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**GUIDELINES ON MITIGATION MEASURES TO REDUCE RISKS OF USE AND
CARRIAGE FOR USE OF HFO AS FUEL BY SHIPS IN ARCTIC WATERS**

1 The Marine Environment Protection Committee, at its eighty second session (30 September to 4 October 2024), approved *Guidelines on mitigation measures to reduce risks of use and carriage for use of HFO as fuel by ships in Arctic waters*, set out in the annex.

2 Member Governments and international organizations are invited to bring the annexed Guidelines to the attention of Administrations, industry, relevant shipping organizations, shipping companies and other stakeholders concerned.

ANNEX

GUIDELINES ON MITIGATION MEASURES TO REDUCE RISKS OF USE AND CARRIAGE FOR USE OF HFO AS FUEL BY SHIPS IN ARCTIC WATERS

PREAMBLE

In recent years there has been a rise in economic activity in the Arctic region associated with community resupply, fishing, production of mineral resources, scientific research and tourism, which has led to an increase in shipping in the region.

Due to both the unique biological diversity and vulnerability of local ecosystems in the Arctic region, there may be increased environmental impacts from a pollution incident involving heavy fuel oil (HFO) related, inter alia, to shipping. In the challenging Arctic environment, the removal of an HFO spill could be a difficult and a long-term task and the consequences of such a spill could dramatically affect the local marine and coastal environment, and in turn impact its inhabitants.

While recognizing that an increasing number of ships are using alternative fuels, as a result of the global sulphur limit, it is still the case that a number of ships in and outside the Arctic are still using HFO and carrying it for use as fuel. With this in mind, special requirements for the use and carriage for use of HFO as fuel in Arctic waters have been developed under MARPOL Annex I, regulation 43A, and these Guidelines are intended to assist in the implementation of those requirements.

These Guidelines on risk mitigation measures have been developed on the basis of existing operational and oil spill response experiences and offer recommendatory measures to help reduce risks associated with the use, and carriage for use of HFO as fuel by ships in Arctic waters. This includes, inter alia, minimizing any adverse environmental impact caused by HFO spills in such waters.

The Guidelines complement the requirements of the International Convention for the Safety of Life at Sea, 1974 (SOLAS), the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto, and as further amended by the Protocol of 1997 (MARPOL), the International Code for Ships Operating in Polar Waters (Polar Code), the International Safety Management Code (ISM Code), the International Convention on Oil Pollution Preparedness, Response and Cooperation (OPRC) and the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978 (STCW).

1 INTRODUCTION

Purpose

1.1 The purpose of these Guidelines is to:

- .1 assist Administrations of the Parties to MARPOL, the coastlines of which border on Arctic waters, to implement measures at national levels to reduce the risk of the use and carriage for use of HFO as fuel on ships in Arctic waters, and to take decisions on waivers pursuant to the requirements of paragraph 4 of regulation 43A of MARPOL Annex I for ships flying their flag while operating in Arctic waters subject to their sovereignty or jurisdiction; and

- .2 provide ship operators of ships planning voyages in the Arctic with recommendations on measures to reduce the risk of spills while using or carrying HFO for use as fuel in Arctic waters.

Definitions

- 1.2 For the purposes of these Guidelines, the following definitions apply:

Arctic coastal State – a State the coastline of which borders on Arctic waters.

Heavy Fuel Oil (HFO) – oil, other than crude oil as referred to paragraph 1.2 of regulation 43 of MARPOL Annex I.

- 1.3 Other terms used in these Guidelines have the same meanings as defined in SOLAS, MARPOL and the Polar Code.

Application

- 1.4 These Guidelines are intended to be applied or consulted by:

- .1 Administrations of Arctic coastal States issuing temporary waivers for ships flying the flag of the Party while operating in Arctic waters subject to the sovereignty or jurisdiction of the Party under paragraph 4 of regulation 43A of MARPOL Annex I;
- .2 Administrations of Arctic coastal States developing and implementing national mitigation measures to reduce risks associated with the use and carriage for use of HFO as fuel by ships in Arctic waters; and
- .3 ship operators planning a voyage in the Arctic or seeking waivers under regulation 43A of MARPOL Annex I.

- 1.5 Section A of these Guidelines includes recommendations primarily intended for operators, and section B includes recommendations for Administrations of Arctic coastal States or Administrations of flag States, where applicable.

