ALASKAN ADVISORY

March 2023

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SECTION 1 — GENERAL

Part 1 provides general, high level, guidance for Polar Code compliance. The guidance is intended for Alaskan waters operations.

APPLICATION

This Advisory is only applicable for operations in polar waters around Alaska (north of 60° N) in areas defined by the IMO Polar Code. The contents of this Advisory are oriented towards operations with SOLAS certified cargo ships operating with minimal polar hazards, including:

- Sea Ice: Ice-free waters only
- Air Temperature: No low air temperature operation(s)
- Ice Accretion: Areas and times where ice accretion is not expected to occur
- Latitude: Within the limitations of Sea Area A3 and below 80° N

The principal months of application are July, August, September and October. Operation(s) outside those months may require closer evaluation than this Advisory gives guidance.

This Advisory is focused on bulk carriers and oil tankers but may be used on other vessel types such as general cargo, research, special mission ships, etc. This Advisory is not intended for yachts, fishing vessels and other non-SOLAS vessels.

INTRODUCTION

The safety and environmental parts of the International Code for Ships Operating in Polar Waters (IMO Polar Code) was formally adopted by the IMO in 2014 and 2015 and entered into force on January 1, 2017, for new ships and after the first SLC Intermediate survey after January 1, 2018, for existing vessels. The mandatory sections of the Code are brought into effect via amendments to SOLAS (new Chapter XIV), MARPOL (amendment to specific Annexes) and the STCW (Standard for Training, Certification and Watchkeeping) convention. The IMO Polar Code assumes that ships are already compliant with these three conventions. Non-SOLAS ships are expected to comply with the Polar Code's requirements as far as is possible and the IMO is creating guidance for these vessels, but non-SOLAS vessels are not considered in this publication.

The Polar Code introduces a list of potential hazards for polar water operations in introduction paragraph 3. Understanding these hazards and their applicability (how they apply or do not apply) to a given vessel's operation is an important aspect in complying with the Polar Code and its overall safety intent. Using a Goal Based Standard (GBS) format, the process of obtaining Polar Ship Certification can range from being a significant challenge to one of relative straight forward ease. This publication aims to provide enough information to make the certification an easier one for the vessel operator.

Notes:

1) **Ice Free Water** means no ice present.
2) **Ship intended to operate in low air temperature** means a ship which is intended to undertake voyages to or through areas where the lowest Mean Daily Low Temperature (MDLT) is below -10° C.

THE PROCESS

Following the shipowner's polar water objectives, the normal process through the Polar Code begins with data collection. This data collection and subsequent analysis will determine which hazards are applicable and their severity to specific ships, operating areas and operating seasons.

The hazards outlined in this publication are for relatively low risk operation(s) where most of the hazards do not apply, and therefore many of the more onerous regulations do not apply. Some hazard data is provided in Appendix I of this Advisory. To obtain more complete and updated data please contact ABS, the contact info is provided on the back page of this Advisory.

After the data has been collected, the formal Operational Assessment (OA) is to be performed as required by Polar Code Part 1/1.5. The OA is required even if the intended operational limitations are like the ones specified in Section 1-1 of this Advisory. With the limitations specified in Section 1-1 the OA will generally be a simplified assessment. It is still very important to understand the hazards and how to ensure the vessel is able to avoid them. An OA considers the hazards employing a risk assessment format. If a hazard's risk is determined to be more than the operator's risk tolerance, then risk control or mitigation measures are proposed to lower the involved risk.

After assessing the risks for each hazard, the individual Polar Code regulations should be thoroughly examined to ensure compliance with the applicable requirements. The OA should formally be documented in a report. There are several types of OAs. The first is done before the Polar Water Operational Manual (PWOM) is written. This OA is typically focused on the specific operational profile for the vessel, such as specific ports or routes and seasons but can also be generalized for a broader area of operation. The second type of OA is done after the Polar Ship Certificate (PSC) is issued. This type of OA is done as part of the voyage planning requirements as required in Polar Code Part I-A/11. This OA considers the operational limitations on the PSC and the procedures in the PWOM. The assessment is to ensure that the planned operation will stay within the limitations (structural, stability, systems, etc.) of the vessel and that the procedures in the PWOM are adequate for the intended voyage.

The focus of this Advisory will be the initial operational assessment, achieved prior to the PWOM being written and well prior to the issuance of the PSC.

After the initial OA, the following step is generally the development of a vessel specific PWOM. The PWOM provides the crew and company with guidance for operations within polar waters. The PWOM should advise the crew how to safely operate their specific vessel in polar waters, how to stay within the operational limitations of the vessel and offer additional information in the event that operational conditions go (slightly) beyond what is expected.

A completed PWOM along with the initial OA report are submitted to ABS for review (not approval). During this review, ABS engineers will ensure the hazards listed in the Polar Code are well considered and that all applicable Polar Code requirements are met. It is noted that the IMO discussions concluded that a PWOM is not an approved document and is expected to be a living document. This means that the PWOM may evolve as operational experience in polar waters increase. A PWOM may undergo subsequent revisions without re-review by ABS, so long as the initially considered hazards and risks have not been changed. If the OA considered hazards and risks have changed from what is stated on an ABS review letter, the new OA and revised PWOM must be resubmitted to ABS for review. See Section 2-7 of this.

As part of the Polar Ship Certification process, an ABS surveyor is required to survey the vessel to ensure it has the equipment and consumables needed to follow the procedures in the PWOM and to meet the requirements of the Polar Code. Upon satisfactory completion, the surveyor will issue the PSC.

The PSC dates are aligned with the SOLAS certificates for flag States that are signatory to the Harmonized System of Survey and Certification (HSSC). Category C ships that do not have new equipment added to the vessel may be eligible for an initial survey waiver as per Polar Code Part I-A/1.3.3. If the survey waiver is the taken option, the survey will be conducted at the next scheduled survey. The details required for a PSC are provided in Appendix II, section 7 – Details for Polar Ship Certificate.

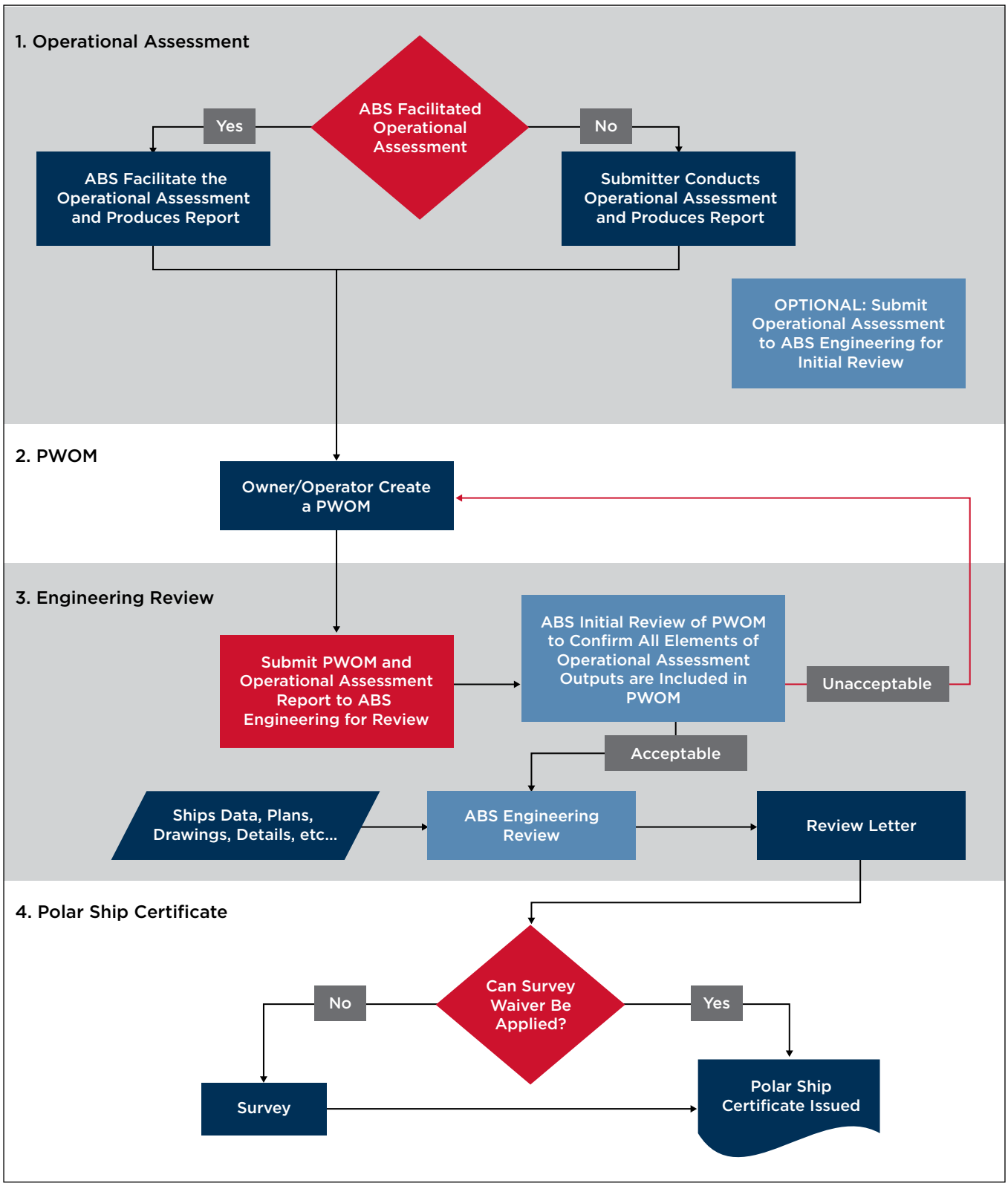


Figure 2: Process to get a Polar Ship Certificate

GOAL-BASED STANDARDS IN THE POLAR CODE

Goal-Based Standards (GBS) are comprised of at least one goal, functional requirements associated with that goal and regulations that if met ensure compliance with the functional requirements.

A list of hazards related to ship operations in polar waters are identified as a basis for the goals and functional requirements within the Polar Code. These hazards are laid out in the Introduction section of the Polar Code. The listed Polar Code hazards represent a minimum list of hazards for polar ships considered to be above and beyond the shipping hazards typically encountered by SOLAS ships.

Chapters 2 through 12 in the safety part of the Polar Code (Part I-A) begin with an established goal and subsequent functional requirements which are linked to the relevant hazards. Each of the functional requirements are then supported by prescriptive regulations as a means for compliance. In some instances, the regulations refer to international standards or classification requirements, such as different International Association of Classification Societies (IACS) Unified Requirements.

[The regulations given in the Polar Code are to be taken as mandatory in nearly all cases. The IMO recognized that alternative solutions are possible while maintaining an equivalent level of safety. In other words, a solution can be proposed that meets the functional requirements while not meeting the prescriptive regulations. To account for this SOLAS Chapter XIV, regulation 4 introduces alternative designs or arrangements. These alternative design(s) or arrangement(s) therefore meets the functional requirement(s) in the Polar Code but does not meet the prescriptive regulations. The Alternative Design and Arrangement regulation can be used for anything in Polar Code chapters 3, 6, 7 and 8. The Alternative Design and Arrangement regulation cannot be used for requirements in the other Polar Code chapters such as 9 and 10 unless authorized by the flag Administration.]

