had a meaning on containerships, and it was not related to spaces delimited by bulkheads with or without cell-guides, noting that it extended above deck, whether the ship had hatches or was hatchless. For the IMDG Code stowage and segregation on containerships of containers that might carry class 7 material, it was clear in 7.4.1 that containers might be carried in ships that were permanently fitted to carry containers or ships not permanently fitted to carry containers, and 7.4.2 included provisions for carriage of containers in hatchless containerships. Further discussions were required to ensure that the Sub-Committee's advice on the IAEA regulations was not in conflict or confusing concerning class 7 material that was carried in containers on ships.

.6 The maximum CSI of 50 for a group of containers must always be maintained. In this regard, there would be no change. The spaces would be divided by bulkheads, not by cell-guides. The Sub-Committee should consider the best term to designate the space.

6.27 Consequently, the Sub-Committee invited WNTI to submit further information on this matter to CCC 10, taking into account the views indicated in paragraph 6.26 above. The Sub-Committee also invited the IAEA Secretariat to inform TRANSSC on the deliberations and outcomes of consideration of this matter.

Issues to be considered by the UNTDG Sub-Committee

6.28 The Sub-Committee noted that the Secretariat had informed the UNTDG Sub-Committee on several findings which might have multimodal transport implications, identified by E&T 38 (CCC 9/6, paragraphs 2.5, 2.9, 2.11, 2.17, 3.25, 3.32, 3.36, 3.45, 3.60 and 3.108). UNTDG 62 had noted that some of these findings could have consequences for multimodal transport and thus result in a number of future amendments to the UN Model Regulations. In particular, concerning the draft amendments to 5.5.4 of the IMDG Code, most experts who took the floor at UNTDG 62 had been of the opinion that the provisions in 5.5.4.3 and 5.5.4.4 were appropriate for maritime transport but not necessarily for other transport modes. UNTDG 62 had preferred to keep the corresponding provisions in the UN Model Regulations basic and had adopted the amendments to 5.5.4, 5.5.4.1 and 5.5.4.2. The expert from the United States, in cooperation with the IMO Secretariat, had volunteered to prepare for UNTDG 63 a document with a more detailed justification for the draft new provisions in 5.5.4.3 and 5.5.4.4 of the IMDG Code.

Report of the Correspondence Group on the Review of Transport Provisions for Vehicles

6.29 The Sub-Committee recalled that CCC 8 had established a Correspondence Group on the Review of Transport Provisions for Vehicles, with terms of reference as set out in paragraph 6.104 of document CCC 8/18 (report of CCC 8).

6.30 In this context, the Sub-Committee had for its consideration document CCC 9/6/1 (United States), containing the report of the Correspondence Group on the Review of Transport Provisions for Vehicles.

6.31 The Sub-Committee noted the Correspondence Group's discussion on requirements for new vehicles (CCC 9/6/1, paragraphs 5 to 33), requirements for damaged vehicles (CCC 9/6/1, paragraphs 34 to 62), draft definitions prepared by a subgroup (CCC 9/6/1, paragraphs 63 to 64) and the Group's recommendation to establish a working group at CCC 9 (CCC 9/6/1, paragraph 65).

6.32 The Sub-Committee noted the following views on this matter:

.1 It would be appropriate to distinguish the requirements between an "in use vehicle" and other "used vehicles". They would both be used; however, they constituted different risks from a fire safety point of view. Therefore, they should be treated separately. "In use vehicles" would be vehicles that, for instance, could be driven on board by their owner, and were generally in good (but used) condition, and they therefore represented a lower risk. They would be registered and have passed the relevant national safety inspections. The recent fire incidents on ro-ro and ro-pax ships had been caused when transporting "used vehicles", but they were vehicles that, for instance, had not passed national safety inspection or vehicles that were impossible to sell on the national market, but were shipped to other markets where there was a demand for them. These "used vehicles" did not necessarily fulfil the criteria for "damaged vehicles", but they were nevertheless high-risk cargo. This was the reason for proposing a new category for "in use vehicles". The Drafting Group at this session could prepare new terms of reference for the re-establishment of the Correspondence Group, including the additional issues raised concerning the definitions of used vehicles. A new work item was decided at MSC 105 where the SSE Sub-Committee was tasked to work on improving fire protection in ro-ro cargo spaces when transporting vehicles with alternative propulsion. The output also includes the issue of charging of vehicles on board. This agenda item was on the agenda for SSE 10 and was scheduled for until 2027 (four sessions). The work in the two Sub-Committees could therefore continue in parallel, but the work between them should be coordinated.

.2 There was a need to continue developing measures to address the potential hazards emanating from the transport of vehicles on ro-ro ships, taking into account the accidents due to fires that had occurred in recent years where these types of ships and cargoes had been involved. Therefore, it would be appropriate to continue deliberations within a working group at this session. Noting the limitations that the Drafting Group on Amendments to the IMDG Code would have in discussing in detail the outstanding issues contained in document CCC 9/6/1, alternatively, the re-establishment of the Correspondence Group could be supported. Coordination of this work with the work carried out by the SSE Sub-Committee was important.

.3 There was a need to identify cars that were severely damaged. In this regard, it should be clarified who was responsible for this identification. Regarding hybrid cars that were carried in containers, when the fuel tank was empty and therefore an exemption applied, there was an issue concerning the fact that lithium battery was not declared and therefore not known by the carrier. All the issues should be further discussed by the Drafting Group, and the Group should also prepare updated terms of reference for the re-establishment of the Correspondence Group.

.4 Many issues remained unresolved, and therefore active participation in the work of the Correspondence Group should be encouraged.

6.33 After consideration, the Sub-Committee instructed the Drafting Group to consider whether it was necessary to re-establish the Correspondence Group and, if so, prepare terms of reference for consideration by the Sub-Committee.

Proposals related to amendment 42-24

Clarification of assigning portable tank special provision for the degree of filling

6.34 The Sub-Committee had for its consideration document CCC 9/6/2 (Republic of Korea), proposing to replace portable tank special provision TP1 with TP2, regarding the maximum degree of filling, in column 14 of the Dangerous Goods List, for some liquid dangerous goods with properties indicated in 4.2.1.9.3 of the IMDG Code.

6.35 The Sub-Committee noted the following views on this matter:

.1 As this proposal would have multimodal consequences, the Republic of Korea should be invited to submit a proposal to UNTDG first.

.2 The proposal aimed to amend column 14 of the Dangerous Goods List in the IMDG Code, which was based on the corresponding list in the UN Model Regulations. Where a substance had a bold "P" in column 4 in the IMDG Code, this only signified that the substance had established and agreed data that meant it must be classified as a marine pollutant. The absence of the "P" did not mean that a substance when tested was not a marine pollutant. UN 2735 was the only entry not marked as a marine pollutant. However, an N.O.S. substance would not be identified as a marine pollutant in column 4. Being an N.O.S substance, it would not be a given that the other criteria in 4.2.1.9.3 of the IMDG Code would be met by the substance. Provision 4.2.1.9.3 required that TP2 was applied to any substance that met the criteria in 4.2.1.9.3 of the IMDG Code, regardless of column 14 having TP1 listed.

6.36 After consideration, the Sub-Committee referred the document to E&T 39 for further consideration with a view to providing advice to the Republic of Korea and CCC 10.

Amendment to 7.2.6.1 of the IMDG Code

6.37 The Sub-Committee had for its consideration document CCC 9/6/6 (Kingdom of the Netherlands), proposing to amend 7.2.6.1 of the IMDG Code to remove any form of possible contradiction in the text.

6.38 The Sub-Committee noted the following views on this matter:

.1 The proposed amendment might not necessarily be needed but could nevertheless be supported.

.2 As the current text was that there must be no dangerous reaction, nor must the four specified things happen, it could be agreed that the intent might be unclear. It could be clearer to add "react dangerously" to the end of the list of things that must not occur, and amend the body text in 7.2.6.1 to read at the end: "provided that the substances in contact with each other would not react and cause:".

6.39 After consideration, the Sub-Committee agreed to the proposal, in principle, and decided to refer the document to E&T 39 for consideration and incorporation, as appropriate, in draft amendment 42-24 to the IMDG Code.

Amendment to 5.4.3.1 of the IMDG Code

6.40 The Sub-Committee had for its consideration document CCC 9/6/7 (Kingdom of the Netherlands), proposing to amend 5.4.3.1 of the IMDG Code when only a stowage plan was used in case of carrying dangerous goods and marine pollutants.

6.41 Following discussion, the Sub-Committee noted the view that the purpose of a stowage plan needed to be clarified, especially concerning whether the stowage plan could replace a dangerous goods manifest.

6.42 After consideration, the Sub-Committee agreed to refer the document to E&T 39 for further consideration with a view to providing advice to the Kingdom of the Netherlands and CCC 10.

Stowage and segregation of lithium battery energy storage cabinets

6.43 The Sub-Committee had for its consideration documents CCC 9/6/8 and CCC 9/6/10 (China), proposing, respectively, draft amendments to chapters 7.4 and 7.6 of the IMDG Code on the stowage and segregation of lithium battery energy storage cabinets; and proposing draft amendments on stowage and handling requirements for UN 3536, with the addition of "SW2".

6.44 The Sub-Committee noted the following views on this matter:

.1 Increasing ventilation in case of fire might not be the right way forward. An alternative could be to require stowage category C, that was stowage on deck only.

.2 More detailed technical discussion would be needed at E&T 39. With regard to document CCC 9/6/10, there might be a need for additional stowage codes SW1, SW11 and SW19.

.3 More holistic consideration of the matters concerning lithium-ion batteries was needed.

6.45 After consideration, the Sub-Committee agreed to the proposals, in principle, and referred the documents to E&T 39 for consideration and incorporation, as appropriate, in draft amendment 42-24 to the IMDG Code. The Sub-Committee also invited China to provide more information to E&T 39, taking into account the views indicated in paragraph 6.44 above.

Amendments to the shipping conditions of seed cakes in the IMDG Code

6.46 The Sub-Committee recalled that CCC 8, having considered document CCC 8/6/12 (China) and the views expressed, had agreed to invite the delegation of China to submit a new proposal on this matter to CCC 9, taking into account the comments made.

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

.1 CCC 9/6/9 (China), proposing improved amendments to the shipping conditions of seed cakes in the IMDG Code, taking into account the comments expressed at CCC 8; and

.2 CCC 9/6/11 (GAFTA), fully supporting China's conclusion in document CCC 8/6/12 that no self-heating accidents had been reported in shipping of mechanically expelled soybean meal and others; and fully supporting the exclusion of the five categories from the provisions of the IMDG Code chapter 3.3.

6.48 The Sub-Committee noted the following views on this matter:

.1 Taking into account multimodal aspects, a proposal should be submitted to UNTDG first.

.2 The relevant provisions in the IMDG Code were mostly aligned with the IMSBC Code, but were not in line with the UN Model Regulations. E&T 39 should be instructed to further consider this issue.

.3 It should be carefully considered to what extent provisions in the IMSBC Code could be a model for provisions in the IMDG Code, owing to differences between transport modes.

.4 Provisions in the IMDG Code and the UN Model Regulations needed to be harmonized to a certain extent. However, different characteristics of seed cakes should be taken into account as well. Therefore, many seed cakes could be exempted, and this was not a multimodal issue.

6.49 After consideration, the Sub-Committee referred the documents to E&T 39 for further consideration, with a view to providing advice to CCC 10.

Establishment of a drafting group

6.50 Having considered the above matters, the Sub-Committee established a Drafting Group on Amendments to the IMDG Code and instructed it, taking into account the comments made and decisions taken in plenary, to:

w*ith regard to the issues highlighted in paragraphs 3.23 to 3.26, 3.66 to 3.73, 3.80 to 3.89 and 3.93 to 3.95 and annexes 4 and 5 to document CCC 9/6:*

.1 further develop draft amendments to the IMDG Code, taking into account the relevant parts of documents CCC 9/6/4, CCC 9/6/5 and CCC 9/6/12;

.2 consider whether it was necessary to establish a correspondence group to progress the issue on CARBON and, if so, prepare terms of reference for consideration by the Sub-Committee; and

with regard to transport provisions for vehicles:

.3 consider whether it was necessary for the Correspondence Group to be re-established and, if so, prepare terms of reference for consideration by the Sub-Committee.

Report of the Drafting Group

6.51 Having considered the report of the Drafting Group on Amendments to the IMDG Code (CCC 9/WP.7), the Sub-Committee approved it in general and took action, as described in the following paragraphs.

UN 3556, UN 3557 and UN 3558

6.52 The Sub-Committee noted the deliberations of the Group on the draft new UN 3556, UN 3557 and UN 3558; and agreed, in principle, to the corresponding draft amendments to the IMDG Code and referred them to E&T 39 for further consideration, with a view to incorporation, as appropriate, in draft amendment 42-24 to the IMDG Code (CCC 9/WP.7, paragraphs 5 to 8 and annex 1).

CARBON

6.53 The Sub-Committee noted the deliberations of the Group on CARBON and the corresponding draft amendments to the IMDG Code prepared by the Group, noting that there were remaining issues in square brackets to be resolved; and agreed, in principle, to the draft amendments to the IMDG Code and referred them to E&T 39 for further consideration, with a view to incorporation, as appropriate, into draft amendment 42-24 to the IMDG Code (CCC 9/WP.7, paragraphs 9 to 12 and annex 2).

Special provisions for seed cake

6.54 The Sub-Committee noted the deliberations of the Group on special provisions for seed cakes and invited interested Member States and international organizations to submit further proposals and information on SP929 to CCC 10 (CCC 9/WP.7, paragraphs 13 to 15 and 23.5).

Competent authorities

6.55 The Sub-Committee noted the deliberations of the Group on competent authorities and agreed, in principle, to the corresponding draft amendments to the IMDG Code, noting that there were remaining issues in square brackets to be resolved; and referred them to E&T 39 for further consideration, with a view to incorporation, as appropriate, into draft amendment 42-24 to the IMDG Code; and invited interested Member States and international organizations to submit further proposals and information on SP907, SP926 and SP928 to CCC 10 (CCC 9/WP.7, paragraphs 16 to 24 and annex 3).

Stowage of N.O.S. substances of class 4.3

6.56 The Sub-Committee noted the deliberations of the Group on stowage of N.O.S. substances of class 4.3 and agreed, in principle, to the corresponding draft amendments to the IMDG Code and referred them to E&T 39 for further consideration, with a view to incorporation, as appropriate, in draft amendment 42-24 to the IMDG Code; and invited Germany, in cooperation with other interested Member States and international organizations, as appropriate, to submit a corresponding proposal for new UN numbers to UNTDG (CCC 9/WP.7, paragraphs 25 to 28 and annex 4).

Re-establishment of the Correspondence Group

6.57 The Sub-Committee agreed to re-establish the Correspondence Group on the Review of Transport Provisions for Vehicles under the coordination of the United States,[4][44] and instructed it to:

.1 continue consideration of amendments to transport provisions for vehicles, taking into account the discussions at CCC 8 on documents CCC 8/6/1, CCC 8/6/6 and CCC 8/6/10, discussions at CCC 9 on document CCC 9/6/1, and the relevant work at the SSE Sub-Committee;

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.2 based on root cause analysis of previous incidents and identified risks and hazards, develop recommendations for the IMDG Code provisions concerning the transport of vehicles, as follows:

.1 provisions for vehicles transported in CTUs, for the following vehicles:

.1 new;

.2 used; and

.3 damaged;

.2 provisions for the following vehicles transported in vehicle, special category and ro-ro spaces:

.1 new;

.2 in use;

.3 used; and

.4 damaged;

.3 provisions for electric and hybrid vehicles; and

.3 submit a report to CCC 10.

6.58 The Sub-Committee encouraged interested Member States and international organizations to actively participate in the work of the Correspondence Group (CCC 9/WP.7, paragraphs 29 to 30).

Draft amendment 42-24 to the IMDG Code and instructions to the E&T Group

6.59 The Sub-Committee authorized E&T 39 to finalize the draft amendments (42-24) to the IMDG Code, based on documents submitted to CCC 9 and taking into account comments made and decisions taken by the Sub-Committee, with a view to submitting the draft amendments to MSC 108 for consideration and adoption (see paragraph 6.20); and to submit a written report to CCC 10.

6.60 The Sub-Committee requested the Secretary-General to circulate, in accordance with SOLAS article VIII, the draft amendments to the IMDG Code (consolidated replacement text), incorporating draft amendments as prepared by E&T 39, for consideration and subsequent adoption by MSC 108.

6.61 The Sub-Committee also instructed E&T 39 to finalize editorial corrections to amendment 41-22 to the Code (MSC.501(105)) and requested the Secretariat to issue such editorial corrections before 1 January 2024, the date when amendment 41-22 would enter into force.

6.62 The Sub-Committee further instructed E&T 39 to prepare related recommendations and circulars for submission to MSC 108 for approval, together with the adoption of amendments to the IMDG Code.

6.63 The Sub-Committee noted that the provisional agenda for E&T 39 was available as document E&T 39/1.

7 REVISION OF THE INTERIM RECOMMENDATIONS FOR CARRIAGE OF LIQUEFIED HYDROGEN IN BULK

Background

7.1 The Sub-Committee recalled that MSC 105 had agreed to include in the biennial agenda of the CCC Sub-Committee for 2022-2023 and the provisional agenda for CCC 8 an output on "Revision of the Interim recommendations for carriage of liquefied hydrogen in bulk", with a target completion year of 2024 (MSC 105/20, paragraph 18.28).

7.2 The Sub-Committee also recalled that CCC 8 had invited interested Member States and international organizations to contact the delegation of Japan with a view to jointly working informally on a submission to CCC 9 containing a draft revised version of resolution MSC.420(97) (CCC 8/18, paragraph 14.5).

Revision of the interim recommendations

7.3 The Sub-Committee had for its consideration document CCC 9/7 (Australia et al.), providing draft revised interim recommendations for carriage of liquefied hydrogen in bulk.

7.4 Following discussion, the Sub-Committee agreed that parts A to C of the draft revised interim recommendations should be finalized by a drafting group during this session, using the annex to document CCC 9/7 as the basis.

Establishment of the Drafting Group

7.5 Subsequently, the Sub-Committee established the Drafting Group on Revision of the Interim Recommendations for Carriage of Liquefied Hydrogen in Bulk and instructed it, taking into account the comments made and decisions taken in plenary, to:

.1 finalize parts A to C of the draft revised interim recommendations based on the annex to document CCC 9/7; and

.2 upon finalization of the draft revised interim recommendations in sub-paragraph .1 above, advise the Sub-Committee on how best to proceed.

Report of the Drafting Group

7.6 Having considered the report of the Drafting Group on Revision of the Interim Recommendations for Carriage of Liquefied Hydrogen in Bulk (CCC 9/WP.6), the Sub-Committee approved it in general and took action as described below.

Revision of the interim recommendations for carriage of liquefied hydrogen in bulk

7.7 The Sub-Committee agreed to the draft MSC resolution on revised interim recommendations for carriage of liquefied hydrogen in bulk, as set out in annex 7, for submission to MSC 108 for adoption (CCC 9/WP.6, paragraphs 9 and 10 and annex).

Completion of the work on the output

7.8 Subsequently, the Sub-Committee noted that the work under this output had been completed (CCC 9/WP.6, paragraph 10).

8 REVISION OF RESOLUTION A.1050(27) TO ENSURE THE SAFETY OF PERSONNEL ENTERING ENCLOSED SPACES ON BOARD SHIPS

Background

8.1 The Sub-Committee recalled that MSC 101 had agreed to include, in the 2020-2021 biennial agenda of the Sub-Committee and the provisional agenda of CCC 7, an output on "Revision of the Revised recommendations for entering enclosed spaces aboard ships (resolution A.1050 (27))", with a target completion date of 2020. The Sub-Committee also recalled that MSC 102 had adjusted the target completion year to 2021 due to the postponement of CCC 7 and that, due to the COVID-19 pandemic, this agenda item had been postponed to CCC 8.

8.2 The Sub-Committee also recalled that CCC 8 had agreed that no specific action needed to be taken at that session under the agenda item and that the item should be kept in abeyance, pending the decision of MSC on the proposed new output. In addition, CCC 8 had noted that documents CCC 8/8 (SIGTTO), CCC 8/8/1 (China) and CCC 8/8/2 (InterManager et al.), together with document CCC 8/5/11 (IBTA), could be further considered at a future session, if the new output was agreed by the Committee; and CCC 8 had also agreed to further consider document III 8/4/5 (China) at CCC 9 (CCC 8/18, paragraphs 8.1 to 8.7).

8.3 Furthermore, the Sub-Committee noted that MSC 106, having noted that the output agreed at MSC 101 had a very specific narrow scope, had agreed to include, in the biennial agenda of the CCC Sub-Committee for 2022-2023 and the provisional agenda of CCC 9, an output on "Revision of resolution A.1050(27) to ensure the safety of personnel entering enclosed spaces on board ships", with a target completion year of 2024, in association with the III, HTW, PPR, SDC and SSE Sub-Committees, as and when requested by the CCC Sub-Committee; and that the new output would absorb the ongoing work of the CCC Sub-Committee on the matter (MSC 106/19, paragraphs 16.29 to 16.31).

Consideration of documents submitted

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

.1 CCC 9/8 (Dominica et al.), introducing and providing comments on the analyses of reported and recorded enclosed space accidents that had occurred on board ships between 1996 and 2023, as well as December 2011 and May 2023;

.2 CCC 9/8/1 (BIMCO et al.), providing a copy of the original resolution A.1050(27) on *Recommendations for entering enclosed spaces aboard ships*, annotated with proposed revisions to the original text to be considered in support of the amendment of the resolution;

.3 CCC 9/8/2 (BIMCO et al.), analysing reported and recorded enclosed space accidents between 2011 and 2023 and providing suggestions for incorporating the learnings from these accidents into a revised resolution on recommendations for entering enclosed spaces; and providing suggestions on where these and other learnings might be incorporated into any revised text, and further providing a draft working proposal to be considered for the basis of any revised recommendations for entering enclosed spaces;

.4 CCC 9/8/3 (ICMA et al.), proposing to raise awareness of the dangers in enclosed spaces from oxygen depletion due to rusting and the emission of dangerous gases from organic types of cargo due to biological degradation; and providing the results of multiple experiments on a range of steel-related spaces containing scrap metal cargo, along with chain lockers and ballast tanks; and in addition, presenting that experiments on an array of organic types of cargo showed the speed of depletion and the emission of toxic gases;

.5 CCC 9/8/4 (ICMA et al.), presenting a framework for managing risks in enclosed spaces on ships; and introducing a classification system, a register and tailored control measures for each classification, with the aim of enhancing safety and mitigating hazards in enclosed space operations;

.6 CCC 9/8/5 (IBTA), providing an updated summary of research carried out into all reported enclosed space-related fatalities across all ship types for the period 2000 to 2022; and aiming to support proposals to amend relevant sections of both the IMSBC Code and the *Revised recommendations for entering enclosed spaces aboard ships* (resolution A.1050(27));

.7 CCC 9/8/6 (China), proposing revisions to *Revised recommendations for entering enclosed spaces on board ships* (resolution A.1050(27)), in order to ensure the safety of personnel entering enclosed spaces on board ships;

.8 CCC 9/8/7 (INTERTANKO), proposing an alternative means to determine that a tank atmosphere was safe for entry that would apply only on chemical tankers following the discharge of certain toxic products where no means of testing for toxicity existed;

.9 CCC 9/8/8 (InterManager), commenting on document CCC 9/8/3 and highlighting the need and availability of gas measuring instruments suitable for the marine environment in order to undertake the measurement of carbon dioxide within enclosed spaces on board ships;

.10 CCC 9/INF.3 (Dominica et al.), analysing reported and recorded enclosed space accidents appertaining to deficient atmospheric conditions that had occurred on board ships between 1996 and 2023, and where appropriate, between December 2011 and May 2023;

.11 CCC 9/INF.4 (BIMCO et al.), providing the rationale for major change to the current resolution A.1050(27) on *Recommendations for entering enclosed spaces aboard ships*, as proposed by the co-sponsors in documents CCC 9/8/1 and CCC 9/8/2;

.12 CCC 9/INF.5 (BIMCO et al.), providing a suggestion for a register of enclosed spaces and an enclosed space contingency plan for the revision of *Recommendations for entering enclosed spaces aboard ships* (resolution A.1050(27)), as proposed in document CCC 9/8/1;

.13 CCC 9/INF.8 (ICMA et al.), proposing to raise awareness of the dangers in enclosed spaces from oxygen depletion due to rusting and the emission of dangerous gases from organic types of cargo due to biological degradation; presenting the results of multiple experiments on a range of steel-related spaces containing scrap metal cargo, along with chain lockers and ballast

tanks, and in addition, presenting that experiments on an array of organic types of cargo showed the speed of depletion and the emission of toxic gases;

.14 CCC 9/INF.9 (ICMA et al.), proposing to inform and raise awareness of the dangers of oxygen depletion in enclosed spaces through the results of multiple experiments on a range of steel-related spaces related to scrap metal cargo, chain lockers and ballast tanks; and

.15 CCC 9/INF.10 (ICMA et al.), showing, primarily, the rapidity with which atmospheres within enclosed spaces might change and that the level of oxygen alone was not a sufficient indicator of safety for personnel entering the enclosed spaces; and that, along with oxygen levels, the levels of carbon dioxide and carbon monoxide must be checked for and provided against, before entry was made to any enclosed space or adjacent connected space.

8.5 In the ensuing discussion, the Sub-Committee noted the following views:

.1 Documents CCC 9/8, CCC 9/8/1 and CCC 9/8/2, as well as the supporting documents CCC 9/INF.3, CCC 9/INF.4 and CCC 9/INF.5, incorporated many previous submissions and discussions on how best to improve the existing Assembly resolution. This information had been used, together with statistical analyses of enclosed space accidents, to develop and propose amendments to the resolution. The aforementioned documents emphasized a need for the proposed major changes following examination of historic accidents, investigation reports and recommendations, as well as statistical analyses of those accidents. Suggested modifications aimed to prevent reoccurrence of these groups of accidents. Many accidents highlighted the need for a comprehensive and better thought-out enclosed space register, as well as carefully considered contingency planning measures to combat situations which did not go according to plan.

.2 In addition to further improvement of resolution A.1050(27), implementation was the key. In this regard, firstly, it should be noted that training and drills were the requirements under SOLAS regulation III/19. This part could be separated from resolution A.1050(27), and the contents could be realigned as supporting guidelines for the regulation. Similarly, issues concerning gas detection device were relevant to SOLAS regulation XI-1/7, as well as the related unified interpretations in MSC.1/Circ.1477 and MSC.1/Circ.1561. With regard to gas detection of toxic cargoes, PPR 10 had concluded that amendments to the IBC Code were required, while general discussion would continue at the ESPH Technical Group. Ventilation and gas detection were, in general, SOLAS chapter II-2, the IBC, IGC, IGF, IMSBC and IMDG Code matters as well. Therefore, discussion in the SDC, SSE, PPR and CCC Sub-Committees was also needed from the perspective of safe entry. Finally, implementation of the ISM Code had been addressed at MSC 107 and also at III 9. There was room for further improvement linked with "time pressure" matter under the HTW Sub-Committee. It was essential that the discussion was linked with existing instruments and discussion, rather than consideration solely within resolution A.1050(27).

.3 All relevant documents should be referred to a Working Group for a comprehensive review. With regard to document CCC 9/8/7, the Working Group should be tasked with considering the proposed ventilation procedure.

.4 The analysis in document CCC 9/8/2 could be supported, and document CCC 9/8/4 pointed to the right direction. All the relevant documents should be considered at the Working Group.

.5 Considering ventilation as a substitute to breathing apparatus, as proposed in document CCC 9/8/7, could not be supported. Nevertheless, document CCC 9/8/7 could be referred to the Working Group.

.6 Documents CCC 9/8/1, CCC 9/8/2 and CCC 9/8/3 should form the basis for work at the Working Group.

.7 Document CCC 9/8/2 should be the basis for work at the Working Group. The proposal in document CCC 9/8/5 to consider amending the IMSBC Code should be regarded as being out of scope of this output. A new output would also be needed concerning the proposal on continuous ventilation in paragraph 4.9 of document CCC 9/8/6. Document CCC 9/8/7 should be kept in abeyance until the work at the ESPH Technical Group and the PPR Sub-Committee was concluded.

.8 Document CCC 9/8/7 should not be referred to the Working Group.

.9 The HTW Sub-Committee should be involved at a later stage concerning training requirements.

.10 Many toxic products contained in the IBC Code could not be tested because there were no suitable gas detectors or gas detection tubes that could measure the presence of these products in the atmosphere. When there were no means for testing, the crew was required to don a self-contained breathing apparatus (SCBA) to enter the tank. The risk in this context concerned the crew who had to use tank hatches, high ladders and tank structures, whilst wearing a SCBA. In this context, document CCC 9/8/7 should be referred to the Working Group.

8.6 In this context, the Sub-Committee agreed:

.1 that, upon finalization of the amendments to resolution A.1050(27) and the identification of impacts on or consequential amendments to other IMO instruments, CCC 10 could consider the involvement of other IMO organs, as necessary;

.2 to keep document CCC 9/8/7 in abeyance for the time being and to further consider this document together with the relevant outcomes of ESPH 29 and the PPR Sub-Committee; and

.3 to instruct the Working Group to prepare amendments to resolution A.1050(27), taking into account documents CCC 9/8, CCC 9/8/1, CCC 9/8/2, CCC 9/8/3, CCC 9/8/4, CCC 9/8/5, CCC 9/8/6, CCC 9/8/8, CCC 9/INF.3, CCC 9/INF.4, CCC 9/INF.5, CCC 9/INF.8, CCC 9/INF.9 and CCC 9/INF.10.

Consideration of documents submitted to previous sessions

8.7 The Sub-Committee had for its consideration documents CCC 8/8 (SIGTTO), CCC 8/8/1 (China), CCC 8/8/2 (InterManager et al.), CCC 8/5/11 (IBTA) and III 8/4/5 (China).

8.8 After consideration, the Sub-Committee instructed the Working Group to prepare amendments to resolution A.1050(27), taking into account documents CCC 8/8, CCC 8/8/1, CCC 8/8/2, CCC 8/5/11 and III 8/4/5.