- 1.6 When implementing mitigation measures to reduce risks of use and carriage for use of HFO as fuel by ships in Arctic waters, consideration should be given to applying, as necessary:

- .1 relevant additional guidance contained in parts I-B and II-B of the Polar Code;
- .2 *Guidance for navigation and communication equipment intended for use on ships operating in polar waters* (MSC.1/Circ.1612);
- .3 the *Interim guidelines on life-saving appliances and arrangements for ships operating in polar waters* (MSC.1/Circ.1614); and
- .4 other applicable IMO guidance and national or industry guidelines* related to Arctic navigation.

* For example, the joint ICS/OCIMF Guidelines for the Development of a Polar Water Operational Manual; the *IMO Guide on Oil Spill Response in Ice and Snow Conditions*.

1.7 Furthermore, there are various bilateral and multilateral cooperation arrangements between Arctic States regarding the safety of navigation and marine pollution prevention and response, which could be considered in the context of risk mitigation measures for ships using HFO and carrying it for use as fuel in Arctic waters.

SECTION A

COMPANIES' GUIDELINES ON MITIGATION MEASURES TO REDUCE RISKS OF USE AND CARRIAGE FOR USE OF HFO AS FUEL BY SHIPS IN ARCTIC WATERS

A1 Navigational measures

A1.1 Planning for Arctic navigation should take into account, to the extent consistent with international law, national requirements of the relevant Administration of any Arctic coastal State in whose Arctic waters passage will be made.

A1.2 In addition, the engagement of Arctic Indigenous Peoples and the utilization of Indigenous Knowledge (for instance on local currents, underwater formations and ice formation) can be useful for supporting safe and low-impact shipping, contributing to reducing spill risks from HFO.

A2 Ship operation

A2.1 Taking due account of the existing experience of a ship's operation in Arctic waters, the following measures to mitigate risks associated with the use and carriage for use of HFO as fuel by ships in Arctic waters could be considered, while ensuring that the safety of operations and the crew is paramount at all times:

- .1 before entering the ice area, HFO should, where practicable, be pumped from the tanks which are potentially more prone to damage in ice navigation (for example, tanks adjacent to the shell plating) into tanks protected by cofferdams or a double skin or that are in other areas less vulnerable in case of an accident;
- .2 where practicable, bunker fuel tanks should preferably have sufficient empty space so that in case of ice damage to the hull the HFO could be pumped from a damaged tank to other tanks;
- .3 hoses and an extra deep-well pump should be available on board in case of an urgent need for pumping of HFO from damaged tanks into other tanks or to another ship;
- .4 the Shipboard Oil Pollution Emergency Plan (SOPEP) should consider and describe, among other things, details of pumping arrangements and available tank spaces for use in an emergency situation;
- .5 fuel levels in bunker tanks should be carefully monitored during ice navigation;
- .6 heating coils for bunker tanks or service tanks, and tracer lines in the bunker transfer line should be checked for effectiveness prior to undertaking the Arctic voyage. In case of steam heating, the maintenance of boiler and steam traps should be carried out as per the maintenance plan prior to undertaking the Arctic voyage;

- .7 fuel transfer pumps and water-removing means should be operable throughout the voyage in Arctic waters in case of hull damage and the need to promptly transfer fuel from the breached tank to mitigate discharge of fuel overboard;
- .8 communication with the shore operation centres or the relevant organizations of the Arctic coastal State should be maintained throughout the voyage;
- .9 before commencing an Arctic voyage, additional appropriate drills should be conducted regarding reduction of the consequences of shell plating damage; stopping bunker leakage from fuel tanks; and preparing for oil spill response. Relevant training should be provided for the crew, and crew members should have sufficient knowledge of emergency actions required in response to a particular accident or emergency situation (see also section 6 of the Guidelines); and
- .10 equipment used during Arctic operations should be thoroughly tested and confirmed as fully operational in the expected cold conditions (temperature and strong wind) before commencing an Arctic voyage.