THRESHOLDS IN THE REGULATIONS

The Polar Code is not a one-size-fits-all regulatory instrument. Several thresholds are established to invoke Polar Code requirements based on the intended operational profile of the vessel. Fundamentally, more severe operating conditions will lead to a more extensive application of the Polar Code requirements. It is important for designers, owners and operators of polar ships to make appropriate decisions and assumptions about a ship's intended operation. Discussions should be held as early as possible with the flag State or ABS to ensure a clear understanding of the applicable regulations. The primary thresholds for regulations in the Polar Code are based on the following conditions:

- Ships intended to operate in ice
- Polar ship categories
- Ships intended to operate in low air temperatures
- Ships intended to operate in areas where ice accretion is likely to occur
- Ships intended to operate above 80° N

If a ship's planned operational profile does not expose the vessel to polar hazards, then the regulations associated with those hazards do not apply. This does not mean that these hazards can be ignored as part of the Polar Code process. The hazard should still be considered, and procedures developed to give the vessel's master and crew guidance on how to avoid or mitigate the risk associated with these hazards. Procedures shall also be developed as contingencies in the event the expected conditions are slightly exceeded.

RISK ASSESSMENT GUIDANCE

The goal of the risk assessments are to determine all applicable hazards associated with a specific operation, considering both the likelihood and consequence of that hazard to the vessel, the crew and the vessel's operation. There are many ways to conduct a risk assessment. Different methods for conducting risk assessments can offer certain advantages or disadvantages depending on the desired outcome.

The Polar Code Part I-B/2.2.2 references ISO/IEC standard IEC 31010 – Risk management – Risk Assessment Techniques. This document provides an overview of different risk techniques and provides guidance for conducting risk assessments. Like the ISO/IEC standard, ABS has published Guidance Notes on Risk Assessment Applications for the Marine and Offshore Industries. The Guidance Notes offer guidance on different risk assessment techniques and provides examples of typical risks for marine applications/operations.

Suggested consequence and likelihood categories have been provided in Table 1 and Table 2 below which can be used for the risk assessment portion of the OA as outlined in Annex 3 of MSC 72/16. A sample risk matrix is also provided which can be used during an OA. When ABS facilitates an OA, a matrix like the one shown in Table 3 is used for every hazard. If more detailed itemized risk assessments are deemed necessary or there is a desire to reduce size, a tabular format can be used as shown in Table 4. In this format the same risk assessments are performed as with Table 3 but the value from one to five is entered for the consequence and likelihood categories. The resultant end risk value is determined by multiplying the consequence value and the likelihood value. It is customary to have the cells color coded based on their value, so the high risks are easily identified.

Table 1: Consequence Categories

Used Here		Consequence Index from Annex 3 of MSC 72/16		
Consequence Categories	**No.**	**Severity**	**Effects on Human Safety**	**Effects on Ship**
No Effect	1	—	—	—
Minor Effect	2	Minor	Single or minor injuries	Local equipment damage
Moderate Effect	3	Significant	Multiple or severe injuries	Non-severe ship damage
Major Effect	4	Severe	Single fatality or multiple severe injuries	Severe damage
Catastrophic	5	Catastrophic	Multiple fatalities	Total loss or oil pollution

Notes:
The time required to obtain replacement parts while in Alaskan waters my influence the consequence aspect of the assessments.

Table 2: Likelihood Categories

Used Here		Frequency Index from Annex 3 of MSC 72/16	
Likelihood Categories	**No.**	**Severity**	**Effects on Human Safety**
At no time	1	—	—
Very rare	2	Extremely remote	Likely to occur once in 10 years in a fleet of 1,000 ships.
Rare	3	Remote	Likely to occur once per year in a fleet of 1,000 ships, i.e., likely to occur in the total life of several similar ships
Sometimes	4	Severe	Likely to occur once per year in a fleet of 10 ships, i.e., likely to occur a few times during the ship's life
Frequently	5	Frequent	Likely to occur once per month on one ship

Table 3: Risk Matrix

Consequence Categories		Likely Categories				
		1	2	3	4	5
		At No Time	Very Rare	Rare	Sometimes	Frequently
1	No Effect					
2	Minor Effect					
3	Moderate Effect					
4	Major Effect					
5	Catastrophic					

Table 4: Itemized Risk Matrix

	Original Assessment			Assessment After RCMs Applied			
Description	Consequence Category	Likelihood Category	Risk	Consequence Category	Likelihood Category	Risk	Comments
Item 1							
Item 2							
...							
Item 2							

GUIDANCE ON ESTIMATING THE MAXIMUM EXPECTED TIME OF RESCUE

The Maximum Expected Time of Rescue (METR) should be determined by an accepted and methodical procedure such as the one in IMO SSE7/4/1 and SSE7/INF.6.

The process of determining the METR is intended to establish the endurance requirements for lifesaving appliances in polar waters the considered timer should commence when the lifesaving appliance(s) is launched. It is recognized that the ship may be at times the safest place to stay until abandonment becomes necessary. For the purposes of estimating the METR, the call for search and rescue is assumed to occur simultaneously with the launch of the lifesaving appliance(s). The end of the METR calculation is determined when the last survivor is no longer in a survival situation, depending on the equipment provided prior to abandoning.

Considering rescue by vessels of opportunity can be a complex task it is therefore suggested to ignore them when calculating the METR. It is noted that vessels sailing together, such as in a convoy, are not considered vessels of opportunity.

Alaskan Polar Waters are within the United States Coast Guard (USCG) District 17. The search and rescue capabilities of the USCG in Alaskan waters can vary from year to year and season to season. Information is required to perform calculations to justify the minimum five-day METR. When estimating the METR, it may be assumed that the USCG SAR assets will launch from Kodiak. Though, in many cases Alaskan polar water operations may have a calculated METR of less than five-days, the Polar Code specifies that five days is the minimum METR to be considered and planned for by polar ship certified vessels.

OPERATIONAL LIMITATIONS

The PSC has three sections for Operational Limitations. An example of the limitations intended with this Advisory are shown in Figure 3:

5.1 Ice Conditions	Limited to ice-free waters only Limited to areas where ice accretion is not expected to occur
5.2 Temperature	Limited to operations in polar waters where the expected lowest MDLT for the area and season of operation is greater than or equal to -10°C
5.3 High Latitudes	Limited to operations in Alaskan Polar waters up to an operational latitude of the lesser of: • 80° North • The limitations of the sea area on the Cargo Ship Safety Radio Certificate • The limitations of the systems used to acquire ice/environmental information

Figure 3: Operational Limitations Section of Polar Ship Certificate

The limitations placed on the PSC are typically based upon the outcomes of the OA and the procedures included in the PWOM. For the purposes of this Advisory, it is assumed that the operational limitations will be very similar to those shown in Figure 3.

ENVIRONMENTAL DATA TO JUSTIFY OPERATIONAL LIMITATIONS

Historical environmental data for sea ice, air temperature and ice accretion shall be used to prove or justify the operational limitations. For example, the operational limitations given in Figure 2 state ice free waters only. Ice data is needed to estimate when and where ice free operations may occur. This data is also required as part of the voyage planning required in the Polar Code Part I-A/11.3.4. This data is to be available for planning purposes to ensure the vessel stays within its limitations.

A sample set of environmental data is provided in Appendix I. This data is only valid for the year of publishing for this Advisory. For other assessments an updated dataset can be obtained from ABS, see contact information on the back page of this Advisory.

NORMAL ADDITIONS OR MODIFICATIONS TO A SHIP TO RECEIVE A POLAR SHIP CERTIFICATE

The Polar Code is a goal-based standard, with several thresholds for requirements. In most cases if a hazard is not applicable to a specific operational profile, the regulations associated with mitigating the risk of that hazard are not applicable. Even though the code has these thresholds there are still a few areas where most vessels seeking a PSC require additions or modifications. A non-exhaustive example list is given below:

1. Two non-magnetic means of determining heading [Part I-A/9.3.2.2.1]
2. Airband radio [Part I-A/10.3.1.3.2]
3. Two remotely rotatable search lights suitable for searching for ice [Part I-A/9.3.3.1]
4. A4 Radio Installation (if going to an area where A4 is needed) [Part I-A/10.3.1.1]
5. Means of obtaining ice and weather information, functional up to the maximum latitude of intended operation. [Part I-A/9.3.1]
6. Manually activated flashing red stern light (if planned operations with icebreakers) [Part I-A/9.3.3.2]
7. Personal and group survival equipment as necessary to enable survival for the maximum expected time of rescue [IMO MSC.1/Circ. 1614] [Part I-A/8.3.3]
8. Heating for emergency fire pump [Part I-A/7.3.2.1]
9. Additional EPIRB (or procedures to extend battery life for the maximum expected time of rescue) [Part I-A/10.3.2.3]
10. Additional batteries for handheld GMDSS radios. (or procedures to extend battery life for the maximum expected time of rescue) [Part I-A/10.3.2.3]
11. Additional water, rations, sea sickness medication [IMO MSC.1/Circ. 1614]
12. Insulated Immersion Suits [Polar Code Part I-A/8.3.3.1.2]

13. Tools for de-icing/anti-icing, e.g., mallets, shovels, scrapers, anti-freeze, salt etc. (if planned operation is in an area at a time where ice accretion is expected to occur or as contingencies). [Part I-A/4.3.1.2.2]
14. Cold weather clothing for crew

Items 1 and 2 in the above list are prescriptive and mandatory for all vessels seeking a PSC. Experience has shown that a GNSS Compass may be the less onerous solution to item 1, and a handheld radio instead of a fixed installation for item 2 is easier as there are no installation drawings required for review and additionally can be included in vessel abandonment procedures.

The PSC is issued on behalf of the flag administration. The flag can waive requirements for equipment at their discretion.

ALTERNATIVE DESIGNS OR ARRANGEMENTS

The Polar Code's Goal-Based Standard (GBS) format allows for technological improvements or acceptance of older designs based on an equivalent level of safety. The GBS format is found in Part I-A of the Polar Code where the chapters have functional requirements itemized underneath the goals. The functional requirements are the mandatory requirements. It is highly recommended to follow the regulations underneath the functional requirements but alternatives to the prescriptive requirements may be accepted by applying the Alternative Design and Arrangement Regulation (SOLAS Chapter XIV, Regulation 4). In accordance with SOLAS, the alternative design and arrangements can be used for anything in Polar Code chapters 3, 6, 7 and 8. This cannot be used for requirements in the other Polar Code chapters such as 9 and 10 unless authorized by the flag administration.

To apply for an alternative, the equivalent level of safety must be technically proven, documented and submitted to ABS for review. In most cases the flag Administration for the vessel will need to approve the proposed alternative, as the PSC is issued by ABS on behalf of the vessel's flag. This process can take time and is therefore recommended to be avoided if possible.

STANDARD FOR SURVIVAL EQUIPMENT

For operations in July, August, September or October to most Alaskan ports, most standard SOLAS equipment may be sufficient but should be carefully evaluated during the OA. In most cases cargo ship operators indicate the preference for use of lifeboats over liferafts in polar waters due to the added protection offered by the boat. It is also very common for operators to have procedures to ensure all survival equipment is launched to maximize available resources after abandonment. Of course, the mode of abandonment must be left to the master. Procedural guidance within the PWOM may assist the master in such decisions along with specific training of the crew.

Procedures and processes to maintain equipment and system functionality can be a challenge, especially if the limitations are beyond those specified in the first section of this Advisory.

An ISO standard for polar survival equipment ISO/DIS 24452 may be referenced for additional information on lifesaving appliances.

CONSIDERATIONS FOR INDIGENOUS POPULATIONS

There are many Alaska Native communities that rely on the Alaskan waters and surrounding coastline. The Alaskan coastline and waters provide subsistence resources, with many groups using the landfast ice and frozen lakes to hunt migrating animals. Marine operations during any season can disrupt the ice and thus the migratory paths of the animals and the local peoples. Marine operations can also disrupt local fish, bird and whale populations, another source of food for the Alaskan Native peoples. Recent experience has clearly indicated that previously considered annual migration/hunting periods and locations are changing and care should be taken in assessing latest information on activity in order not to interfere.