Holistic approach on the human element

8.9 The Sub-Committee recalled that CCC 8, having considered the request of MSC 105 (MSC 105/20, paragraph 16.3) to assess the involvement of the Sub-Committee in the human element within its remit, had invited interested Member States and international organizations to submit relevant proposals, as appropriate (CCC 8/18, paragraph 17.1). The Sub-Committee also noted that MSC 105 had requested the Secretariat to assist relevant bodies with the above assessment, in order to provide appropriate information for future action.

8.10 The Sub-Committee had for its consideration document CCC 9/13/1 (Secretariat), providing background information on the holistic approach to the human element, including an initial indication of relevant work of the Sub-Committee related to the human element.

8.11 After consideration, the Sub-Committee:

.1 noted information provided in document CCC 9/13/1 on the CCC Sub-Committee's involvement in the human element within its remit, in particular with regard to the implications for the human element arising from handling of dangerous goods and the development of alternative fuels and related technologies;

.2 noted the broad number of relevant areas under the Sub-Committee's purview, and that more time might be needed to conduct a detailed analysis; and

.3 having noted the ongoing development under this agenda item, in particular the relevant proposals in document CCC 9/8, instructed the Working Group on Revision of Resolution A.1050(27) to consider how the outcomes of the revision of resolution A.1050(27) could best contribute to a holistic approach on the human element, taking into account document CCC 9/13/1.

Establishment of a working group

8.12 Having considered the above matters, the Sub-Committee established the Working Group on Revision of Resolution A.1050(27) and instructed it, taking into account the comments made and decisions taken in plenary, to:

.1 prepare draft amendments to resolution A.1050(27), taking into account documents CCC 9/8, CCC 9/8/1, CCC 9/8/2, CCC 9/8/3, CCC 9/8/4, CCC 9/8/5, CCC 9/8/6, CCC 9/8/8, CCC 8/8, CCC 8/8/1, CCC 8/8/2, CCC 8/5/11, III 8/4/5, CCC 9/INF.3, CCC 9/INF.4, CCC 9/INF.5, CCC 9/INF.8, CCC 9/INF.9 and CCC 9/INF.10;

.2 further consider document CCC 9/13/1, in particular that depending on the progress made under sub-paragraph .1 above, consider how the outcomes of the revision of resolution A.1050(27) could best contribute to a holistic approach on the human element; and

.3 consider whether it was necessary to establish a correspondence group to progress the aforementioned matters and, if so, prepare terms of reference for consideration by the Sub-Committee.

Report of the Working Group

8.13 Having considered the report of the Working Group on Revision of Resolution A.1050(27) (CCC 9/WP.5), the Sub-Committee approved it in general and took action, as described in the following paragraphs.

Draft amendments to resolution A.1050(27)

8.14 The Sub-Committee noted the discussion and progress made by the Group on draft amendments to resolution A.1050(27), i.e. the draft revised recommendations for entering enclosed spaces aboard ships (CCC 9/WP.5, paragraphs 4 to 22 and the annex).

Holistic approach on the human element

8.15 The Sub-Committee noted the deliberation of the Group with regard to the holistic approach on the human element and invited MSC to note that the proper implementation of the ISM Code, in particular an effective implementation of resolution A.1050(27) through the Safety Management System, was crucial to ensuring the safety of enclosed space entry (CCC 9/WP.5, paragraphs 23 to 26).

Establishment of a Correspondence Group

8.16 The Sub-Committee agreed to establish a Correspondence Group on Revision of Resolution A.1050(27), under the coordination of Japan,[55] and instructed it to:

.1 further develop the draft recommendations using the annex to document CCC 9/WP.5 as the basis, with a view to finalizing at CCC 10, in particular, by the following actions:

.1 considering including requirements relating to the information provided in documents CCC 9/8/3, CCC 9/INF.9 and CCC 9/INF.10, if appropriate;

.2 considering the text referring to the implementation of the ISM Code (cover pages and preamble);

.3 considering the text to improving communication between ship and shore personnel for better informing the risk of entering enclosed spaces, in particular to shore personnel (paragraph 6.1*bis* in square brackets);

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.4 considering whether the list of oxygen-depleting solid bulk cargoes should be included and, if so, improving the list (paragraph 10.3.3);

.5 considering appendix 3 (example of an Enclosed Space Register) for improvement; and

.6 considering whether appendix 4 (example of an Enclosed Space Contingency Plan) and relevant sentences, i.e. paragraph 11.7 etc. should be retained or modified or deleted; and

.2 submit a written report to CCC 10.

9 CONSIDERATION OF REPORTS OF INCIDENTS INVOLVING DANGEROUS GOODS OR MARINE POLLUTANTS IN PACKAGED FORM ON BOARD SHIPS OR IN PORT AREAS

General

9.1 The Sub-Committee recalled that MSC 105 had approved MSC.1/Circ.1649 on *Guidelines for the implementation of inspection programmes for cargo transport units* and encouraged Member States and international organizations to implement them.

Inspection programmes for cargo transport units carrying dangerous goods

9.2 The Sub-Committee noted document CCC 9/INF.2 (Secretariat), containing the consolidated results from 2022 of container inspection programmes, submitted by Canada, Chile, Finland, the United States and Hong Kong, China, through GISIS. The Sub-Committee was informed that, out of the 51,330 CTUs inspected, 4,024 CTUs were found to have deficiencies, which meant that 7.84% of the CTUs inspected had deficiencies. With regard to the type of deficiencies, placarding and marking, securing/stowage inside the unit, marking and labelling of packages and serious structural deficiencies were the main deficiencies found.

9.3 The Sub-Committee expressed its appreciation to those Member States that had submitted the results of container inspection programmes and urged Member States who had not yet carried out container inspection programmes to submit the relevant information to the Organization in accordance with MSC.1/Circ.1649. In this context, the Sub-Committee also noted a statement by the observer from WSC, expressing concerns about the low reporting numbers on container inspection results and emphasizing the importance of joint efforts by the maritime authorities and industry to enhance the safety of containers.

Updates from the Secretariat

9.4 The Sub-Committee noted the following verbal updates provided by the Secretariat:

.1 the technical development on updates to the GISIS module on Reports of CTUs inspections in accordance with MSC.1/Circ.1649 had been ongoing and the Sub-Committee would be informed on the status of such updates;

.2 the Secretariat had been following the instructions from MSC on the implementation of MSC.1/Circ.1649 in collaboration with the FAO/ International Plant Protection Convention (IPPC), in particular participating in IPPC's work through its Focus Group on Sea Containers; and

.3 IPPC was preparing its recommendation regarding how to reduce the introduction of pests through the container pathway, which was expected to be considered at the eighteenth session of the Commission on Phytosanitary Measures (CPM 18), in March or April 2024, and the related outcomes of CPM 18 in 2024 would be reported to the Sub-Committee by the Secretariat, for Member States and international organizations to provide comments and take action, as appropriate.

10 UNIFIED INTERPRETATION OF PROVISIONS OF IMO SAFETY, SECURITY AND ENVIRONMENT-RELATED CONVENTIONS

10.1 The Sub-Committee recalled that this was a continuous item on the Sub-Committee's biennial agenda and that A 30 had expanded the output to include all proposed unified interpretations (UI) to provisions of IMO safety, security and environment-related Conventions, so that any newly developed or updated draft unified interpretation could be submitted for the consideration of the Sub-Committee, with a view to developing an appropriate IMO interpretation.

Draft unified interpretations of appendix 1 - Individual schedules of solid bulk cargoes of the IMSBC Code (resolution MSC.268(85))

10.2 The Sub-Committee recalled that document CCC 9/10 (IACS) had been considered under agenda item 5 (see paragraphs 5.62 to 5.64).

Clarification of IGC Code requirements

Instructions to the Working Group on Amendments to the IGF Code and Revision of the IGC Code

Draft interpretation of paragraphs 4.4.1, 4.5, 4.6.2.1 and 4.6.2.4 of the IGC Code and paragraphs 4.7.1, 4.7.3, 4.7.4.1 and 4.7.7 of the 1983 IGC Code

10.3 The Sub-Committee considered document CCC 9/10/1 (IACS), proposing a draft interpretation of the IGC Code related to secondary barrier testing and effectiveness assessment. Following discussion, the Sub-Committee noted concerns expressed about an additional requirement to the annual survey introduced by the proposed UI, while the Sub-Committee also noted the merit of the proposal. Subsequently, the Sub-Committee agreed that it would be more appropriate to address the matter through amendments to the IGC Code and instructed the Working Group on Amendments to the IGF Code and Revision of the IGC Code (see paragraph 3.31) to further consider document CCC 9/10/1 and advise the Sub-Committee on how best to proceed.

Proposals in document CCC 9/10/2

10.4 The Sub-Committee considered document CCC 9/10/2, containing proposals in relation to sections 4.23.1.1, 4.23.1.2, 4.23.2.5, 4.23.4, 4.23.3.1, 4.23.3.2, 5.2.2.1, 5.12.4, 5.12.3.1, 8.1, 9.4.4, 16.3.4, 17.1 and 17.4 of the IGC Code, and noted the following views:

.1 document CCC 9/10/2 should be further considered in the Working Group;

.2 the proposal in section B should be further progressed as a UI;

.3 with regard to section D 3, it was impossible to determine the uniform value of the safety factor as it depended on the evaluation method, such as theoretical formulae or detailed structural analysis, therefore the proposal in section D 3 should not be further proceeded either as a UI or as amendments to the IGC Code;

.4 the proposal in section E should be further progressed as amendments to the IGC Code;

.5 the proposal in section F should be further considered in the Working Group as draft amendments; and

.6 the proposals in document CCC 9/10/2 could be further progressed both as UIs as an interim solution and amendments to the IGC Code from a longer-term perspective.

10.5 Subsequently, the Sub-Committee instructed the Working Group on Amendments to the IGF Code and Revision of the IGC Code (see paragraph 3.31) to further consider document CCC 9/10/2, except for the relevant proposal as set out in section D 3, and advise the Sub-Committee on how best to proceed.

Report of the Working Group

10.6 Having considered the relevant part of the Report of the Working Group on Amendments to the IGF Code and Revision of the IGC Code (CCC 9/WP.4), the Sub-Committee took action as follows.

10.7 The Sub-Committee noted the Group's discussion on the draft UI proposals and that, due to time restrictions, not all the UIs had been addressed and, therefore, further work was needed intersessionally (CCC 9/WP.4, paragraphs 8.2 to 8.7);

Instructions to the Correspondence Group

10.8 The Sub-Committee instructed the Correspondence Group on Amendments to the IGF Code and Review of the IGC Code established under agenda item 3 (paragraph 3.36) to consider the proposals in sections B, C, D0, D1, D2, E and F of document CCC 9/10/2 and take action, as appropriate.

Unified interpretation of paragraph 2.4 of the IGC Code

10.9 The Sub-Committee considered document CCC 9/10/3 (Republic of Korea), proposing to clarify the applicable requirements on the safe location of storage tanks containing liquefied carbon dioxide collected from ship's exhaustion gas emissions, with a view towards global and uniform implementation, and noted the following views:

.1 onboard carbon capture and storage should be considered by the Committee;

.2 it was premature for the Sub-Committee to consider the matter regarding onboard carbon capture and storage as proposed in document CCC 9/10/3, noting that this was currently being considered by MEPC, and the use of such technology had not yet been agreed; in addition, MSC 107 had agreed to include in the biennial agenda of the Committee an output on "Development of a safety regulatory framework to support the reduction of GHG emissions from ships using new technologies and alternative fuels", and decisions in this regard would be made by MSC at a future stage;

.3 document CCC 9/10/3 could be kept in abeyance;

.4 a holistic review of the safe use of onboard carbon capture and storage should be carried out and other IMO bodies might be involved in the further development of the safety requirements;

.5 provisions on the safe use of onboard carbon capture and storage should be developed as goal-based regulations based on a risk assessment associated with such technology; and

.6 noting that amending the IGC Code was the proper way to advance the safe use of onboard carbon capture and storage, the Sub-Committee should invite submissions to amend the IGC Code.

10.10 Subsequently, the Sub-Committee invited interested Member States and international organizations to consider submissions regarding the safe use of onboard carbon capture and storage to a future session of the Committee.

Unified interpretation of regulation 10.2.4 of the IGF Code

10.11 The Sub-Committee considered document CCC 9/10/4 (China), proposing to add a UI to regulation 10.2.4 of the IGF Code to provide that, where an exhaust system needed to serve two or more gas consumers according to the design purpose, an equivalent design plan must also be considered as satisfying the requirement of regulation 10.2.4. Following discussion, the Sub-Committee noted the following views:

.1 amendments to the IGF Code would be more appropriate to address the matter than the proposed UI; and

.2 there was no need to further proceed with either a UI or amendments to regulation 10.2.4 of the IGF Code.

10.12 Subsequently, the Sub-Committee invited interested Member States and international organizations to consider a submission on draft amendments to the IGF Code to a future session of the Sub-Committee.

11 BIENNIAL STATUS REPORT AND PROVISIONAL AGENDA FOR CCC 10

General

11.1 The Sub-Committee noted that MSC 106 and MEPC 79 had approved the current biennial status of the Sub-Committee and the provisional agendas for CCC 9 (MSC 106/19, annex 27), which had been confirmed by MSC 107 and MEPC 80.

11.2 With regard to new outputs, the Sub-Committee noted that MSC 107 had agreed to:

.1 include in its post-biennial agenda an output on "Revision of the Revised guidelines for the preparation of the Cargo Securing Manual (MSC.1/Circ.1353/Rev.2) to include a harmonized performance standard for lashing software to permit lashing software as a supplement to the Cargo Securing Manual", with two sessions needed to complete the item; and

.2 include in the biennial agenda of the Sub-Committee for the 2024-2025 biennium and the provisional agenda of CCC 10 an output on "Development of measures to prevent the loss of containers at sea", with a target completion year of 2025.

Biennial status report and proposed biennial agenda

11.3 Taking into account the progress made at the session, the Sub-Committee prepared the updated biennial status report for the 2022-2023 biennium (CCC 9/WP.2, annex 1), and the proposed biennial agenda for the 2024-2025 biennium (CCC 9/WP.2, annex 2), as set out in annexes 8 and 9, for submission to C 130, with a view to approval by A 33, MSC 108 and MEPC 81, as appropriate.

Proposed provisional agenda for CCC 10

11.4 Taking into account the progress made at the session, the Sub-Committee prepared the proposed provisional agenda for CCC 10, as set out in annex 10 (CCC 9/WP.2, annex 3), for approval by MSC 108 and MEPC 81.

Correspondence groups established at the session

11.5 The Sub-Committee recalled that it had established correspondence groups on the following subjects, due to report to CCC 10:

.1 development of technical provisions for safety of ships using alternative fuels and related technologies (see paragraph 3.26);

.2 amendments to the IGF Code and review of the IGC Code (see paragraphs 3.36, 4.33 and 10.8);

.3 review of transport provisions for vehicles (see paragraph 6.57); and

.4 revision of resolution A.1050(27) (see paragraph 8.16).

Arrangements for the next session

11.6 The Sub-Committee agreed to establish, at its next session, working and drafting groups on the following subjects:

.1 development of technical provisions for safety of ships using alternative fuels (agenda item 3);

.2 amendments to the IGF Code and review of the IGC Code (agenda items 3 and 4);

.3 review of the resolution A.1050(27) (agenda item 8);

.4 amendments to the IMDG Code (agenda item 6); and

.5 development of measures to prevent the loss of containers at sea (agenda item 11),

whereby the Chair, taking into account the submissions received on the respective subjects, would advise the Sub-Committee before CCC 10 on the final selection of such groups.

Intersessional meetings

11.7 The Sub-Committee noted that MSC 107 had approved two intersessional meetings of the E&T Group for the IMSBC Code, one in the spring of 2024 and another one immediately after CCC 10. The Sub-Committee invited MSC 108 to approve an intersessional working group on development of technical provisions for safety of ships using alternative fuels, with associated draft terms of references as set out in annex 2, from 9 to13 September 2024, immediately prior to CCC 10 (see also paragraph 3.25).

Date of the next session

11.8 The Sub-Committee also noted that its tenth session had been tentatively scheduled to take place from 16 to 20 September 2024.

12 ELECTION OF CHAIR AND VICE-CHAIR FOR 2024

12.1 In accordance with the Rules of Procedure of the Maritime Safety Committee and the and Marine Environment Protection Committee, the Sub-Committee unanimously re-elected Ms. MaryAnne Adams (Marshall Islands) as Chair and Mr. David Anderson (Australia) as Vice-Chair, both for 2024.

13 ANY OTHER BUSINESS

Estimate of containers lost at sea

13.1 The Sub-Committee noted with appreciation the information contained in document CCC 9/INF.25 (Australia et al.), providing updates on the progress of the Top Tier JIP on container losses. The Sub-Committee also had for its consideration document CCC 9/13 (WSC), providing a 2023 update on an estimate of the number of containers lost at sea. The Sub-Committee decided to forward the above documents to CCC 10 as they provided useful information for consideration under the new agenda item on "Development of measures to prevent the loss of containers at sea".

Holistic approach on the human element

13.2 The Sub-Committee recalled that the matter related to a holistic approach on the human element and document CCC 9/13/1 had been considered under agenda item 8 (see paragraphs 8.9 to 8.11 and 8.15).

BoxTech Technical Characteristics Database

13.3 The Sub-Committee had for its consideration document CCC 9/13/3 (BIC), providing an update on BIC's progress in further developing the BoxTech Global Container Database. Following discussion, the Sub-Committee invited BIC to submit proposals to CCC 10 under the agenda item on "Development of measures to prevent the loss of containers at sea" on how BoxTech could further contribute to improving safety in relation to containers lost at sea.

ACEP information

13.4 The Sub-Committee considered document CCC 9/13/4 (BIC), providing updated reports on the activity of the Global ACEP Database since CCC 8, in particular that it raised awareness about the lack of audits to ensure that operators continue to inspect containers according to the requirements set out in the programme and in accordance with the CSC Convention in certain cases.

13.5 In this context, the Sub-Committee noted, with appreciation, BIC's continued efforts in maintaining and running the Global ACEP Database as a free service for all users and urged Administrations and stakeholders to consider the benefits of the Global ACEP Database and make their ACEP information publicly available, and encouraged them to periodically evaluate, by audits or other equivalent means, that the provisions of the approved programme were being fully followed.

ISO's actions to support reducing GHG emissions in the maritime sector

13.6 The Sub-Committee noted, with appreciation, the information contained in document CCC 9/INF.26 (ISO), providing information on the work being conducted within ISO in support of GHG maritime emission reductions goals. In this context, the Sub-Committee invited interested Member States and international organizations to participate in the ISO standards development process.

Expressions of condolence

13.7 The Sub-Committee noted with great sadness the recent passing away of Mr. Ivan Nikolov of Germany and Dr. James Cowley of Vanuatu and expressed its condolences to their families and the delegations of Germany and Vanuatu, and requested their delegations to convey its sincere sympathy to their families and colleagues.

Expression of appreciation

13.8 The Sub-Committee expressed appreciation to the following delegates and members of the Secretariat, who had recently relinquished their duties, retired or been transferred to other duties, or were about to do so, for their invaluable contribution to its work and wished them a long and happy retirement or, as the case might be, every success in their new duties:

- Mr. Damien Chevallier (France) (on new duties)
- Mr. Pierre Dufour (France) (on retirement)
- Ms. Sarah Etheridge (IACS) (on retirement)
- Ms. Svenja Friedrich (Germany) (on new duties)
- Captain Tero Jokilehto (Finland) (on retirement)
- Mr. Sverrir Konrádsson (Iceland) (on retirement)
- Mr. Richard Mason (EC) (on retirement)
- Mr. Naohiro Saito (IMO) (on transfer)
- Mr. Hanqiang Tan (Singapore) (on new duties)
- Ms. Lynn Tan (IMO) (on new duties)
- Mr. Joseph Westwood-Booth (IMO) (on retirement)
- Madame Geneviève Van Rossum (France) (on retirement).

14 ACTION REQUESTED OF THE COMMITTEES

14.1 During the meeting held on 29 September 2023, delegations were given the opportunity to provide comments on the draft report (CCC 9/WP.1) and the Secretariat then prepared the revised draft report (CCC 9/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 9 October 2023, 23.59 (UTC+1) to do so by correspondence, in accordance with paragraphs 4.37 and 4.38 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.5) (see paragraph 1.7).

14.2 The Marine Environment Protection Committee, at its eighty-first session, is invited to:

.1 endorse the updated work plan for the development of new alternative fuels (paragraphs 3.24 and annex 1);

.2 approve the biennial status report of the Sub-Committee for the 2022-2023 biennium, taking into account the outcome of C 130 (paragraph 11.3 and annex 8);

.3 approve the proposed biennial agenda of the Sub-Committee for the 2024- 2025 biennium, taking into account the outcome of C 130 (paragraph 11.3 and annex 9); and

.4 approve the proposed provisional agenda for CCC 10 (paragraph 11.4 and annex 10).

14.3 The Maritime Safety Committee, at its 108th session, is invited to:

.1 endorse the updated work plan for the development of new alternative fuels (paragraphs 3.24 and annex 1);

.2 approve an intersessional working group on development of technical provisions for safety of ships using alternative fuels, with the associated draft terms of references as set out in annex 2, from 9 to 13 September 2024, immediately prior to CCC 10 (paragraphs 3.25 and 11.7 and annex 2);

.3 approve the draft amendments to the IGF Code, with a view to subsequent adoption (paragraph 3.35 and annex 3);

.4 approve the draft MSC circular on revised guidelines on the application of high manganese austenitic steel for cryogenic service (MSC.1/Circ.1599/Rev.2), for dissemination as MSC.1/Circ.1599/Rev.3 (paragraph 4.27 and annex 4);

.5 approve the draft MSC circular on guidelines for the acceptance of alternative metallic materials for cryogenic service in ships carrying liquefied gases in bulk and ships using gases or other low-flashpoint fuels (MSC.1/Circ.1622), for dissemination as MSC.1/Circ.1622/Rev.1 (paragraph 4.28 and annex 5);

.6 approve the draft MSC circular on interim guidelines for use of LPG cargo as fuel (paragraph 4.30 and annex 6);

.7 note the deliberation of the Sub-Committee with regard to the application of the new IGC Code amendments and that the current scope of the output might need to be revisited subject to the outcome of the investigation on the matter (paragraph 4.32.2 and paragraph 9.6 of CCC 9/WP.4);

.8 note the deliberations of the Sub-Committee on document CCC 9/5/10 concerning a proposal to amend 4.2 of the IMSBC Code regarding the cargo information to be provided by the shipper and sample cargo declaration; and the invitation to interested Member States and international organizations to submit a proposal to the MSC for a new output (paragraphs 5.34 and 5.35);

.9 note that E&T 39 was authorized to finalize draft amendment to the IMDG Code, together with related recommendations and circulars, for submission to MSC 108 for consideration with a view to adoption, as appropriate (paragraph 6.59);

.10 adopt the draft MSC resolution on revised interim recommendations for carriage of liquefied hydrogen in bulk; and note that the work under the output on "Revision of the Interim recommendations for carriage of liquefied hydrogen in bulk" has been completed (paragraphs 7.7 and 7.8 and annex 7);

.11 note that the proper implementation of the ISM Code, in particular an effective implementation of resolution A.1050(27) through the Safety Management System, is crucial to ensure the safety of enclosed space entry (paragraph 8.15 and CCC 9/WP.5, paragraphs 23 to 26);

.12 note the invitation to interested Member States and international organizations to consider a submission on the safe use of onboard carbon capture and storage to a future session of the MSC (paragraph 10.10);

.13 concurrently approve the biennial status report of the Sub-Committee for the 2022-2023 biennium, taking into account the outcome of C 130 and MEPC 81 (paragraph 11.3 and annex 8);

.14 concurrently approve the proposed biennial agenda of the Sub-Committee for the 2024-2025 biennium, taking into account the outcome of C 130 and MEPC 81 (paragraph 11.3 and annex 9); and

.15 concurrently approve the proposed provisional agenda for CCC 10 (paragraph 11.4 and annex 10).

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ANNEX 1

UPDATED WORK PLAN FOR THE DEVELOPMENT OF NEW ALTERNATIVE FUELS UNDER THE IGF CODE

Meeting	Tasks
ISWG-AF 1* [6] 9-13 Sep 2024	- further develop guidelines for ships using hydrogen as fuel - further develop guidelines for ships using ammonia as fuel - if time permits, further develop guidelines for low-flashpoint oil fuels
CCC 10 16-20 Sep 2024	- prepare amendments to the IGF Code → Natural Gas - finalize guidelines for ships using hydrogen as fuel - finalize guidelines for ships using ammonia as fuel - if time permits, further develop guidelines for low-flashpoint oil fuels - if time permits, start to discuss the development of mandatory instruments regarding methyl/ethyl alcohols
MSC 109 (2-6 Dec 2024)	- approval of the guidelines for ships using hydrogen as fuel - approval of the guidelines for ships using ammonia as fuel
CCC 11 Sep 2025	- further develop/finalize guidelines for low-flashpoint oil fuels - if time permits, develop mandatory instruments regarding methyl/ethyl alcohols - if time permits, start to discuss the development of mandatory instruments regarding fuel cells
MSC 111 May 2026	- approval of the guidelines for low-flashpoint oil fuels
CCC 12 Sep 2026	- further develop/finalize mandatory instruments regarding methyl/ethyl alcohols - further consider the development of mandatory instruments regarding fuel cells

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* The establishment of the *Intersessional Working Group on Development of Technical Provisions for Safety of Ships Using Alternative Fuels* (ISWG-AF) is subject to approval by MSC 108 and endorsement by the Council.

ANNEX 2

DRAFT TERMS OF REFERENCE FOR THE INTERSESSIONAL WORKING GROUP ON DEVELOPMENT OF TECHNICAL PROVISIONS FOR SAFETY OF SHIPS USING ALTERNATIVE FUELS

The Working Group is instructed, taking into account the comments and decisions made at CCC 9 and MSC 108 to:

.1 further develop the draft interim guidelines for ships using hydrogen as fuel, towards finalization, based on annex 1 to document CCC 9/WP.3 and taking into account the report of the intersessional correspondence group to CCC 10, as well as documents CCC 9/3, CCC 9/3/11, CCC 9/3/12, CCC 9/3/15, CCC 9/INF.17 and CCC 9/INF.18;

.2 further develop the draft interim guidelines for ships using ammonia as fuel, towards finalization, based on annex 2 to document CCC 9/WP.3 and taking into account the report of the intersessional correspondence group to CCC 10, as well as annexes 5 to 7 to document CCC 9/3/Add.1, documents CCC 9/3, CCC 9/3/1, CCC 9/3/2, CCC 9/3/13, CCC 9/3/14, CCC 9/INF.7, CCC 9/INF.16 and CCC 9/INF.27;

.3 if time permits, further develop the draft interim guidelines for ships using low-flashpoint oil fuels, based on annex 2 to document CCC 9/3/Add.1 and taking into account the outcome of the work of the intersessional correspondence group, as well as annex 3 to document CCC 9/3/Add.1 and document CCC 9/3/10;

.4 submit a written report to CCC 10.

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ANNEX 3[17]

DRAFT AMENDMENTS TO THE IGF CODE

PART A-1
SPECIFIC REQUIREMENTS FOR SHIPS USING NATURAL GAS AS FUEL

2 General

2.2 Definitions

1 The following new paragraph 2.2.44 is added after existing paragraph 2.2.43:

"2.2.44 *Ship constructed on or after 1 January 2028* means:

.1 for which the building contract is placed on or after 1 January 2028; or

.2 in the absence of a building contract, the keels of which are laid or which are at a similar stage of construction on or after 1 July 2028; or

.3 the delivery of which is on or after 1 January 2032."

5 Ship design and arrangement

5.3 Regulations – General

2 The following new paragraph is inserted after sub-paragraph 5.3.3.5 and before sub-paragraph 5.3.3.6:

"5.3.3.5.1 For vessels with suction wells installed in fuel tanks, the bottom of the suction well may protrude into the vertical extent of the minimum distance specified in 5.3.3.5, provided that such wells are as small as practicable and the protrusion below the inner bottom plating does not exceed 25% of the depth of the double bottom or 350 mm, whichever is less."

3 In sub-paragraph 5.3.4.2, the definition of "*H*" is replaced by the following:

"*H* is the distance from baseline, in metres, to the lowermost boundary of the fuel tank excluding the pump well, if installed;"

7 Material and general pipe design

7.3 Regulations for general pipe design

4 The following new paragraph is inserted after paragraph 7.3.1.3 and the subsequent sub-paragraphs 7.3.1.4 and 7.3.1.5 are renumbered as 7.3.1.5 and 7.3.1.6 accordingly:

"7.3.1.4 For ships constructed on or after 1 January 2028, pressure relief valves discharging liquid or gas from the piping system shall discharge into the fuel tanks

[1] Tracked changes are created using "strikeout" for deleted text and "grey shading" to highlight all modifications and new insertions, including deleted text, based on resolution MSC.391(95).

whenever the tank MARVS pressure is lower than the setting of the pressure relief valves in accordance with the arrangements in 9.4.2, and shall be designed to ensure that the required discharge capacity is met. Alternatively, they may discharge to the vent mast, if means are provided to detect and dispose of any liquid that may flow into the vent system."

9 Fuel supply to consumers

9.4 Regulations on safety functions of gas supply system

5 The following new paragraph is inserted after paragraph 9.4.1 and the subsequent sub-paragraphs 9.4.2 to 9.4.10 are renumbered as 9.4.3 to 9.4.11 accordingly:

"9.4.2 For ships constructed on or after 1 January 2028, fuel tank inlets from safety relief valve discharge lines, protecting the piping system according to 7.3.1.4, shall be provided with non-return valves in lieu of valves that are automatically operated when the safety system required in 15.2.2 is activated. Safe means for tank isolation during maintenance shall be available according to 18.3 without affecting proper operation of safety relief valves."