A2.2 To implement the foregoing measures to mitigate risks relating to the use and carriage for use of HFO as fuel by ships in Arctic waters and on the basis of the *Guidance on best practice for fuel oil purchasers/users for assuring the quality of fuel oil used on board ships* (MEPC.1/Circ.875), companies responsible for complying with the ISM Code are encouraged to develop and implement relevant procedures on ships operating in Arctic waters, including the following:

- .1 the SOPEP should be supplemented with a procedure specifying crew actions in case of an HFO spill in low temperatures, a detailed plan of HFO transfer during the voyage in Arctic waters, the use of emergency oil spill response equipment on board, and the number and capacity of additional pumps available on board for HFO transfer; and
- .2 where applicable, emergency procedures for voyage planning in Arctic waters including ship-to-ship bunker fuel oil transfer and bunkering operations, and that cover all operational aspects, risk assessment, control systems, and communication between ships and with the responsible shore facility.

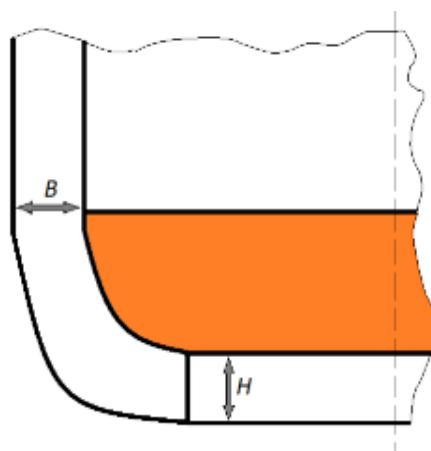
A3 HFO bunkering

A3.1 When planning bunkering operations in Arctic waters, the main causes of bunker spills should be taken into account, which include damage to the hoses when receiving or unloading bunkers and damage to the hull of the ship due to collision with another ship, contact with the coast, grounding or ice damage.

A3.2 To prevent HFO spills, all operations involving the transfer of HFO should be carried out by crew members who are familiar with the location and design of tanks and pipelines on the vessel, and who have relevant training for bunkering operations. Operations should be carried out according to the ship's safety management system procedures, with which all personnel involved should be familiar. Prior to the transfer of HFO, a reliable two-way communication connection should be established between the ship and the responsible personnel ashore or on board another ship involved (using a common language agreed upon). It is strongly recommended that appropriate procedures (e.g. spill response coordination) are developed and included in the SOPEP (section 5 Additional Information (Non-Mandatory) or SMPEP as appropriate).

A3.3 Measures should be taken to prevent the occurrence of water hammer in hoses and pipelines and to ensure the proper rigging and use of bunker hoses. During the transfer process, in order to prevent kinking and twisting, there should be no bends with a radius of less than the minimum allowable for the type and size of hose. In order to avoid rupture of the bunker hose, the maximum surge pressure arising in the pipeline should at no point exceed the burst pressure of the hose.

A3.4 Where the structural requirements of the part II-A, chapter 1, regulation 1.2 of the Polar Code do not otherwise apply, it is preferable that fuel tanks intended for receiving HFO be located at a distance of not less than 0.76 m from the outer plating. A typical arrangement of a fuel tank on board a ship that meets these requirements is shown in figure 1. The above should be taken into account when developing the bunker or transfer plan.



B > 760 mm; H > 760 mm

Figure 1: Permissible arrangement of a heavy fuel tank on board that meets the requirement of paragraph 4.4 of the draft guidelines or in accordance with regulation 12a of Annex I to MARPOL, if applicable

A3.5 In order to prevent HFO spills during bunkering of a ship, the following should be considered:

- .1 Before taking on fuel, supply hoses should be visually examined, test records checked and all deck scuppers should be securely closed to prevent oil from going overboard in case of an overflow or leak.

- .2 Hoses and cargo booms should be supplied before and after loading with only sealed flanges.
- .3 After starting HFO bunkering operations, frequent checks and tank measurements on both the ship and shore facilities should be carried out. In the case of any discrepancies, the bunkering operations should be stopped immediately and checks for leaks undertaken and confirmed to be in order before bunkering operations are resumed.
- .4 Pressure gauges and tank levels should be continuously monitored, and associated valves should be operated with low flow rate during changing over tanks. Spill response equipment, as detailed in the SOPEP/SMPEP, should be kept at the ready.
- .5 Hose material and hose connections should be tested prior to commencing bunkering to ensure that they operate effectively during low temperatures.

A3.6 To prevent damage to hoses during HFO bunkering operation, hoses should be confirmed as having:

- .1 been rigged in compliance with minimum bend radius;
- .2 a design pressure at least 1 MPa and a burst pressure of at least four times higher than the design pressure;
- .3 been hydrostatically tested to their design pressure in accordance with the manufacturer's recommendations; and
- .4 if floating, having been marked with high visibility colours and reflective stripes to visualize the hoses in the dark or at night.