Operators should be aware of the Alaska populations in the area of operation and any local wildlife that could be interrupted or negatively impacted. While enroute it is advisable to stay within established shipping corridors and masters should contact the USCG Sector Anchorage when needed. The port facility or the vessel's agents can also be a resource for reducing the impact of the operation on the local environment and peoples. The following sources provides additional information:

https://www.pame.is/document-library/pame-reports-new/pame-ministerial-deliverables/2021-12th-arctic-council-ministerial-meeting-reykjavik-iceland/788-overview-of-low-impact-shipping-corridors-other-shipping-management-schemes/file

IMO NCSR 5/3/7 - ROUTEING MEASURES AND MANDATORY SHIP REPORTING SYSTEMS, Establishment of two-way routes and precautionary areas in the Bering Sea and Bering Strait

NCSR 5/3/8 - ROUTEING MEASURES AND MANDATORY SHIP REPORTING SYSTEMS, Establishment of three new areas to be avoided in the Bering Sea

MARINE WILDLIFE

As part of the voyage planning requirements found in Polar Code chapter 11, the master shall consider a route through polar waters taking into account current information and measures to be taken when marine mammals are encountered. As discussed in the previous section, marine operations can impact local fish, bird, and whale populations. The environmental pollution from the operation can damage the local environment in which the sea life live and hunt. Although not required by the Polar Code, the vessel's Underwater Radiated Noise (URN) may be a consideration. The URN from the propulsion machinery and other equipment can disrupt communication between different whale species and has led to significant decrease in whale populations around busy ports such as the port of Vancouver, B.C. Canada. The lights on vessels can attract birds, causing them to strike the lights and potentially become injured or die.

To reduce the environmental impact of the operation, the vessel speed can be reduced where such actions are prudent, or routing altered. Speed reductions can lessen the underwater noise from the vessel and reduce the likelihood and consequence of striking a marine mammal. Caution should be taken to avoid the hunting and spawning grounds of the marine mammals. There are several species of land animals that also rely on local fish and marine mammals, such as Alaskan brown bears. The bears require the sustenance from the fish and marine mammals to survive the long Alaskan winters. Any interruption in the local sea life can negatively impact the shore-based wildlife. Some useful links are provided below:

https://files.worldwildlife.org/wwfcmsprod/files/Publication/file/20tn3hjotq_report_wwf_arctic_arcnet_introductory_guide_a4_hires_final_webversion.pdf?_ga=2.62537647.2017083424.1666279484-1234889066.1666279484

https://ak.audubon.org/conservation/ecological-atlas-bering-chukchi-and-beaufort-seas

https://www.fisheries.noaa.gov/alaska/marine-mammal-protection/co-management-marine-mammals-alaska

https://files.worldwildlife.org/wwfcmsprod/files/Publication/file/3w8rtbuh00_WWF_Bering_Straits_Shipping_Report_UPDATE.pdf?_ga=2.62537647.2017083424.1666279484-1234889066.1666279484

TRAINING

Part I-A/Chapter 12 of the Polar Code contains the training requirements. The aim for this Advisory is for cargo ships operating in Ice Free waters. Table 4 below is a copy from the Polar Code's regulations and outlines the training requirements based on the vessel type and the ice conditions.

Table 4: Itemized Risk Matrix

Ice Conditions	Tankers	Passenger Ships	Other
Ice Free	Not applicable	Not applicable	Not applicable
Open Waters	Basic training for master, chief mate and officers in charge of a navigational watch	Basic training for master, chief mate and officers in charge of a navigational watch	Not applicable
Other Waters	Advanced training for master and chief mate. Basic training for officers in charge of a navigational watch	Advanced training for master and chief mate. Basic training for officers in charge of a navigational watch	Advanced training for master and chief mate. Basic training for officers in charge of a navigational watch.

Note 1: Ice Free Water means no ice present. If ice of any kind is present this term shall not be used.
Note 2: Open Waters means a large area of freely navigable water in which sea ice is present in concentrations less than 1/10. No ice of land origin is present.
Note 3: Other Waters means waters other than Ice Free or Open Waters.
Note 4: Ice of land origin means ice formed on land or in an ice shelf, found floating in water.

Training required in chapter 12 of the Polar Code is to be provided by an organization recognized by the vessel's flag administration.

[The training requirements in chapter 12 of the Polar Code, are minimums. Training and experience are vital to safe ship operations, training is a sound investment in the safety of the vessel. If any ice is expected during the planed operation, ABS suggests the crew have at least the basic training, even if chapter 12 does not require it. Another option is the use of Ice Navigators to aid the master and crew in polar waters.]

ENVIRONMENTAL PROTECTION REGULATIONS

Part II-A of the Polar Code contains the pollution prevention measures that are enabled by amendments to the annexes in MARPOL.

CHAPTER 1 – PREVENTION OF POLLUTION BY OIL

With the focus of this Advisory on Category C cargo ships, the requirements in this chapter are simply zero oil discharge in Arctic waters, i.e., 0 ppm. Antarctic waters were already set to zero discharge by MARPOL, Annex I, Chapter 3, Part C, Regulation 15.

Resolution MEPC.329(76) amends MAPROL Annex I, prohibiting the use and carriage for use as fuel of heavy fuel oil (HFO) by ships in Arctic waters. This comes into effect on July 1, 2024, unless the ship is:

- a Polar Code Category A ship,
- a Polar Code Category B ship, or
- a Polar Code Category C ship that was designed and built-in accordance with MARPOL Regulation 12A, "Oil Fuel Tank Protection".

In these three cases, the prohibition of use and carriage of heavy fuel comes into effect on July 1, 2029. Please contact ABS if further information or details are required.

While in polar waters the Oil Record Book(s) should have entries if any oil operations take place in polar waters. The Shipboard Oil Pollution Emergency Plan (SOPEP) or Shipboard Marine Pollution Emergency Plan (SMPEP) may need to be updated/amended for polar water operations.

CHAPTER 2 – CONTROL OF POLLUTION BY NOXIOUS LIQUID SUBSTANCES IN BULK

This chapter prohibits the discharge of any noxious liquid substances, or mixtures containing such substances. Similarly, operation in polar waters is to be considered in the Cargo Record Book, the manual, and the SMPEP as applicable.

CHAPTER 3 – PREVENTION OF POLLUTION BY HARMFUL SUBSTANCES CARRIED BY SEA IN PACKAGED FORM

Not applicable at this time.

CHAPTER 4 – PREVENTION OF POLLUTION BY SEWAGE FROM SHIPS

For Category C Ships, this chapter in the Polar Code modifies MARPOL Annex IV by treating ice in the same way MARPOL treats land. For example, MARPOL Annex IV Regulation 11.1.1 states:

> *"the ship is discharging comminuted and disinfected sewage using a system approved by the Administration in accordance with regulation 9.1.2 of this Annex at a distance of more than 3 nautical miles from the nearest land, or sewage which is not comminuted or disinfected, at a distance of more than 12 nautical miles from the nearest land, provided that, in any case, the sewage that has been stored in holding tanks, or sewage originating from spaces containing living animals, shall not be discharged instantaneously but at a moderate rate when the ship is en route and proceeding at not less than 4 knots; the rate of discharge shall be approved by the Administration based upon standards developed by the Organization"*

whereas Polar Code Part II-A/4.2.1 states:

> *".1 the ship is discharging comminuted and disinfected sewage in accordance with regulation 11.1.1 of MARPOL Annex IV at a distance of more than 3 nautical miles from any ice-shelf or fast ice and shall be as far as practicable from areas of ice concentration exceeding 1/10; or*

.2 the ship is discharging sewage that is not comminuted or disinfected in accordance with regulation 11.1.1 of MARPOL Annex IV and at a distance of more than 12 nautical miles from any ice-shelf or fast ice and shall be as far as practicable from areas of ice concentration exceeding 1/10; or

.3 the ship has in operation an approved sewage treatment plant certified by the Administration to meet the operational requirements in either regulation 9.1.1 or 9.2.1 of MARPOL Annex IV, and discharges sewage in accordance with regulation 11.1.2 of Annex IV and shall be as far as practicable from the nearest land, any ice-shelf, fast ice or areas of ice concentration exceeding 1/10."

CHAPTER 5 – PREVENTION OF POLLUTION BY GARBAGE FROM SHIPS

This Polar Code chapter modifies the MARPOL Annex V Regulation 4 requirements to include ice in the 12 nautical mile limit for food waste discharge. The discharge of food wastes onto ice is prohibited, and any discharge of animal carcasses is prohibited. The Garbage Record Book and Garbage Management Plan are to consider polar water operations.

ENVIRONMENTAL REQUIREMENTS NOT INCLUDED IN PART II OF THE POLAR CODE

Resolution MEPC.329(76) amends MAPROL Annex I, prohibiting the use and carriage for use as fuel of heavy fuel oil by ships in Arctic waters. Heavy fuels are banned from Antarctic waters by MARPOL Annex I, Chapter 9. The ban for Arctic waters comes into effect on July 1, 2024 unless the ship is a Polar Code Category A or B ship (Ice Class PC7 up to Ice Class PC1) or was designed and built-in accordance with MARPOL Regulation 12A, "Oil Fuel Tank Protection." In these cases, the prohibition of use and carriage of heavy fuel comes into effect on July 1, 2029.

SECTION 2 – ALASKA GENERAL

GENERAL

The state of Alaska is the Northern most state of the United States of America, bordering Canada to the East and Russia to the west across the Bearing Strait. Alaska has a small population compared to other US states but is very rich in natural resources. The abundance of resources and required Northern resupply leads to the majority of the marine traffic in Alaskan waters.

COMMON PORTS CONSIDERED FOR COMMERCIAL MARINE TRAFFIC

Note to vessel operators: All the towns/villages or coastlines in Alaska, including the ones listed below should not be approached by a marine vessel, unless a matter of emergency or previous arrangements with the community. All communities rely on harvesting marine resources year-round and lack of prior arrangement may disrupt activities or disturb culturally important locations. For further information see these research vessel standards of care developed by communities in the region:

http://nebula.wsimg.com/3f6e3c7518e6de0f4b323a47884e6748?AccessKeyId=4913A243119CE1325FB9&disposition=0&alloworigin=1

Red Dog: (This port is specifically covered in Part 3 of this Advisory). Red Dog is a port that services the Red Dog mining operation. The port is located at 67° 34' 42" N x 164°03' 30" W and is capable of handling up to 1.4 million tons of zinc and lead concentrates annually during the summer shipping season (June/July to middle or end of October). The port is considered a remote location and has no services available such as provisioning, repairs, freshwater or bunkers. Vessel loading operations are conducted offshore at an anchorage site roughly three to five miles off the coast. More information is available in documentation for vessel owners provided by the port operations.

Nome: The port of Nome is located at 64° 29' 54" N x 165° 25' 48" W on the southern side of the Seward Peninsula in central western Alaska. The south dock (City) is located on the Port of Nome's causeway. This dock is approximately 61 m long with a water depth of approximately 6.9 m and typically handles bulk cargo and fuel deliveries for the community. The north dock (WestGold) is approximately 58 m long with 6.9 m water depth and handles rock and gravel exports. The north dock is also used for loading and unloading heavy equipment. A port expansion project is planned to extend the capabilities of the port.

Kotzebue: is a port located approximately 300 km northeast of Nome at 66° 53' 49" N x 162° 35' 18" W . The wharf receives containerized and general cargo as well as petroleum products. The wharf has berthing for approximately 122 m with 3 m of water depth.

Point Barrow: Located at the northernmost point of Alaska in the town called Utqiagvik. There is currently no docking or berthing facilities at point Barrow, but it included in this list for its geographical significance. The community resupply happens by air or by barges during the ice-free period. Cruise ships stay offshore and have sent passengers ashore using small tenders. There are motivations to build a small conventional port at Point Barrow, but construction has not started as of the publishing of this Advisory.