11 Fire safety

11.3 Regulations for fire protection

6 Paragraph 11.3.1 is replaced by the following:

"11.3.1 ~~Any space containing equipment for the fuel preparation such as pumps, compressors, heat exchangers, vaporizers and pressure vessels shall be regarded as a machinery space of category A for fire protection purposes~~. For ships constructed on or after 1 January 2028, fuel preparation rooms shall, for the purpose of the application of SOLAS regulation II-2/9, be regarded as a machinery space of category A."

7 In paragraph 11.3.2, after the last sentence ending with "considered a class 2.1 package.", the following new text is added:

"For ships constructed on or after 1 January 2028, any boundary facing the fuel tank on the open deck which is separated by a minimum distance, as determined to the satisfaction of the Administration through a heat analysis to provide protection equivalent to an A-60 class division, shall be considered acceptable. Intermediate structures providing heat protection to the above spaces may also be considered acceptable."

8 After paragraph 11.3.2 and before paragraph 11.3.3, the following new sub-paragraphs are added:

"11.3.2.1 For oil tankers and chemical tankers constructed on or after 1 January 2028, A-60 insulation, required by SOLAS regulation II-2/9.2.4.2.5, shall be considered to meet the requirements of 11.3.2 provided that the fuel tank is located in the cargo area forward of accommodation spaces, service spaces, control stations, escape routes and machinery spaces. Consideration for the protection of accommodation block sides may be necessary.

11.3.2.2 Fuel tanks shall be segregated from cargo in accordance with the requirements of the International Maritime Dangerous Goods (IMDG) Code where fuel tanks are regarded as bulk packaging. For the purposes of stowage and segregation requirements of the IMDG Code, a fuel tank on the open deck shall be considered as a class 2.1 package.

11.3.2.3 For ships constructed on or after 1 January 2028 and notwithstanding the requirements of 11.3.2, where no source of gas release from the fuel containment system is considered possible, e.g. a type C tank in which tank connections are in a tank connection space, A-60 class shielding is not required."

9 Paragraph 11.3.3.1 is replaced by the following:

"11.3.3.1 Notwithstanding the last sentence in paragraph 11.3.3, for ships constructed on or after 1 January 2028 ~~4~~, the fuel storage hold space may be considered as a cofferdam provided that:

.1 the type C tank is not located directly above machinery spaces of category A or other rooms with high fire risk; and

.2 the minimum distance to the A-60 boundary from the outer ~~shell~~ surface of the insulation system of ~~the~~ a type C tank or the boundary of the tank connection space, if any, is not less than 900 mm. For the vacuum insulated type C tank, outer surface of the insulation system means outer surface of the outer shell."

12 Explosion prevention

12.5 Hazardous area zones

10 In paragraph 12.5.2, the existing text is modified, as follows:

"12.5.2 Hazardous area zone 1

12.5.2.3 For ships constructed on or after 1 January 2028, areas on open deck, or semi-enclosed spaces on deck, within 3 m of any fuel tank outlet, gas or vapour outlet,* bunker manifold valve, other fuel valve, fuel pipe flange, ~~fuel preparation room~~ ventilation outlets from zone 1 spaces and fuel tank openings for pressure release provided to permit the flow of small volumes of gas or vapour mixtures caused by thermal variation;

*Such areas are, for example, all areas within 3 m of fuel tank hatches, ullage openings or sounding pipes for fuel tanks located on open deck and gas vapour outlets."

11 The following new sub-paragraph is inserted after sub-paragraph 12.5.2.3 and the subsequent sub-paragraphs 12.5.2.4 to 12.5.2.9 are renumbered as 12.5.2.5 to 12.5.2.10 accordingly.

"12.5.2.4 for ships constructed on or after 1 January 2028, areas on open deck, or semi-enclosed spaces on open deck above and in the vicinity of fuel tank vent mast outlet within a vertical cylinder of unlimited height and 6 m radius centred upon the centre of the outlet, and within a hemisphere of 6 m radius below the outlet. Where due to the size and layout of the vessel it is not possible to maintain the above distances, a reduced zone can be

accepted based on a dispersion analysis, based on 50% LEL criteria. The zone dimensions shall never be less than those given in 12.5.2.3, and shall include a surrounding zone 2 hazardous area meeting the dimensions given in 12.5.3.1."

12 In paragraph 12.5.3, the new sub-paragraph is inserted after sub-paragraph 12.5.3.2:

"12.5.3 Hazardous area zone 2

12.5.3.3 In lieu of 12.5.3.1, for ships constructed on or after 1 January 2028, this zone includes spaces 4 m beyond the cylinder and 4 m beyond the hemisphere defined in 12.5.2.4".

13 Ventilation

13.3 Regulations – General

13 Paragraph 13.3.5 is replaced by the following:

"13.3.5 For ships constructed on or after 1 January 2028, ~~A~~air inlets for hazardous enclosed spaces shall be taken from areas that, ~~in the absence of the considered~~ except for the inlets, would be non-hazardous. ~~Air inlets for non-hazardous enclosed spaces shall be taken from non-hazardous areas at least 1.5 m away from the boundaries of any hazardous area. Where the inlet duct passes through a more hazardous space, the duct shall be gas-tight and have over-pressure relative to this space.~~ Air inlets for non-hazardous enclosed spaces shall be taken from non-hazardous areas at least 1.5 m away from the boundaries of any hazardous area."

14 The following new paragraph is inserted after paragraph 13.3.7 and the subsequent paragraphs 13.3.8 to 13.3.10 are renumbered as 13.3.9 to 13.3.11:

"13.3.8 For ships constructed on or after 1 January 2028:

.1 where the ventilation ducts serving non-hazardous spaces pass through a hazardous space, the ducts shall be gas-tight and have overpressure relative to that hazardous space; and

.2 where the ventilation ducts serving hazardous spaces pass through less hazardous spaces, the ducts shall be gas-tight and have underpressure relative to less hazardous or non-hazardous spaces. Ventilation pipes serving hazardous spaces that pass through non-hazardous spaces, and that are fully welded and designed in accordance with chapter 7, are acceptable without the need for underpressure."

APPENDIX[28]

CHECK/MONITORING SHEET FOR THE PROCESS OF AMENDING THE CONVENTION AND RELATED MANDATORY INSTRUMENTS (PROPOSAL/DEVELOPMENT)

Part III – Process monitoring to be completed during the work process at the Sub- Committee and checked as part of the final approval process by the Committee (refer to paragraph 3.2.1.3)

1	The Sub-Committee, at an initial engagement, has allocated sufficient time for technical research and discussion before the target completion date, especially on issues needing to be addressed by more than one Sub-Committee and for which the timing of relevant Sub-Committee meetings and exchanges of the result of consideration needed to be carefully examined.	Yes
2	The scope of application agreed at the proposal stage was not changed without the approval of the Committee.	Yes
3	The technical base document/draft amendment addresses the proposal's issue(s) through the suggested instrument(s); where it does not, the Sub-Committee offers the Committee an alternative method of addressing the problem raised by the proposal.	Yes
4	Due attention is to be paid to the *Interim Guidelines for the systematic application of the grandfather clause* (MSC/Circ.765).	Yes
5	All references have been examined against the text that will be valid if the proposed amendment enters into force.	Yes
6	The location of the insertion or modified text is correct for the text that will be valid when the proposed text enters into force on a four-year cycle of entry into force, as other relevant amendments adopted might enter into force on the same date.	Yes
7	There are no inconsistencies in respect of scope of application between the technical regulation and the application statement contained in regulation 1 or 2 of the relevant chapter, and application is specifically addressed for existing and/or new ships, as necessary.	Yes
8	Where a new term has been introduced into a regulation and a clear definition is necessary, the definition is given in the article of the Convention or at the beginning of the chapter.	Yes
9	Where any of the terms "fitted", "provided", "installed" or "installation" are used, consideration has been given to clarifying the intended meaning of the term.	Yes

[2] The appendix is provided in English only.

10	All necessary related and consequential amendments to other existing instruments, including non-mandatory instruments, in particular to the forms of certificates and records of equipment required in the instrument being amended, have been examined and included as part of the proposed amendment(s).	Yes
11	The forms of certificates and records of equipment have been harmonized, where appropriate, between the Convention and its Protocols.	N/A
12	It is confirmed that the amendment is being made to a currently valid text and that no other bodies are concurrently proposing changes to the same text.	Yes
13	All entry-into-force criteria (building contract, keel laying and delivery) have been considered and addressed.	Yes
14	Other impacts of the implementation of the proposed/approved amendment have been fully analysed, including consequential amendments to the "application" and "definition" regulations of the chapter.	Yes
15	The amendments presented for adoption clearly indicate changes made with respect to the original text, so as to facilitate their consideration.	Yes
16	For amendments to mandatory instruments, the relationship between the Convention and the related instrument has been observed and addressed, as appropriate.	Yes
17	The related record format has been completed or updated, as appropriate.	Yes

RECORD FORMAT

The following records should be created and kept updated for each regulatory development.

The records can be completed by providing references to paragraphs of related documents containing the relevant information, proposals, discussions and decisions.

1 Title (number and title of regulation(s))
IGF Code chapters 2, 5, 7, 9, 11, 12 and 13
2 Origin of the requirement (original proposal document)
It's a continuous agenda item and see section 5 (history of discussion) for more information.
3 Main reason for the development (extract from the proposal document)
"Amendments to the IGF Code and development of guidelines for alternative fuels and related technologies" is a continuous agenda item and those draft amendments could not be completed at CCC 8, were finalized at CCC 9. The amendments include a variety of issues, including pump suction wells, safety relief valve discharge, fuel preparation rooms, structural fire protection and hazardous zones.
4 Related output
Amendments to the IGF Code and development of guidelines for alternative fuels and related technologies (2.3)

5	**History of the discussion (approval of work programmes, sessions of sub-committees, including CG/DG/WG arrangements)**
CCC 6 endorsed the new work plan for the next phase of the development of the IGF Code, and endorsed the change of status of the existing output on "Amendments to the IGF Code and development of guidelines for low-flashpoint fuels to be "continuous" to avoid requesting constant extensions. **CCC 8** developed amendments, which were approved at MSC 107 for adoption at MSC 108. **CCC 9** developed additional amendments, which had not been agreed upon at CCC 8, with a view to entry into force on 1 January 2028.	
6	**Impact on other instruments (codes, performance standards, guidance circulars, certificates/records format, etc.)**
Not applicable	
7	**Technical background**
7.1	***Scope and objective (to cross-check with items 4 and 5 in part II of the checklist)***
The amendments include a variety of issues, including pump suction wells, safety relief valve discharge, fuel preparation rooms, structural fire protection and hazardous zones.	
7.2	***Technical/operational background and rationale (e.g. summary of FSA study, if available, or engineering challenge posed)***
Not applicable	
7.3	***Source/derivation of requirement (non-mandatory instrument, industry standard, national/regional requirement)***
Not applicable	
7.4	***Short summary of requirement (what is the new requirement – in short and lay terms)***
The amendments will enhance safety by regulating a variety of issues, including pump suction wells, safety relief valve discharge, fuel preparation rooms, structural fire protection and hazardous zones.	
7.5	***Points of discussions (controversial points and conclusion)***
Not applicable	

***

ANNEX 4[19]

DRAFT MSC CIRCULAR

REVISED GUIDELINES ON THE APPLICATION OF HIGH MANGANESE AUSTENITIC STEEL FOR CRYOGENIC SERVICE ~~(MSC.1/CIRC.1599/REV.2)~~

1 Owing to the growing global demand for liquefied natural gas (LNG) as an environment-friendly energy source and the increased construction and operation of LNG-fuelled ships, the Maritime Safety Committee, at its ninety-sixth session (11 to 20 May 2016), agreed to the need to ensure that cargo and fuel tanks of LNG carriers and LNG-fuelled ships were safe, and hence tasked the Sub-Committee on Carriage of Cargoes and Containers with addressing the matter by developing amendments to the IGC and IGF Codes in order to include high manganese austenitic steel for cryogenic service.

2 The Maritime Safety Committee, at its 100th session (3 to 7 December 2018), acknowledging the increasing use of high manganese austenitic steel by the industry for cryogenic service and the need for guidance in this respect, approved the *Interim guidelines on the application of high manganese austenitic steel for cryogenic service* (MSC.1/Circ.1599).

3 The Maritime Safety Committee, at its 102nd session (4 to 11 November 2020), approved the Revised Interim Guidelines (MSC.1/Circ.1599/Rev.1), prepared by the Sub-Committee on Carriage of Cargoes and Containers, at its sixth session (9 to 13 September 2019).

4 The Maritime Safety Committee, at its 105th session (20 to 29 April 2022), approved the Revised Guidelines (MSC.1/Circ.1599/Rev.2), ~~as set out in the annex~~ prepared by the Sub-Committee on Carriage of Cargoes and Containers, at its seventh session (6 to 10 September 2021).

5 The Maritime Safety Committee, at its [108th session (15 to 24 May 2024)], approved the Revised Guidelines, as set out in the annex, containing modifications to the application and appendix 2, as set out in the annex, prepared by the Sub-Committee on Carriage of Cargoes and Containers, at its ninth session (20 to 29 September 2023).

6~~5~~ The Committee agreed to keep the Revised Guidelines under review, taking into account operational experience gained with their application.

7~~6~~ Member States are invited to bring the Revised Guidelines to the attention of all parties concerned.

8~~7~~ This circular supersedes MSC.1/Circ.1599/Rev.~~1~~2.

[1] The revised circular will be disseminated as MSC.1/Circ.1599/Rev.3 and modifications are shown in grey shading.

ANNEX

REVISED GUIDELINES ON THE APPLICATION OF HIGH MANGANESE AUSTENITIC STEEL FOR CRYOGENIC SERVICE

Part I
General

1 Scope

These *Guidelines on the application of high manganese austenitic steel for cryogenic service* provide the designer and manufacturer with practical information on the design and construction of cargo and fuel tanks using high manganese austenitic steel for cryogenic service, to comply with the Design Conditions defined in section 4.18 of the IGC Code and section 6.4.12 of the IGF Code.

2 Application

2.1 These Guidelines are not intended to replace any requirements of the IGC and IGF Codes. They are intended as complementary requirements for the utilization of high manganese austenitic steel in the design and fabrication of cargo and fuel tanks complying with the IGC and IGF Codes subject to the following:

.1 Application is suitable for the following cargoes and/or fuels if authorized by the IGC and IGF Codes:

.1 Ammonia, anhydrous

.~~1~~2 Butane (all isomers);

.~~2~~3 Butane-propane mixture;

.~~3~~4 Carbon Dioxide (High Purity and reclaimed quality);

.~~4~~5 Ethane;

.~~5~~6 Ethylene;

.~~6~~7 Methane (LNG);

.~~7~~8 Pentane (all isomers); and

.~~8~~9 Propane.

.2 Application is limited to plates (hot rolled) between 6 mm and 40 mm thick.

.3 The post-weld stress relief heat treatment referenced in 17.12.2.2 of the IGC Code is waived for ammonia cargo and/or fuel tanks containing ammonia.

2.2 The application of high manganese austenitic steel for cargo and fuel tanks is limited by the requirements specified in the following.

3 Definitions

High manganese austenitic steel: Steel with a high amount of manganese in order to retain austenite as its primary phase at atmospheric and service temperature.

Under-matched welds: For welded connections where the weld metal has lower yield or tensile strength than the parent metal.

Part II
Material specifications and testing requirements

4 Material specification

4.1 The material specification should be submitted to the Administration for approval. The test requirements and acceptance criteria for the material are described in detail in the appendix.

4.2 The steel should be fully killed and fine-grained. The condition of supply for all material should be hot rolled with subsequent controlled cooling as necessary. The reduction ratio of slab to finished product thickness should not be less than 3:1. Other conditions of supply should be in accordance with those prescribed by the Administration.

4.3 The use of high manganese austenitic steel is limited to steel plates with a thickness between 6 mm and 40 mm. For thicknesses greater than 40 mm, special consideration may be given by the Administration. Other dimensions may be subject to acceptance by the Administration.

5 Chemical composition

The chemical composition for high manganese austenitic steel should meet the requirements of recognized standards, such as ASTM standard A1106/A1106M-17 as shown in table 1, or ISO 21635:2018.

Table 1: Chemical composition for high manganese austenitic steel
(Ref. ASTM standard A1106/A1106M-17)

	Chemical Composition (wt.%, product)								
	C	Si	Mn	P	S	Cr	Cu	B	N
Requirements	0.35 - 0.55	0.10 - 0.50	22.50 - 25.50	Max. 0.030	Max. 0.010	3.00 - 4.00	0.30 - 0.70	Max. 0.005	Max. 0.050

Note: Silicon (Si) may be less than 0.10 %, provided total aluminium is 0.03 % or higher, or provided acid soluble aluminium is 0.025 % or higher.

6 Mechanical properties

Mechanical properties for the base metal of high manganese austenitic steel should meet the requirements of the IGC and IGF Codes, as relevant, and also recognized standards applied to chemical composition, such as ISO 21635:2018 (refer to table 2 below) or ASTM A1106/A1106M-17. Compliance should also be documented in accordance with material testing requirements and acceptance criteria outlined in the appendix.

.1 Base metal

Table 2: Mechanical properties for base metal of high manganese austenitic steel
(Reference ISO 21635:2018)

Minimum yield strength (0.2 % offset) N/mm^2	**Tensile strength** N/mm^2	**Minimum elongation** % at $5.65\sqrt{S_0}$
400	800 to 970	22.0

(Note the impact test requirements as specified in table 6.3 of the IGC Code or table 7.3 of the IGF Code, as relevant)

.2 As-welded condition

Table 3: Typical mechanical properties for "As-welded condition"

Tensile properties		
Minimum yield strength (0.2 % offset) N/mm^2	**Minimum tensile strength** N/mm^2	**Minimum elongation** % at $5.65\sqrt{S_0}$
400	660	22.0

(Note the impact test requirements as specified in table 6.3 of the IGC Code or table 7.3 of the IGF Code, as relevant)

7 Welding of metallic materials and non-destructive testing

Welding of metallic materials and non-destructive testing should be in accordance with chapter 6 of the IGC Code or chapter 16 of the IGF Code. See "Material testing requirements and test acceptance criteria" as set out in the appendix. Typical minimum values of yield and tensile strength for welded conditions are shown in table 3.

8 Material testing and acceptance criteria

The material testing and applied acceptance criteria should be in accordance with chapter 6 of the IGC Code or chapter 16 of the IGF Code and the appendix. Compliance should also be documented in accordance with the material testing requirements and acceptance criteria outlined in the appendix.

9 Manufacturer approval scheme

Approval of the manufacturer should be carried out in accordance with section 6.2.2 of the IGC Code or section 16.1.1 of the IGF Code and to the satisfaction of the Administration.

Part III
Application

10 Design application

10.1 General

10.1.1 The relevant load conditions and design conditions should be established in accordance with section 4.18 of the IGC Code or section 6.4.12 of the IGF Code. Guidance on special considerations for high manganese austenitic steel is described below.

10.1.2 For the selection of relevant safety factors for high manganese austenitic steels (see paragraphs 4.21 to 4.23 of the IGC Code or section 6.4.15 of the IGF Code), the safety factors specified for "Austenitic Steels" should be applied both for the base material and for as-welded condition.

10.2 Ultimate design condition

(Reference: section 4.18.1 IGC Code or section 16.3.3 IGF Code)

It should be noted that high manganese austenitic steels normally have under-matched welds and, therefore, it is of great importance that the design values of the yield strength and tensile strength are based on the "minimum mechanical properties" for the base material and as-welded condition (see section 6 on Mechanical Properties). Note the limitation for under-matched welds defined in section 4.18.1.3.1.2 of the IGC Code or section 16.3.3.5.1 of the IGF Code.

10.3 Buckling strength

10.3.1 Buckling strength analysis should be carried out based on recognized standards. Functional loads as defined in section 4.3.4 of the IGC Code or section 6.4.1.6 of the IGF Code should be considered. Note that design tolerances should be considered where relevant and be included in the strength assessment as required in section 6.6.2.1 of the IGC Code or section 16.4.2 of the IGF Code.

10.3.2 It should be noted that the acceptance criteria for the flooding load cases are different from other buckling load cases. Furthermore, the acceptance criteria for flooding load cases, as defined in the IGC Code and the IGF Code, are also different, as the IGF Code requires the tank to "keep its integrity after flooding to ensure safe evacuation of the ship" (section 6.4.1.6.3.3 of the IGF Code), while the IGC Code only refers to endangering the integrity of the ship's hull (section 4.3.4.3.3 of the IGC Code).

10.4 Fatigue design condition (Reference: 4.18.2 IGC Code and 6.4.12.2 IGF Code)

The fatigue design curves for base material and for welded conditions have been documented as a comparison with recognized S-N curves, as provided by the D-curve in reference 11.4 (table 4) and FAT 90 provided by reference 11.5 (figure 1). Fatigue tests have been carried out for butt welded joints only. However, for other details, the application of other S-N curves should be to the satisfaction of the Administration. Section 4.18.2.4.2 of the IGC Code and section 6.4.12.2.4 of the IGF Code specify the design S-N curves to be based on a 97.6% probability of survival corresponding to the mean-minus-two-standard-deviation curves of relevant experimental data up to final failure.

S-N curve	$N \le 10^7$ cycles		$N > 10^7$ cycles $\log \bar{a}_2$ $m_2 = 5.0$	Fatigue limit at 10^7 cycles (MPa) *)	Thickness exponent k	Structural stress concentration embedded in the detail (S-N class), see also equation (2.3.2)
	m_1	$\log \bar{a}_1$				
B1	4.0	15.117	17.146	106.97	0	
B2	4.0	14.885	16.856	93.59	0	
C	3.0	12.592	16.320	73.10	0.05	
C1	3.0	12.449	16.081	65.50	0.10	
C2	3.0	12.301	15.835	58.48	0.15	
D	3.0	12.164	15.606	52.63	0.20	1.00
E	3.0	12.010	15.350	46.78	0.20	1.13
F	3.0	11.855	15.091	41.52	0.25	1.27
F1	3.0	11.699	14.832	36.84	0.25	1.43
F3	3.0	11.546	14.576	32.75	0.25	1.61
G	3.0	11.398	14.330	29.24	0.25	1.80
W1	3.0	11.261	14.101	26.32	0.25	2.00
W2	3.0	11.107	13.845	23.39	0.25	2.25
W3	3.0	10.970	13.617	21.05	0.25	2.50
*) see also [2.11]						

Table 4: (S-N curves in air): High manganese austenitic steel has been documented to be equal or better than the D-curve (reference 11.4) for as-welded condition without stress concentration from any structural details

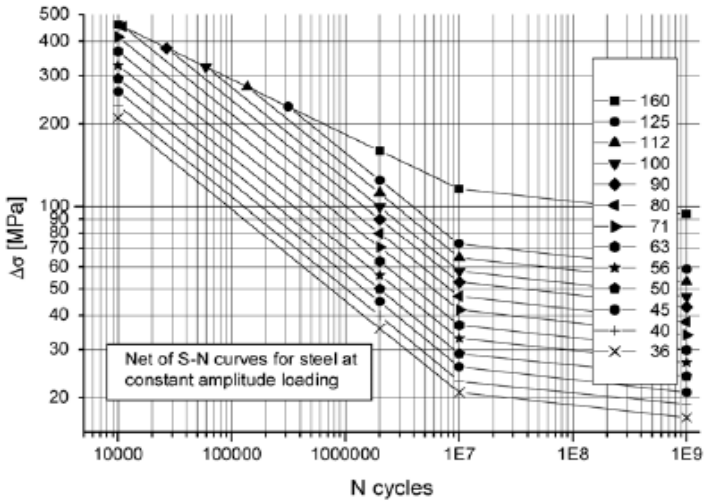


Figure 1: Reference S-N curve to high manganese austenitic steel is the FAT 90 curve (reference 11.5). The FAT 90 curve is as welded condition without stress concentration from any structural details.

10.5 Fracture mechanics analyses

10.5.1 For a cargo tank or fuel tank where a reduced secondary barrier is applied, fracture mechanics analysis should be carried out in accordance with the IGC or IGF Code.

10.5.2 Fracture toughness properties should be expressed using recognized standards. Depending on the material, fracture toughness properties determined for loading rates similar to those expected in the tank system should be required. The fatigue crack propagation rate properties should be documented for the tank material and its welded joints for the relevant service conditions. These properties should be expressed using a recognized fracture mechanics practice relating the fatigue crack propagation rate to the variation in stress intensity, ΔK, at the crack tip. The effect of stresses produced by static loads should be taken into account when establishing the choice of fatigue crack propagation rate parameters.

10.5.3 Note that for the application where very high static load utilization is relevant, alternative methods such as ductile fracture mechanic analyses should be considered.

10.5.4 An example of a typical Crack Tip Opening Displacement (CTOD) value at cryogenic condition can be found in figure 2.

10.5.5 A fracture mechanics analysis is required for type B tanks (section 4.22.4 of the IGC Code and section 6.4.15.2.3.3 of the IGF Code) where a reduced secondary barrier is applied. Fracture mechanics analysis may also be required for other tank types as found relevant to show compliance with fatigue and crack propagation properties. Note that CTOD values used in fracture mechanics analysis may in any case be an important property to analyse to ensure that materials are considered suitable for the application.

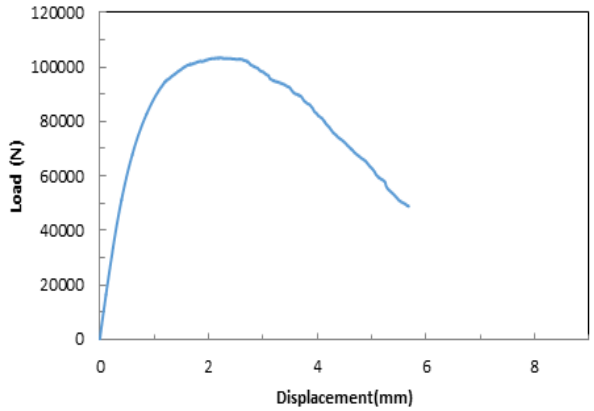
<table>
<tr><td colspan="10">CTOD TEST REPORT</td></tr>
<tr><td colspan="5"></td><td>REPORT NO.</td><td colspan="4"></td></tr>
<tr><td>Test Method Standard</td><td colspan="4">ISO 12135/15653 Specimen No.</td><td>FCAW-2</td><td>Test Date</td><td colspan="3"></td></tr>
<tr><td>Specimen configuration</td><td colspan="5">Square Cross-Section 3 Point Bend(W=B)</td><td colspan="2">Crack plane orientation</td><td colspan="2">L-T</td></tr>
<tr><td rowspan="4">Specimen Dimensions</td><td colspan="2"></td><td>1</td><td colspan="2">2</td><td>3</td><td colspan="3">Average</td></tr>
<tr><td colspan="2">Thickness, B (mm)</td><td>40</td><td colspan="2">40</td><td>40</td><td colspan="3">40</td></tr>
<tr><td colspan="2">Width, W (mm)</td><td>80</td><td colspan="2">80</td><td>80</td><td colspan="3">80</td></tr>
<tr><td colspan="2">Span, S (mm)</td><td>320</td><td colspan="3">Knife edge thickness, z (mm)</td><td colspan="3">0</td></tr>
<tr><td rowspan="5">Test Material</td><td colspan="6">Young's Modulus of Elasticity, E (MPa)</td><td colspan="4">182,000</td></tr>
<tr><td colspan="6">YS(0.2% proof), σ_{YSP} (MPa)</td><td colspan="4">474</td></tr>
<tr><td colspan="6">TS, σ_{TSP} (MPa)</td><td colspan="4">780</td></tr>
<tr><td colspan="6">YS(0.2% proof), σ_{YS} (MPa)</td><td colspan="4">655</td></tr>
<tr><td rowspan="2">Machined Notch (mm)</td><td colspan="2">Width, N</td><td colspan="2">Length, Lmc</td><td colspan="2">Root Radius</td><td colspan="2"></td></tr>
<tr><td colspan="2">4.7</td><td colspan="2">32.4</td><td colspan="2">0.1</td><td colspan="2"></td></tr>
<tr><td>Test Condition</td><td colspan="6">Temperature (℃)</td><td colspan="4">-165</td></tr>
<tr><td rowspan="9">Test Result</td><td colspan="10"> 
</td></tr>
<tr><td colspan="10">Crack Length to Tip of Fatigue Pre crack (mm)</td></tr>
<tr><td>a_1</td><td>a_2</td><td>a_3</td><td>a_4</td><td>a_5</td><td>a_6</td><td>a_7</td><td>a_8</td><td>a_9</td><td>a_0</td></tr>
<tr><td>37.62</td><td>39.28</td><td>39.36</td><td>38.95</td><td>39.24</td><td>38.27</td><td>38.55</td><td>38.67</td><td>37.21</td><td>38.72</td></tr>
<tr><td colspan="2">a_0/W</td><td colspan="2">0.54</td><td colspan="4">Plastic Component of V, V_p (mm)</td><td colspan="2">1.53</td></tr>
<tr><td colspan="10">Critical CTOD (mm)</td></tr>
<tr><td colspan="4">Type of CTOD</td><td colspan="6">Total CTOD</td></tr>
<tr><td colspan="4">δm</td><td colspan="6">0.53</td></tr>
</table>

Figure 2: Example of typical values for CTOD test at -165°C

10.6 Welding

10.6.1 Welding should be carried out in accordance with section 6.5 of the IGC Code or section 16.3 of the IGF Code, and to the satisfaction of the Administration.

10.6.2 For welding, the following points should be considered:

.1 for reducing the heat input during production:

.1 special attention should be given to the first root pass when applying flux-cored arc welding (FCAW); reduced amperage should be considered; and

.2 welding heat input of maximum 30 kJ/cm should be used as guidance for 3G position, as that has less heat input for 1G position;

.2 distance between the weld and nozzle should be kept to a minimum to reduce the oxygen content at the vicinity of the weld pool;

.3 weld gas composition of FCAW should normally be an 80/20 mix of argon and carbon dioxide; and

.4 appropriate ventilation should be provided to reduce exposure to hazardous welding fumes.