A3.7 Pumping HFO can create a pressure in the pipeline that exceeds the allowable operating pressure of the hose. If there is no pressure relief valve on the pump, a pressure relief valve should be installed in the pipeline. The pressure relief valve should open at a pressure of no more than 10% above the design pressure of the hose.

A3.8 Procedures for the use of hoses in bunkering of HFO should be documented in the ship's SOPEP/SMPEP.

A4 Communication

For ships operating in Arctic waters, reliable two-way communication between the ship, other ships and the Administration of the Arctic coastal State is one of the prerequisites for safe operation in high latitudes and for the reduction of risks to the marine environment for ships using and carrying for use HFO as fuel.

A5 Enhancement of HFO spill preparedness, early detection and response

A5.1 Along with relevant preventive measures to mitigate risks of HFO spills, a robust response system needs to be established for such an incident. Bearing in mind the specific features of the Arctic region, the key aspect should be the enhancement of services and arrangements, and broadening of cooperation among the Arctic coastal States, in order to provide adequate response.

A5.2 Staging of relevant oil spill response equipment in seaports and, where practicable and appropriate, on board ships using and carrying for use HFO as fuel, in line with the risks identified, would assist in regional preparedness for a pollution incident and would contribute to mitigation of risk of pollution and to minimization of consequences of HFO spill incident.

A5.3 The Agreement on Cooperation on Marine Oil Pollution Preparedness and Response in the Arctic (MOSPA), which entered into force on 25 March 2016, is a useful instrument governing cooperation and information-sharing on fuel oil, including heavy oil, pollution incidents in the Arctic region.

A5.4 Ships should provide information regarding the planned route to the relevant competent national body of the Administration of the Arctic coastal State through whose waters the voyage will occur, and to the specialized organization responsible for preparedness for an HFO pollution incident, where applicable.

Preparedness during bunkering operations

A5.5 In order to reduce the risk of pollution due to HFO spills and ensure rapid response in case of an accident, bunkering operations of HFO should be carried out within the boundaries of seaports where possible. Additionally, harbour masters should be notified prior to and upon completion of bunkering operations, and of the quantity of HFO bunkered.

A5.6 During bunkering operations involving HFO in an ice-free area or where ice coverage does not exceed 10%, all ships and units engaged should utilize oil containment booms, to prevent any HFO spill spreading beyond the extent of the boom. The harbour master should decide on the requirements for the use of booms during bunkering operations involving HFO. No bunkering operations should be allowed in wind conditions above 14 m per second or wave heights over 1.25 m. The maritime administration should establish restrictions for bunker operations based on the characteristics and practice of the seaport.

A5.7 Where bunkering operations of HFO cannot be carried out within a seaport area, relevant services and arrangements for emergency response to HFO spills should be organized in close proximity to the location of the bunkering operations, such as on board a sea tug standing by in the vicinity. In addition, in such cases the harbour master of the nearest seaport should be notified prior to and on completion of bunkering operations, including the quantity of HFO bunkered.

Recommendations on the extended content of Shipboard Oil Pollution Emergency Plans (SOPEPs) or Shipboard Marine Pollution Emergency Plans (SMPEPs)

A5.8 Ship operators of ships using or carrying HFO for use as fuel are recommended to include the following in the SOPEP or SMPEP, as applicable:

- .1 possible scenarios of HFO spill incidents such as:
 - .1 an oil spill associated with an overflow of a fuel tank during bunkering or fuel transfer between tanks, between ships or between ship and ashore facilities;
 - .2 an oil spill associated with damage to the hull and breach of fuel tanks through a collision with another ship, the shore, port infrastructures or through contact with ice;
 - .3 grounding leading to hull damage and breach of fuel tanks; and
 - .4 leakage of banker hose or pipelines;

- .2 standardized procedures for responding to HFO pollution to ensure the safety of the ship's crew and, as far as practicable, the efficiency of work to mitigate any consequences of pollution;
- .3 procedures regarding immediate notification to the Administration of the Arctic coastal State and flag State and continuous monitoring of the spread of spill, as far as practicable;
- .4 inventory and maintenance requirements of pollution response equipment carried on board along with guidelines to assist the master in determining when such use is warranted;
- .5 crew training requirements (type and frequency) related to the use of oil spill response equipment carried on board; and
- .6 schedule for regular onboard drills, plan testing and training exercises related to HFO spill response, which should be carried out in accordance with the procedures provided in the SOPEP/SMPEP, aimed at ensuring crew preparedness to respond safely and effectively to any pollution incidents.