St. Lawrence Island: The town of Savoonga is a small town of about 700 people located central north of St. Lawrence Island. The other town on the island is Gambell, located on the northwest corner of the island also with approximately 700 people. Neither town has a dock or wharf capable of accommodating a commercial cargo ship. Fuel and provisions for the towns are typically provided by barges.

Prudhoe Bay: A small port on the north coast of Alaska located at 70° 19' 32" N x 148° 42' 41" W . The town serves primarily to support the Prudhoe Bay Oil Field.

Little Diomede Island: An island located at 65° 45' 15" N x 168° 55' 15" W. As of 2022, the island has a permanent population of 77. The Island has no dock or means of berthing a commercial vessel. Cruise ships have stopped at the island, anchored offshore, sending guest ashore via tendered launch. Community resupply is normally provided by helicopters, but there are usually 1 or 2 tank barges annually to refill the community's fuel tanks.

SOUTHERN ALASKA NORTH OF 60°

The popular Alaskan port of Anchorage is located at 61° 14' 25" N x 149° 53' 10" W within Cook Inlet. Similarly, Valdez is located in Prince William Sound at 61° 7' 51" N x 146° 20' 54" W . Both ports are north of the nominal 60° N boundary for polar waters but these ports are not considered to be polar waters in accordance with the Polar Code. Therefore, the Polar Code does not apply to operations in these Southern Alaska inlets that reach north of 60° N. These ports can have sea ice, low temperatures, ice accretion and other low temperature related hazards, therefore due caution for operations is advised and the Polar Code process can be used to manage the risks of operations in these waters. The U.S. Coast Guard published "*Operating Guidelines for Ice Conditions in Cook Inlet*" which should be referenced for vessels planning operations to Cook Inlet.

NORMAL ADDITIONS OR MODIFICATIONS TO A SHIP TO RECEIVE A POLAR SHIP CERTIFICATE

See Normal Additions or Modifications to a Ship to Receive a Polar Ship Certificate of this Advisory.

THE OPERATIONAL ASSESSMENT (OA)

In accordance with the Polar Code, the shipowner is required to undertake an OA for all ships entering polar waters. The OA is required to establish the applicability of the various polar hazards, identify risk control measures (RCMs) and operational limitations to be listed on the PSC. The shipowner is to evaluate the ship's design features and the ship's operational procedures against possible hazards and to identify and mitigate any risks during the operations in polar waters. For existing vessels, the outcomes of the assessment should be incorporated in the operational procedures and included in the PWOM to avoid, minimize or respond to the risks.

The Polar Code specifies that the assessment should be the basis of:

1. Defining the operational limitations to be listed on the PSC
2. The operational procedures in the Polar Water Operational Manual (PWOM) to mitigate the identified polar hazards
3. The means and procedures for the survival of crew in the event of abandonment

Most prudent operators carry out these types of assessments (e.g., risk assessments) on a regular basis as part of their internal safety management systems. The required assessment in the Polar Code is not intended to replace existing risk management practices; rather, it aims to formalize best practices for ships operating in polar waters.

It is recommended in the Code to carry out the OA in accordance with established best practices which, in principle, involve:

A Hazard Identification Step – Sources of hazards are identified in the Introduction to the Polar Code. The relevance of these sources of hazards will be determined, primarily, by the environmental conditions. For example, ice accretion

is a hazard source but if the ship is not likely to operate in areas subject to ice accretion, then the ice accretion hazard is not relevant. Thus, relevant hazards can be assessed by considering the environmental conditions.

Model for Analysis of Risks – For the most part, the Polar Code has already taken the common hazards and provided regulations to mitigate the risk associated with them. The Polar Code is therefore a useful tool in modeling and assessing risk. However, any risk modeling also needs to include areas where the Polar Code explicitly leaves the provision of mitigation means up to the assessment.

Implement Risk Control Measures – Polar Code prescriptive requirements may be used as risk control measures. In most cases the prescriptive regulations in the Code will be suitable means for mitigation. However, for areas where there are no regulations that lead to explicit procedures or equipment, such as abandonment, risk control measures need to be deployed.

ABS generally follows the practice outlined in the ABS *Guidance Notes on Risk Assessment Application for the Marine and Offshore Oil and Gas Industry.* The risk assessment workshop is recommended to bring together competent operational personnel, shore based technical and support staff and polar subject matter experts (SMEs). The following steps are suggested:

A. Define the intended operational parameters:
   - Operational area, destination, transit route or the range of latitude
   - Period/dates of operations in polar waters
   - Polar Service Temperature (PST) if the ship is intended to operate in low air temperatures
   - Escorting operation, escorted operation or independent operation
   - Method of assessing operational limitations in ice, such as the Polar Operational Limit Assessment Risk Index System (POLARIS) or other methods
   - Maximum Expected Time of Rescue (METR)

B. Define the intended operational scenarios taking into consideration the following:
   - Operation in low air temperature
   - Operation in ice
   - Operation in high latitude
   - Potential for abandonment onto ice or land

C. Identify relevant hazards defined in the Polar Code and any additional hazards specific for the ship or the intended operations.
   - Ice, topside icing, low temperature, extended period of darkness or daylight, high latitude, remoteness, lack of crew experience, lack of suitable emergency response, rapid changing and severe weather, sensitive natural environment – identified in the Polar Code
   - Any additional hazards specific for the ship or the intended operations

D. Develop a model for analyzing risks considering probability and consequence levels for the defined operational scenarios.

E. Assess the risks using a selected methodology and determine acceptability. Consideration for the vessel's design characteristics and past operational experience, including experience of sister vessels.

F. Identify current or develop new risk control measures that aim to reduce the frequency (i.e., probability) or mitigate the consequence of failures through design features, operational procedures or company training policies.
   - The accepted risk control measures are to be documented in the PWOM.

G. If there is no available risk control option or the risk is not acceptable, the operational parameters should be revised to lower the risk.

The Thresholds in the Regulation section of this Advisory contains recommended consequence and likelihood categories that may be used during the assessments.

The OA is the key to a successful polar code application, it forms the basis upon which the PWOM is developed. It is also the basis upon which the PWOM will be reviewed. The OA process is one that shouldn't be taken lightly and can take some considerable time. Caution is advised to not underestimate the level of effort required to perform and document a good OA.

An example OA Report for operation to Red Dog is given in Appendix II of this Advisory.

THE POLAR WATER OPERATIONAL MANUAL (PWOM)

To obtain a PSC the vessel must have a PWOM on board. The requirement for the PWOM is the entirety of Polar Code chapter 2 which states the following:

CHAPTER 2 – POLAR WATER OPERATIONAL MANUAL (PWOM)

2.1 Goal

The goal of this chapter is to provide the owner, operator, master and crew with sufficient information regarding the ship's operational capabilities and limitations in order to support their decision-making process.

2.2 Functional Requirements

2.2.1 In order to achieve the goal set out in paragraph 2.1 above, the following functional requirements are embodied in the regulations of this chapter.

2.2.4 The Manual shall include or refer to specific procedures to be followed in the event of incidents in polar waters.

2.2.5 The Manual shall include or refer to specific procedures to be followed in the event that conditions are encountered which exceed the ship's specific capabilities and limitations in paragraph 2.2.2.

2.2.6 The Manual shall include or refer to procedures to be followed when using icebreaker assistance, as applicable.

2.3 Regulations

2.3.1 In order to comply with the functional requirements of paragraphs 2.2.1 to 2.2.6, the Manual shall be carried on board.

2.3.2 In order to comply with the functional requirements of paragraph 2.2.2, the Manual shall contain, where applicable, the methodology used to determine capabilities and limitations in ice.

2.3.3 In order to comply with the functional requirements of paragraph 2.2.3, the Manual shall include risk-based procedures for the following:

.1 voyage planning to avoid ice and/or temperatures that exceed the ship's design capabilities or limitations;

. .2 arrangements for receiving forecasts of the environmental conditions;

.3 means of addressing any limitations of the hydrographic, meteorological and navigational information available;

.4 operation of equipment required under other chapters of this Code; and

.5 implementation of special measures to maintain equipment and system functionality under low temperatures, topside icing and the presence of sea ice, as applicable.

2.3.4 In order to comply with the functional requirements of paragraph 2.2.4, the Manual shall include risk-based procedures to be followed for:

.1 contacting emergency response providers for salvage, search and rescue (SAR), spill response, etc., as applicable; and

.2 in the case of ships ice strengthened in accordance with chapter 3, procedures for maintaining life support and ship integrity in the event of prolonged entrapment by ice.

2.3.5 In order to comply with the functional requirements of paragraph 2.2.5, the Manual shall include risk-based procedures to be followed for measures to be taken in the event of encountering ice and/or temperatures which exceed the ship's design capabilities or limitations.

2.3.6 In order to comply with the functional requirements of paragraph 2.2.6, the Manual shall include risk-based procedures for monitoring and maintaining safety during operations in ice, as applicable, including any requirements for escort operations or icebreaker assistance. Different operational limitations may apply depending on whether the ship is operating independently or with icebreaker escort. Where appropriate, the PWOM should specify both options.

2.2.2 The Manual shall include information on the ship-specific capabilities and limitations in relation to the assessment required under paragraph 1.5.

2.2.3 The Manual shall include or refer to specific procedures to be followed in normal operations and in order to avoid encountering conditions that exceed the ship's capabilities.

The PWOM provides guidance to the master, crew and company of the vessel on how to safely operate that specific vessel in the polar environment as defined in the OA. The PWOM should clearly indicate the vessel's capabilities in air temperatures and sea ice. These limitations can simply be:

- No low air temperature as defined in the Polar Code (MDLT < -10°), and avoiding cooler air temperatures such as areas and times where the air temperature is forecasted to be below XX°C. The temperature is to be ship specific and determined by the owner/operator but should never exceed the temperatures for which the hull steel grades are suitable (ABS MVR 3-1-2/3.5) or the ratings of systems and equipment related to safety or environmental protection.
- No sea ice (Ice free waters only)

Or the limitations can be more specific to the vessel's capabilities, which are linked to the vessel's ice class for sea ice operations and rated temperature for hull, machinery, lifesaving appliances, navigational equipment, etc.

The manual must give the operator guidance on how to avoid operating in times and areas where the vessel's capabilities may be exceeded. The PWOM should also give contingency procedures on actions for the crew if the vessel's capabilities are slightly exceeded.

The Polar Code's Appendix II contains a template table of contents for a PWOM. Some flags make this format mandatory and ABS highly recommends following this format as it makes the manual more recognizable for new crew members and makes for easier review.

Since the PWOM is guidance for a crew on how to safely operate that specific vessel in polar waters the PWOM must be ship specific. Any manual found containing terms such as "if fitted" will be flagged by ABS review engineers as not being ship specific. It doesn't do a crew any good to have a great deal of procedures for equipment or systems that the ship does not have. The body of the PWOM which contains the procedures should not contain non-relevant information. Information that may be useful to the crew but is not ship specific may be included in an appendix.

A PWOM is a reviewed document and not an approved document. This was an intentional distinction from the IMO as it is expected that a Recognized Organization (RO) should not approve an operator's procedures for safe polar operations. It is also expected that as more experience is gained with the vessel and vessel's personnel in polar conditions that the procedures will evolve. It is the expectation of ABS that a reviewed PWOM will be updated regularly. Most updates are not expected to require a re-review unless the hazards or operational limitations are to be changed, the manual has significantly changed since the initial review or if significant modifications/alterations to the vessel have taken place which would impact the manual. During an annual survey the ABS surveyor will check the PWOM on board and compare with the PWOM that was reviewed.