10.7 Non-destructive testing (NDT)

The scope of non-destructive testing (NDT) should be as required by section 6.5.6 of the IGC Code or section 16.3.6 of the IGF Code. NDT procedures should be in accordance with recognized standards to the satisfaction of the Administration. For high manganese austenitic steel suitable NDT procedures normally applicable for austenitic steels should be used.

10.8 Corrosion resistance

10.8.1 Appropriate measures with respect to corrosion protection and avoidance of a corrosive environment should be taken. Particularly for LNG fuel tanks that may not be in operation, appropriate precautions should be taken at all times to ensure that empty tanks are filled with inert gas or dry air when not in use.

11 References

ASTM A1106 / A1106M-17: Standard Specification for Pressure Vessel Plate, Alloy Steel, Austenitic High Manganese for Cryogenic Application

ISO 21635:2018 Ships and marine technology – Specification of high manganese austenitic steel used for LNG tanks on board ships

Material testing requirements and acceptance criteria (appendix)

DNVGL-RP-C203 Fatigue design of offshore steel structures

IIW 1823-07 Recommendations for fatigue design of welded joints and components

BS 7910:2013 + A1:2015 Guide to methods for assessing the acceptability of flaws in metallic structures

APPENDIX 1

MATERIAL TESTING REQUIREMENTS AND ACCEPTANCE CRITERIA FOR HIGH MANGANESE AUSTENITIC STEEL

1 Test of base material

1.1 Chemical composition Recognized standards, such as ASTM A1106/A1106M-17 or ISO 21635:2018.
Test acceptance criteria In accordance with recognized standards.

1.2 Micrographic examination This test should be carried out in accordance with 6.3.4 of the IGC Code and 16.2.4 of the IGF Code, i.e. recognized standards, such as ASTM E112.
Test acceptance criteria Microstructure to be reported for reference (i.e. grain size/precipitations).

1.3 Tensile test This test should be carried out in accordance with 6.3.1 of the IGC Code and 16.2.1 of the IGF Code. Samples should be taken from three heats of different compositions, both at room and cryogenic temperatures.
Test acceptance criteria The yield, tensile strength and elongation should be in accordance with the recognized standard applied for Chemical composition (2.1) such as ASTM A1106/A1106M-17 or ISO 21635:2018.

1.4 Charpy impact test This test should be carried out in accordance with 6.3.2 of the IGC Code and 16.2.2 of the IGF Code.
Test acceptance criteria In accordance with table 6.3, as for austenitic steels, of the IGC Code and table 7.3 of the IGF Code. *Guidance note 9 of tables 6.3 and 7.3: Impact tests should not be omitted for high manganese austenitic steel owing to lack of experience.*

1.5 Charpy impact test on strain aged specimens Recognized standards, such as ASTM E23.
Test acceptance criteria In accordance with table 6.3, as for austenitic steels, of the IGC Code and 16.2.2 of the IGF Code. *Guidance note 9 of tables 6.3 and 7.3 are not applicable for high manganese steel owing to lack of experience.*

1.6 Drop weight test Recognized standards should be applied, such as ASTM E208. Tests should be carried out at -196°C.
Test acceptance criteria No break at test temperature as defined by the applied standard.

1.7 Fatigue test (S-N curve) The basis for establishing S-N Curves should be in accordance with 4.18.2.4.2 of the IGC Code and 6.4.12.2.4 of the IGF Code.
Test acceptance criteria S-N curves should be minimum the fatigue strength as established curves for steel as defined in IIW or DNVGL-RP-C203.

1.8 CTOD (crack tip opening displacement) test Recognized standards, such as ASTM E1820, BS 7448 or ISO 12135, should be used for these purposes.
Test acceptance criteria CTOD minimum value should be in accordance with design specification for testing at room and cryogenic temperatures as per design conditions. As ~~a~~ guidance a minimum CTOD value of 0.2 mm is often required.

1.9 Corrosion test These tests should be carried out in accordance with recognized standards.
Test acceptance criteria In accordance with recognized standard or approved by the Administration.
1.9.1 Intergranular corrosion test This test should be carried out in accordance with recognized standard, such as ASTM A262.
Test acceptance criteria In accordance with recognized standard or approved by the Administration.
1.9.2 General corrosion test This test should be carried out in accordance with recognized standards, such as ASTM G31.
Test acceptance criteria In accordance with recognized standard or approved by the Administration.
1.9.3 Stress corrosion cracking test This test should be carried out to the satisfaction of the Administration, in accordance with recognized standards, such as ASTM G36 and ASTM G123.
Test acceptance criteria In accordance with recognized standard or approved by the Administration.

1.9.4 Corrosion test for ammonia compatibility The additional test should be carried out in accordance with the test requirements set out in appendix 2 to qualify for ammonia service.
Test acceptance criteria In accordance with the acceptance criteria set out in appendix 2.

2 Tests of welded condition (including HAZ)

2.1 Micrographic examination This test should be carried out in accordance with 6.3.4 of the IGC Code and 16.2.4 of the IGF Code, i.e. recognized standards, such as ASTM E112 (or equivalent).
Test acceptance criteria Microstructure should be reported for reference (i.e. grain size/precipitations).

2.2 Hardness test This test should be carried out in accordance with 6.3.4 and 6.5.3.4.5 of the IGC Code and 16.2.4 and 16.3.3.4.5 of the IGF Code, i.e. recognized standards, such as ISO 6507-1.
Test acceptance criteria The hardness value should be reported for reference.

2.3 Cross-weld tensile test This test should be carried out in accordance with 6.5.3.5.1 of the IGC Code and 16.3.3.5.1 of the IGF Code as the relevant requirement for under-matched welds. Recognized standards, such as ASTM E8/E8M, should be applied.
Test acceptance criteria In accordance with 4.18.1.3.1.2 of the IGC Code and 6.4.12.1.1.3 of the IGF Code.

2.4 Charpy impact test This test should be carried out in accordance with 6.3.2 and 6.5.3.4.4 of the IGC Code and 16.2.2 and 16.3.3.4.4 of the IGF Code.
Test acceptance criteria In accordance with 6.5.3.5.3 of the IGC Code and 16.3.3.5.3 of the IGF Code.

2.5 CTOD (crack tip opening displacement) test Recognized standards, such as ASTM E1820, BS 7448 or ISO 15653, should be used for these purposes.
Test acceptance criteria CTOD minimum value should be in accordance with design specification for testing at room and cryogenic temperatures as per design conditions. As a guidance a minimum CTOD value of 0.2 mm is often required.

2.6 Ductile fracture toughness test, Jlc Recognized standards, such as ASTM E1820 or ISO 15653. The ductile fracture toughness test may be omitted at the discretion of the Administration.
Test acceptance criteria In accordance with recognized standard.

2.7 Bending test This test should be carried out in accordance with 6.3.3 of the IGC Code and 16.2.3 of the IGF Code.
Test acceptance criteria No fracture should be acceptable after a 180° bend as required for welded material as per 6.5.3.5.2 of the IGC Code and 16.3.3.5.2 of the IGF Code.

2.8 Fatigue test (S-N curve) The basis for establishing S-N Curves should be in accordance with 4.18.2.4.2 of the IGC Code and 6.4.12.2.4 of the IGF Code.
Test acceptance criteria S-N curves should be minimum the fatigue strength as established curves for steel as defined in IIW or DNVGL-RP-C203.

2.9 Corrosion test These tests should be carried out in accordance with recognized standards.
Test acceptance criteria In accordance with recognized standard or approved by the Administration.
2.9.1 Intergranular corrosion test This test should be carried out in accordance with recognized standard, such as ASTM A262.
Test acceptance criteria In accordance with recognized standard or approved by the Administration.

2.9.2 General corrosion test This test should be carried out in accordance with recognized standards, such as ASTM G31.
Test acceptance criteria In accordance with recognized standard or approved by the Administration.
2.9.3 Stress corrosion cracking test This test should be carried out to the satisfaction of the Administration, in accordance with recognized standard, such as ASTM G36, ASTM G58 and ASTM G123.
Test acceptance criteria In accordance with recognized standard or approved by Administration.
2.9.4 Corrosion test for ammonia compatibility The additional test should be carried out in accordance with the test requirements set out in appendix 2 to qualify for ammonia service.
Test acceptance criteria In accordance with the acceptance criteria set out in appendix 2.

References:

ASTM E466-15 *Standard Practice for Conducting Force Controlled Constant Amplitude Axial Fatigue Tests of Metallic Materials*

ASTM E1290-08e1 *Standard Test Method for Crack-Tip Opening Displacement (CTOD) Fracture Toughness Measurement (Withdrawn 2013)*
ASTM G31 *Standard Guide for Laboratory Immersion Corrosion Testing of Metals*.

ASTM B858 *Standard Test Method for Ammonia Vapor Test for Determining Susceptibility to Stress Corrosion Cracking in Copper Alloys*

ISO 12737:1999 *Metallic materials – Determination of plane-strain fracture toughness*[2]

ISO 15653:2018 *Metallic materials – Method of test for the determination of quasistatic fracture toughness of welds*[3]

IIW 1823-07 *Recommendations for fatigue design of welded joints and components*

ISO 12135:2016 *Metallic materials – Unified method of test for the determination of quasistatic fracture toughness*

ISO 15653:2018 Metallic materials – *Method of test for the determination of quasistatic fracture toughness of welds*

[2] Replace ASTM E1820-18 Standard Test Method for Measurement of Fracture Toughness, BS 7448 1:1991 – Fracture mechanics toughness tests. Method for determination of KIc, critical CTOD and critical J values of metallic materials.

[3] Supersede BS 7448-2 – Fracture Mechanics Toughness Tests: Method for Determination of KIc, Critical CTOD and Critical J Values of Welds in Metallic Materials.

APPENDIX 2

ADDITIONAL COMPATIBILITY TEST REQUIREMENTS FOR AMMONIA SERVICE

The test shall be carried out in accordance with a recognized standard such as ASTM B858. This standard is applicable to copper alloys and not specifically to high manganese austenitic steel. Consequently, the following additional non-standard test shall be performed:

1 Specimens should be prepared in accordance with standards ISO 7539-2 and ISO 16540. The specimens should be bent, prior to testing, using the four points bending test under constant strain. The total maximum strain of the sample should be equal to the yield strength of the material at atmospheric temperature. Strain gauges should be applied to measure the strain applied. In the case of welded specimens, strain gauges should be applied to each side of the welded joint. The sample should be constrained to maintain its form during testing. The details are described in Specimen preparation.

2 A total of 36 specimens (three welded and three base metal at each ammonia environment) should each be immersed in the following four ammonia environments for a period of 30 days:

.1 liquid phase ammonia environments, obtained by cooling of ammonia at slightly lower temperature than the boiling temperature of ammonia e.g. -33.5^{o}C and at atmospheric pressure with the following liquid ammonia compositions:

.1 0.1% weight of water and 2.5 ppm of oxygen; and

.2 2.5 ppm of oxygen;

.2 gas phase ammonia environments at ambient temperature (+25^{o}C) and atmospheric pressure with the following gas ammonia compositions:

.1 pure ammonia (≥99.99%); and

.2 0.9% volume of oxygen and 99.1%volume of ammonia;

.3 gas phase ammonia environments at -20^{0}C and atmospheric pressure with the following gas ammonia compositions:

.1 pure ammonia (≥99.99%); and

.2 0.9% volume of oxygen and 99.1%volume of ammonia.

Stress corrosion cracking tests shall be performed in agreement with requirements of standards ISO 7539 and ISO 16540.

3 Test report shall provide all procedures, set up data, examinations, information about the environment, in agreement with standard ISO 16540 and include:

.1 the orientation, types, and dimensions of specimens;

.2 description of materials:

.1 chemistry and tensile properties of base plate;

.2 chemistry and tensile properties of welding consumables;

.3 type of welding, hardness of the weld metal and heat affected zones;

.3 four points bending test set up data;

.4 target stress and applied deflection;

.5 strain measurement procedures;

.6 loading procedures; and

.7 test environment (temperature, water and oxygen content, and pH).

Test acceptance criteria

After immersion, all specimens should be examined for stress corrosion cracking under an optical microscope with proper magnification. The location and the number of cracks should be specified, and a fluorescent penetration test performed to confirm the results as necessary. For welded joints, the location of cracks should be described as located in the base metal, weldment or HAZ. If no superficial crack is observed, a longitudinal cut should be done at two different locations and a cross section examination with proper magnification should be performed. The presence of any corrosion pitting and the maximum depth should be reported. The results should be approved by the Administration.

Loading jig

The loading jig made of corrosion resistant alloys with spacing between outer rollers of 85 mm shown in figure 1 is to be used to apply a constant deflection to the specimen. The specimen is electrically isolated from the ceramic rollers in order to avoid undesirable galvanic corrosion.

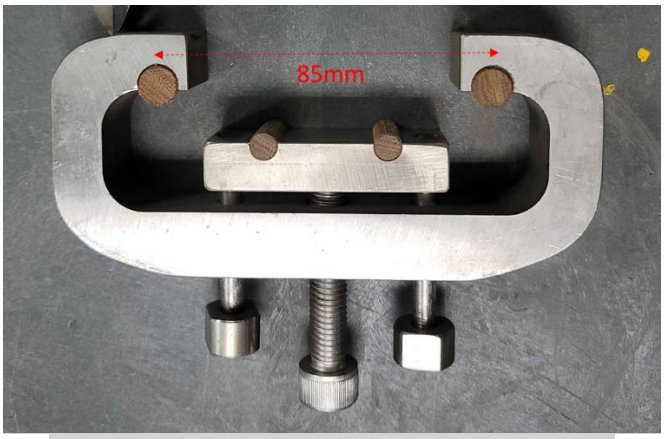


Figure 1: Four-point bend loading jig design

Specimen preparation

The specimens are machined from a 40 mm thick hot rolled plate and are not subjected to post-weld heat treatment. The outer radius of the specimen subject to bending is the original surface of the hot rolled plate. They are bent prior to testing and surface would be exposed to ammonia in a tank is not machined.

Four-point bend specimens are flat strips of uniform rectangular cross section and uniform thickness except in the case of testing welded specimens with one face in the as-welded condition as shown in figure 2. The original surface from a 40 mm hot rolled plate (cap bead in case of welded specimen) is the one to be observed. For weldments, the weld bead to be tested is the weld cap.

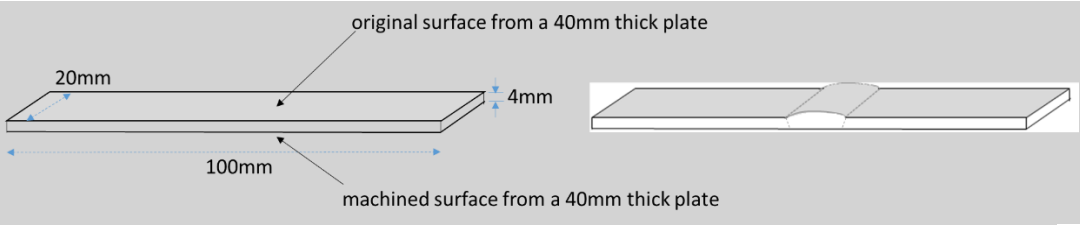


Figure 2: Four-point bend specimens (parent specimen and as-welded specimen)

Strain gauging

Dial gauge will be attached for measurement of deflection at the centre of the face in tension. The loading of the specimen is such that it reaches to the required yield strength level and then the specimen is constrained to maintain its form during testing. The amount of deflection, y, is set as the formula below complying with ISO 16540.

$$Y = \frac{(3H^2 - 4A^2)\sigma}{12Et}$$

where σ is the required stress (yield strength in this case), E is the modulus of elasticity, t is the specimen thickness, A is the distance between the inner and outer supports, and H is the distance between the outer supports. Prior to four-point bending, a uniaxial tensile test of a 40 mm thick plate will be performed to determine the yield strength to be applied for the calculation of the amount of deflection required. For the simplicity of the welded specimen testing, the same amount of the deflection as for the parent plate is to be set out.

~~The test should be carried out in accordance with a recognized standard such as ASTM B858. This standard is applicable to copper alloys and not specifically to high manganese austenitic steel. Consequently, the following additional non-standard test should be performed:~~

~~.1 Specimens should be prepared in accordance with standards ISO 7539-2 and ISO 16540. The specimens should be bent, prior to testing, using the four points bending test under constant strain. The total maximum strain of the sample should be equal to the yield strength of the material at atmospheric temperature. Strain gauges should be applied to measure the strain applied. In the case of welded specimens, strain gauges should be applied to each side of the welded joint. The sample should be constrained to maintain its form during testing.~~

~~.2 Two specimens (one welded and one base metal) should each be immersed in the following four ammonia environments for a period of 30 days:~~

~~.1 liquid phase ammonia environments, obtained by cooling of ammonia below liquefaction temperature with the following liquid ammonia compositions:~~

~~.1 0.1% weight of water and 2.5 ppm of oxygen; and~~

.2 2.5 ppm of oxygen.

.2 gas phase ammonia environments, at ambient temperature and atmospheric pressure with the following compositions:

.1 pure ammonia; and

.2 0.9% volume of oxygen and 99.1% volume of ammonia.

Stress corrosion cracking tests should be performed in agreement with requirements of standards ISO 7539 and ISO 16540.

.3 Test report should provide all procedures, set up data, examinations, information about the environment, in agreement with standard ISO 16540 and include:

.1 the orientation, types and dimensions of specimens;

.2 four points bending test set up data;

.3 target stress and applied deflection;

.4 strain measurement procedures;

.5 loading procedures; and

.6 test environment.

Test acceptance criteria

After immersion, all specimens should be examined for stress corrosion cracking under an optical microscope with proper magnification. The location and the number of cracks should be specified, and a dye penetrant test performed to confirm the results as necessary. For welded joints, the location of cracks should be described as located in the base metal, weldment or HAZ. If no superficial crack is observed, a longitudinal cut should be done at two different locations and a cross section examination with proper magnification should be performed. The presence of any corrosion pitting and the maximum depth should be reported. The results should be approved by the Administration.

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ANNEX 5[110]

DRAFT MSC CIRCULAR

REVISED GUIDELINES FOR THE ACCEPTANCE OF ALTERNATIVE METALLIC MATERIALS FOR CRYOGENIC SERVICE IN SHIPS CARRYING LIQUEFIED GASES IN BULK AND SHIPS USING GASES OR OTHER LOW-FLASHPOINT FUELS

1 The Maritime Safety Committee, at its 102nd session (4 to 11 November 2020), acknowledging a potential need for alternative metallic materials to be used for the construction and safe operation of low-temperature fuel and cargo-carrying ships and the need for guidance in this respect, approved the *Guidelines for the acceptance of alternative metallic materials for cryogenic service in ships carrying liquefied gases in bulk and ships using gases or other low-flashpoint fuels* (MSC.1/Circ.1622)~~, as set out in the annex~~, prepared by the Sub-Committee on Carriage of Cargoes and Containers (CCC), at its sixth session (9 to 13 September 2019).

2 The Maritime Safety Committee, at its 105th session (20 to 29 April 2022), approved amendments to the Guidelines (MSC.1/Circ.1648), prepared by the Sub-Committee on Carriage of Cargoes and Containers (CCC), at its seventh session (6 to 10 September 2021).

3 The Maritime Safety Committee, at its [108th session (15 to 24 May 2024)], having qualified high manganese austenitic steel for ammonia service and to revise additional compatibility test requirements for ammonia service, approved the *Revised* g*uidelines for the acceptance of alternative metallic materials for cryogenic service in ships carrying liquefied gases in bulk and ships using gases or other low-flashpoint fuels*, as set out in the annex, for dissemination as MSC.1/Circ.1622/Rev.1, prepared by the Sub-Committee on Carriage of Cargoes and Containers (CCC) at its ninth session (20 to 29 September 2023).

~~2~~4 The Revised ~~G~~Guidelines incorporate the amendments in MSC.1/Circ.1648; and provide detailed guidance on how to document alternative metallic materials for their suitability and compliance with the IGC and IGF Codes, and a framework for evaluation and approval of alternative metallic materials for cryogenic service.

~~3~~5 Member States are invited to bring the annexed Revised Guidelines to the attention of all parties concerned.

6 This circular supersedes MSC.1/Circ.1622 and revokes MSC.1/Circ.1648.

[1] The revised circular will be disseminated as MSC.1/Circ.1622/Rev.1. The revised circular incorporates previous amendments made to the Guidelines through MSC.1/Circ.1648, as well as new modifications introduced at CCC 9. The modifications to MSC.1/Circ.1622 are shown in grey shading.

ANNEX

REVISED GUIDELINES FOR THE ACCEPTANCE OF ALTERNATIVE METALLIC MATERIALS FOR CRYOGENIC SERVICE IN SHIPS CARRYING LIQUEFIED GASES IN BULK AND SHIPS USING GASES OR OTHER LOW-FLASHPOINT FUELS

PART 1
GENERAL

1 Introduction

1.1 Ships carrying liquefied gases in bulk should comply with the requirements of the IGC Code adopted by resolution MSC.370(93), as amended. Ships using gases or other low-flashpoint fuels should comply with the requirements of the IGF Code, adopted by resolution MSC.391(95), as amended.

1.2 The requirements for metallic materials used in low temperature applications on board ships constructed in accordance with the IGC and IGF Codes are contained in tables 6.2, 6.3 and 6.4 of the IGC Code and tables 7.2, 7.3 and 7.4 of the IGF Code, respectively. The requirements are identical in both Codes and specify the minimum design temperatures for specific materials based upon chemical composition, mechanical properties and heat treatment. These approved materials have been incorporated in the Codes since their inception and have provided over 40 years of satisfactory service experience.

1.3 There is recent interest in adding new metallic materials to the list of those already covered by the Codes. *Interim guidelines on the application of high manganese austenitic steel for cryogenic service* were adopted and disseminated as MSC.1/Circ.1599. In the process of developing the Interim guidelines, significant experience in the evaluation of this alternative material was acquired. The recommendations contained in MSC.1/Circ.1599 are used as the basis for these Guidelines.

2 Application

2.1 These Guidelines apply to metallic materials not listed in tables 6.2, 6.3 and 6.4 of the IGC Code and tables 7.2, 7.3 and 7.4 of the IGF Code respectively. The testing requirements set out herein provide guidance for the acceptance of alternative metallic materials based upon the equivalency provisions contained in section 1.3 of the IGC Code or alternative design requirements contained in section 2.3 of the IGF Code. The Guidelines apply only to materials used for products listed in chapter 19 of the IGC Code or MSC circulars approved by the Organization, or fuels addressed by the IGF Code.

2.2 The Guidelines also apply to alternative metallic materials having a minimum design temperature between 0ºC and -165ºC or lower if authorized by the Administration in the range of minimum and maximum thicknesses tested during the approval process, up to a maximum thickness of 40 mm. Thicknesses in excess of 40 mm should be approved by the Administration or recognized organization acting on its behalf. In addition to approval for a minimum design temperature of -165ºC, alternative metallic materials may be approved for intermediate minimum design temperatures of -55ºC, -60ºC, -65ºC, -90ºC and -105ºC. Alternative metallic materials qualified at a lower temperature are suitable for use at the intermediate minimum design temperature.

2.3 The Guidelines only apply to alternative metallic materials formed or manufactured by rolling, extrusion, casting or forging.

2.4 Alternative metallic materials approved in accordance with the Guidelines may be used in the construction of cargo containment and piping system under chapter 4 of the IGC Code or similar parts of fuel tanks, under chapter 6 of the IGF Code or piping systems under section 5.12 of the IGC Code and section 7.4.1.2 of the IGF Code. They should be approved for specific cargoes or fuels listed in the IGC or IGF Codes based upon their design temperature and their compatibility with the cargo or fuel. This Guideline does not address material forming part of the hull structure.

3 Definitions

3.1 *Alternative metallic materials*: Homogeneous ferrous and non-ferrous alloys having uniform composition in any direction formed by hot rolling, cold rolling, extrusion, casting or forging, whose compositions or heat treatments are not listed in tables 6.2, 6.3 and 6.4 of the IGC Code and tables 7.2, 7.3 and 7.4 of the IGF Code, respectively.

3.2 *Established metallic materials*: Metallic materials listed in tables 6.2, 6.3 and 6.4 of the IGC Code and tables 7.2, 7.3 and 7.4 of the IGF Code, respectively, or by an IMO MSC circular.

3.3 *Equivalent alternative metallic materials*: Alternative metallic materials having chemical and mechanical properties that are equivalent or superior to those listed in tables 6.2, 6.3 and 6.4 of the IGC Code and tables 7.2, 7.3 and 7.4 of the IGF Code, respectively, that have been approved under these Guidelines.

3.4 *Other alternative metallic materials*: Alternative metallic materials having mechanical properties that do not meet those listed in tables 6.2, 6.3 and 6.4 of the IGC Code and tables 7.2, 7.3 and 7.4 of the IGF Code, respectively.

3.5 *Recognized standards*: Applicable international or national standards acceptable to the Administration, or standards laid down and maintained by the recognized organization.

3.6 *Administration*: Government of the State whose flag the ship is entitled to fly.

PART II
MATERIAL SPECIFICATIONS AND TESTING REQUIREMENTS

4 Material specification

4.1 All alternative metallic materials should have a recognized standard for cryogenic service for consideration under these Guidelines. The standard should cover specific forms of the material being approved, including plates, sections, castings, forgings or pipes, and should specify heat treatment and grain structure. The standard should meet the scope and general requirements of section 6.2 of the IGC Code. Micro-alloying elements not identified in the recognized standards may be considered subject to approval by the Administration.

4.2 Alternative metallic material, including plates, castings and forgings, should be joined using an approved method specified by a recognized standard. When applied, conventional welding procedures qualified in accordance with a recognized standard and complying with procedures contained in chapter 6.5 of the IGC Code and part B-1, section 16.3 of the IGF Code should be specified for the welding of alternative metallic materials. The welding procedures should specify heat input and pre- and post-weld heat treatment.

4.3 Welding procedures and non-destructive testing (NDT) should be specified for all alternative metallic materials. These procedures should conform to a recognized standard and comply with testing requirements specified in chapter 6.5 of the IGC Code and part B-1, section 16.3 of the IGF Code.

5 Testing

5.1 Test requirements are provided in the appendix to the Guidelines and are based upon section 6.3 of the IGC Code and part B-1, section 16.2 of the IGF Code.

5.2 Depending on the design temperature, Charpy V-notch tests should be conducted in accordance with the footnotes in the applicable tables given in chapter 6 of the IGC Code and section 7 of the IGF Code.

5.3 Subject to the approval of the Administration, consideration can be given to alternative test methods that provide an equivalent level of safety. Test requirements should not be waived unless there is a valid technical justification, or the material properties can be confirmed by another test method. Test requirements may be waived if not required for specific tank types within chapter 4 of the IGC Code, section 6 of the IGF Code or if not required for similar established metallic materials.

5.4 The testing of alternative metallic material should be conducted on at least one of the following forms: plates, castings, forgings or pipes. The testing of any form should meet the sampling and specimen position requirements of section 6.4 of the IGC Code and section 7.4 of the IGF Code. Initial testing should be conducted on the form reflecting the application of an alternative metallic material. Approval is limited to forms for which test results are provided; however, all forms do not have to be considered for approval of the alternative metallic material. If a waiver of requirements for post-weld heat treatment is sought, additional welded samples with the required post-weld heat treatment should be provided for comparison purposes.

5.5 Corrosion sensitization can occur in stainless and other austenitic steels. In such cases, the Administration may require additional corrosion testing such as an Intergranular Corrosion Test such as ASTM A262 and a Stress Corrosion Cracking Test such as ASTM G36 or ASTM G123.

6 Acceptance criteria

6.1 Test acceptance criteria are provided in the appendix to this Guideline and are based upon section 6.3 of the IGC Code and part B-1, section 16.2 of the IGF Code.

6.2 The application of an alternative metallic material in a specific design should be based upon the adequacy of the material for the design loads and the suitability of the material properties for their intended use in accordance with the design conditions specified in section 4.18 of the IGC Code and section 6.4.12 of the IGF Code.

6.3 Approval of alternative metallic materials should be for each form of the material for which there are satisfactory test results.

7 Novel design and equivalent arrangements

Alternative metallic materials may be used in the design of novel containment systems under section 4.27 of the IGC Code and section 6.4.16 of the IGF Code. Section 2.1 in appendix 5 of the IGC Code and part A-1 annex, section 2.1 of the IGF Code require the use of established metallic materials. The use of other alternative metallic materials should not be considered in a design.

PART III
APPLICATION

8 Approval procedures

8.1 Upon satisfactory completion of testing of the appropriate forms and acceptance of the results, an alternative metallic material is considered to be an accepted equivalent alternative metallic material for the purpose of the Guidelines.

8.2 The approval should specify any limitations that have been identified in the inherent properties of the approved alternative metallic material that may need to be considered in its use. These properties may include, but are not limited to:

.1 under-matching/over-matching of welds;

.2 pre- and post-weld heat treatment;

.3 corrosion;

.4 specific NDT requirements or limitations; and

.5 toxicity of welding fumes.

8.3 Tables 6.2, 6.3 and 6.4 of the IGC Code and tables 7.2, 7.3 and 7.4 of the IGF Code may be modified to incorporate new alternative metallic materials subject to the following:

.1 material should be qualified using these Guidelines;

.2 material compatibility for all intended cargoes should be demonstrated;

.3 relevant fabrication experience on any tank type on a ship should be documented;

.4 material should have minimum of 5 years of service experience on board a ship or equivalent to one special survey cycle;

.5 service experience should be on a ship in service, relevant to the material's future use; and

.6 if simulation is used, credit may be given to a reduced service period upon completion of the first intermediate survey. The scope of this survey should be in accordance with the requirements of the first special survey, including NDT, of the tank.

9 Application

The Administration should assign approved safety factors based upon those for nickel steels, carbon manganese steels, austenitic steels or aluminium alloys in the IGC and IGF Codes.

10 References

MSC.1/Circ.1599/Rev.[2] *Interim guidelines on the application of high manganese austenitic steel for cryogenic service.*

APPENDIX 1

MATERIAL TESTING REQUIREMENTS AND ACCEPTANCE CRITERIA

1 Test of base material

1.1 **Material specifications**: Chemical composition and mechanical properties meeting a recognized standard for the alternative metallic material intended for cryogenic service.