Emergency response equipment

A5.9 Ship operators are encouraged to contact in advance and engage in contracts with specialized pollution response organizations that have the necessary resources and emergency response equipment in Arctic waters and have been accredited and approved by the national Administration of an Arctic coastal State, where such service is available. Oil spill response services and arrangements should be accredited and/or approved by the national Administration of the Arctic coastal States under a statutory accreditation/approval system, when such a process is already in place.

A5.10 Consideration may be given to certain types of appropriate oil spill response equipment being carried on board ships in Arctic waters to manage an HFO spill on deck. If ship operators are considering the carriage of additional oil spill response equipment on board, priority should be given to HFO collection tanks, sorbents, trench tools and equipment for supplying steam, if the ship is not equipped with a steam supply system.

A5.11 As far as possible, practicable and safe, due to the remoteness of the Arctic region and limited shore resources, ships near to any ship that has encountered problems, including pollution incident involving HFO, should provide assistance where available if requested to do so by the local/national authority.

A6 Familiarization, training and drills

A6.1 Notwithstanding the requirements of the STCW Convention, chapter I, regulation I/14, companies should ensure that seafarers are adequately familiar with specific emergency response duties in case of an HFO spill in Arctic waters regarding actions to be taken to mitigate pollution and damage to the marine environment.

A6.2 Requirements and frequency related to onboard drills and training for HFO pollution prevention and response are recommended to be included in the ship's SOPEP or SMPEP Manual as applicable (see also paragraph A5.9) and should take into account the requirements in the Polar Code and company requirements set out in the ship's Polar Water Operational Manual (PWOM).

Enhanced preparedness for an HFO spill and actions to be taken in an emergency

A6.3 When preparing to respond to an HFO spill, the limitations of the ship in responding to such an HFO spill should be taken into account, as well as the physical and chemical characteristics of spilled HFO and its effect on the efficiency of collection, storage and disposal systems.

A6.4 Seafarers' preparedness to respond in case of accidents and emergencies involving an HFO spill should be one of a ship's drill priorities.

A6.5 Emergency preparedness training should also take into account possible limitations to external SAR and pollution response services due to location remoteness and lack of communication quality.

A6.6 Seafarers should be familiarized with the potentially serious consequences of any incidents related to HFO in Arctic waters.

Training and familiarization on board under the provisions of the STCW Convention and Code

A6.7 Masters, officers in the deck and engine departments, and other seafarers whose duties may involve handling HFO on board ships operating in Arctic waters should receive relevant familiarization and training regarding actions to be taken in case of an HFO spill.

A6.8 Onboard training and familiarization conducted by the company in accordance with regulation I/14 of the STCW Convention for seafarers whose duties may involve handling HFO on board ships operating in Arctic waters should include:

- .1 the content of the PWOM specific to the ship and individual duties and responsibilities;
- .2 fire-fighting system limitations related to HFO;
- .3 safety and pollution prevention procedures related to the use and carriage for use of HFO as fuel;
- .4 bunkering procedures, fuel transfer procedures and the importance of heating fuel oil and prevention of spills through overflow pipes or via air pipes;
- .5 role and working procedures to mitigate environmental pollution; and
- .6 duties and responsibilities and actions to be taken in case of an HFO spill.

A6.9 In line with the requirements of the ISM Code, the use and carriage for use of HFO as fuel in Arctic waters should be identified as a critical operation and the company's safety management system should provide for measures to minimize the risk of pollution due to an HFO spill; this should include established emergency drills. Seafarers with emergency duties related to HFO should be familiarized with the procedures and their duties.

- A6.10 Additional familiarization for engineer officers may include, but not be limited to:
- .1 characteristics of fuel oils when used in Arctic waters;
 - .2 management of HFO transfers in low ambient temperatures, switching between HFO and other fuels, and oil-spill equipment limitations;
 - .3 MARPOL requirements regarding pollution prevention in Arctic waters;
 - .4 provisions of the Polar Code on mitigating environmental risks during operations in Arctic waters;
 - .5 provisions of the Guidelines to mitigate risks associated with the use and carriage for use of HFO as fuel by ships in Arctic waters; and
 - .6 proper handling of HFO in the Arctic area (fuel bunkering, storage, transfer and emergency response preparation).