SECTION 3 – RED DOG

GENERAL

This part of the Advisory is intended to be a quick reference specifically for the common polar waters port of Red Dog. Additional information and other considerations are given in the other parts of this Advisory and are recommended reading.

Normal operations to Red Dog are for the ice free and warmer air summer months, generally from June through October. Before June the air has warmed but the sea ice has not yet melted. Beginning in October the air temperature quickly drops below freezing but sea ice has not yet begun to form. For this Advisory it is assumed that the operational limitations will be:

1. Ice Free conditions
2. Non low air temperature

See Figure 3 for more detailed operational limitations.

As a consideration of changing Arctic ice patterns, in more recent years, small multiyear ice floes have been spotted drifting south in the northern Bearing Sea as the first year ice in the area is breaking up in the spring and early summer. The Polar ice pack conditions are changing, with extents receding, the first year ice is less present. Lower amounts of first year ice allows the multiyear ice to become more freely mobile. This is more likely in the early part of the season when the first year ice is melting but has occurred prior to that regular start of the Red Dog season.

MINIMUM EQUIPMENT REQUIREMENTS – RED DOG

It is recommended that the items listed in Section 2-5: Normal additions or Modifications to a ship to get a Polar Ship Certificate, be reviewed. The most frequently required items for a bulk carrier going to Red Dog are:

1. Two non-magnetic means of determining heading [Part I-A/9.3.2.2.1]
2. Airband radio [Part I-A/10.3.1.3.2]
3. Two remotely rotatable search lights suitable for searching for ice [Part I-A/9.3.3.1]

Two Non-magnetic Means Guidance: Polar Code Part I-A/9.3.2.2.1 states: "ships shall have two non-magnetic means to determine and display their heading. Both means shall be independent and shall be connected to the ship's main and emergency source of power."

The two non-magnetic means of determining heading is the most common equipment needed for ships calling Red Dog. SOLAS ships are required to have a gyrocompass which counts as the first means. The second means can be:

- A GNSS Compass (satellite compass)
- A second gyrocompass
- Another means that is acceptable to the flag Administration of the vessel

These systems can be connected into the integrated bridge, but if so, they must meet the requirements in SOLAS Chapter V. If they are not connected to the integrated bridge system, this should be mentioned in the PWOM that this device is for polar operations.

Airband Radio Guidance: Polar Code Part I-A/10.3.1.3.2 states: "…equipment for voice communications with aircraft on 121.5 and 123.1 MHz."

There are many different models of Airband radios. Some radio types are a fixed type that require installation. The installation may be subject to engineering review; therefore, it is recommended that a handheld radio be used. The only requirement is that the radio needs to be able to transmit and receive on the two aircraft emergency channels: 121.5 and 123.1 MHz. It is recommended to confirm this send and receive ability before ordering the radio.

Search Lights Guidance: Polar Code Part I-A/9.3.3.1 states: "…with the exception of those solely operating in areas with 24 hours daylight, shall be equipped with two remotely rotatable, narrow-beam search lights controllable from the bridge to provide lighting over an arc of 360 degrees, or other means to visually detect ice."

The original intention for this requirement when the Polar Code was being developed was for high powered (~2,000 W) Xenon searchlights as is seen on many polar going icebreakers. This type of search light, or equivalent, may be appropriate for ships that need to operate in ice in the dark.

For ships that will operate in ice-free waters only, the searchlights or other means to visually detect ice are still required unless operating in polar waters with 24 hours of daylight. Normally this requirement is met by vessels having lights as required by the Suez Canal Rules of Navigation; a large searchlight forward and two bridgewing projectors. If there is to be any nighttime navigation in polar waters, the searchlight/projectors must be able to project light well beyond the bow of the ship and be able to be directed to highlight possible ice sightings. Some vessels have alternative forms of lighting that may fall under the "other means to visually detect ice". When this is the case, it is expected that the vessel's PWOM will contain guidance to the crew stating that while transiting at night in polar waters, the vessel's master shall operate at a speed considering the vessel's stopping distance or maneuvering characteristics and the range at which ice floes can be detected.

Some special considerations can be made for the "…or other means to visually detect ice." This is not clearly defined in the Polar Code. For this, the operations and other illumination sources may be considered provided the vessel's speed and stopping/maneuvering is such that it is not out running the lighting system. Statement to this effect would need to be in the PWOM. Other alternatives such as thermal imagery, ice radars, drones, etc. may also be considered with sufficient technical justification and redundancy.

The remotely rotatable requirement is intended to be directly controlled from within the bridge. With bridgewing projectors this can be achieved by manually directing the lights or by assigning crew to control the light and radio communication from the navigation officer.

THE RED DOG OPERATIONAL ASSESSMENT (OA)

An OA is a mandatory step to be taken for all ships entering polar waters {Polar Code Part I-A/1.5}. In the initial assessment it is expected that the vessel's capabilities will be closely examined and identified. It is also required that all the hazards for the planned polar water operations be evaluated carefully, and risk control measures developed if the risks are determined to be unacceptable. It is also normal during this assessment that the Polar Code's regulations be examined thoroughly to ensure the vessel complies with the regulations. A PSC may be valid for all polar waters, provided the PWOM covers the appropriate hazards and risk control measures for those hazards. In a case where an OA was initially performed considering a specific route/location, but the PWOM was developed reasonably well for other polar water operations, a revised OA may be needed for the new route(s)/location(s). It is expected that this assessment will be such that it evaluates the new route's/location's hazards to ensure that the limitations on the PSC will not be exceeded, and that the procedures in the PWOM are sufficient for managing the risks.

The OA process is a good opportunity for those not familiar with polar operations to become more aware of the potential hazards.

The recommended steps to take for a Red Dog OA are:

1. Review available environmental data (see Appendix I for example) to confirm:
   a. Ice free conditions
   b. Not low air temperature
2. Create an OA Report. The example/template given in Appendix II may be useful.
3. Go through the risk assessments, documenting the hazards and their associated risks.
4. Go through the Polar Code regulations. Using a table format like the one given in the addendum of Appendix II has proven to be useful. This table forms part of the OA report and gives evidence that the Polar Code regulations are all being met. Any applicable regulations in Polar Code chapters 3, 6, 7 or 8 that are not met may be considered for an alternative design or arrangement.
5. If any risk control measures (RCM) are applied, revisit the risk matrices, indicating how the risk is being controlled and how the risk level has dropped. In the example OA report this is achieved by marking "original risk" where the initial assessment placed the risk level, and then an "X" for the risk level after the RCM is applied or an itemized risk matrix as shown in Table 4.

THE RED DOG POLAR WATER OPERATIONAL MANUAL (PWOM)

For an operation to Red Dog for a non-ice strengthened bulk carrier in the summer months, many of the sections of the PWOM will not apply. Any section that is found to be not applicable to the intended operation cannot be skipped but should be indicated that the section is not applicable to the intended operation.

It is very important to write the PWOM in a way that is appropriate for the intended polar operations for the vessel. For example, a PWOM for Red Dog that goes into great detail on safe operations in ice gives an indication that the operator intends to operate the vessel in ice. This will raise questions during the review as to whether the operator truly understands the hazard or if the operation is going well beyond Red Dog.

Many PWOMs submitted to ABS for review include references to/from the Canadian Coast Guard's "Ice Navigation in Canadian Waters." An example figure that is often used in PWOMs from this publication is given below in Figure 4. The Ice Navigation in Canadian Waters publication is a very good document and highly recommended reading, but most of the concepts within this document are intended for ice going vessels. Including such information in a PWOM for a vessel limited to operations in ice free waters only is misleading and will very likely result in technical comments. If operations in ice is expected and these figures are required to be in the PWOM, this Advisory is not applicable.

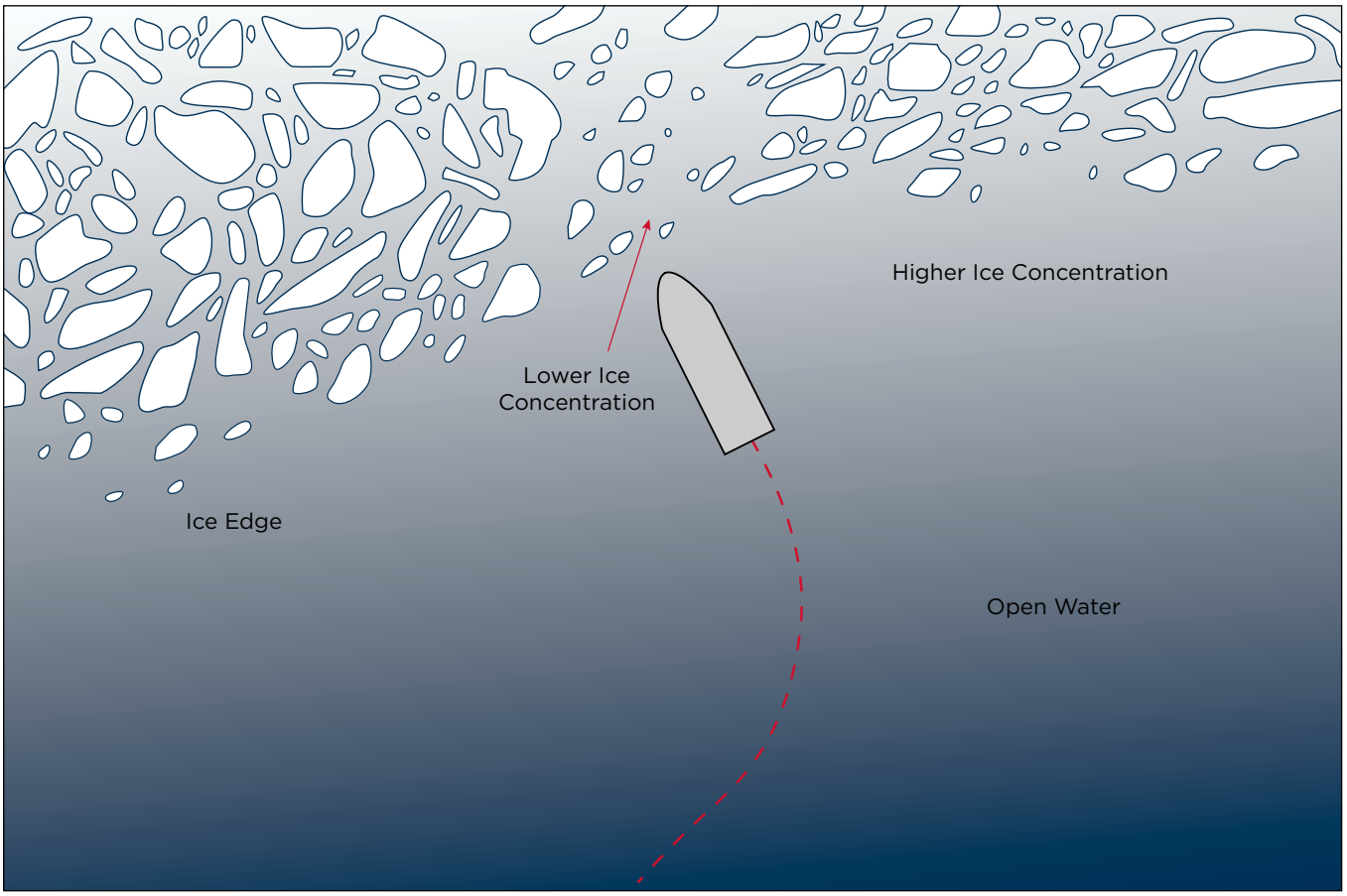


Figure 4: Figure 49 from the Canadian Coast Guard Ice Navigation in Canadian Waters

Source: Ice Navigation in Canadian Waters, available here for download: https://www.ccg-gcc.gc.ca/publications/icebreaking-deglacage/ice-navigation-glaces/page01-eng.html

A PWOM specifically for Red Dog shouldn't be too long or complex. An example/template PWOM for a bulk carrier specifically dedicated to Red Dog operations is given in Appendix III.