Acceptance criteria: in accordance with the recognized standard.

1.2 **Micrographic examination**: The test should be carried out in accordance with section 6.3.4 of the IGC Code using recognized standards such as ASTM E112.

Acceptance criteria: Microstructure including grain size. The absence of precipitations, segregation and cracking should be reported. Acceptance should be to the satisfaction of the Administration.

1.3 **Tensile test**: The test should be carried out in accordance with section 6.3.1 of the IGC Code. Samples should be taken from three heats of different compositions, both at room and cryogenic temperatures equal to the minimum design temperature of the alternative metallic material. The number of samples should be sufficient to provide statistically valid results.

Acceptance criteria: The yield strength, tensile strength and elongation should be in accordance with the recognized standard for the chemical composition given in 1.1 of this appendix.

1.4 **Charpy impact test**: The test should be carried out in accordance with section 6.3.2 of the IGC Code. Samples should be taken from three heats of different compositions, both at room and cryogenic temperatures equal to the required test temperature. Impact tests should not be omitted for austenitic steels due to lack of experience. Test temperatures should be as follows:

Material thickness (mm)	Test temperature (°C)
t < 25	5°C below design temperature (ferritic steel only)
25 < t ≤ 30	10°C below design temperature
30 < t ≤ 35	15°C below design temperature
35 < t ≤ 40	20°C below design temperature

Acceptance criteria: unless higher values are required by the material specification

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Material	Test piece	Minimum average energy (KV)
Ferrous alloy plates	Transverse	27 J
Ferrous alloy sections and forgings	Longitudinal	41 J
Non-Ferrous alloy		Not required, subject to the approval of the Administration

1.5 **Charpy impact test on strain aged specimens**: The test should be carried out in accordance with a recognized standard such as ASTM E23. Strain ageing consists of 5% deformation for one hour at 250ºC in accordance with IACS UR W11. Samples should be taken from three heats of different compositions, both at room and cryogenic temperatures equal to the minimum test temperature. Impact tests should not be omitted for austenitic steels due to lack of experience. Test temperatures should be as follows:

Material thickness (mm)	Test temperature (ºC)
t < 25	5ºC below design temperature (ferritic steel only)
25 < t ≤ 30	10ºC below design temperature
30 < t ≤ 35	15ºC below design temperature
35 < t ≤ 40	20ºC below design temperature

Acceptance criteria: unless higher values are required by the material specification.

Material	Test piece	Minimum average energy (KV)
Ferrous alloy plates	Transverse	27 J
Ferrous alloy sections and forgings	Longitudinal	41 J
Non-Ferrous alloy	-	Not required, subject to the approval of the Administration

1.6 **Drop weight test**: Applicable only for ferritic steels including ferritic-austenitic (duplex) grade. The aim of the test is to establish the nil ductility transition temperature (NDTT). Samples should be taken from three heats of different compositions, both at room and cryogenic temperatures equal to the minimum test temperature. The test should be carried out in accordance with a recognized standard such as ASTM E208 for ferritic steels.

Acceptance criteria: No break at 10ºC below the design temperature.

1.7 **Fatigue test**: The basis for documenting adequate fatigue performance (S-N curves) should be in accordance with paragraph 4.18.2.4.2 of the IGC Code. The extent of fatigue testing is based on comparison with recognized S-N curves for metallic materials (such as IIW or DNVGL-RP-C203 or BS 7608).

The fatigue tests should be based on a minimum of five test samples at each stress level. For a "one slope S-N curve" a minimum of three stress levels should be tested. Additional stress levels are to be tested for "two slope S-N curves". As guidance, stress levels should be selected to achieve in the range of 10^5 to 10^8 cycles.

Acceptance criteria: The fatigue test results should be at least equal to or better than the reference S-N curve.

1.8 **CTOD (Crack Tip Opening Displacement) test**: The test should be carried out in accordance with a recognized standard such as ASTM E1820, BS 7448 or ISO 12135.

Acceptance criteria: CTOD minimum value should be in accordance with the design specification for testing at room and cryogenic temperatures equal to the minimum design temperature of the material. A minimum of three successful tests should be performed at room and cryogenic temperatures. As guidance a minimum CTOD value of 0.2 mm is often required.

1.9 **Corrosion test:** The type of corrosion tests to be applied will depend on the material, type of weld and the specific cargoes or fuels listed in the IGC or IGF Codes. The tests should include tests for general corrosion, intergranular corrosion and stress corrosion. The tests should be carried out in accordance with, ASTM A262, ASTM G31, ASTM G36, ASTM G58, ASTM G123 or other relevant recognized standards. In the absence of a relevant recognized standard for the specific cargo or fuel, the test procedures should align with the general principles of corrosion tests that follow the recognized standards listed herein. ~~**Corrosion test**: The type of corrosion tests to be applied will depend on the material to be qualified. The tests should include tests for general corrosion, intergranular corrosion and stress corrosion. The tests should be carried out in accordance with relevant standards.~~

Acceptance criteria: In accordance with the relevant recognized standard approved by the Administration for the material's intended service. In the absence of a relevant recognized standard for the specific cargoes or fuels, the results should align with other recognized standards, and projected corrosion rates and test outcomes should be subject to the satisfaction of the Administration. ~~***Acceptance criteria***: In accordance with the relevant recognized standard approved by the Administration for the material's intended service.~~

2 Test of welded condition (including HAZ)

2.1 **Micrographic examination**: The test should be carried out in accordance with section 6.3.4 of the IGC Code using recognized standards such as ASTM E112.

Acceptance criteria: Microstructure including grain size, absence of precipitations, segregation and cracking should be reported. Acceptance should be to the satisfaction of the Administration.

2.2 **Hardness test**: The test should be carried out in accordance with section 6.3.4 and paragraph 6.5.3.4.5 of the IGC Code in accordance with recognized standards such as ISO 6507-1.

Acceptance criteria: The hardness value should be to the satisfaction of the Administration.

2.3 **Cross-weld tensile test**: This test should be carried out in accordance with paragraph 6.5.3.4.1 of the IGC Code. Recognized standards such as ASTM E8/E8M may be applied.

Acceptance criteria: In accordance with paragraph 6.5.3.5.1 of the IGC Code. The presence of under-matched welds should be considered for the intended application in accordance with paragraph 4.18.1.3.1.2 of the IGC Code.

2.4 **Charpy impact test**: This test should be carried out in accordance with section 6.3.2 and paragraph 6.5.3.4.4 of the IGC Code.

Acceptance criteria: In accordance with paragraph 6.5.3.5.3 of the IGC Code.

2.5 **CTOD (Crack Tip Opening Displacement) test**: The test should be carried out in accordance with a recognized standard such as ASTM E1820 or ISO 15653. The notch introduced in the test should be positioned in the microstructure with the lowest fracture toughness.

Acceptance criteria: CTOD minimum value should be in accordance with the design specification for testing at room and cryogenic temperatures equal to the minimum design temperature of the material. A minimum of three successful tests should be performed at room and cryogenic temperatures. As guidance a minimum CTOD value of 0.2 mm is often required.

2.6 **Ductile fracture toughness test (J_{Ic})**: The test should be carried out in accordance with a recognized standard such as ASTM E1820, ASTM E2818, ISO 15653 or ISO 12135. The notch introduced in the test should be positioned in the microstructure with the lowest fracture toughness. The ductile fracture toughness test may be carried out as an alternative to the CTOD test in 2.5 at the discretion of the Administration.

Acceptance criteria: In accordance with the recognized standard. A minimum of three successful tests should be performed at room and cryogenic temperatures.

2.7 **Bending test**: The test should be carried out in accordance with section 6.3.3 of the IGC Code.

Acceptance criteria: No fracture should be acceptable after a 180^{o} bend as required for welded material in accordance with paragraph 6.5.3.4.3 and 6.5.3.5.2 of the IGC Code.

2.8 **Fatigue test**: The basis for documenting adequate fatigue performance (S-N curves) should be in accordance with paragraph 4.18.2.4.2 of the IGC Code. The extent of fatigue testing is based on comparison with recognized S-N curves for metallic materials (such as IIW or DNVGL-RP-C203). The fatigue tests should be based on a minimum of five test samples at each stress level. For a "one slope S-N curve" a minimum of three stress levels should be tested. Additional stress levels to be tested for "two slope S-N curves". As guidance, stress levels should be selected to achieve in the range of 10^5 to 10^8 cycles.

Acceptance criteria: The fatigue test results should be at least equal to, or better than, the reference SN curve.

2.9 **Corrosion test**: The type of corrosion tests to be applied will depend on the material, type of weld and the specific cargoes or fuels listed in the IGC or IGF Codes. The tests should include tests for general corrosion, intergranular corrosion and stress corrosion. The tests should be carried out in accordance with, ASTM A262, ASTM G31, ASTM G36, ASTM G58, ASTM G123 or other relevant recognized standards. In the absence of a relevant recognized standard for the specific cargo or fuel, the test procedures should align with the general principles of corrosion tests that follow the recognized standards listed herein.~~The type of corrosion tests to be applied will depend on the material and type of weld to be qualified. The tests should include tests for general corrosion, intergranular corrosion and stress corrosion. The tests should be carried out in accordance with relevant standards.~~

Acceptance criteria: In accordance with the relevant recognized standard approved by the Administration for the material's intended service. In the absence of a relevant recognized standard for the specific cargoes or fuels, the results should align with other recognized standards, and projected corrosion rates and test outcomes should be subject to the satisfaction of the Administration~~In accordance with the relevant standard approved by the Administration for the material's intended service~~.

2.10 **Corrosion test for ammonia compatibility**: The additional test should be carried out in accordance with the test requirements set out in appendix 2 to qualify for ammonia service.

Acceptance criteria: The test should be in accordance with the acceptance criteria set out in appendix 2.

APPENDIX 2

ADDITIONAL COMPATIBILITY TEST PROCEDURES FOR AMMONIA SERVICE

The test shall be carried out in accordance with a recognized standard such as ASTM B858. This standard is applicable to copper alloys and not specifically to high manganese austenitic steel. Consequently, the following additional non-standard test shall be performed:

1 Specimens should be prepared in accordance with standards ISO 7539-2 and ISO 16540. The specimens should be bent, prior to testing, using the four points bending test under constant strain. The total maximum strain of the sample should be equal to the yield strength of the material at atmospheric temperature. Strain gauges should be applied to measure the strain applied. In the case of welded specimens, strain gauges should be applied to each side of the welded joint. The sample should be constrained to maintain its form during testing. The details are described in Specimen preparation.

2 A total of thirty-six specimens (three welded and three base metal at each ammonia environment) should each be immersed in the following four ammonia environments for a period of 30 days:

.1 liquid phase ammonia environments, obtained by cooling of ammonia at slightly lower temperature than the boiling temperature of ammonia e.g. -33.5^{o}C and at atmospheric pressure with the following liquid ammonia compositions:

.1 0.1% weight of water and 2.5 ppm of oxygen; and

.2 2.5 ppm of oxygen;

.2 gas phase ammonia environments at ambient temperature (+25^{o}C) and atmospheric pressure with the following gas ammonia compositions:

.1 pure ammonia (≥99.99%); and

.2 0.9% volume of oxygen and 99.1%volume of ammonia;

.3 gas phase ammonia environments at -20^{0}C and atmospheric pressure with the following gas ammonia compositions:

.1 pure ammonia (≥99.99%); and

.2 0.9% volume of oxygen and 99.1%volume of ammonia.

Stress corrosion cracking tests shall be performed in agreement with requirements of standards ISO 7539 and ISO 16540.

3 Test report shall provide all procedures, set up data, examinations, information about the environment, in agreement with standard ISO 16540 and include:

.1 the orientation, types, and dimensions of specimens;

.2 description of materials:

.1 chemistry and tensile properties of base plate;

.2 chemistry and tensile properties of welding consumables;

.3 type of welding, hardness of the weld metal and heat affected zones;

.3 four-point bending test set-up data;

.4 target stress and applied deflection;

.5 strain measurement procedures;

.6 loading procedures; and

.7 test environment (temperature, water and oxygen content, and pH).

Test acceptance criteria

After immersion, all specimens should be examined for stress corrosion cracking under an optical microscope with proper magnification. The location and the number of cracks should be specified, and a fluorescent penetration test performed to confirm the results as necessary. For welded joints, the location of cracks should be described as located in the base metal, weldment or HAZ. If no superficial crack is observed, a longitudinal cut should be done at two different locations and a cross section examination with proper magnification should be performed. The presence of any corrosion pitting and the maximum depth should be reported. The results should be approved by the Administration.

Loading jig

The loading jig made of corrosion resistant alloys with spacing between outer rollers of 85 mm shown in figure 1 is to be used to apply a constant deflection to the specimen. The specimen is electrically isolated from the ceramic rollers in order to avoid undesirable galvanic corrosion.

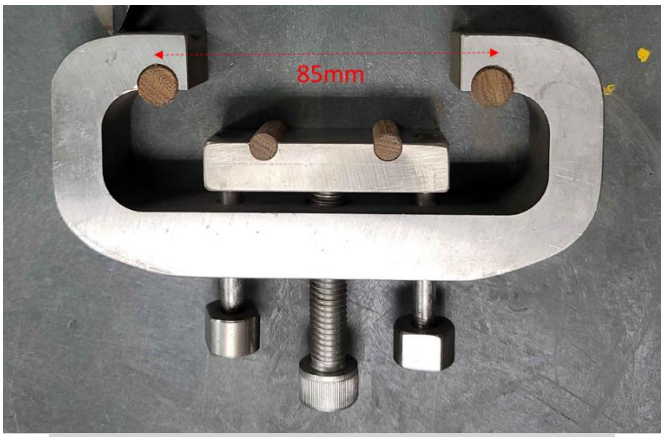

Figure 1: Four-point bend loading jig design

Specimen preparation

The specimens are machined from a 40 mm thick hot rolled plate and are not subjected to post-weld heat treatment. The outer radius of the specimen subject to bending is the original surface of the hot rolled plate. They are bent prior to testing and surface would be exposed to ammonia in a tank is not machined.

Four-point bend specimens are flat strips of uniform rectangular cross section and uniform thickness except in the case of testing welded specimens with one face in the as-welded condition as shown in figure 2. The original surface from a 40 mm hot rolled plate (cap bead in case of welded specimen) is the one to be observed. For weldments, the weld bead to be tested is the weld cap.

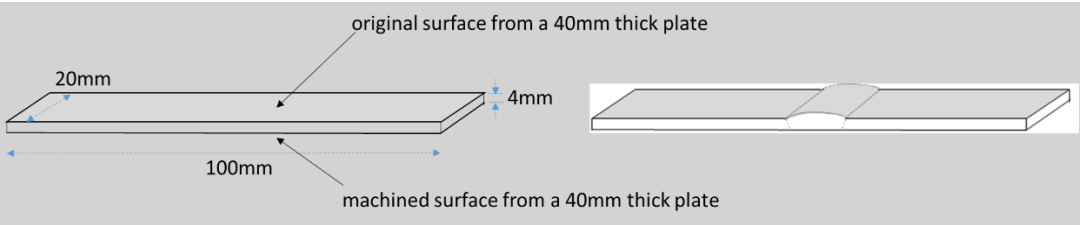

Figure 2: Four-point bend specimens (parent specimen and as-welded specimen)

Strain gauging

Dial gauge will be attached for measurement of deflection at the centre of the face in tension. The loading of the specimen is such that it reaches to the required yield strength level and then the specimen is constrained to maintain its form during testing. The amount of deflection, y, is set as the formula below complying with ISO 16540.

$$Y = \frac{(3H^2 - 4A^2)\sigma}{12Et}$$

where σ is the required stress (yield strength in this case), E is the modulus of elasticity, t is the specimen thickness, A is the distance between the inner and outer supports, and H is the distance between the outer supports. Prior to four-point bending, uniaxial tensile test of a 40 mm thick plate will be performed to determine the yield strength to be applied for the calculation of the amount of deflection required. For the simplicity of the welded specimen testing, the same amount of the deflection as for the parent plate is to be set out.

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ANNEX 6

DRAFT MSC CIRCULAR

INTERIM GUIDELINES FOR USE OF LPG CARGO AS FUEL

1 The Maritime Safety Committee (MSC), at its [108th session (15 to 24 May 2024)], having considered a proposal made by the Sub-Committee on Carriage of Cargoes and Containers at its ninth session (20 to 29 September 2023), approved the *Interim guidelines for use of LPG cargo as fuel*, as set out in the annex, with a view to providing guidance for safe use of LPG cargo as fuel in relation to the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code), as amended.

2 The Committee agreed to keep the Interim Guidelines under review and to amend them in view of the experience gained with their application and/or as and when the circumstances so warrant.

3 Member States are invited to bring the annexed Interim Guidelines to the attention of all parties concerned.

ANNEX

INTERIM GUIDELINES FOR USE OF LPG CARGO AS FUEL

1 PREAMBLE

1.1 Chapter 16 of IGC Code provides specific provisions for use of liquefied natural gas (LNG) cargo as fuel. For other cargo gases including LPG, section 16.9 (Alternative fuels and technologies) of the IGC Code requires that the same level of safety as natural gas is ensured.

1.2 For the purpose of section 16.9 of the IGC Code, the safety level of the design for each ship should be demonstrated as specified in SOLAS regulation II-1/55 for use of LPG cargo as fuel.

1.3 The purpose of these Interim Guidelines is to provide unified specific guidance for ships using liquefied petroleum gas (LPG) cargo as fuel until such provisions are incorporated in the IGC Code, with a view to responding to the industry's urgent need for such guidance.

1.4 The provisions in the Interim Guidelines take into account the goal-based approach (MSC.1/Circ.1394/Rev.2), as they reference existing provisions of the IGC Code, which is a goal-based instrument. Therefore, goals and functional requirements were specified forming the basis for the design, construction and operation.

2 GUIDANCE

2.1 Application

2.1.1 These Interim Guidelines apply to gas carriers as defined in SOLAS regulation VII/11.2 complying with the requirements of the IGC Code using LPG cargoes as fuel, as a supplement to the existing provisions of chapter 16 of the IGC Code.

2.1.2 LPG as provided in chapter 16 of the IGC Code, is composed of propane (C_3H_8), butane (C_4H_{10}), or a propane-butane mixture as listed in chapter 19 of the IGC Code and may contain small amounts of other hydrocarbons and impurities. It can be in either a liquefied or gaseous state. LPG in the liquefied state is referred to as LPG liquid, and LPG in the gaseous state is referred to as LPG vapour.

2.1.3 A gas fuel consumer is any unit within the ship using cargo vapour or liquid as a fuel.

2.2 Goal

2.2.1 The goal of these Interim Guidelines is to ensure safe and reliable operation of fuel supply systems and consumers for use of LPG cargo as fuel.

2.3 Functional provisions

2.3.1 Single failure should not cause leakage of fuel into the space where fuel consumers are installed.

2.3.2 Effectiveness of the ventilation and detection for LPG leakage should be ensured taking into account characteristics of LPG.

2.3.3 Since LPG has different properties depending on the composition ratio of propane and butane, the composition ratio of fuel should be suitable for normal operation of the fuel consumer.

2.3.4 Fuel supply systems should be designed to prevent fuel from unintended phase changes in processing of fuel supply to consumers considering vapour pressure at the working temperature, as follows:

.1 where fuel is supplied in the gaseous state, measures should be taken so that the temperature of fuel is not lowered to the dew point at the working pressure; and

.2 where fuel is supplied in the liquid state, measures should be taken so that the pressure of fuel is not lowered to the vapour pressure at the working temperature.

2.3.5 Vent, purging and bleed lines of fuel supply systems should be designed to prevent LPG liquid from being released to the atmosphere.

2.4 Supplementary guidance to the provisions of chapter 16[1]

2.4.1 In accordance with the principles of para. 16.9 of the IGC Code, LPG cargoes may be utilized in machinery spaces of category A. In these spaces, it may be utilized only in systems such as boilers, inert gas generators, internal combustion engines, gas combustion units and gas turbines.

2.4.2 The LPG fuel supply systems and LPG fuel consumers should be designed for operation with the possible range of composition of the intended fuel. Information about the range of acceptable compositions should be provided on board.

2.4.3 The fuel supply system should comply with the requirements of paragraphs 16.4.1, 16.4.2, 16.4.3 and 16.5 of the IGC Code.

2.4.4 LPG fuel consumers should exhibit no external visible flame and should maintain the uptake exhaust temperature sufficiently below the auto-ignition temperature of the fuel. In a mixture of gases, the component with the lowest auto-ignition temperature should be the appropriate reference.

2.4.5 LPG vapour or liquid may be used as fuel in systems referenced in paragraph 2.4.1.

2.4.6 Provision should be made for inerting and venting to a safe location the gas fuel piping systems located in the machinery space. For permanent installations, the inert gas piping connected to the fuel piping should be fitted with double block and bleed valves. In addition, a non-return valve should be installed in the inert gas piping upstream of the double block and bleed valves. For liquid fuel supply systems, consideration should be given to draining the piping without release of liquid to the atmosphere.

2.4.7 The supply and return piping of each gas consumer unit should be provided with fuel isolation by automatic double block and bleed, vented to a safe location, under both normal and emergency operation. The automatic valves should be arranged to fail to the closed position on loss of actuating power. In a space containing multiple consumers, the shutdown of one should not affect the gas fuel supply to the others. For liquid fuel supply systems, the piping should be drained without release of liquid to the atmosphere.

[1] See sections 16.1 to 16.6 of chapter 16 of the IGC Code based on which the supplementary guidance has been provided for use of LPG cargo as fuel.

2.4.8 Gas nozzles and the burner control system should be configured such that gas fuel can only be ignited by an established oil fuel flame, unless the boiler and combustion equipment is designed and approved by the Administration or recognized organization acting on their behalf, to ignite on gas fuel.

2.5 Additional provisions

2.5.1 Risk assessment

2.5.1.1 A risk assessment should be conducted of the LPG fuel arrangements to document an equivalent level of safety to utilizing LNG as fuel. Consideration should be given to the hazards associated with the arrangement, operation and maintenance of the fuel system, considering reasonably foreseeable failures.

2.5.1.2 The risk assessment should address the consequences of fuel leakage, considering the properties of LPG gas and its accumulation or escape into another space.

2.5.2 Arrangements of spaces containing gas fuel consumers

2.5.2.1 A single failure of fuel systems in the machinery space should not lead to a gas release in the machinery space. Fuel piping should be of double wall design or ducted and the outer boundary should be continuous in the space. Non-continuous double barriers should not be used under the circumstances described in paragraph 16.4.6.2 of the IGC Code.

2.5.2.2 The air inlet of the annular space should not be in the machinery space. In addition, the air inlet of the annular space should be in a location which would be safe in the absence of the air inlet. Consideration should be given to the risk of liquid carry-over resulting from a liquid leak.

2.5.3 Fuel supply

2.5.3.1 Where fuel supply systems supply LPG liquid, vent and purging should lead to a fuel tank, gas-liquid separator or similar device. Heating of the gas-liquid separator may be required for ships operating in cold areas.

2.5.3.2 Fuel supply systems referenced in paragraph 2.5.3.1 and vent masts should be fitted with an inert gas purging interface and should include a means for preventing condensation of vapour in the system.

2.5.3.3 In application of paragraph 16.4.3.2 of the IGC Code, the ventilation inlets for the double wall piping and ducts should be in a non-hazardous area, away from ignition sources. Ventilation outlets for the double wall piping and ducts should be in the cargo area.

2.5.4 Fuel plant ventilation and gas detection

2.5.4.1 In addition to the requirements of paragraphs 16.3.1 and 16.5.1 of the IGC Code, special consideration should be given to the density and lower explosion limit (LEL) of LPG vapour. Ventilation capacity, including ventilation inlet and outlet location, should be supported by numerical calculations, such as a computational fluid dynamics (CFD) analysis. Notwithstanding, for spaces within the cargo area, on the open deck and containing LPG fuel conditioning equipment, the requirements of paragraph 12.1.3 of the IGC Code should apply.

2.5.4.2 In addition to the requirements of paragraph 13.6.12 of the Code, gas detection heads should be fitted in spaces where LPG vapour may accumulate particularly where air circulation is reduced or near the bottom of the space. The suitability of their location should be supported by numerical calculations, such as a CFD analysis or physical smoke test.

2.5.5 Combustion equipment

2.5.5.1 Gas fuel consumer exhaust gas temperature should be continuously monitored.

2.5.5.2 Gas turbines should be fitted with a gas-tight enclosure unless fuel supply piping meets the requirements of paragraph 16.4.3 of the IGC Code. The consequences of gas leakage should be evaluated based on the risk assessment in paragraph 2.5.1.

APPENDIX[2]

REFERENCES TO THE IGC CODE

Paragraph No. of the Interim Guidelines	IGC Code reference
2.4.1	16.1
2.4.2	16.1.2 (new draft paragraph)
2.4.3	16.2.1
2.4.4	16.2.2
2.4.5	16.2.3 (new draft paragraph)
2.4.6	16.4.1.2
2.4.7	16.4.5
2.4.8	16.6.2.4

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[2] The appendix has been provided in English only, for information purposes to keep the references for future use, and will be removed when final MSC circular has been circulated, following the expected approval by the Committee.

ANNEX 7

DRAFT MSC RESOLUTION

REVISED INTERIM RECOMMENDATIONS FOR CARRIAGE OF LIQUEFIED HYDROGEN IN BULK

THE MARITIME SAFETY COMMITTEE,

RECALLING Article 28(b) of the Convention on the International Maritime Organization concerning the functions of the Committee,

NOTING that the International Convention for the Safety of Life at Sea ("the Convention"), 1974 and the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk ("the IGC Code") currently do not specifically provide requirements for carriage of liquefied hydrogen in bulk by sea,

NOTING ALSO that paragraph 5 of Preamble of the IGC Code states that requirements for new products and their conditions of carriage will be circulated as recommendations, on an interim basis, prior to the entry into force of the appropriate amendments.

RECOGNIZING a need for the development of the Revised interim recommendations for carriage of liquefied hydrogen in bulk,

ACKNOWLEDGING that, in the interim, there is an urgent need to provide recommendations to the Administrations on safe carriage of liquefied hydrogen in bulk,

ACKNOWLEDGING ALSO that the Revised interim recommendations are intended to facilitate establishment of a tripartite agreement for a pilot ship, which will be developed for the research and demonstration of safe long-distance overseas carriage of liquefied hydrogen in bulk,

HAVING CONSIDERED the Revised interim recommendations prepared by the Sub-Committee on Carriage of Cargoes and Containers, at its ninth session,

1 ADOPTS the Revised interim recommendations for carriage of liquefied hydrogen in bulk, the text of which is set out in the annex to the present resolution;

2 INVITES Member States to apply the Revised interim recommendations to the pilot ship carrying liquefied hydrogen in bulk taking the explanatory notes into consideration;

3 AGREES to acquire information on safe carriage of liquefied hydrogen in bulk prior to amendment to the IGC Code for the inclusion of liquefied hydrogen;

4 ALSO AGREES that these Revised interim recommendations may need to be reviewed if they are to be applied to ships other than the pilot ship;

5 URGES Member States and the industry to submit information, observations, comments and recommendations based on the practical experience gained through the application of the Revised interim recommendations and submit relevant safety analysis on ships carrying liquefied hydrogen in bulk;

6 DETERMINES that the present resolution revokes resolution MSC.420(97).

ANNEX

REVISED INTERIM RECOMMENDATIONS FOR CARRIAGE OF LIQUEFIED HYDROGEN IN BULK

1 INTRODUCTION

1.1 For the carriage of liquefied gases in bulk by ships, the ships should comply with the relevant requirements in the IGC Code, as amended ~~by resolution MSC.370(93)~~ ("the Code"). The scope of the Code provided in paragraph 1.1.1 is:

> "The Code applies to ships regardless of their size, including those of less than 500 gross tonnage, engaged in the carriage of liquefied gases having a vapour pressure exceeding 0.28 MPa absolute at a temperature of 37.8°C, and other products, as shown in chapter 19, when carried in bulk".

1.2 A ship carrying liquefied hydrogen in bulk (hereinafter called "liquefied hydrogen carrier") should comply with the Code.

1.3 The Code requires that a gas carrier should comply with the minimum requirements for the cargo listed in chapter 19. However, the requirements for liquefied hydrogen are not specified in the Code.

1.4 This annex provides the Revised interim recommendations, as referred to in paragraph 5 of the preamble of the Code, for the carriage of liquefied hydrogen in bulk, which are intended to provide the basis for the future minimum requirements for the carriage of this cargo. The Revised interim recommendations are intended to facilitate the establishment of a tripartite agreement among the relevant Administrations for the carriage of liquefied hydrogen in bulk. However, they are not intended to prohibit the adoption of designs and arrangements other than those specified in the Code or in these recommendations, at the discretion of the Administrations.

1.5 These recommendations have been developed under the assumption that a liquefied hydrogen carrier does not carry liquefied gases other than liquefied hydrogen. These recommendations, therefore, are not applicable to liquefied hydrogen carriers carrying gases other than liquefied hydrogen.

1.6 In the Code, reference is made to paragraph 5 of the Preamble; paragraph 1.1.6.1; and Note No.8 on completion of certificate in "model form of international certificate of fitness for the carriage of liquefied gases in bulk" in appendix 2 to the Code.

1.7 These Revised interim recommendations consist of the following parts. Part A is applicable to ships with any type of cargo containment system. Part B and subsequent part(s) prescribe additional special requirements for cargo containment systems of specific types.

Part A: General (applicable to ships with any type of cargo containment system);

Part B: Cargo containment systems of independent cargo tanks using vacuum insulation; and

Part C: Cargo containment systems of independent cargo tanks using insulation materials and hydrogen gas in the inner insulation spaces.

1.8 Part A of this document was developed based on the design of parts B and C. If subsequent part(s) are added, the special requirements prescribed in part A may be reviewed.