SECTION B

GUIDELINES FOR ADMINISTRATIONS ON MITIGATION MEASURES TO REDUCE RISKS OF USE AND CARRIAGE FOR USE OF HFO AS FUEL BY SHIPS IN ARCTIC WATERS

B1 Navigational measures

B1.1 Planning for Arctic navigation should take into account, to the extent consistent with international law, national requirements of the relevant Administration of any Arctic coastal State in whose Arctic waters passage will be made.

B1.2 In addition, the engagement of Arctic Indigenous Peoples and the utilization of Indigenous Knowledge (for instance on local currents, underwater formations and ice formation) can be useful for supporting safe and low-impact shipping, contributing to reducing spill risks from HFO.

B2 Ship operation

Taking due account of the existing experience of a ship's operation in Arctic waters, the following measure to mitigate risks associated with the use and carriage for use of HFO as fuel by ships in Arctic waters could be considered, while ensuring that the safety of operations and the crew are paramount at all times: communication with the shore operation centres or the relevant organizations of the Arctic coastal State should be maintained throughout the voyage.

B3 HFO bunkering

B3.1 In order to prevent HFO spills during bunkering of a ship, the following should be considered:

- .1 Before taking on fuel, supply hoses should be visually examined, test records checked and all deck scuppers should be securely closed to prevent oil from going overboard in case of an overflow or leak.
- .2 Hoses and cargo booms should be supplied before and after loading with only sealed flanges.

- .3 After starting HFO bunkering operations frequent checks and tank measurements on both the ship and shore facilities should be carried out. In the case of any discrepancies the bunkering operations should be stopped immediately and checks for leaks undertaken and confirmed to be in order before bunkering operations are resumed.
- .4 Pressure gauges and tank levels should be continuously monitored, and associated valves should be operated with low flow rate during changing over tanks. Spill response equipment, as detailed in the SOPEP/SMPEP, should be kept at the ready.
- .5 Hose material and hose connections should be tested prior to commencing bunkering to ensure that they operate effectively during low temperatures.

B3.2 Pumping HFO can create a pressure in the pipeline that exceeds the allowable operating pressure of the hose. If there is no pressure relief valve on the pump, a pressure relief valve should be installed in the pipeline. The pressure relief valve should open at a pressure of no more than 10% above the design pressure of the hose.

B3.3 Procedures for the use of hoses in bunkering of HFO should be documented in the ship's SOPEP/SMPEP.

B4 Communication

For ships operating in Arctic waters, reliable two-way communication between the ship, other ships and the Administration of the Arctic coastal State is one of the prerequisites for safe operation in high latitudes and for the reduction of risks to the marine environment for ships using and carrying for use HFO as fuel.

B5 Enhancement of HFO spill preparedness, early detection and response

B5.1 Along with relevant preventive measures to mitigate risks of HFO spills, a robust response system needs to be established for such an incident. Bearing in mind the specific features of the Arctic region, the key aspect should be the enhancement of services and arrangements, and broadening of cooperation among the Arctic coastal States, in order to provide adequate response.

B5.2 Staging of relevant oil spill response equipment in seaports and, where practicable and appropriate, on board ships using and carrying for use HFO as fuel, in line with the risks identified, would assist in regional preparedness for a pollution incident and would contribute to mitigation of risk of pollution and to minimization of consequences of HFO spill incident.

B5.3 The Agreement on Cooperation on Marine Oil Pollution Preparedness and Response in the Arctic (MOSPA), which entered into force on 25 March 2016, is a useful instrument governing cooperation and information-sharing on fuel oil, including heavy oil, pollution incidents in the Arctic region.

B5.4 In the event that a country volunteers to manage the response operation on the high seas beyond their territorial waters, that country should initiate the development of the relevant requirements for the response, including whether assistance would be requested from other countries. Special consideration for development of joint response requirements and/or contingency plans, particularly bilateral intergovernmental agreements aimed at combating pollution, should be given to areas where Arctic waters of one country are adjacent to Arctic waters of another country, especially if either country issues waivers under regulation 43A of MARPOL Annex I to allow ships under its flag to use HFO as fuel after 2024, when a ban of the use of HFO as fuel in Arctic waters will be in effect.