SECTION 4 – ABS POLAR CODE SERVICES AVAILABLE

SERVICES AVAILABLE

ABS participated at the IMO during the development of the Polar Code and has a deep understanding of the requirements, the background behind the requirements, and the intentions of the Code. ABS has taken this vast experience and knowledge of the Polar Code to develop services to help shipowners/operators minimize risks, while also minimizing the level of effort required to progress through to obtaining a PSC.

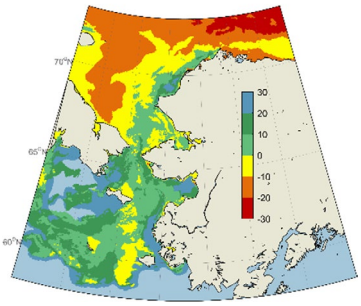
These services evolve over time, and it is therefore best if the ABS polar SMEs are contacted for the latest service offerings. These services range from hazard data collection and analysis through to a fully facilitated OA and final survey for obtaining a PSC. ABS SMEs may be contacted via the contact information on the back page of this Advisory.

4-1-1 ABS HETC

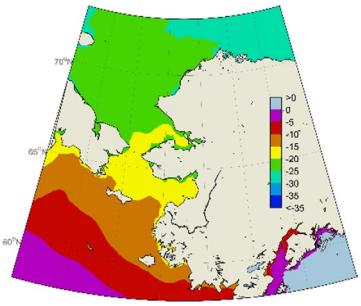
The ABS Harsh Environment Technology Center (HETC) was established in conjunction with Memorial University in St. John's, NL, Canada. The HETC is partially a research and development center and partially an advisory service for polar and low temperature operations. The ABS HETC has a team of engineers that are experts on many things including Polar Code application, ice class, winterization and ice loads on various machinery, hulls and structures, including light and non-ice strengthened structures.

Tools – The ABS HETC has developed an in-house tool for evaluating environmental polar hazards such as sea ice, air temperature and ice accretion. The outputs from this tool are a series of figures for various locations around the world, and a color scheme that depicts the level of the hazard. Sea ice data is processed using the IMO POLARIS methodology and is presented in RIO groupings of 10. Temperature is processed following the Polar Code's definition of MDLT, or the IACS rules definition of MDAT. Ice accretion is a topic of research and development at the HETC, future tools are under development, current tools use internationally published methodologies to estimate ice accretion.

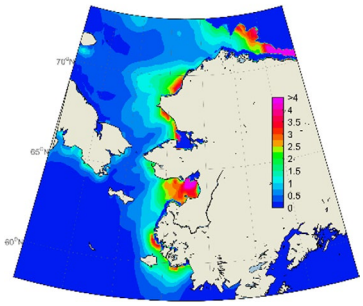
Sea Ice



Air Temperature



Ice Accretion



The output from these tools is used in many ways, such as ice class selection which is not discussed in this Advisory. For the application to polar waters and compliance with the Polar Code, the outputs from these tools are used in the OA to focus the operational window or determine operational profile capabilities for the vessel to optimize chartering opportunities. When multiple years of data are used, this analysis serves to meet the requirements of Polar Code Part I-A/11.3.4

Operational Assessment Preparation – Gathering data and becoming familiarized with the requirements of the Polar Code can be a challenge. The ABS HETC has years of experience with offering training and preparing company, vessel and operationally specific guidance. The guidance is in the form of a report that the HETC calls the "Pre-OA Report" (Pre-Operational Assessment Report). This report contains the environmental hazard analysis mentioned above, some interpretation as to what those hazards mean for the intended operational profile (if possible). The report also gives guidance on what risk assessments should be made, considerations during the assessments and suggestions for risk control measures. The Pre-OA Report can save significant overall time and provide a guide in accomplishing the mandatory OA, follow on PWOM and Polar Ship Certification.

Operational Assessment – The ABS HETC SMEs can join you for an OA. These SMEs will guide the process, making sure you are asking and answering the right questions and make sure you do not go off track. ABS HETC SMEs have years of experience with various risk control measures and can guide you based on past experiences. ABS SMEs will document the process and create an OA report that can be used to write a PWOM.

SECTION 5 – GLOSSARY AND ACRONYMS

ABS	American Bureau of Shipping
AIRSS	Canadian Arctic Ice Regime Shipping System
CatZOC	Categories of Zone Of Confidence
CFR	Code of Federal Regulations
DIS	Draft International Standard (ISO)
EPIRB	Emergency Position-indicating Radio Beacon
GBS	Goal Based Standard
GMDSS	Global Maritime Distress and Safety System
GNSS	Global Navigation Satelite System
HETC	Harsh Environment Technology Center
HSSC	Harmonized System of Survey and Certification
IACS	International Association of Classification Societies
IEC	International Electrotechnical Commission
IMO	International Maritime Organization
ISO	International Standards Organization
MARPOL	Marine Pollution Prevention
MDAT	Mean Daily Average Temperature
MDLT	Mean Daily Low Temperature
MEPC	Maritime Environmental Protection Committee (IMO)
METR	Maximum Expected Time to Rescue
MSC	Maritime Safety Committee (IMO)
NSR	Northern Sea Route
NWP	Northwest Passage
OA	Operational Assessment
PC	Polar Class
POLARIS	Polar Operational Limit Assessment Risk Index System
PSC	Polar Ship Certificate
PST	Polar Service Temperature
PWOM	Polar Water Operational Manual
R&D	Research and Development
RCM	Risk Control Measure
RIO	Risk Index Outcome
RO	Recognized Organization
RV	Risk Value
SitRep	Situation report
SLC	SOLAS Safety Construction
SME	Subject Matter Expert
SMPEP	Shipboard Marine Pollution Emergency Plan
SOLAS	Safety Of Life At Sea
SOPEP	Shipboard Oil Pollution Emergency Plan
SSE	IMO Sub-Committee on Ship Systems and Equipment
STCW	Standard for Training, Certification and Watchkeeping
USCG	United States Coast Guard

APPENDIX I – ENVIRONMENTAL HAZARD DATA

This data is produced by the ABS Harsh Environment Technology Center (HETC). Updated or higher resolution data is available upon request. Request for data can be made by the contacts on the back page of this Advisory.

DESCRIPTIONS OF THE DATA AND ANALYSIS

SEA ICE

IMO POLARIS

The IMO has developed a harmonized methodology for assessing operational limitations in ice called the Polar Operational Limit Assessment Risk Indexing System (POLARIS). The detailed background and description of this system are described in an IMO Circular – MSC.1-Circ.1519. The system incorporates experience and best practices from the Canadian AIRSS system and the Russian Ice Certificate concept with additional input provided by other coastal administrations having experience regulating marine traffic in ice conditions. The basis of POLARIS is an evaluation of the risks posed to the ship by ice conditions using the World Meteorological Organization (WMO) nomenclature and the ship's assigned ice class (or lack thereof).

POLARIS can be used for voyage planning or on-board decision-making in real time on the bridge. As with any methodology, it is not intended to replace an experienced Master's master's judgement. POLARIS assesses ice conditions based on a Risk Index Outcome (RIO) which is determined by the following simple calculation:

$$RIO = (C_1 \times RV_1) + (C_2 \times RV_2) + (C_3 \times RV_3) + (C_4 \times RV_4)$$

Where:

- $C_1 \ldots C_4$ – Concentrations of ice types within ice regime
- $RV_1 \ldots RV_4$ – Corresponding risk index values for a given Ice Class (see Table 6)

The Risk Values (RV) are a function of ice class, season of operation, and operational state (i.e., independent operation or icebreaker escort). An example table of RVs is shown in Table 6. Risk levels are higher with increasing ice thickness and decreasing ice class. POLARIS establishes RVs for the seven (7) IACS Polar Classes, four (4) Finnish-Swedish Ice Classes, and non-ice strengthened ships. For an example non-ice strengthened category C ship, only the bottom row of risk values needs to be considered.

A positive RIO indicates an acceptable level of risk where operations may proceed normally. A negative RIO indicates an increased risk level, potentially to unacceptable levels. Criteria is established, as shown in Table 7. For negative RIOs the system suggests that operations should both be stopped and reassessed or proceed cautiously with reduced speeds (IMO terminology is "subject to special consideration"). For a Category A or B ship, IMO POLARIS methodology permits a -10 RIO, but this is at elevated risk operation. This negative RIO should never be used for planning purposes, it is intended to be used to help the Polar Class ship carefully get out of the hazardous ice conditions. A Category C ship is not permitted the negative RIO.

Table 6: POLARIS Risk Values (RVs)

Increasing Ice Thickness (severity)

WINTER RISK VALUES (RVs)

POLAR SHIP CATEGORY	ICE CLASS	ICE FREE	NEW ICE	GREY ICE	GREY WHITE ICE	THIN FIRST YEAR 1ST STAGE	THIN FIRST YEAR 2ND STAGE	MEDIUM FIRST YEAR 1ST STAGE	MEDIUM FIRST YEAR 2ND STAGE	THICK FIRST YEAR	SECOND YEAR	LIGHT MULTI YEAR	HEAVY MULTI YEAR
		--	0-10 cm	10-15 cm	15-30 cm	30-50 cm	50-70 cm	70-95 cm	95-120 cm	120-200 cm	200-250 cm	250-300 cm	300+ cm
A	PC1	3	3	3	3	2	2	2	2	2	2	1	1
	PC2	3	3	3	3	2	2	2	2	2	1	1	0
	PC3	3	3	3	3	2	2	2	2	2	1	0	-1
	PC4	3	3	3	3	2	2	2	2	1	0	-1	-2
	PC5	3	3	3	3	2	2	1	1	0	-1	-2	-2
B	PC6	3	2	2	2	2	1	1	0	-1	-2	-3	-3
	PC7	3	2	2	2	1	1	0	-1	-2	-3	-3	-3
C	IA Super	3	2	2	2	2	1	0	-1	-2	-3	-4	-4
	IA	3	2	2	2	1	0	-1	-2	-3	-4	-5	-5
	IB	3	2	2	1	0	-1	-2	-3	-4	-5	-6	-6
	IC	3	2	1	0	-1	-2	-3	-4	-5	-6	-7	-8
	NO ICE CLASS	3	1	0	-1	-2	-3	-4	-5	-6	-7	-8	-8