PART A
GENERAL
(APPLICABLE TO SHIPS WITH ANY TYPE OF CARGO CONTAINMENT SYSTEM)

2.1 Definition

2.1.1 The following definition should apply for the purpose of these Revised interim recommendations.

Permeation is flow of a fluid through another material by diffusion without a defect or opening of the latter.[111]

2.2 Requirements for carriage of liquefied hydrogen in bulk

2.2.1 The requirements for the carriage of liquefied hydrogen in bulk have been developed based on the results of a comparison study of similar cargoes listed in chapter 19 of the Code, e.g. liquefied natural gas.

2.2.2 Chapter 19 of the Code governs the application of general requirements for respective cargoes. Selections of the general requirements for respective cargoes are expressed in columns 'c' to 'g'. In addition to general requirements, special requirements may apply to specific cargoes depending on the properties/hazards of the cargoes.

2.2.3 Tables 1 and 2 specify the proposed selection of the general requirements and the special requirements, respectively, for liquefied hydrogen. In addition to table 2, special requirements for cargo containment systems of specific types are prescribed in part B or subsequent part(s).

Table 1: Requirements for carriage of liquefied hydrogen in bulk

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*
Product name		***Ship type***	***Independent tank type C required***	***Control of vapour space within cargo***	***Vapour detection***	***Gauging***		***Special requirements***
Hydrogen		2G	-	-	F	C		See table 2 and, either corresponding table 4 or table 5, as appropriate for the type of cargo containment systems

[1] See paragraph 3.79 of ISO/TR 15916:2015.

Table 2: Special requirements for carriage of liquefied hydrogen in bulk

No.	Special requirement	Related hazard
A-1	Requirements for materials whose design temperature is lower than -165°C should be agreed with the Administration, paying attention to appropriate standards. Where minimum design temperature is lower than -196°C, property testing for insulation materials should be carried out with the appropriate medium, over a range of temperatures expected in service.	Low temperature (see 4.2.1)
A-2	Materials of construction and ancillary equipment such as insulation should be resistant to the effects of high oxygen concentrations caused by condensation and enrichment at the low temperatures attained in parts of the cargo system (refer to the requirement for nitrogen). This special requirement is applied to all locations where contact with condensed oxygen is anticipated under normal conditions and foreseeable single failure scenarios.	Low temperature (see 4.2.2)
A-3	For cargo pipes containing liquid hydrogen and cold hydrogen vapour, measures should be taken to prevent the exposed surfaces from reaching -183°C. For places where preventive measures against low temperature are not sufficiently effective, such as cargo manifolds, other appropriate measures such as ventilation which avoids the formation of highly enriched oxygen and the installation of trays recovering liquid air may be permitted in lieu of the preventive measures. Insulation on liquid hydrogen piping systems exposing to air should be of non-combustible material and should be designed to have a seal in the outer covering to prevent the condensation of air and subsequent oxygen enrichment within the insulation.	Low temperature (see 4.2.2)
A-4	Appropriate means, e.g. filtering, should be provided in cargo piping systems to remove impure substances condensed at low temperature.	Low temperature (see 4.2.3)
A-5	Pressure relief systems should be suitably designed and constructed to prevent blockage due to formation of water or ice.	Low temperature (see 4.2.4)
A-6	At places where contact with hydrogen is anticipated, suitable materials should be used to prevent any structural deterioration owing to hydrogen embrittlement and degradation of strength and fatigue properties due to continual exposure to hydrogen, as necessary.	Hydrogen embrittlement (see 4.3)
~~7~~	~~All welded joints of the shells of cargo tanks should be of the in-plane butt weld full penetration type. For dome-to-shell connections only, tee welds of the full penetration type may be used depending on the results of the tests carried out at the approval of the welding procedure.~~	~~Permeability (see 4.4.1)~~
A-7 ~~8~~	Double tube structures ensuring no leakage, or fixed hydrogen detectors being capable of detecting a hydrogen leak, should be provided for confined places where leakage of hydrogen may occur, such as cargo valves, flanges and seals.	Susceptibility to leakage ~~Permeability~~ (see 4.4.2)
A-8 ~~9~~	Helium or a mixture of 5% hydrogen and 95% nitrogen should be used as the tightness test medium for cargo tank and cargo piping.	Susceptibility to leakage ~~Permeability~~ (see 4.4.3)

No.	Special requirement	Related hazard
A-9 ~~10~~	The amount of carbon dioxide carried for a carbon dioxide fire-extinguishing system should be sufficient to provide a quantity of free gas equal to 75% or more of the gross volume of the cargo compressor and pump rooms in all cases.	Fire by Hydrogen (see 4.7.3) Wide range of flammability limits (see 4.10)
A-10 ~~11~~	When deterioration of insulation capability by single damage is possible, appropriate safety measures should be adopted taking into account the deterioration.	High pressure (see 4.8)
~~12~~	~~When vacuum insulation is used for a cargo containment system, the insulation performance should be evaluated to the satisfaction of the Administration based on experiments, as necessary.~~	~~General (see 4.1)~~
A-11 ~~13~~	Appropriate measures should be provided to prevent vents becoming blocked by accumulations of ice formed from moisture in the air.	General (see 4.1)
A-12 ~~14~~	Due consideration should be given to means for handling boil-off gas.	High pressure (see 4.8)
A-13 ~~15~~	Due consideration should be given to static electricity associated with rotating or reciprocating machinery including the installation of conductive machinery belts and precautionary measures incorporated in operating and maintenance procedures, in addition to the bonding of tanks, piping and equipment required by paragraph 5.7.4 of the Code. Anti-static clothing and footwear, and a portable hydrogen detector should be provided for each crew member working in the cargo area.	Static electricity (see 4.9.2)
A-14 ~~16~~	~~An~~ The cargo operation manuals ~~for a liquefied hydrogen carrier~~ required in paragraph 18.2 of the Code should include limitations of various operations in relation to environmental conditions.	Wide range of flammability limits (see 4.10)
A-15 ~~17~~	An appropriate procedure should be established for warm-up, inert gas purge, gas-free, hydrogen purge and pre-cooling. The procedure should include: .1 selection of inert gas in relation to temperature limit; .2 measurement of gas concentration; .3 measurement of temperature; .4 rates of supply of gases; .5 conditions for commencement, suspension, resuming and termination of each operation; .6 treatment of return gases; and .7 discharge of gases.	Prevention of dangerous purging operation (see 4.11)
A-16 ~~18~~	Only almost pure para-hydrogen (i.e. more than 95%) should be loaded in order to avoid excessive heating by ortho- to para-hydrogen conversion.	General (see 4.1)
A-17 ~~19~~	Fire detectors for detecting hydrogen fire should be selected ~~after due deliberation~~, taking into account the features of hydrogen fire, to the satisfaction of the Administration.	Features of hydrogen fire and fire hazard (see 4.7.4)
A-18 ~~20~~	At the design stage, dispersion of hydrogen from vent outlets should be analysed in order to minimize risk of ingress of flammable gas into accommodation spaces, service spaces, machinery spaces and control stations. Extension of hazardous areas should be considered based on the results of the analysis.	Low density and high diffusivity (see 4.5)

No.	Special requirement	Related hazard
A-1921	Due consideration should be given to appropriate safety measures to prevent formation of explosive mixture in the case of a leakage and permeation of hydrogen, including: .1 installation of hydrogen detectors in order to detect a possible ground-level travel of low temperature hydrogen gas, and at high points in spaces where warm hydrogen gas can be trapped; and .2 application of "best practice" for land-based liquid hydrogen storage taking into account appropriate guidance such as "Cryogenics Safety Manual – Fourth Edition (1998)"[8].	General (see 4.1)
A-2022	In the case that fusible elements are used as a means of fire detection required by paragraph 18.10.3.2 of the Code, flame detectors suitable for hydrogen flames should be provided in addition at the same locations. Appropriate means should be adopted to prevent the activation of ESD system owing to false alarm of flame detectors, e.g. avoiding activation of ESD system by single sensor (voting method).	Fire hazard (see 4.7.4)
A-2123	Consideration should be given to enhance the ventilation capacity of the enclosed spaces subject to liquefied hydrogen leakage and permeation, taking into account the latent heat of vaporization, specific heat and the volume of hydrogen gas in relation to temperature and heat capacity of adjacent spaces.	Low density and high diffusivity (see 4.5)
A-2224	Liquid and gas hydrogen pipes should not pass through enclosed spaces in addition to those referred to in paragraph 5.2.2.1.2 of the Code, unless: .1.1 the spaces are equipped with gas detection systems which activate the alarm at not more than 2030% LFL and shut down the isolation valves, as appropriate, at not more than 4060% LFL (see sections 16.4.2 and 16.4.8 of the Code); and .1.2 the spaces are adequately ventilated; or .2 the spaces are maintained in an inert condition. ~~This requirement is not applicable to spaces constituting a part of a cargo containment system using vacuum insulation where the degree of vacuum is monitored.~~	Susceptibility to leakage ~~Permeability~~ (see 4.4)
A-2325	A risk assessment should be conducted to ensure that risks arising from liquefied hydrogen cargo affecting persons on board, the environment, the structural strength or the integrity of the ship are addressed. Consideration should be given to the hazards associated with properties of liquefied hydrogen and hydrogen gas, physical layout, operation and maintenance, following any reasonably foreseeable failure. For the risk assessment, appropriate methods, e.g. HAZID, HAZOP, FMEA/FMECA, what-if analysis, etc., should be adopted taking into account IEC/ISO 31010:2019~~2009~~ "Risk management – Risk assessment techniques"[7] and SAE ARP 5580-2001 "Recommended failure modes and effects analysis (FMEA) practices for non-automobile applications"[9].	General (see 4.1)

No.	Special requirement	Related hazard
A-24 ~~26~~	Relief valve sizing should be undertaken for the most onerous scenario. ~~Whether This~~ The evaluation should include the fire scenario ~~is brought into existence due to fire or by loss of vacuum from the overall insulation system should be assessed~~ and should consider the resulting magnitude of the heat flux on the cargo containment system ~~in each case~~.	High pressure hazard (see 4.8)
A-25 ~~27~~	A filling limit exceeding 98% at reference temperature should not be permitted.	High pressure hazard (see 4.8)
A-26 ~~28~~	Bolted flange connections of hydrogen piping should be avoided where welded connections are feasible.	Susceptibility to leakage ~~Permeability~~ (see 4.4.2)
A-27 ~~29~~	Due consideration should be given to the invisible nature of hydrogen fire from the viewpoint of safety of ships and especially personnel in case of fire.	Fire hazard (see 4.7.1)

3 EXPLANATION ON GENERAL REQUIREMENTS

3.1 Properties of liquefied hydrogen

The application of general requirements in the Code for liquefied hydrogen has been considered based on a comparison study on the physical properties of liquefied hydrogen and LNG. LNG and liquefied hydrogen are cryogenic liquids, non-toxic, and generate flammable high- pressure gas. For reference, table 3 shows the comparison of physical properties of hydrogen and methane, the major component of LNG.

Table 3: Comparison of physical properties of Hydrogen and Methane

	Hydrogen	Methane	References
Boiling temperature (K)*	20.3	111.6	ISO[1)], Annex A, Table A.3
Liquid density (kg/m^3)*	70.8	422.5	ISO[1)], Annex A, Table A.3
Gas density (kg/m^3)** (Air: 1.198)	0.084	0.668	NIST RefProp[10)]
Viscosity (g/cm•s x 10^{-6}) Gas Liquid	 8.8 13.49	 10.91 116.79	 NIST RefProp[10)] NIST RefProp[10)]
Flame temperature in air (°C)	2396	2230	Calculated using Cantera and GRI 3.0 mechanism
Maximum burning velocity (m/s)	3.15	0.385	Calculated using Cantera and GRI 3.0 mechanism
Heat of vapourization (J/g)*	454.6 ~~448.7~~	510.4	ISO[1)], Annex A, Table A.3
Lower flammability limit (% vol. fraction)***	4~~.0~~	5.3	ISO[1)], Annex B, Table B.2
Upper flammability limit (% vol. fraction)***	77~~75.0~~	17.0	ISO[1)], Annex B, Table B.2
~~Lower detonation limit (%vol. fraction)***~~	~~18.3~~	~~6.3~~	~~ISO[1)], Annex B, Table B.2~~
~~Upper detonation limit (% vol. fraction) ***~~	~~59.0~~	~~13.5~~	~~ISO[1)], Annex B, Table B.2~~
Minimum ignition energy (mJ)***	0.017	0.274	ISO[1)], Annex B, Table B.2
Auto-ignition temperature. (~~°C~~K)***	858~~585~~	810~~537~~	ISO[1)], Annex B, Table B.2

	Hydrogen	Methane	References
Toxicity	Non	Non	Orange book[5)]
Temperature at critical point (K)	33.19****	190.55	Hydrogen: ISO[1)], Annex A, Table A.1 Methane: The Japan Society of Mechanical Engineers, Data Book, Thermophysical Properties of Fluids (1983)
Pressure at critical point (kPaA)	1315~~1297~~****	4595	Hydrogen: ISO[1)], Annex A, Table A.1 Methane: The Japan Society of Mechanical Engineers, Data Book, Thermophysical Properties of Fluids (1983)

Remarks:
* At their normal boiling points for comparison purpose.
** At normal temperature and pressure.
*** Ignition and combustion properties for air mixtures at 25°C and 101.3 kPaA.
**** Normal Hydrogen.

3.2 Explanation on respective requirements

3.2.1 Ship type (column 'c')

As the hazard associated with hydrogen cargo is flammability but not toxicity, the ship type is considered 2G.

~~3.2.1.1 As a result of the studies, the following points were noted in relation to ship type allocated in the Code:~~

~~.1 type 1G is allocated only to dangerous goods of class 2.3[12*] in the International Maritime Dangerous Goods Code, but not to class 2.2 and class 2.1;~~

~~.2 type 2G and type 2PG are allocated mainly to non-toxic flammable gases of class 2.1; and~~

~~.3 type 3G is allocated only to non-flammable and non-toxic gases of class 2.2.~~

~~3.2.1.2 "Type 2PG" is not applicable to liquefied hydrogen for the reason that the design temperature is lower than -55°C. Taking into account that liquefied hydrogen is a class 2.1 dangerous good, it is appropriate to allocate "type 2G" to liquefied hydrogen.~~

3.2.2 Independent tank type C required (column 'd')

Independent tank type C is allocated only to dangerous goods of class 2.3 whose vapour density is heavier than air. Independent tank type C is considered not to be required for liquefied hydrogen.

~~[*] Toxic and flammable gases are classified as class 2.3 with subsidiary class 2.1.~~

3.2.3 Control of vapour space within cargo tank (column 'e')

Special environment controls such as drying and inerting are generally required for liquid chemical products in consideration of the reactivity of cargo vapour and air. As is the case for LNG, it is considered not to be necessary to apply such requirements for liquefied hydrogen.

3.2.4 Vapour detection (column 'f')

Because hydrogen is flammable and non-toxic, it is appropriate to require Flammable (F) as vapour detection for liquefied hydrogen.

3.2.5 Gauging (column 'g')

On the grounds that Closed (C) gauging is required, in principle, for flammable or toxic cargoes, such as methane, it is considered to be appropriate to require Closed (C) gauging for hydrogen, taking into account that hydrogen has high ignitability and a wide flammable range in air and that closed gauging is effective to prevent leakage of gases into air.

4 SPECIAL REQUIREMENTS AGAINST HAZARDS OF LIQUEFIED HYDROGEN

4.1 Hazards of liquefied hydrogen to be considered

4.1.1 The hazards related to liquefied hydrogen are low ignition energy, a wide range of flammability limits, low visibility of flames in case of fire, high flame velocity which may lead to the detonation with shockwave, low temperature and liquefaction/solidification of inert gas and constituents of air which may result in an oxygen-enriched atmosphere, high ~~permeability~~ permeation, low viscosity and hydrogen embrittlement including weld metals. Where vacuum insulation is adopted, due consideration should be given to the possibility of untimely deterioration of insulation properties at the envisaged carriage temperatures of liquid hydrogen. The vacuum insulation evaluation should be specified for the normal range or upper limit of cold vacuum pressure (CVP), and loss of vacuum should be defined with respect to this value. Accordingly, effect of vacuum pressure should be taken into account at the time of design and testing of ~~cargo containment systems and~~ piping with vacuum insulation. Supporting structure and adjacent hull structure should be designed taking into account the cooling owing to loss of vacuum insulation.

4.1.2 Hydrogen is essentially a mixture of ortho- and para-hydrogen, with an equilibrium concentration of 75% ortho-hydrogen and 25% para-hydrogen at ambient temperature. When liquefied at 20K, there is a slow but continuous transformation of ortho-hydrogen to para-hydrogen. The exothermic conversion of the nuclear spin isomers of hydrogen (ortho- to para-hydrogen) may take place and the effect of the conversion may have an impact on the cooling capacity and relief valve capacity of the vessel's equipment.

~~4.1.3 For consideration on the special requirements for liquefied hydrogen carriers, bibliographic studies were conducted using the references at the end of this document, in particular, ISO/TR 15916, "High Pressure Gas Safety Act"[1] (Japanese law), "Safety standard for hydrogen and hydrogen system" by AIAA[2] and NFPA 2 "Hydrogen Technologies Code"[6]. The majority of special requirements for liquefied hydrogen carriers are provided based on ISO/TR 15916. This standard refers to liquefied hydrogen tank storage facilities on shore, tank trucks and so on, and includes basic viewpoints when discussing the properties of liquefied hydrogen.~~

4.1.3~~4~~ Trace amounts of air will condense or solidify in an environment with liquid hydrogen possibly resulting in an unstable and explosive mixture. Precautions should be taken to assure that the possibility of condensed air is accounted within properly secured hazard areas.

4.2 Low temperature hazard

4.2.1 Selection of appropriate material

4.2.1.1 Tables 6.3 and 6.4 in the Code prescribe material selection for piping or cargo tanks whose design temperature is -165°C or higher. According to Note 2 of table 6.3 and Note 3 of table 6.4 of the Code, the requirements for materials whose design temperatures are lower than -165°C should be specially agreed with the Administration. In this regard, the publication by AIAA[2)] introduces some appropriate materials corresponding to the design temperature and the Administration should take into account such references for the material selection.

4.2.1.2 Although paragraph 4.19.3 in the Code requires testing of materials used for thermal insulation for various properties adequate for the intended service temperature, the minimum test temperature is -196°C. The requirements in the Code do not refer to the normal boiling point of hydrogen, being -253°C. In case of carriage of liquefied hydrogen, special requirements should be provided to consider the lower design temperature.

4.2.2 Measures for condensed air

4.2.2.1 In the case of nitrogen whose normal boiling point is -196°C, for which air condensation and oxygen enrichment are concerns, the following special requirement has already been included in paragraph 17.17 in the Code:

> "Material of construction and ancillary equipment such as insulation shall be resistant to the effect of high oxygen concentrations caused by condensation and enrichment at the low temperatures attained in parts of the cargo system. Due consideration shall be given to ventilation in such areas where condensation might occur to avoid the stratification of oxygen-enriched atmosphere."

A similar special requirement is applicable to hydrogen.

4.2.2.2 A vent may be blocked by accumulation of ice formed from moisture in the air, which may result in excessive pressure leading to rupture of the vent and relevant piping (see paragraph 4.2.4).

4.2.3 Removal of impure substances condensed

The removal of impure substances, such as those contained in condensate in pipes, should be separately considered. Installation of filters can be an appropriate measure and should be stipulated as a special requirement.

4.2.4 Prevention of blockage due to formation of water or ice

Pressure relief systems may become blocked due to formation of water or ice, depending on the temperature and humidity of air, resulting from the low temperature of the cargo and its vapour (see paragraph 4.2.2). Appropriate means should be provided to prevent such phenomena.

4.3 Hydrogen embrittlement

4.3.1 Selection of appropriate materials should be required to prevent failures owing to hydrogen embrittlement. The publication by AIAA[2)] introduces some appropriate materials resistant to hydrogen embrittlement, and concludes that aluminium is the material least affected.

4.3.2 International or national standards should be followed for the selection of materials for the design of liquefied and gaseous hydrogen installations in a marine environment.

4.4 ~~Permeability~~ Susceptibility to leakage

~~4.4.1 Prevention of leakage from cargo tanks~~

~~To mitigate leakage of hydrogen, it is deemed appropriate to require "butt weld full penetration" type welds, regardless of tank types, taking into account the high permeability of hydrogen. Furthermore, dome-to-shell connections welds and nozzle welds should be designed with full penetration regardless of tank types, taking into account paragraphs 4.20.1.1 and 4.20.1.2 of the Code.~~

4.4.~~2~~1 Prevention of leakage from pipes

To mitigate undetected accumulation of hydrogen in a confined space, effective measures should be employed to reduce the possibility of leakage of hydrogen, taking its ~~high permeability~~ leakage characteristics into account. Effective measures can be double tube structures, or fixed hydrogen leak detectors in areas assessed as being highly hazardous with regard to hydrogen leakage. Hydrogen leakage through welds, joints and seals is an important consideration for the design of hydrogen systems and an important operational issue.

4.4.~~3~~2 Implementation of effective tightness test

~~4.4.3.1~~4.4.2.1 Tightness tests for cargo tanks and cargo pipes/valves are required by paragraphs 4.20.3.2, 5.13.1 and 5.13.2.3 in the Code respectively. Helium or a mixture of 5% hydrogen and 95% nitrogen should be used as the medium for tightness tests, instead of air, because ~~the permeability of~~ hydrogen is ~~high~~ highly susceptible to leakage.

~~4.4.3.2~~4.4.2.2 For a hydrogen installation, the pipework should be pressure-tested at its design pressure. Consideration should be given to using oxygen-free nitrogen with a small molecule tracer gas, such as helium as the test medium and an electronic leak detector for identifying leaks.

4.4.~~4~~3 Confirmation of appropriate operating procedure

Instructions/manuals containing the operating procedures for the prevention of leakage during transport, methods for early detection in case of leakage, and appropriate measures after such events, should be provided. For this, paragraph 18.3 of the Code requires that the information shall be on board and available to all concerned, giving the necessary data for the safe carriage of cargo. In detail, the Code requires such information on action to be taken in the event of spills or leak, countermeasures against accidental personal contact, procedures for cargo transfer, and emergency procedures to be on board. With regard to the manuals on procedures for liquefied hydrogen during carriage and transfer operations, the requirements in the Code are applicable and no special requirement is necessary.

4.5 Low density and high diffusivity

Though low density and high diffusivity of hydrogen may reduce the possibility of formation of a flammable atmosphere in open spaces, adequate ventilation is necessary for enclosed spaces in cargo areas where formation of hydrogen-oxygen/air mixture may occur. Paragraph 12.2 of the Code requires fixed ventilation systems or portable mechanical ventilation for such enclosed spaces. These requirements in the Code are applicable to liquefied hydrogen carriers and no special requirement is necessary in this regard.

4.6 Ignitability

4.6.1 The Code requires electrical bonds of the piping and the cargo tanks in paragraph 5.7.4, exclusion of all sources of ignition in paragraph 11.1.2, electrical installations to minimize the risk of fire and explosion from flammable products in paragraph 10.2.1 and so on, in order to prevent ignition of flammable cargoes.

4.6.2 The Code requires compliance with the relevant standards issued by the International Electrotechnical Commission (IEC) and the IEC standards specify the details of such safety measures depending on the respective properties of flammable gases including hydrogen. No special requirement is necessary with regard to ignitability of hydrogen.*

4.7 Fire hazard

4.7.1 Safety of personnel in case of fire

To avoid the effects of flame and UV radiation produced by a hydrogen fire, it is effective to use fire-fighter's outfits and protective equipment. The Code already requires fire-fighter's outfits for ships carrying flammable products in paragraph 11.6.1 and safety equipment in paragraph 14.3. This issue should be considered as the matter of cargo information required by paragraph 18.3 of the Code. Due consideration should be given to the invisible nature of hydrogen fire.

4.7.2 Compatibility of fire-extinguishing systems

Dry chemical powder fire-extinguishing or carbon dioxide fire-extinguishing systems are considered to be effective in case of hydrogen fire and such fire-extinguishing systems are already required by paragraphs 11.4 and 11.5 of the Code. Special requirements for installation of other types of fire-extinguishing systems are considered unnecessary, except with regard to the increased of amount of carbon dioxide required, as mentioned in the next paragraph in this document.

4.7.3 Increase of the amount of gas for carbon dioxide fire-extinguishing systems

4.7.3.1 Paragraph 11.5.1 of the Code requires as follows:

> "Enclosed spaces meeting the criteria of cargo machinery spaces in 1.2.10, and the cargo motor room within the cargo area of any ship, shall be provided with a fixed fire-extinguishing system complying with the provisions of the FSS Code and taking into account the necessary concentrations/application rate required for extinguishing gas fires."

4.7.3.2 Chapter 5 of the FSS Code, i.e. Fixed gas fire-extinguishing systems, requires that the quantity of carbon dioxide for cargo spaces, unless otherwise provided, shall be sufficient to give a minimum volume of free gas equal to 30% of the gross volume of the largest cargo space to be protected in the ship, in paragraph 2.2.1.1.

4.7.3.3 On the other hand, NFPA 12[3)] requires that the design quantity of carbon dioxide for hydrogen fire should be 75% or more of the gross volume of the protected space. The special requirement for an increased amount of carbon dioxide should be provided for carbon dioxide fire-extinguishing systems.

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* Electrical equipment used in hydrogen/air mixture should be, at least, the type of "II-C" and "T-1" as the group based on the maximum experimental safe gap for flameproof enclosures and the temperature class based on maximum surface temperature, respectively, according to ISO/IEC 80079-20-1~~IEC 60079-20-1~~[4)].

4.7.4 Features of hydrogen fire

Hydrogen burns at high temperature, but generally gives off less radiant heat than propane or other hydrocarbons (e.g. only about 10% of that radiated by an equal-sized propane flame). Although the heat radiated by a hydrogen flame is also relatively low compared to hydrocarbons, it is important to take into account the differences in heats of combustion, burning rate and flame size. Hydrogen flames are colourless or nearly colourless. Both of these characteristics make it more difficult to detect a hydrogen fire. Even relatively small hydrogen fires are very difficult to extinguish. The only reliable approach to extinguish a fire is to shut off the source of hydrogen supply.

4.8 High pressure hazard

4.8.1 High pressure is a hazard common to hydrogen and other flammable gases listed in the Code. To prevent overpressure, the Code requires various measures such as pressure control and pressure design. Specifically, paragraph 8.2, in regard to the provision of pressure control of cargo tanks, requires fittings of pressure relief valves to the cargo tanks. Furthermore, paragraph 7.1.1 requires temperature control by the use of mechanical refrigeration and/or design to withstand possible increases of temperature and pressure. In addition, paragraph 15.2 specifies the filling limit of cargo tanks taking into account cargo volume increase by its thermal expansion. These requirements are applicable for hydrogen and no special requirement is considered necessary in this regard.

~~4.8.2 Vacuum insulation systems are likely to be used for liquefied hydrogen containment systems and the insulation capability of such systems may be adversely affected by damage to the system, depending on the design of the system. If a rapid deterioration of the insulation system took place, rapid increase of temperature in the cargo tank would occur and/or the rate of vapourization of liquefied hydrogen might exceed the capacity of pressure relief valves. To prevent such dangerous deterioration of insulation, appropriate safety measures should be taken.~~

4.8.2~~3~~ Boil-off may be a more significant issue for hydrogen than for LNG in particular when insulation properties have deteriorated. Means of handling boil-off gas should be carefully considered taking into account the following issues:

.1 Re-liquefaction of hydrogen involves very specific and costly equipment. Cargo cooling in order to avoid boil-off shows the same kind of issues; and

.2 Notwithstanding the provision in paragraph 7.4.1 of the Code, thermal oxidation of hydrogen may be permitted in accordance with paragraph 1.3 of the Code.

4.8.3~~4~~ The special requirements in these aspects are considered necessary.

4.9 Health hazard

4.9.1 Human safety concern under low temperature

With regard to the influences of cold hydrogen on persons' bodies, suitable protective equipment is effective. In this aspect, paragraph 14.1 of the Code requires suitable protective equipment taking into account the character of the products; therefore, no special requirement is considered necessary.

4.9.2 Static electricity

Hydrogen ignition energy is very low and hydrogen can be easily ignitable by static electricity and due consideration should be given to this issue, in accordance with the requirement in the Code on suitable protective equipment.

4.9.3 Oxygen depletion and asphyxiation

Leakage of hydrogen may cause low level of oxygen and associated asphyxiation.

4.10 Wide range of flammable limits

4.10.1 Extinguishing hydrogen fire

4.10.1.1 As mentioned in paragraph 4.6, for flammable products the Code already requires elimination of sources of ignition, including use of electrical installations of appropriate types in order to minimize the risk of fire and explosion. No special requirement is considered necessary with regard to ignitability of hydrogen.

4.10.1.2 Furthermore, with regard to the wide range of flammable limits of hydrogen, the increased quantities of carbon dioxide as a fire-extinguishing medium should be specified as mentioned in paragraph 4.7. No additional special requirement is considered to be necessary with regard to the wide range of flammable limits of hydrogen.

4.10.2 Disposal of cold hydrogen gas

The wide flammability range makes disposal of cold hydrogen gas a major hazard. Cold plumes of released hydrogen may impede adequate ~~and inadequate~~ dilution of hydrogen down to below 4% ~~provide possibilities for~~ and may lead to flash-back to the vent from distant ignition sources outside safety-controlled areas. The low ignition energy and wide flammable range may present significant challenges.

4.11 Prevention of dangerous purging operation

4.11.1 During cargo operations for maintenance, pipes and tanks should be purged with an inert gas or inert gases as illustrated in the figure below. For safety, due consideration should be given to temperature and boiling points of the inert gases. Residual pockets of hydrogen or the purge gas will remain in the enclosure if the purging rate, duration or extent of mixing is too low. Therefore, reliable gas concentration measurements should be obtained at a number of different locations within the system for suitable purges. Temperature should also be measured at a number of locations. Oxidizing agents may exist in a hydrogen containing equipment, specifically: air, cold box atmospheres containing air diluted with nitrogen, or oxygen-enriched air that can be condensed on process pipe work within the cold box in special circumstances.

4.11.2 There are special measures that may need to be put in place in order to mitigate the hazards, e.g. air should be eliminated by nitrogen purge prior to introduction of hydrogen into cargo piping or processing equipment. Nitrogen should then be eliminated by hydrogen purge, where there is a possibility of its solidification in the subsequent process.