B5.5 For prompt response to possible HFO spills in the Arctic, capability for early detection of oil spills is strongly recommended. Environmental monitoring by satellite and unmanned aerial vehicles fitted with an IR sensor can be used for these purposes when available. Equipment for HFO detection in the infrared band may also be installed on ships. National aerial surveillance capabilities in the Arctic region and exchange of information could be enhanced through international cooperation.

B5.6 Ships should provide information regarding the planned route to the relevant competent national body of the Administration of the Arctic coastal State through whose waters the voyage will occur, and to the specialized organization responsible for preparedness for an HFO pollution incident, where applicable.

Preparedness during bunkering operations

B5.7 In order to reduce the risk of pollution due to HFO spills and ensure rapid response in case of an accident, bunkering operations of HFO should be carried out within the boundaries of seaports, where possible. Additionally, harbour masters should be notified prior to and upon completion of bunkering operations, and of the quantity of HFO bunkered.

B5.8 During bunkering operations involving HFO in an ice-free area or where ice coverage does not exceed 10%, all ships and units engaged should utilize oil containment booms, to prevent any HFO spill spreading beyond the extent of the boom. The harbour master should decide on the requirements for the use of booms during bunkering operations involving HFO. No bunkering operations should be allowed in wind conditions above 14 m per second or wave heights over 1.25 m. The Administration should establish restrictions for bunker operations based on the characteristics and practice of the seaport.

Preparedness for response

B5.9 For the delivery and deployment of HFO spill response equipment, it is recommended to engage strategically based sea tugs as response ships, where available and practicable. The Administration of the Arctic coastal State should determine the appropriate number of such response ships and their optimal locations, based on the intensity of ship traffic and the most used routes by ships using or carrying HFO for use as fuel.

B5.10 The response ship should have a radar system able to detect oil and ice and consideration may be given to carrying on board an unmanned aircraft fitted with an IR sensor for air reconnaissance of the affected area and monitoring of any spill spread, in addition to other oil spill response equipment.

B5.11 It is recommended that adequate HFO spill response resources and arrangements be made available in seaports located within Arctic waters, as deemed appropriate through assessment of the risk of HFO spills in or near these ports. These services and arrangements may be deployed upon the decision of the Administration of the Arctic coastal State as appropriate.

Emergency response equipment

B5.12 Ship operators are encouraged to contact in advance and engage in contracts with specialized pollution response organizations that have the necessary resources and emergency response equipment in Arctic waters and have been accredited and approved by the national Administration of the Arctic coastal States, where such service is available. Oil spill response services and arrangements should be accredited and/or approved by the national Administration of the Arctic coastal States under a statutory accreditation/approval system, when such a process is already in place.

B5.13 The following emergency response equipment could be considered for storing on board sea salvage tugs, or response ships, if available, to address potential HFO spills:

- .1 oil booms not less than three times the ship length, capable of containment in wave heights up to 1.25 m and wind speed up to 14 m per second or within the restrictions established by the maritime administration of the Arctic coastal States, and which will create a barrier around the ship in case of emergency, thereby preventing HFO spread;
- .2 floating beacons with a VHF/GNSS position transmitter to monitor the spread of the HFO spill in case of emergency – at least four pieces;
- .3 autonomous oil-gathering systems to remove HFO from ice and from ice-free areas, one set;
- .4 autonomous oil-pumping systems, such as oil skimmers, suitable for high viscosity oil and low temperature capable (with integrated pumping system, provided with heating system or annular injection system); pumping devices will be dimensioned according to the storage capacities available on board;
- .5 hot water high-pressure washers – at least one set;
- .6 one suitable (work/life) boat capable of installing/towing the oil boom;
- .7 elastic floating tanks, which are more compact for placement aboard the ship, for oil removal and storage – a capacity of 50% of the maximum amount of the HFO carried as fuel;
- .8 sorbents and absorbing materials with the absorbing capacity of 20% of the maximum amount of the HFO carried as fuel;
- .9 individual personal protection equipment (PPE) for use when responding to an oil spill, including for use in Arctic conditions (suits, gloves, goggles, etc.) – for 200% of the ship's crew;
- .10 filter respirators suitable for use with HFO vapours – for 200% of the ship's crew; and
- .11 two-gas detector for HFO vapours and personal gas detectors for the ship's crew.