Decreasing Ice Class

Increased Risk

Table 7: POLARIS Risk Index Outcome (RIO) Criteria

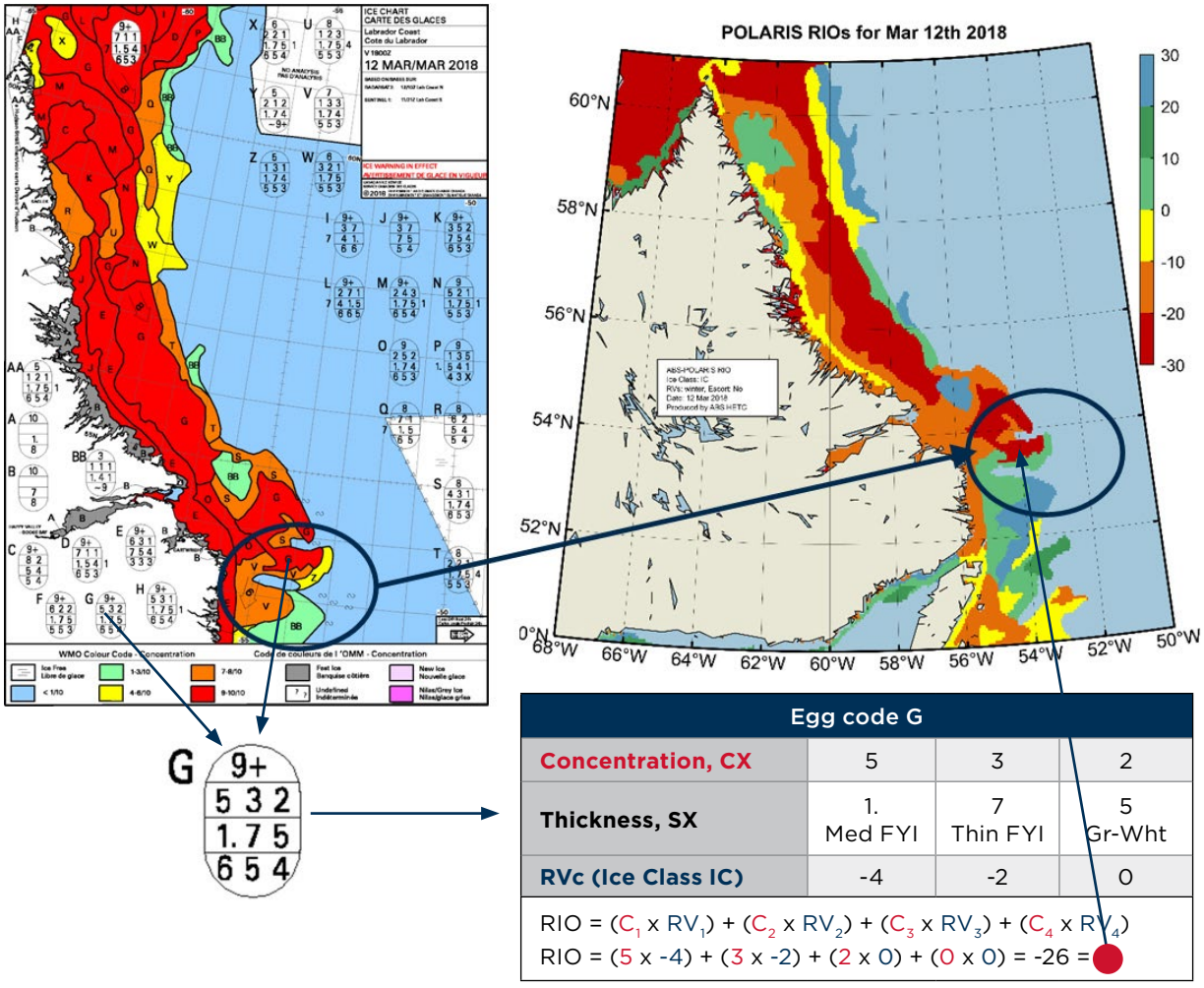
RIO_{SHIP}	Ice classes PC1-PC7	Ice classes below PC 7	Color Code
20 ≤ RIO	Normal operation	Normal operation	
10 ≤ RIO < 20			
0 ≤ RIO < 10			
-10 ≤ RIO < 0	Elevated operational risk	Operation subject to special consideration	
-20 ≤ RIO < -10	Operation subject to special consideration	Operation subject to special consideration	
-30 ≤ RIO < -20			

ABS-POLARIS

ABS-POLARIS is a tool developed by ABS to process raw ice chart data (in SIGRID3 format) using the IMO POLARIS methodology. ABS-POLARIS determines RIOs and replots ice charts as ice risk charts that are specific to the ship's ice class notation. The tool can process and plot a single ice chart as an Ice RIOs chart or process multiple ice charts to evaluate statistical values of RIOs. For example, the ABS-POLARIS tool can take five years of ice data for a region covering the first week of a month and produce an average RIO for the region. This can be used to evaluate operational probabilities in the given area or evaluate the likelihood of the ship encountering ice conditions that exceed its capabilities in that time period. Alternatively, the tool can be used as a means of optimizing the ice class selection if an operational area and timeframe are known. Or it can take AIS data and estimate the RIOs in regions that the vessel sailed.

Figure 5 shows an ABS-POLARIS analysis for March 12, 2018, for the Labrador Coast ice chart. The left side map is the ice chart (screenshot of PDF) and the right-side map is the POLARIS analysis using ABS-POLARIS. Areas shaded in yellow, orange and red indicate negative RIOs as described in Table 7. One of the ice regimes included in the ice chart is selected to demonstrate the POLARIS calculation procedure. Regime "G" (>9/10th coverage, comprised of Medium First Year Ice, Thin First Year Ice, and Grey-White Ice) shows a -26 RIO for an Ice Class IC vessel. This low RIO is considered an unacceptably high risk to Ice Class IC ships and must be avoided.

Canadian Ice Service Chart **ABS-POLARIS**



Egg code G			
Concentration, CX	5	3	2
Thickness, SX	1. Med FYI	7 Thin FYI	5 Gr-Wht
RVc (Ice Class IC)	-4	-2	0

$RIO = (C_1 \times RV_1) + (C_2 \times RV_2) + (C_3 \times RV_3) + (C_4 \times RV_4)$

$RIO = (5 \times -4) + (3 \times -2) + (2 \times 0) + (0 \times 0) = -26$ =

Figure 5: ABS-POLARIS Example – March 12, 2018 – Labrador Coast

ICE DATA

To apply ABS-POLARIS to assess ice conditions for Alaskan waters, a data set is required. There are several sources of ice data depending on the region of interest. Charts are typically produced every few days and are available in PDF and SIGRID format. In late 2015, the Alaska Sea Ice Program (ASIP) began posting SIGRID files daily on their website. These files have been obtained and stored on servers at ABS HETC. The ABS process is to use at least five years of ice data. The data is available at https://www.weather.gov/afc/ice.

ABS-POLARIS ANALYSIS

The analysis presented in the "Ice" column of Figure 14 to Figure 18 represents a five-year average of RIOs from 2018 to 2022 for a non-ice strengthened ship. The ABS-POLARIS averaging algorithm only accounts for areas where ice is present in the average. Figure 6 graphically shows how the program stacks and calculates the average. If a location only has ice present for a single year the program will only use the year with data in the average. This means that the only ice chart with ice will be the ice shown in the final output. For example, in the lower points of Figure 6, a star indicates the presence of ice and circles indicate an ice-free area. The five-year average figure will be the RIO from the only year with ice in the area. This results in a slightly conservative ice analysis.

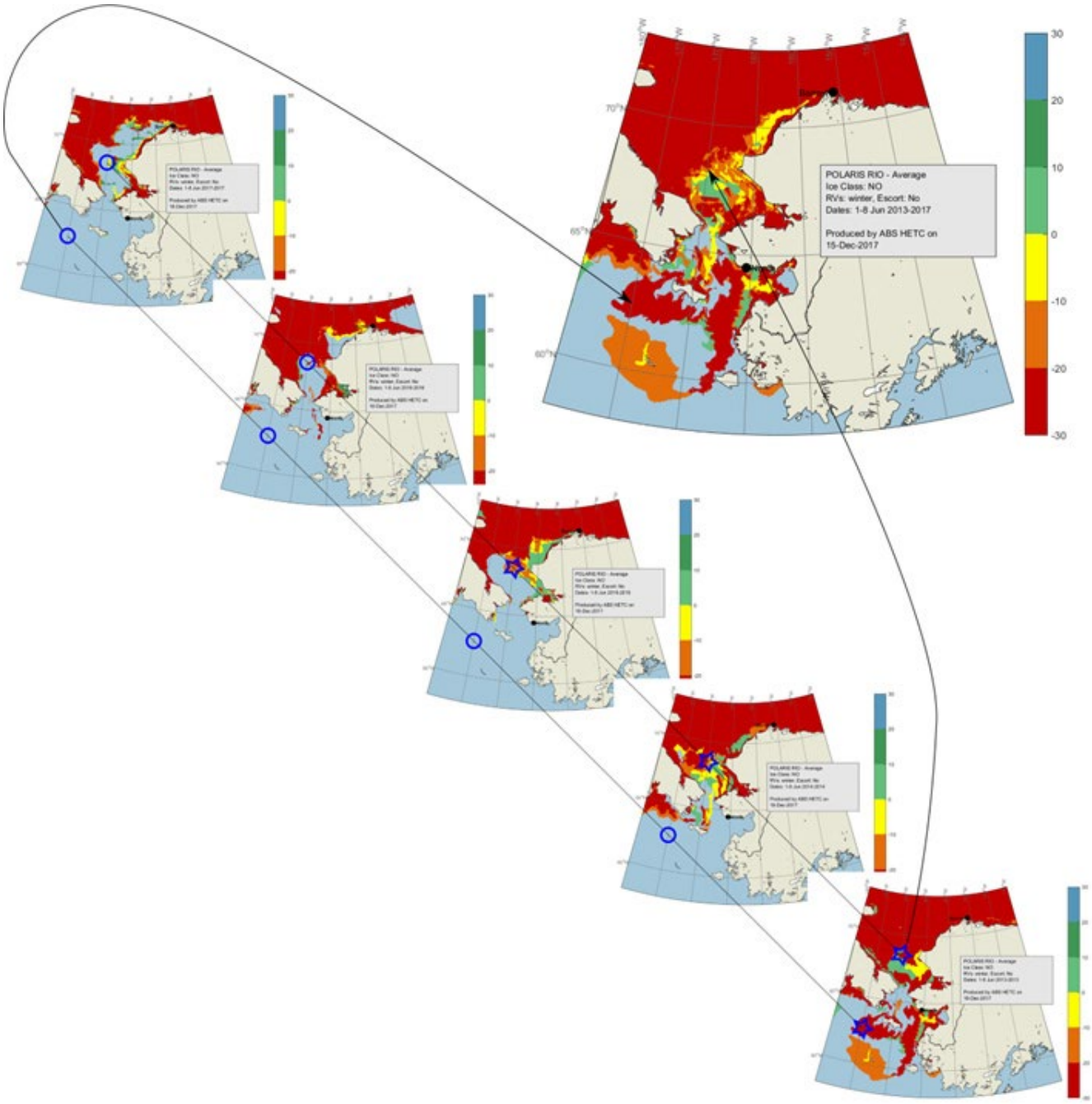


Figure 6: ABS-POLARIS Averaging

AIR TEMPERATURE

Low air temperature is a key hazard recognized by the IMO Polar Code. Regulations are imposed on ships "intended to operate in low air temperatures."

For ships expected to encounter low air temperatures, the Polar Code introduces a new term called the Polar Service Temperature (PST).

Low air temperatures are a seasonal phenomenon with significant variability within different Polar Regions and at different times of the year. Many areas of the Arctic are not particularly cold in the summer months. Therefore, the Code has established a temperature threshold for "ships operating in low air temperature" based on the Mean Daily Low Temperature (MDLT) for the intended area and season of operation. The MDLT is a set of statistical mean of daily low temperatures for each day of the year, over a minimum 10-year period. Ships that operate in areas and seasons where the Lowest MDLT is below 10° C are considered to be operating in "low air temperature" and therefore a PST

must be specified for the vessel and shall be at least 10° C below the lowest MDLT. Figure 7 illustrates conceptually how an appropriate PST would be specified based on available historical data.

For new ships, the PST would typically be defined by the owner/operator for the intended operational profile. The ship systems, equipment and materials would then be specified and reviewed/tested in accordance with the selected PST. For existing ships, the onboard systems, equipment and structural materials would typically dictate the minimum allowable PST for the ship (unless new equipment is provided or retested to lower temperatures).

For ships that are intended to operate in areas where the MDLT is above -10° C, the PST and the low air temperature requirements are not applicable. However, there are some regulations that are applicable for ships intended to operate in temperatures below freezing (MDLT< 0° C).