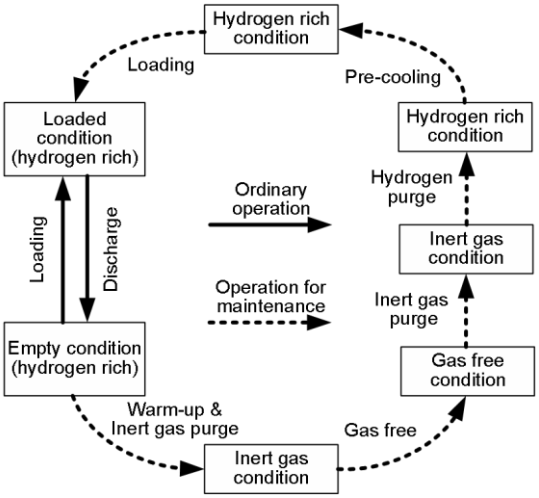

Figure 1

References in part A

1 ISO/TR 15916:2015, Basic consideration for the safety of hydrogen systems (ISO)

2 American Institute of Aeronautics and Astronautics, "Safety Standard for Hydrogen and Hydrogen Systems (Guide to Safety of Hydrogen and Hydrogen Systems)", 2005 (AIAA)

3 NFPA 12: Standard on Carbon Dioxide Extinguishing Systems ~~2005~~2020 Edition (NFPA)

4 ISO/IEC 80079-20-1:2017~~IEC 60079-20-1 Ed.1.0:2010 (b)~~ Explosive atmospheres – Part 20-1: Material characteristics for gas and vapour classification – Test methods and data

5 UN Recommendations on the Transport of Dangerous Goods – Model Regulations, ~~Nineteenth~~ twenty-second revised edition

6 NFPA 2: Hydrogen Technologies Code 2016 Edition (NFPA)

7 IEC/ISO 31010:2019~~2009~~ Risk management – Risk assessment techniques

8 Cryogenics Safety Manual – Fourth Edition (1998)

9 SAE ARP 5580-2001 "Recommended failure modes and effects analysis (FMEA) practices for non-automobile applications"

10 National Institute of Standards and Technology (NIST) RefProp database

Part B
Cargo containment systems of independent cargo tanks using vacuum insulation

5 Additional requirements

5.1 Additional special requirements for cargo containment systems of independent cargo tanks using vacuum insulation are prescribed in table 4 and these special requirements should apply in addition to the requirements in table 2.

Table 4: Special requirements for cargo containment systems of independent cargo tanks using vacuum insulation

No.	Special requirement	Related hazard
B-1 ~~12~~	~~When vacuum insulation is used for a cargo containment system,~~ The insulation performance of vacuum insulation of cargo containment system should be evaluated to the satisfaction of the Administration based on experiments, as necessary.	General (see 4.1 and 6.1)
B-2	Notwithstanding special requirement A-22, liquid and gas hydrogen pipes may pass through ~~This requirement is not applicable to~~ spaces constituting a part of a cargo containment system using vacuum insulation where the degree of vacuum is monitored.	Susceptibility to leakage ~~Permeability~~ (see 4.4)
B-3	When selecting the most onerous scenario stipulated in special requirement A-24, the evaluation should include ~~whether this scenario is brought into existence due to~~ fire or ~~by~~ loss of vacuum from the overall insulation system ~~should be assessed~~ and should also consider the resulting magnitude of the heat flux in case of a single failure on the cargo containment system ~~considered~~ in each case.	High pressure hazard (see 4.8 and 6.2)

6 Additional special requirements to mitigate hazards of liquefied hydrogen

6.1 Hazards of liquefied hydrogen to be considered

6.1.1 In addition to 4.1.1, due consideration should be given to the possibility of untimely deterioration of insulation properties at the envisaged carriage temperatures of liquid hydrogen. The vacuum insulation evaluation should be specified for the normal range or upper limit of cold vacuum pressure (CVP), and loss of vacuum should be defined with respect to this value. Accordingly, effect of vacuum pressure should be taken into account at the time of design and testing of cargo containment systems ~~and piping~~. Supporting structure and adjacent hull structure should be designed taking into account the cooling owing to loss of vacuum insulation.

~~4.1.3~~6.1.2 For consideration on the special requirements for this part ~~liquefied hydrogen carriers~~, bibliographic studies were conducted using the references at the end of this document, in particular, ISO/TR 15916[1)], "High Pressure Gas Safety Act" (Japanese law), "Safety standard for hydrogen and hydrogen system" by AIAA[2)] and NFPA 2 "Hydrogen Technologies Code"[3)]. The majority of special requirements for liquefied hydrogen carriers are provided based on ISO/TR 15916. This standard refers to liquefied hydrogen tank storage facilities on shore, tank trucks and so on, and includes basic viewpoints when discussing the properties of liquefied hydrogen.

6.2 High pressure hazard

~~4.8.~~ In addition to 4.8, vacuum insulation systems are likely to be used for liquefied hydrogen containment systems and the insulation capability of such systems may be adversely affected by damage to the system, depending on the design of the system. If a rapid deterioration of the insulation system took place, rapid increase of temperature in the cargo tank would occur and/or the rate of vapourization of liquefied hydrogen might exceed the capacity of pressure relief valves. To prevent such dangerous deterioration of insulation, appropriate safety measures should be taken.

References in part B

1 ISO/TR 15916:2015, Basic consideration for the safety of hydrogen systems (ISO)

2 American Institute of Aeronautics and Astronautics, "Safety Standard for Hydrogen and Hydrogen Systems (Guide to Safety of Hydrogen and Hydrogen Systems)", 2005 (AIAA)

3 NFPA 2: Hydrogen Technologies Code 2016 Edition (NFPA)

Part C
Cargo containment systems of independent cargo tanks using insulation materials and hydrogen gas in the inner insulation spaces

7 Application of the requirements in this part

7.1 Design of cargo containment systems

The safety measures set out in this part should apply to cargo containment systems of independent cargo tanks using insulation materials and hydrogen gas in the inner insulation spaces as described below.

Figure 2 illustrates a cargo containment system of independent cargo tanks using insulation materials and hydrogen gas in the inner insulation spaces. In this cargo containment system, an inner shell corresponds to a cargo tank. An insulation structure is installed outside of the inner shell. The insulation structure consists of an inner insulation space, an outer shell and an outer insulation layer from the inside. The inner insulation layer, which is located outside the inner shell, is a part of the inner insulation space. The inner insulation space needs to be filled with the appropriate gas to prevent condensation and/or solidification of a large amount of gas caused by the low temperature of the inner shell surface, which will be almost equal to the boiling point of hydrogen. Thus, the inner insulation space is filled with hydrogen gas and no liquid.

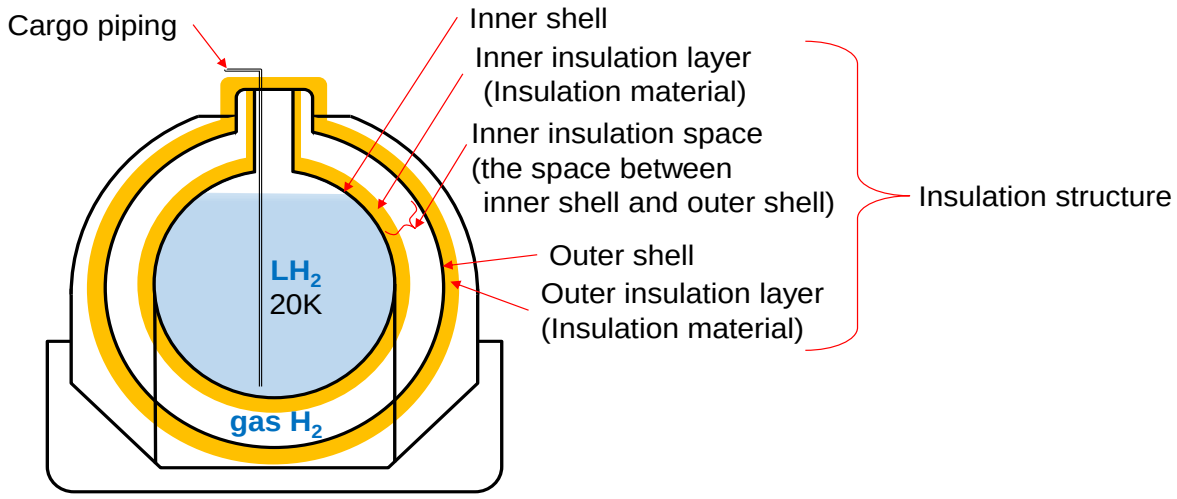

Figure 2 Illustration of cargo containment system

7.2 Conditions for the application of the requirements in this part

The safety requirements set out in this part should apply under the following conditions of use:

.1 the inner shell satisfies the requirements of the Code for a cargo tank; and

Note: This part focuses on the safety measures for the inner insulation space and the outer shell, as a part of the insulation structure for which no specific requirements are specified in the Code.

.2 appropriate measures are adopted to prevent leakage of gas from the inner insulation space to ensure the reliability of the insulation structure, taking into account that the space is filled with flammable gas.

8 Additional requirements

Special requirements for the cargo containment systems are prescribed in table 5 and these special requirements should apply in addition to the requirements in table 2.

Table 5: Special Requirements for cargo containment systems of independent cargo tanks using insulation materials and hydrogen gas in the inner insulation spaces

No.	Special Requirement	Explanation
C-1	The outer shell of the cargo containment system should be located at the distance from the ship's outer shell, as required in paragraphs 2.4.1 and 2.4.2 of the Code for cargo tanks of type 2G ship.	
C-2	Strength of the outer shell should be determined by analyses and tests considering safety principles, all applicable design conditions, materials used, and construction processes in reference to chapter 4 of the Code, and should be approved by the Administration.	
C-3	Notwithstanding special requirement C-2, the temperature of the outer shell should be determined by a temperature calculation, under the assumption that the inner shell is at the cargo temperature.	
C-4	The following special requirements should be applied to the outer shell. .1 All joints of the outer shell should be welded and of full penetration type. All joints of the outer shell should be of in-plane butt weld, as far as practicable. Tee welds of full penetration type may be used depending on the results of the test carried out at the approval of the welding procedure where the in-plane butt weld is not practicable due to the construction process and structure of the outer shell. .2 If a manhole is sealed by welding using backing rings, backing rings may be left after welding without removal, provided that they do not cause any significant harmful effects.	see 9.1
C-5	The outer shell should be subjected to pneumatic pressure testing to check its strength.	see 9.2
C-6	Appropriate thermal insulation should be provided to keep the temperature of the outer shell and outer insulation layer above the boiling point of oxygen. The insulation performance should be evaluated to the satisfaction of the Administration based on experiments, as necessary. When applying paragraph 4.19.1.1.5 of the Code, the degradation of insulation performance caused by hydrogen atmosphere should be considered. Means should be provided for monitoring the condition of the insulation for detection of failures.	

No.	Special Requirement	Explanation
C-7	The pressure of the inner insulation space should be monitored taking into account the requirement for a cargo tank in paragraph 13.4 of the Code.	see 9.3
C-8	Under normal conditions, appropriate measures should be taken to maintain the pressure of the inner insulation space within the design limits.	see 9.3
C-9	Pressure and vacuum relief valves should be provided for inner insulation space which may be subject to pressures beyond their design capabilities, taking into account the requirements for pressure relief systems of cargo tanks in paragraphs 8.2 and 8.3 of the Code. The appropriate capacity of vacuum relief valves should be provided taking into account the expected rate of pressure drop in the inner insulation space of the cargo tanks of the ship under normal cargo operations, which replaces the requirements of paragraph 8.3.1.2 of the Code. When applying 8.3.2 of the Code, the vacuum relief valves should not admit air to the inner insulation space. In the event that the pressure relief valve for the inner insulation space is activated, the hydrogen gas release should be vented to a safe location.	see 9.3
C-10	The requirements in chapter 5 other than 5.3 and 5.10 of the Code, i.e. the requirements for cargo piping outside the cargo areas, should be applied for piping handling hydrogen for the inner insulation space.	
C-11	Appropriate measures should be taken for atmosphere control of the inner insulation space, e.g. inerting, gas freeing, aerating and purging, etc. (see also A-15).	
C-12	The special requirement A-8 should be applied to the tightness test of outer shell.	
C-13	The special requirements A-3 and A-4 should be applied to piping handling hydrogen for the inner insulation space.	
C-14	The special requirements A-8 and A-26 should be applied to exposed parts of piping handling hydrogen for the inner insulation space.	
C-15	Special requirement A-7 need not be applied to piping handling hydrogen for the inner insulation space, other than piping penetrating the inner shell, located inside the inner insulation space.	see 9.4
C-16	Notwithstanding special requirement A-22, piping handling hydrogen for an inner insulation space may pass through other inner insulation spaces.	
C-17	The requirements for type C independent tank should be applied to the inner shell.	
C-18	Manholes for access from or to the inner insulation space through the inner shell should not be permitted.	
C-19	Cargo piping connected to the inside of the inner shell should be led directly from the weather deck. No pipe should penetrate the inner shell from or to the inner insulation space.	

9 Explanation of special requirements

9.1 Welding of the outer shell

9.1.1 As mentioned in 7.2, the outer shell is a part of the insulation structure that has the function to contain hydrogen gas in the inner insulation space, but not to contain liquefied hydrogen.

9.1.2 Due to the high leakage of hydrogen, which is filled in inner insulation space, it is essential to ensure the reliability of tightness of the outer shell. This reliability is subject to evaluation and approval by the Administration. To ensure the tightness of the outer shell, equivalent welding requirements for the inner shell, i.e. cargo tank, should be applied to the outer shell as far as practicable. Therefore, all joints of the outer shell should be of the in-plane butt weld full penetration type, referring to paragraph 4.20.1 of the Code. On the other hand, it may not be practicable to use in-plane butt weld for the outer shell due to the construction procedure and structure. Considering that only gas is filled in the inner insulation space, no liquid pressure is applied on the outer shell. Therefore, using tee welds of the full penetration type is deemed acceptable for those areas, depending on the results of the test carried out at the approval of the welding procedure.

9.1.3 A manhole, when installed on the outer shell, can be sealed by gaskets or by welding. Welding is deemed to be a more reliable method to prevent hydrogen leakage, and removal of the backing rings is typically not possible due to the construction procedure. Considering that no liquid pressure is applied on manholes and backing rings, there is no significant concern from strength point of view. Therefore, not removing backing rings is deemed acceptable, unless any conceivable harmful effects, such as fatigue strength, are identified.

9.2 Testing of outer shell

While pressure testing is to be conducted on the outer shell to check for strength, filling the inner insulation space with water is unrealistic because the insulation materials are installed in the inner insulation space. In addition, it is assumed that only gas is stored in the inner insulation space, therefore, a pneumatic pressure test is sufficient to reproduce the operational condition of the outer shell. This special requirement is related to paragraphs 4.20.3.1 and 4.23.6.7 of the Code.

9.3 Pressure of the inner insulation space

Keeping an appropriate pressure of the inner insulation space is essential for preventing the inner and the outer shell from rupturing and buckling.

9.4 Leak detection for piping handling hydrogen for the inner insulation space located inside the inner insulation space

The purpose of special requirement A-7 is to avoid forming flammable atmosphere. Because the inner insulation space is filled with hydrogen, no additional risk is created by leakage of hydrogen from the places, located inside the inner insulation space, where leakage of hydrogen may occur such as valves, flanges and seals of piping handling hydrogen for the inner insulation space. Thus, special requirement A-7 does not contribute to improve safety for such piping, which is different from the piping for cargo handling. Provision C-15 is necessary to enable the design for control to change atmosphere or for maintenance.

References in part C

1 ISO/TR 15916:2015, Basic consideration for the safety of hydrogen systems (ISO)

2 American Institute of Aeronautics and Astronautics, "Safety Standard for Hydrogen and Hydrogen Systems (Guide to Safety of Hydrogen and Hydrogen Systems)", 2005 (AIAA)

3 NFPA 2: Hydrogen Technologies Code 2016 Edition (NFPA)

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ANNEX 8

BIENNIAL STATUS REPORT FOR THE 2022-2023 BIENNIUM*

Sub-Committee on Carriage of Cargoes and Containers (CCC)									
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	1.17	Review of IGC Code	2023~~3~~4	MSC	CCC		Ongoing	Extended	MSC 103/21, paragraph 18.2; MSC 104/18, paragraph 15.16, MSC 105/20, paragraph 18.50; CCC 9/14, section 4
Notes	CCC 9 requested the extension of TCY to 2024 to continue the review.								
2. Integrate new and advancing technologies in the regulatory framework	2.3	Amendments to the IGF Code and development of guidelines for alternative fuels and related technologies	Continuous	MSC	HTW / PPR / SDC / SSE	CCC	Ongoing	Ongoing	MSC 94/21, paragraphs 18.5 and 18.6; MSC 96/25, paragraphs 10.1 to 10.3; MSC 97/22, paragraph 19.2; PPR 6/20, paragraph 3.39; MSC 102/24, paragraph 21.4; MSC 106/19, paragraph 16.42. MSC 106/16/5; CCC 9/14, section 3
Notes:	MSC 106 changed description in order to accommodate the consideration of alternative fuels not having a low-flashpoint. This resulted the deletion of output 2.24 on "Development of guidelines for the safety of ships using ammonia as fuel" to avoid duplication.								

* Amended text shown in tracked changes using "strikeout" for deleted text and "grey shading" to highlight new insertions.

Sub-Committee on Carriage of Cargoes and Containers (CCC)									
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	New	Development of a safety regulatory framework to support the reduction of GHG emissions from ships using new technologies and alternative fuels	Continuous	MSC	CCC, HTW, III, SDC, SSE, and MEPC	MSC		No work requested	MSC 107/20, paragraph 17.6
~~2. Integrate new and advancing technologies in the regulatory framework~~	~~2.22~~	~~Amendments to the IGC and IGF Codes to include high manganese austenitic steel and related guidance for approving alternative metallic material for cryogenic service~~	~~2023~~	~~MSC~~	~~CCC~~		~~Completed~~	~~Completed~~	~~MSC 96/25 paragraph 23.4; MSC 98/23, annex 38; MSC 100/20 paragraph 17.21; MSC 102/24, paragraph 21.6; MSC 104/18, paragraph 15.16; MSC 105/20, paragraph 14.3; MSC 106/19, paragraph 3.46; resolutions MSC.523(106) and MSC.524(106) CCC 8/18, section 4~~
~~2. Integrate new and advancing~~	~~2.25~~	~~Revision of the Interim~~	~~2024~~	~~MSC~~	~~CCC~~		~~In progress~~	~~Completed~~	~~MSC 105/20, paragraph 18.28~~

Sub-Committee on Carriage of Cargoes and Containers (CCC)									
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**
~~technologies in the regulatory framework~~		~~recommendations for carriage of liquefied hydrogen in bulk~~							~~CCC 8/18, section 14; CCC 9/14, section 7~~
~~4. Engage in ocean governance~~	~~4.4~~	~~Development of measures regarding the detection and mandatory reporting of containers lost at sea that may enhance the positioning, tracking and recovery of such containers~~	~~2023~~	~~MSC~~	~~NCSR~~	~~CCC~~	~~Completed~~		~~MSC 103/21, paragraph 18.34; MSC 107/22, paragraph 11.7 CCC 8/18, section 11~~
Notes:	MSC 107 approved amendments to SOLAS chapter V prepared by CCC 8.								
6. Address the human element	6.1	Role of the human element	Continuous	MSC / MEPC	III / PPR / CCC / SDC / SSE / NCSR	HTW	No work requested	No work requested	MSC 89/25, paragraphs 10.10, 10.16 and 22.39 and annex 21; MEPC 78/17, paragraphs. 10.4 and 13; CCC 8/18, paragraph 17.1; CCC 9/13/1

Sub-Committee on Carriage of Cargoes and Containers (CCC)									
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 element	6.2	Validated model training courses	Continuous	MSC / MEPC	III / PPR / CCC / SDC / SSE / NCSR	HTW	No work requested	No work requested	MSC 100/20, paragraphs 10.3 to 10.6 and 17.28; MSC 105/20, section 16 PPR 9/21, section 12; MEPC 79/15, paragraphs 9.1, 9.14 to 9.15 MSC 100/20, paragraphs 10.3 to 10.6 and 17.28 CCC 6/14, sections 2 and 13
6. Address the human element	6.15	Revision of resolution A.1050(27) to ensure the safety of personnel entering enclosed spaces on board ships	2024	MSC	III / HTW / PPR / SDC / SSE	CCC	In progress	Ongoing	MSC 101/24, paragraph 21.48; MSC 104/18, paragraph 15.16; MSC 106/19, paragraph 16.31; CCC 9/14, section 8
Notes:	MSC 106 expanded the scope of "Revision of the Revised recommendations for entering enclosed spaces aboard ships (resolution A.1050(27))" and modified the description, with a target completion year of 2024, assigning the CCC Sub- Committee as the coordinating organ, in association with the III, HTW, PPR, SDC and SSE Sub-Committees.								

Sub-Committee on Carriage of Cargoes and Containers (CCC)									
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	7.1	Unified interpretation of provisions of IMO safety, security, environment, facilitation, liability and compensation-related conventions	Continuous	MSC / MEPC / FAL / LEG	III / PPR / CCC / SDC / SSE / NCSR		Ongoing	Ongoing	MSC 76/23, paragraph 20.3; MSC 78/26, paragraph 22.12; MEPC 78/17, section 4, and paragraphs 5.6 and 5.7; MEPC 79/15, paragraphs. 4.8, 4.26, 4.27, 6.26 to 6.29; MEPC 80/17, paragraphs 4.11 and 5.24 CCC 7/15, section 11; MSC 105/20, paragraph 15.7; CCC 8/18, paragraph 12.11; CCC 9/14, section 10
7. Ensure regulatory effectiveness	7.10	Amendments to the IMDG Code and supplements	Continuous	MSC	CCC		Ongoing	Ongoing	MSC 105/20, paragraphs 3.59 and 14.4 CCC 8/18, section 6; CCC 9/14, section 6

Sub-Committee on Carriage of Cargoes and Containers (CCC)									
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	7.13	Amendments to the IMSBC Code and supplements	Continuous	MSC	CCC		Ongoing	Ongoing	MSC 105/20, paragraphs 14.4 and 3.57; MSC 107/20, paragraphs 17.10 and 17.12 CCC 8/18, section 5; CCC 9/14, section 5
7. Ensure regulatory effectiveness	7.15	Development of amendments to SOLAS chapter II- 2 and the FSS Code concerning detection and control of fires in cargo holds and on the cargo deck of container ships	2025	MSC	CCC	SSE	No work requested	No work requested	MSC 103/21, paragraph 18.8; SSE 8/20, section 10; MSC 106/19, section 9; SSE 9/20, section 10
~~7. Ensure regulatory effectiveness~~	~~7.25~~	~~Amendments to the International Code for the Safe Carriage of Grain in Bulk (resolution MSC.23 (59)) to introduce a new class of loading conditions for special compartments~~	~~2023~~	~~MSC~~	~~CCC~~		~~Completed~~		~~MSC 104/18, paragraph 15.16; MSC 107/20, paragraph 11.5 MSC 104/18, paragraph 15.16; CCC 8/18, paragraph 7.6 and annex 5.~~

Sub-Committee on Carriage of Cargoes and Containers (CCC)									
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**
Notes:	MSC 108 to consider adoption of approved amendments.								
7. Ensure regulatory effectiveness	7.28	Consideration of reports of incidents involving dangerous goods or marine pollutants in packaged form on board ships or in port areas	Annual	MSC / MEPC	III	CCC	Completed	Completed	CCC 7/15, section 9 CCC 8/18, section 9; CCC 9/14, section 9
7. Ensure regulatory effectiveness	New	Development of measures to prevent the loss of containers at sea	2025	MSC	SDC, NCSR, HTW, III	CCC		No work requested	MSC 107/20, paragraph 17.37

OUTPUTS ON THE COMMITTEE'S POST-BIENNIAL AGENDA THAT FALL UNDER THE PURVIEW OF THE SUB-COMMITTEE

Sub-Committee on Carriage of Cargoes and Containers (CCC)								
Number	Biennium (when the output was placed on the post-biennial agenda)	Reference to Strategic Direction, if applicable	Description	Parent organ(s)	Associated organs(s)	Coordinating organ(s)	Timescale (sessions)	References
212	2022-2023	7	Revision of the Revised guidelines for the preparation of the Cargo Securing Manual (MSC.1/Circ.1353/Rev.2) to include a harmonized performance standard for lashing software to permit lashing software as a supplement to the Cargo Securing Manual	MSC	CCC		2	MSC 107/20, paragraph 17.25

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ANNEX 9

PROPOSED BIENNIAL AGENDA FOR THE 2024-2025 BIENNIUM*

SUB-COMMITTEE ON CARRIAGE OF CARGOES AND CONTAINERS (CCC)						
Reference to SD, if applicable	**Output number**	**Description**	**Parent organ(s)**	**Associated organ(s)**	**Coordinating organ**	**Target completion year**
1. Improve implementation	1.17	Review of IGC Code	MSC	CCC		2023~~3~~4
2. Integrate new and advancing technologies in the regulatory framework	2.3	Amendments to the IGF Code and development of guidelines for alternative fuels and related technologies	MSC	HTW/PPR/ SDC/SSE	CCC	Continuous
2. Integrate new and advancing technologies in the regulatory framework	New	Development of a safety regulatory framework to support the reduction of GHG emissions from ships using new technologies and alternative fuels	MSC	CCC, HTW, III, SDC, SSE, and MEPC	MSC	Continuous
~~2. Integrate new and advancing technologies in the regulatory framework~~	~~2.22~~	~~Amendments to the IGC and IGF Codes to include high manganese austenitic steel and related guidance for approving alternative metallic material for cryogenic service~~	~~MSC~~	~~CCC~~		~~2023~~

* Amended text shown in tracked changes using "strikeout" for deleted text and "grey shading" to highlight new insertions.

SUB-COMMITTEE ON CARRIAGE OF CARGOES AND CONTAINERS (CCC)						
Reference to SD, if applicable	**Output number**	**Description**	**Parent organ(s)**	**Associated organ(s)**	**Coordinating organ**	**Target completion year**
~~2. Integrate new and advancing technologies in the regulatory framework~~	~~2.25~~	~~Revision of the Interim recommendations for carriage of liquefied hydrogen in bulk~~	~~MSC~~	~~CCC~~		~~2024~~
~~4. Engage in ocean governance~~	~~4.4~~	~~Development of measures regarding the detection and mandatory reporting of containers lost at sea that may enhance the positioning, tracking and recovery of such containers~~	~~MSC~~	~~NCSR~~	~~CCC~~	~~2023~~
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	6.15	Revision of resolution A.1050(27) to ensure the safety of personnel entering enclosed spaces on board ships	MSC	III / HTW / PPR / SDC / SSE	CCC	2024
7. Ensure regulatory effectiveness	7.1	Unified interpretation of provisions of IMO safety, security, environment, facilitation, liability and compensation-related conventions	MSC / MEPC / FAL / LEG	III / PPR / CCC / SDC / SSE / NCSR		Continuous
7. Ensure regulatory effectiveness	7.10	Amendments to the IMDG Code and supplements	MSC	CCC		Continuous

SUB-COMMITTEE ON CARRIAGE OF CARGOES AND CONTAINERS (CCC)						
Reference to SD, if applicable	**Output number**	**Description**	**Parent organ(s)**	**Associated organ(s)**	**Coordinating organ**	**Target completion year**
7. Ensure regulatory effectiveness	7.13	Amendments to the IMSBC Code and supplements	MSC	CCC		Continuous
7. Ensure regulatory effectiveness	7.15	Development of amendments to SOLAS chapter II-2 and the FSS Code concerning detection and control of fires in cargo holds and on the cargo deck of container ships	MSC	CCC	SSE	2025
~~7. Ensure regulatory effectiveness~~	~~7.25~~	~~Amendments to the International Code for the Safe Carriage of Grain in Bulk (resolution MSC.23 (59)) to introduce a new class of loading conditions for special compartments~~	~~MSC~~	~~CCC~~		~~2023~~
7. Ensure regulatory effectiveness	7.28	Consideration of reports of incidents involving dangerous goods or marine pollutants in packaged form on board ships or in port areas	MSC / MEPC	III	CCC	Annual
7. Ensure regulatory effectiveness	New	Revision of the Revised guidelines for the preparation of the Cargo Securing Manual (MSC.1/Circ.1353/Rev.2) to include a harmonized performance standard for lashing software to permit lashing software as a supplement to the Cargo Securing Manual	MSC	CCC		2025
7. Ensure regulatory effectiveness	New	Development of measures to prevent the loss of containers at sea	MSC	SDC, NCSR, HTW, III	CCC	2025

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ANNEX 10

PROPOSED PROVISIONAL AGENDA FOR CCC 10

Opening of the session

1 Adoption of the agenda

2 Decisions of other IMO bodies

3 Amendments to the IGF Code and development of guidelines for alternative fuels and related technologies (2.3)

4 Review of the IGC Code (1.17)

5 Amendments to the IMSBC Code and supplements (7.13)

6 Amendments to the IMDG Code and supplements (7.10)

7 Revision of the Revised guidelines for the preparation of the Cargo Securing Manual (MSC.1/Circ.1353/Rev.2) to include a harmonized performance standard for lashing software to permit lashing software as a supplement to the Cargo Securing Manual

8 Revision of the Revised recommendations for entering enclosed spaces aboard ships (resolution A.1050 (27)) (6.23)]

9 Consideration of reports of incidents involving dangerous goods or marine pollutants in packaged form on board ships or in port areas (7.28)

10 Unified interpretation of provisions of IMO safety, security, and environment-related conventions (7.1)

11 Development of measures to prevent the loss of containers at sea

12 Biennial status report and provisional agenda for CCC 11

13 Election of Chair and Vice-Chair for 2025

14 Any other business

15 Report to the Committees

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ANNEX 11

STATEMENTS BY DELEGATIONS AND OBSERVERS[113]

AGENDA ITEM 2

Statement by the delegation of Australia

Australia echoes the condolences expressed by others for Morocco and Libya.
Australia aligns with the comments of Spain on behalf of the EU, and others condemning Russia's invasion of Ukraine.
Aside from the terrible damage and loss of life, Russia's war is causing immense human suffering and exacerbating existing fragilities in the global economy.
Australia condemns Russia's weaponisation of food including its decision to terminate the Black Sea Grain Initiative (BSGI) and its attacks on Ukrainian agriculture, shipping, and export infrastructure.
Russia understands the impacts that its actions have on global food prices and what these price rises mean for Russia's own food exports. Russia – aside from financially profiting from attacks on civilian infrastructure – also understands the impact on the world's most vulnerable, including those represented by many member states here.
Australia requests to have this statement attached to the report of this meeting.