Services and arrangements for response to HFO spills in ports and areas within the Arctic waters

B5.14 Technical requirements for oil spill response equipment should be determined by the local conditions of each port, hydro-meteorological and infrastructural features. The following equipment could be considered for each port to be able to implement appropriate emergency response:

- .1 an oil boom up to 200 m in length and composed of air inflatable chambers for efficient containment of an HFO spill in open waters and in wave heights up to 2 m and wind speeds up to 20 m per second or within the restrictions established by the maritime administrations of the Arctic coastal States;

- .2 an oil boom at least three times the ship length for ships that use or carry HFO for use as fuel, and, for bunkering ships (tankers), a second oil boom of at least one ship length for efficient HFO containment in wave height up to 1.25 m and wind speed up to 15 m per second;
- .3 a boom defence for operation in shallow waters with wall height in the range of 450-750 mm for connection with ashore point where the HFO spill is most likely to contaminate the shoreline and to prevent any secondary pollution of the sea area;
- .4 at least one autonomous oil-gathering system (such as oil skimmers, suitable for high viscosity oil and low temperature) capable of gathering and pumping the maximum amount of HFO carried as fuel within 24 hours in both open water and compacted ice conditions;
- .5 at least one set of high-pressure high temperature washers to heat and reduce viscosity of the spilled HFO while working on gathering the spill;
- .6 at least one port tug or suitable (salvage) vessel/workboat to install an oil boom in all described weather conditions;
- .7 tanks for oil recovery and storage, with total capacity reaching 250% of the maximum amount of HFO carried for use; tanks should be equally distributed between ports along the ship route; and
- .8 at least 300 kg of sorbents and absorbing materials.

B5.15 Each Administration of an Arctic coastal State may establish special organizations responsible for deployment of oil spill response services and should ensure appropriate arrangements in ports for preparedness for HFO spill.

B5.16 In addition to traditional mechanical oil removal, alternate response techniques should be considered and provisioned for. Consultation with the affected State or States is required to ensure the proposed techniques are permitted under national laws and regulations and the techniques must be approved for each pollution incident. Response techniques for removing or recovering sinking oil products should also be considered and provisioned for. The *IMO Guide on Oil Spill Response in Ice and Snow Conditions* provides a reference to the advantages and limitations of available techniques.

B6 Familiarization, training and drills

B6.1 Masters, officers in the deck and engine departments, and other seafarers whose duties may involve handling HFO on board ships operating in Arctic waters should receive relevant familiarization and training regarding actions to be taken in case of an HFO spill. Specialized training regarding oil-spill response should be conducted in training centres ashore and include, but not be limited to, spill assessment, the spilled oil's fate/behaviours and the handling of pollution-related equipment.

Enhanced preparedness for an HFO spill and actions to be taken in an emergency

B6.2 Seafarers' preparedness to respond in case of accidents and emergencies involving an HFO spill should be one of a ship's drill priorities.

Training and familiarization on board and training under the provisions of the STCW Convention and Code

B6.3 Onboard training and familiarization conducted in accordance with regulation I/14 of the STCW Convention for seafarers whose duties may involve handling HFO on board ships operating in Arctic waters should include:

- .1 the content of the PWOM specific to the ship and individual duties and responsibilities;
- .2 fire-fighting system limitations related to HFO;
- .3 safety and pollution prevention procedures related to the use and carriage for use of HFO as fuel;
- .4 bunkering procedures, fuel transfer procedures and the importance of heating fuel oil and prevention of spills through overflow pipes or via air pipes;
- .5 role and working procedures to mitigate environmental pollution; and
- .6 duties and responsibilities and actions to be taken in case of an HFO spill.

B6.4 Additional familiarization for engineer officers may include, but not be limited to:

- .1 characteristics of fuel oils when used in Arctic waters;
- .2 management of HFO transfers in low ambient temperatures, switching between HFO and other fuels, and oil-spill equipment limitations;
- .3 MARPOL requirements regarding pollution prevention in Arctic waters;
- .4 provisions of the Polar Code on mitigating environmental risks during operations in Arctic waters;
- .5 provisions of the Guidelines to mitigate risks associated with the use and carriage for use of HFO as fuel by ships in Arctic waters; and
- .6 proper handling of HFO in the Arctic area (fuel bunkering, storage, transfer and emergency response preparation).