Statement by the delegation of Canada

Thank you chair. Canada wishes to join others in expressing our condolences to the delegations and all the people of Libya and Morocco affected by the natural disasters
Canada continues to condemn in the strongest possible terms the illegal, unprovoked attacks by Russia and stand firm in our support for Ukraine.
Canada was disappointed by Russia's withdrawal from the Black Sea Grain Initiative and supports efforts that Ukraine has taken to establish a safe corridor for merchant vessels that are critical to supporting global food security.
To keep this brief, we wish to align with the statements of the US, UK, Spain, and Australia and ask that our statement be included in the report of the Sub-Committee.

Statement by the delegation of France

Madame la Présidente,
C'est ma première intervention en tant que nouvelle représentante permanente de la France auprès de l'Organisation Maritime Internationale et je voudrais en saluer les honorables participants.
Mon intervention sera donc rapide et se contentera d'apporter son entier soutien à la déclaration qui a été faite par l'Espagne au nom des Etat membres de l'Union européenne en appui à l'intervention du délégué de l'Ukraine.
La France condamne en particulier les conséquences de la guerre d'agression menée par la Russie sur la navigation dans cet espace maritime, les menaces sur la sécurité des cargaisons, notamment dangereuses, et le blocus illégal imposé aux ports ukrainiens, qui menace la sécurité alimentaire mondiale.
Nous souhaitons que cette déclaration soit annexée au rapport du sous-comité.
Merci Madame la Présidente.

[1] Statements have been included in this annex in the order in which they are listed in the report, sorted by agenda items and in the language of submission (including translation into any other language if such translation was provided).

Statement by the delegation of Ireland

Thank you, Madam Chair.
Ireland fully supports the statement made by the delegation of Spain and the EU Member States.
Ireland reaffirms its steadfast support to Ukraine in the face of continued Russian aggression.
Ireland co-sponsored and fully supports the IMO Council paper 35/3/3 addressing the Russian Federation's invasion of Ukraine and condemning its grave impacts on seafarers, commercial shipping and the maritime environment in the Black Sea and the Sea of Azov.
It is critical that the supplies of necessary fuel, food and medicines are allowed to flow both safely and unimpeded into and from Ukraine.
Ireland deeply regrets the decision by the Russian Federation to suspend its involvement in the Black Sea Grain Initiative.
This deal is vital for ensuring the export of much needed grain and fertilisers to address the global food crisis exacerbated by Russia's war against Ukraine. In the words of the UN Secretary-General, this agreement is a ray of hope in a world darkened by global crises. Its continued implementation could not be more urgent.
In turning its back on this deal, Russia could exacerbate the situation for millions of people across the world already at risk of starvation.
The continuing Russian full-scale military invasion of Ukraine is illegal and immoral, involving the utterly unacceptable targeting of civilians and civilian infrastructure, the prohibited use of weapons and indiscriminate attacks.
A full, immediate, and comprehensive cessation of Russian hostilities and the withdrawal of the Russian military from the entire territory of Ukraine within its internationally recognised borders is immediately required to ensure the safety of all civilians there. We are unwavering in our solidarity with the people of Ukraine and our support for Ukraine's sovereignty and territorial integrity.
Thank you, Chair.

Statement by the delegation of Japan

Russia's aggression against Ukraine is an attempt of unilateral change of the status quo by force and an infringement of Ukraine's sovereignty and territorial integrity, which constitutes a clear violation of international law, and is a grave breach of the United Nations Charter. All actions that shake the very foundation of international order are absolutely unacceptable, and Japan condemns Russia's actions in the strongest terms. Japan urges Russia to cease its ongoing aggression and to withdraw its troops and military equipment immediately, completely and unconditionally from the entire internationally recognized territory of Ukraine.
Japan further expresses its disappointment with the withdrawal of Russia from the Black Sea Grain Initiative and expresses serious concern on endangered marine traffic. Japan would like to continue to cooperate with IMO, UN and all relevant parties towards resumption of safe and stable maritime transport in this area.
In this regard, this delegation thanks Ukraine for providing updates in its initiatives to ensure the safety of shipping in the area and welcomes such an initiative.

Statement by the delegation of the Kingdom of the Netherlands

Thank you Chair,
I will be brief. The Netherlands would also like to express their deepest sympathy for the countries effected by the natural disasters. Our thoughts are with you.
The Netherlands would also like to support the statements made by Spain on behalf of the European Union, and many others and express it's full solidarity with Ukraine and the Ukrainian people.
Thank you

Statement by the delegation of Portugal

Thank you, Madam Chair,
The delegation of Portugal thanks Ukraine for its update regarding the current situation in the Black Sea and we align ourselves with the statement delivered by Spain on behalf of the Member States of the European Union.
Portugal expresses its unwavering solidarity with Ukraine and the Ukrainian people and condemns in the strongest possible terms the aggression of the Russian Federation against Ukraine, including the Russian attacks against civilian infrastructures, port facilities and merchant ships.
We are counting 574 days of an unprovoked and unjustifiable aggression, which grossly violates International Law and in particular the Charter of the United Nations. Russia must act in accordance with the U.N. Charter and respect the sovereignty of Ukraine, withdrawing from its entire territory. Freedom of navigation must also be respected.
Madam Chair,
Portugal takes this opportunity to highlight once more the importance of the Black Sea Grain Initiative as a remarkable achievement of the United Nations, including the IMO, also due to the personal commitment of the U.N. Secretary-General Antonio Guterres. As we all know, said agreement allowed the shipment of almost 33 million tonnes of grain and other foodstuffs, reaching regions where it is most needed.
The recent decision of the Russian leadership to terminate the Black Sea Grain Initiative is regrettable and as the U.N. Secretary-General said and we quote "with the termination of the Black Sea Initiative, the most vulnerable will pay the highest price."
Since then, we heard the news of the safe departure of five merchant ships using the maritime corridor established by Ukraine, a much-welcomed development.
We kindly ask that our intervention be reflected in the Sub-Committee's report.
On a separate note, this delegation joins the Sub-Committee in expressing our deepest condolences and sincere solidarity to Libya and Morocco for the tragic losses.
Thank you.

Statement by the delegation of the Russian Federation

Прежде всего, хотелось бы отметить то, что мы неоднократно говорили в этих стенах, - данная Организация, и в частности наш Подкомитет (сугубо технический) не являются подходящей площадкой для обсуждения подобных политических вопросов.

Считаем, что политические темы должны обсуждаться на площадке в ООН, тем более там как раз идет сессия Генеральной Ассамблеи в эти дни. Вы знаете, госпожа Председатель, в мире сейчас много различных горячих точек и конфликтов, к сожалению, их количество не уменьшается, а скорее наоборот. Если мы здесь в стенах ИМО будем уделять время каждому такому случаю, то у нас не останется времени для обсуждения непосредственно тех задач, которые стоят перед нами. Вы сами сказали в своем выступлении при открытии сессии несколько минут назад, что у нас очень много работы и наш Комитет (КБМ) ждет от нас реальных результатов.

Наша делегация решительно отвергает все безосновательные обвинения, сделанные в адрес России делегацией Украины и другими, в особенности того, что касается намеренного разрушения гражданских объектов и атак на гражданские торговые суда.

Упомянутые делегацией Украины атаки на гражданские суда недобросовестно преподносятся членам ИМО, поскольку подобные заявления не имеют под собой никакой доказательной базы и не подкреплены никакими фактами. Более того, в течение последних месяцев несколько гражданских судов безопасно покинуло порты Украины и направилось по своим назначениям.

Целью же высокоточных атак Вооруженными Силами Российской Федерации являются военные поставки государств НАТО осуществляемые через украинские порты

(в том числе склады боеприпасов). В этой связи хотели бы призвать Украину прекратить использовать гражданскую, в том числе портовую инфраструктуры, для укрытия военного оборудования, оружия и боеприпасов.

Более того, именно вооруженные силы Украины продолжают каждодневно обстреливать гражданские объекты в Донецкой и Запорожской областях, а также в Крыму, что естественно влечет жертвы среди мирного населения и разрушения.

Что касается непосредственно «черноморской зерновой инициативы», то следует отметить, что в течение года реализации этой инициативы, киевский режим не брезговал под прикрытием морского гуманитарного коридора для судоходства совершать провокации и атаки против российских гражданских и военных объектов. По существу, подконтрольные Киеву порты и открытый Россией безопасный коридор для вывоза украинского зерна использовались для проведения террористических нападений в нарушение духа и буквы «черноморской инициативы».

В отношении Меморандума Россия-ООН, который являлся частью «сделки», то он на деле так и не заработал. Из пяти предусмотренных Меморандумом Россия-ООН системных задач не выполнено ни одной.

В этих условиях откровенного саботажа в реализации Стамбульских соглашений продолжение не оправдавшей своего гуманитарного предназначения «черноморской инициативы» потеряло всякий смысл. Российская сторона возразила против продолжения зерновой инициативы и без участия России «черноморская инициатива» прекратила свое функционирование с 18 июля 2023 года.

При этом официальные лица Российской Федерации неоднократно заявляли, что готовы будут вернуться к обсуждению этого вопроса после выполнения всех пунктов Меморандума Россия-ООН.

В отношении заявлений делегации Украины о создании так называемого «нового гуманитарного коридора для безопасного движения судов», то для того, чтобы любая предложенная инициатива имела бы шанс на эффективное воплощение, в особенности в текущей ситуации в том регионе, необходимо согласие и учет интересов всех задействованных сторон.

First of all, we would like to emphasize what we have repeatedly said here - this Organization, and in particular our Sub-Committee (purely technical) is not a suitable platform for discussing such political issues.

We believe that political topics should be discussed at the UN, especially since the General Assembly is currently in session there. You know, Madam Chair, there are many different hot spots and conflicts in the world now, unfortunately, their number is not decreasing, but rather the opposite. If we here at IMO devote time to each such case, then we will not have time left to discuss directly the tasks that face us. You said in your speech at the opening of the session just some minutes ago that we have a lot of work to do, and our Committee (MSC) expects real results from us.

Our delegation strongly rejects all baseless accusations made against Russia by the Ukrainian delegation and others, especially those related to the deliberate destruction of civilian objects and attacks on civilian merchant ships.

The attacks on civilian ships mentioned by the Ukrainian delegation are presented in bad faith to IMO Members, since such statements have no evidence base and are not supported by any facts. Moreover, over the past months, several civilian ships have safely left Ukrainian ports and headed to their destinations.

In fact, the targets of high-precision strikes by the Armed Forces of the Russian Federation are military supplies of NATO states carried out through Ukrainian ports (including ammunition depots). In this regard, we would like to urge Ukraine to stop using civilian infrastructure, including port infrastructure, to shelter military equipment, weapons and ammunition.

Moreover, it is the Ukrainian armed forces that continue to shell civilian facilities in the Donetsk and Zaporozhye regions every day, as well as in Crimea, which naturally leads to civilian casualties and destructions.

As to the "Black Sea Grain Initiative" itself, it should be noted that during the year of functioning of this initiative, the Kiev regime did not disdain, under the cover of the maritime humanitarian corridor for shipping, to carry out provocations and attacks against Russian civilian and military facilities. Essentially, ports controlled by Kiev and the safe corridor opened by Russia for the export of Ukrainian grain were used to carry out terrorist attacks in violation of the spirit and letter of the "Black Sea Initiative".

Regarding the Russia-UN Memorandum, which was part of the "deal", it never actually worked. Of the five systemic tasks provided for in the Russia-UN Memorandum, not a single one has been completed.

In these conditions of outright sabotage in the implementation of the Istanbul Agreements, the continuation of the "Black Sea initiative", which did not live up to its humanitarian purpose, lost all meaning. The Russian side objected to the continuation and without Russia's participation, the "Black Sea initiative" ceased to function on July 18, 2023.

At the same time, officials of the Russian Federation have repeatedly stated that they will be ready to return to discussing this issue after all points of the Russia-UN Memorandum have been fulfilled.

Regarding the statements of the Ukrainian delegation about the creation of the so- called "new humanitarian corridor for the safe passage of ships", it should be noted, that in order for any proposed initiative to have a chance of effective implementation, especially in the current situation in that region, it is necessary to have the consent and take into account the interests of all parties involved.

Statement by the delegation of Spain

Muchas gracias, señora presidenta.
En nombre de los Estados Miembros de la Unión Europea, los cuales son todos ellos miembros de la OMI, España desea expresar la plena solidaridad de la UE y de sus Estados Miembros con Ucrania y el pueblo ucraniano.
Condenamos en los términos más enérgicos posibles la agresión no provocada e injustificada de la Federación de Rusia contra Ucrania, que viola gravemente el derecho internacional y la Carta de las Naciones Unidas, y socava la seguridad y la estabilidad internacional.
Exigimos que la Federación de Rusia cese inmediatamente sus acciones militares, retire todas sus tropas de todo el territorio de Ucrania y respete plenamente la integridad territorial, la soberanía y la independencia de Ucrania dentro de sus fronteras internacionalmente reconocidas, y acate la resolución de la Asamblea General de la ONU titulada "Agresión contra Ucrania", respaldada por 141 Estados en su undécimo periodo extraordinario de sesiones de emergencia.
Apoyamos con determinación el derecho inherente de Ucrania a la autodefensa y los esfuerzos de las fuerzas armadas ucranianas por defender la integridad territorial y la población de Ucrania, de conformidad con el artículo 51 de la Carta de las Naciones Unidas.
La Federación de Rusia debe respetar en todo momento las obligaciones que le incumben en virtud del derecho internacional, incluido el derecho internacional humanitario y de los derechos humanos, en lo que respecta a la protección de los civiles, las mujeres y los niños.
Además, rechazamos enérgicamente y condenamos de manera inequívoca el intento de anexión ilegal de las regiones ucranianas de Donetsk, Luhansk, Zaporizhzhia y Kherson por parte de la federación de Rusia.
España agradece la información facilitada por la delegación de Ucrania sobre la situación actual en el Mar Negro y condena los ataques sistemáticos con misiles contra las infraestructuras portuarias ucranianas y las instalaciones de almacenamiento de grano en la región de Odesa y los intentos de destruir el puerto de Odesa y los del río Danubio desde la retirada de Rusia de la Iniciativa de Granos del Mar Negro el pasado mes de julio.

España reitera la exigencia de que la Federación de Rusia ponga fin a sus actividades ilícitas, garantice la seguridad y el bienestar de la gente de mar, la protección del transporte marítimo internacional y del medio marino en todas las zonas afectadas, y respete sus obligaciones en virtud de los tratados y convenios internacionales pertinentes.
España pide además a la Federación de Rusia que se abstenga de amenazar a las cadenas internacionales de suministro que apoyan a otros países y proporcionan alimentos dirigiendo sus intentos de ataque contra buques de carga civiles.
España acoge con agradecimiento los esfuerzos de Ucrania encaminados a salvaguardar la seguridad, la estabilidad y la libertad de navegación internacional en el Mar Negro y prevenir una crisis alimentaria mundial.
Solicitamos que esta declaración sea incluida como anexo en el informe final del Subcomité.
Muchas gracias

Thank you Chair,
On behalf of the Member States of the European Union, which are all members of the IMO, Spain wishes to express the EU's and its MS' full solidarity with Ukraine and the Ukrainian people.
We condemn in the strongest possible terms Russia's unprovoked and unjustified act of aggression against Ukraine, which grossly violates international law and the UN Charter, and undermines international security and stability.
We demand that Russia immediately cease its military actions, withdraw all its troops from the entire territory of Ukraine and fully respect Ukraine's territorial integrity, sovereignty and independence within its internationally recognised borders and abide by UN General Assembly resolution titled "Aggression against Ukraine" supported by 141 states at the 11th emergency special session.
We resolutely support Ukraine's inherent right of self-defence and the Ukrainian armed forces' efforts to defend Ukraine's territorial integrity and population in accordance with Article 51 of the UN Charter. Russia must always respect its obligations under international law, including international humanitarian and human rights law, including with respect to the protection of civilians, women and children.
Furthermore, we strongly reject and unequivocally condemn Russia's attempted illegal annexation of the Ukrainian regions of Donetsk, Luhansk, Zaporizhzhia and Kherson.
Spain thanks the information provided by the delegation of Ukraine about the current situation in the Black Sea and strongly condemns the systematic missile attacks against the Ukrainian port infrastructures and grain storage facilities in Odesa region and the attempts to destroy Odessa port and those on the Danube River since Russia withdrew from the Black Sea Grain Initiative last July.
Spain reiterates the demand that the Russian Federation cease its unlawful activities, to ensure the safety and welfare of seafarers, the security of international shipping and the marine environment in all affected areas and respect its obligations under relevant international treaties and conventions.
Spain further calls on the Russian Federation to refrain from threatening international supply chains that supported other countries and provided food by targeting civilian cargo ships.
Spain welcomes the efforts made by Ukraine initiative aiming at safeguarding safety, stability, and freedom of international navigation in the Black Sea and preventing a global food crisis.
We request this statement to be annexed to the Sub-Committee's report.

Statement by the delegation of Sweden

Thank you Madam Chair,
Sweden would firstly like to support what was just stated by Spain and wishes to express our full solidarity with Ukraine and the Ukrainian people.

We condemn in the strongest possible terms Russia's unprovoked and unjustified act of aggression against Ukraine, which grossly violates international law and the UN Charter, and undermines international security and stability.
We demand that Russia immediately cease its military actions, withdraw all its troops from the entire territory of Ukraine and fully respect Ukraine's territorial integrity, sovereignty and independence within its internationally recognised borders and abide by UN General Assembly resolution titled "Aggression against Ukraine" supported by 141 states at the 11th emergency special session.
We resolutely support Ukraine's inherent right of self-defence and the Ukrainian armed forces' efforts to defend Ukraine's territorial integrity and population in accordance with Article 51 of the UN Charter. Russia must always respect its obligations under international law, including international humanitarian and human rights law, including with respect to the protection of civilians, women and children.
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Sweden in thankful for the information provided by the delegation of Ukraine about the current situation in the Black Sea and condemns the systematic missile attacks against the Ukrainian port infrastructures and grain storage facilities in Odesa region and the attempts to destroy Odessa port and those on the Danube River since Russia withdrew from the Black Sea Grain Initiative last July.
We reiterate the demand that the Russian Federation cease its unlawful activities, to ensure the safety and welfare of seafarers, the security of international shipping and the marine environment in all affected areas and respect its obligations under relevant international treaties and conventions.
We further calls on the Russian Federation to refrain from threatening international supply chains that supported other countries and provided food by targeting civilian cargo ships.
And we welcome the efforts made by Ukraine initiative aiming at safeguarding safety, stability, and freedom of international navigation in the Black Sea and preventing a global food crisis.
We request this statement to be annexed to the Sub-Committee's report.

Statement by the delegation of Ukraine

Madam Chair,
I would like to join other delegations in expressing our deepest condolences to the Governments and people of Morocco and Libya where extreme earthquake and flooding have taken thousands of lives. Our thoughts and prayers are with the families of victims of these devastating natural disasters.
Madam Chair,
I avail myself of this opportunity to brief distinguished Member States about the current situation after the Russia's withdrawal from the Black Sea Grain Initiative.
In egregious violation of international law, the Russian military continued to obstruct Black Sea shipping.
In fact, Russia has never stopped its violations even having taken some commitments under the Grain initiative.
About a week before the withdrawal from the Grain deal Russia commenced systematic missile attacks against the Ukrainian port infrastructure and grain storage facilities in Odesa region.
For over 2 months, Russia relentlessly attempts to destroy ports of Big Odesa and those on the Danube River, which became the main route for the export of agricultural products remaining for Ukraine.
A total of over 130 hits on port infrastructure facilities in the Odesa region were recorded for the mentioned period. As a result of these attacks, 105 port infrastructure facilities and agricultural plants, 93 vehicles and 6 Ukrainian civilian ships were partially damaged, more than 10 civilians were injured. Almost 300,000 tons of agricultural products were destroyed.

The only purpose of these actions is to prevent the export of Ukrainian grain by sea, reduce its availability on global markets, and increase food prices for Russian benefit.
In this way, Russia deliberately blackmails the world with the threat of a food crisis, which simultaneously continuing illicit trafficking of Ukrainian agricultural products looted by Russian military from the temporarily occupied territories in Luhansk, Donetsk, Kherson and Zaporizhzhia regions. This has to be punished and those involved in this outright robbery have to bear responsibility.
Madam Chair,
Following the end of the Grain Initiative, Ukraine has introduced a special maritime corridor, which was announced by this delegation at the 129th session of the IMO Council.
At the outset, it is intended to facilitate the safe evacuation of those ships, stranded in Ukrainian ports since the commencement of the Russian full-scale invasion of Ukraine (primarily from Chornomorsk, Odesa, and Pivdennyi).
Since 15 August, **5** vessels used this corridor to exit Ukraine's territorial waters:

.1 the container ship **Joseph Schulte** (Hong Kong flag) on 16 August 2023;

.2 the bulk carrier **Primus** (flag of Liberia) on 27 August 2023 (which apparently was the one of the main targets of the Russian missile attack, recently reported by the UK intelligence);

.3 2 bulk carriers **Anna-Theresa** (flag of Liberia) and OCEAN COURTESY (flag of Marshall Islands) on 1 September 2023;

.4 another bulk carrier PUMA (Cayman Islands flag) left on 15 September 2023.

Despite Russia's numerous attempts to disrupt international supply chains, Ukraine remains faithful to its obligations to food importers.
Taking into account the world's growing need for Ukrainian products, we are doing our utmost to revive the free movement of ships in both directions, in particular for the purposes of transportation of grain and other foodstuffs, mainly to African and Asian countries.
First steps were made in this direction with **2** bulkers "**Resilient Africa**" and "**Aroyat**" (both under flag of Palau) arriving recently to the port of Chornomorsk to load about 20,000 tons of wheat.
Moreover, as announced by President Zelenskyy at the SDG Summit in New York to prevent any upheavals in the world food market, the international community can create hubs for millions of tons of grain per year in particularly sensitive areas, inter alia at seaports in Africa.
Whatever the problem is, we can find a solution through cooperation.
Madam Chair,
It is obvious that Russia has failed to resume its naval blockade of Ukrainian ports to the extent it had before the grain deal.
The successful passage of the mentioned ships through the new maritime corridor also shows that the grain initiative can exist without Russia.
Thus, any attempts to revive the defective Grain Initiative (like other international agreements with Russia on board), especially by proposing concessions to Russia, loosening the sanctions regimes or supporting its grain and fertilizers exports etc., are counterproductive. Evil can not be trusted.
It would deal a severe blow to international obligations and international law and encourage Moscow to continue its aggressive actions, bolster its sense of impunity.
To increase the security for ships, Ukraine is strengthening and broadening its military presence in the Black Sea. Efforts are put in place to demilitarize the Russian Black Sea fleet that is used by the aggressor to terrorize the commercial shipping in the area. Thus, any Russian warship or submarine, which is engaged in launching attacks at Ukrainian civilians, is considered a legitimate target, wherever it is located.

Ukraine has also established a generous compensation scheme (with a budget of 540 mln USD) that is intended to support commercial shipping to and from Ukraine and underpin liability arising from an attack on merchant ships that enter the Black Sea with the intention of loading and/or unloading goods in Ukraine's territory.
All efforts of the international community and reputable international organizations like UN, IMO, FAO, UNCTAD and others should be focused on restoring the free shipping in the Black Sea region and minimizing the impacts of possible world food crisis.
We must do it, and we will.
I thank you, Madam Chair, and request that this statement is reflected in the Sub- Committee's report and also appended to its Annex.

Statement by the delegation of the United Kingdom

Thank you, Chair.
The United Kingdom continues to stand united with our international partners in condemning, in the strongest possible terms, the Russian government's reprehensible actions, which are a violation of international law and the UN Charter.
We will continue to support the Ukrainian government in the face of this assault on their sovereignty and territorial integrity. The UK and the international community stand against this naked aggression and for freedom, democracy and the sovereignty of nations around the world.
[Like others,] the United Kingdom is disappointed in the collapse of the Black Sea Grain Initiative, once again Putin is using food as a weapon. We should not, again, have to remind Russia to stop using people's hunger as a weapon in their war against Ukraine.
The United Kingdom strongly condemns Russia's egregious attacks on Ukrainian ports and grain infrastructure, and calls for them to cease immediately. These include a thwarted missile attack against a civilian cargo vessel highlighted by declassified intelligence. These attacks are a cynical attempt to choke the Ukrainian economy and prevent its grain reaching world markets, impacting on food security for the world's poorest. Ukraine has an undeniable right to export its own goods and produce, and the United Kingdom is working with Ukraine and other partners to enable Ukraine to continue exporting its grain through all routes.
The United Kingdom will continue to denounce and condemn the illegal war of aggression waged by Russia against Ukraine in flagrant violation of international law and to call for the complete, immediate and unconditional withdrawal of Russian armed forces from all Ukrainian territory.
Thank you, Chair.

Statement by the delegation of the United States

The United States condemns in the strongest possible terms the Russian Federation's unprovoked and illegal war against Ukraine. The Russian Federation's invasion of Ukraine is a violation of the United Nations Charter and inconsistent with the purposes of the IMO as set out in Article 1 of the IMO Convention. Russia's blatant disregard for the repeated demands of the UN General Assembly and IMO member states to end its illegal war of choice and withdraw its military forces from Ukraine is reprehensible and is not the position of a responsible member of this organization. Putin continues to weaponize food, threatening the food security of the world's most vulnerable populations. Just since July, when Russia withdrew from the Black Sea Grain Initiative, systematic Russian attacks on Ukraine's civilian agricultural infrastructure and ports have destroyed some 280,000 tons of grain – enough to feed over one million people for a year. The deliberate targeting of commercial vessels, as highlighted by the distinguished delegations of the United Kingdom and Ukraine, demonstrate an appalling disregard for the safety of seafarers and commercial shipping and are directly contrary to the principles upon which IMO was founded. The United States welcomes Ukraine's efforts to implement a special maritime corridor to facilitate the safe movement of commercial vessels in its territorial waters.

We demand that Russia cease its attacks on and threats to commercial vessels which place the safety of seafarers and commercial shipping at risk. We once again call on the Russian Federation to immediately cease its military action and unconditionally withdraw all its military forces and equipment from the entire territory of Ukraine, including its territorial waters. We ask that our statement be appended to the report of this subcommittee. Thank you, Chair.

AGENDA ITEM 3

Statement by the delegation of Singapore

Thank you, Chair.
As this is the first time that we are taking the floor, Singapore would like to offer our condolences to the delegations and families of those affected by recent natural disasters in Morocco and Libya.
Singapore was among the IMO member states which participated in the Correspondence Group (CG), and we support the CG's report. We also appreciate the comments submitted that were aimed at improving the report.
Singapore intends to continue contributing and participating in this important work of developing guidelines.
Chair, we note that ammonia currently appears to be one of the most promising low- or zero- carbon marine fuels, and is also an important energy carrier for hydrogen. Singapore launched our National Hydrogen Strategy in late 2022, where we plan to embark on hydrogen pathfinder projects, including the use of ammonia. The relevant government agencies in Singapore are currently evaluating proposals from the global community received under an Expression of Interest (EOI) that was launched by the Singapore government, from December 2022 to April 2023, for the development of end-to-end low- or zero-carbon ammonia power generation and bunkering solution in Singapore. Through this EOI, Singapore plans to work with academia and industry to work on the challenges of ammonia bunkering and we will update IMO and fellow colleagues periodically.
Apart from the EOI, the MPA had also embarked, in 2022, with industry, classification societies, and fellow port authorities, on a series of collaborations to (i) develop ammonia- fuelled vessels and ammonia bunkering infrastructure, (ii) conduct safety studies involving ammonia bunkering, and (iii) harmonise ammonia bunkering safety guidelines between ports. In short, seeking to have a safe and integrated ammonia (as fuel) supply chain.
We also developed a methodology for trials of vessels using new and alternative marine fuels. The methodology entails:

.1 Conducting thorough end-to-end operational and other risk assessments, including for the entire supply chain;

.2 Conducting safety assessments of the bunkering and the receiving vessels;

.3 Developing transit passage plans and emergency response plans that are coordinated across relevant government agencies, maritime and port users and the local community;

.4 Deploying a validated dispersion model that runs 24/7; and

.5 Designing and mandating training programmes to ensure that seafarers, operators and engineers are well equipped to safely handle the new fuels.

This was developed to ensure the safety of the port, vessels, and seafarers when trialling or using new and alternative marine fuels. Each of these fuels have different characteristics and require specific measures to prevent and mitigate any incidents involving these fuels.

The methodology was successfully applied in our preparation for the world's first ship-to-containership methanol bunkering, and Singapore is able to share our experiences in using this methodology to help member States and the industry more quickly adopt other fuels such as ammonia and hydrogen. For methanol, we will be enhancing this to include simultaneous operations of cargo handling and bunkering at our port, the safe maintenance of these vessels and the carbon accounting in due course.

Chair, Singapore recognises the imperative for international shipping to meet the targets in the 2023 IMO Strategy adopted in July 2023, and we stand ready to inform and update this Sub-Committee and fellow IMO members and observer organisations on lessons learnt and useful information from the development efforts and trials in Singapore. Where useful or necessary, the guidelines developed at this Committee can incorporate such information or lessons learnt.

In closing, we can support the recommendation of the CG to establish a Working Group under the TOR, as set out in paragraph 28 of CCC 9/3.

Thank you Chair.