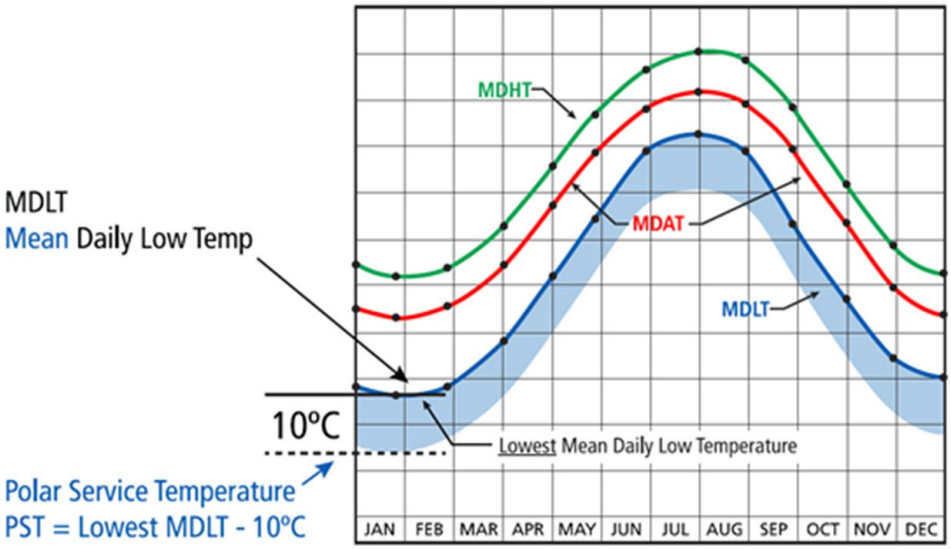


Figure 7: Polar Service Temperature (PST) definition

For the sample temperature analysis provided in this advisory, historical hindcast temperature data obtained from the United States National Oceanic and Atmospheric Administration's (NOAA) National Operational Model Archive and Distribution System (NOMADS) was used to analyze the temperature conditions for the North American Arctic. Specifically, the NOMADS Global Forecast System (GFS) "Analysis-Only" – "two m above sea surface level" data set was utilized. This hindcast model produces temperature data four times per day over a global grid (0.5 deg x 0.5 deg). 10 years of data (2013-2022) was compiled and processed to prepare the temperature isothermal plots shown below in Figure 14 through Figure 18.

It is noted that MDLT is a statistical mean of daily low temperatures. As noted earlier, air temperatures can fluctuate with significant variability. While the MDLT for a date and location might be above -10° C or above 0° C, there is still a probability of short-term temperature drops that should be considered in the onboard risk-based operational procedures and during voyage planning.

The temperature analysis presented in the "Temp" column of Figure 14 to Figure 18 should not be taken as the hard boundary for operational limits. Rather they should be used logically for risk assessments, operational profile decision-making, and planning purposes. Voyage planning would use data like this as an input into decision-making but the actual temperature and forecast should drive operational decisions. It is expected that the PWOM will give clear guidance on how the ship can be safely operated in cooler temperatures.

The temperatures in the "Temp" column of Figure 14 to Figure 18 are represented by colors as shown in Figure 8.

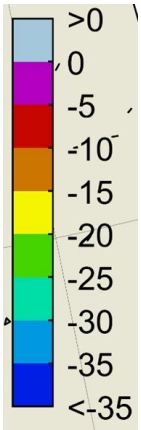


Figure 8: Temperature Colors used in Analysis [°C]

ICE ACCRETION

Another threshold for regulations in the Polar Code is "ships intended to operate in areas and during periods where ice accretion is likely to occur." This is mainly focused on icing from sea spray and not related to atmospheric icing such as freezing rain. Ice accretion occurs when temperatures are low and there is a source of water for wetting the deck, superstructure and other exposed parts of a vessel or equipment. Ice accretion is most severe in sub-freezing temperatures and open water conditions where there is wave-induced sea spray. When ice is present, waves are suppressed and sea spray is minimized, which significantly reduces the chance of ice accretion. Topside icing can potentially have a negative effect on a vessel's stability, especially for smaller ships. Ice accretion can hinder access to safety critical equipment and reduce functionality of deck machinery. It poses a safety hazard to escape routes and other exposed passageways.

Some environmental and operational factors that affect the severity of ice accretion are the air temperature, seawater temperature, ship speed and ship heading relative to wind, waves and ocean swell. Design features that influence the probability of icing mainly include the ship's length and freeboard height. Generally, for the same environmental conditions, there will be more sea spray reaching the vessel deck, superstructure, etc., when the vessel is traveling faster into the wind and waves, and for smaller vessels and ships with less freeboard.

ABS has developed a marine ice accretion tool based upon a formulation developed by Overland in 1986 (Overland, Pease, Preisendorfer, & Comiskey, 1986). The ABS program takes various datasets, processes them, extracts needed information, converts it to a format compatible with all the other datasets, runs the Overland ice accretion formula for each coordinate, examines sea ice data and eliminates the ice accretion in-way of sea ice at a user specified concentration, typically seven tenths.

The outputs from the ABS program are intended to be used as an information source for voyage planning. For tactical voyage planning, a master is expected to review weather forecasts and make informed decisions based on air temperature, wind speed, sea state and knowledge of the subject vessel's characteristics.

The Polar Code has several sections pertaining to ice accretion. Perhaps the most explicit ice accretion requirement is in chapter 4 on stability. Here the code has requirements for any ship, operating in areas where ice accretion is likely to occur, to have additional stability evaluations conducted. Regulation 4.3.1.1 has a value of 30 kg/m2 on exposed weather decks and gangways.

It is the decision of the operator to determine if the vessel is going to operate in an area where ice accretion is likely to occur. The information presented in the "Ice Accretion" column of Figure 14 to Figure 18 may be used help with that decision.

If operating in an area on the figures that has any color other than the darkest blue, it is the recommendation of ABS that the vessel is operating in an area where ice accretion may likely occur. This does not mean there will be ice accretion, just that the potential is greater. It is also worth noting that there is conservativism built into these analysis figures. This comes from the calculation itself that is based on smaller vessels and the weekly maximum is used. The overall plot is then a mean (average) of 10 years of weekly maximum ice accretion rates. See Figure 10 for a graphical description of the accretion rates and Figure 14 through Figure 18 for the plots.

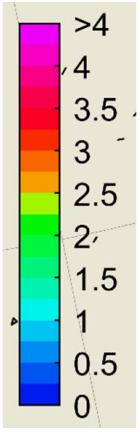


Figure 9: Ice Accretion Rate Colors used in Analysis [cm/hr]

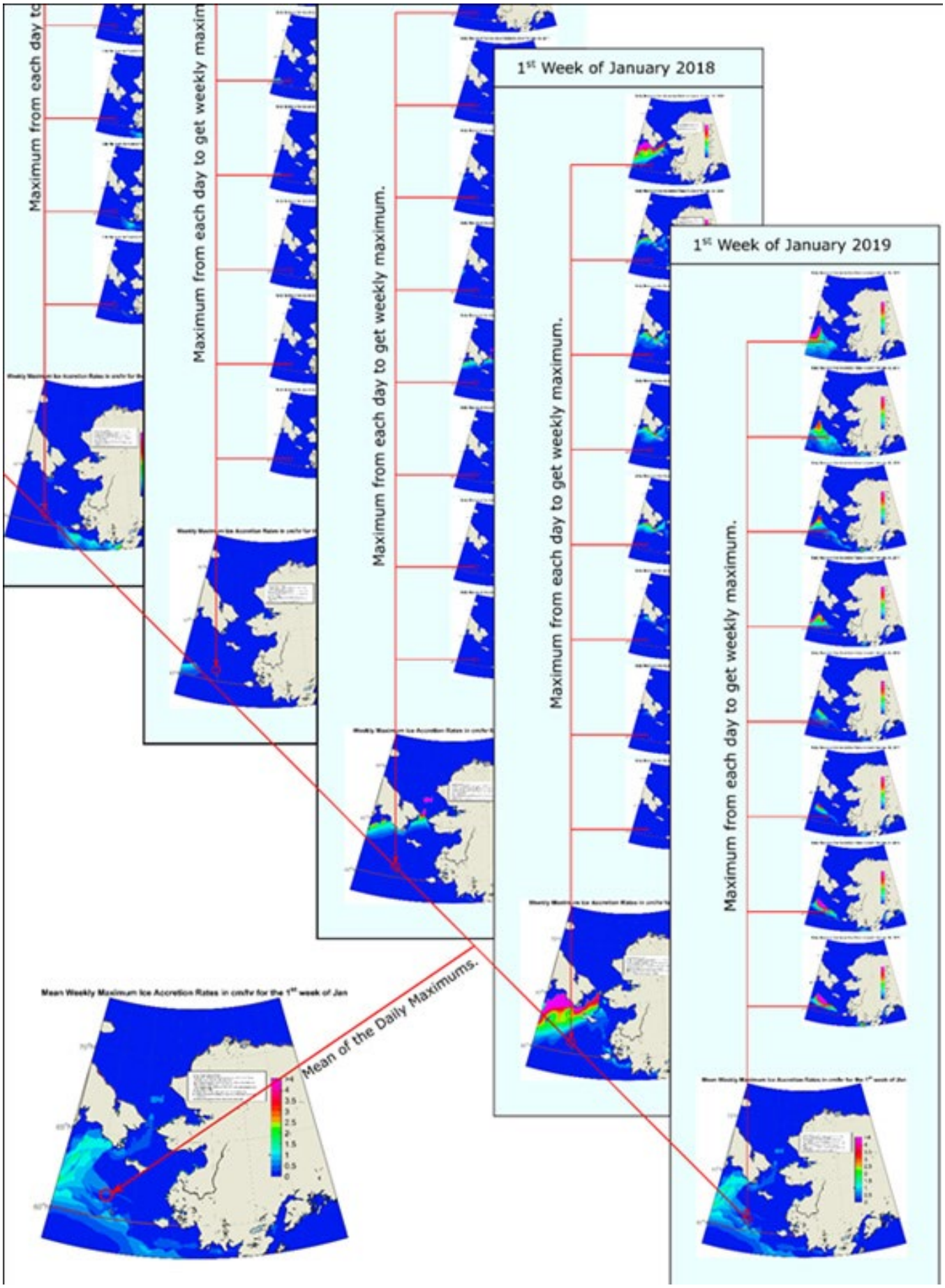


Figure 10: ABS Ice Accretion, Combining Multiple Years into One Plot

PRECIPITATION

To examine precipitation volumes in the Arctic, there are several sources available. For this analysis NCEP Reanalysis data was provided by the NOAA/OAR/ESRL PSD, Boulder, Colorado, USA, from their Web website at https://www.esrl.noaa.gov/psd/.

The data obtained from NOAA was in units of kg/m2/s. Using the following formulation, the precipitation rate is converted into mm/hr.

$$\frac{Precipitation\ Rate\ \left[{}^{kg}/_{m^2/s}\right]}{Water\ Density\ \left[{}^{kg}/_{m^3}\right]} => \left[\frac{m}{s}\right] \times \frac{1000\ mm}{m} \times \frac{3600\ s}{hr} => \left[\frac{mm}{hr}\right]$$

The images in the "Precipitation" column of Figure 14 to Figure 18 give weekly high precipitation rates for a 10-year period, 2013 to 2022 . For example, the first image in the precipitation column of Figure 6 is the maximum of the highest precipitation rates for the week of June 1st, to June 8th, 2013, June 1st, to June 8th, 2014, June 1st, to June 8th, 2015 etc.

Precipitation does not mean snowfall or freezing rain. Therefore, the plots are limited based on a daily low temperature of +3° C or cooler. An example to explain this, first image in the precipitation column of Figure 14, wherever there is colour (other than the darkest blue) the daily low temperature was cooler than +3° C and there was precipitation on that day. The areas where no precipitation fell are ignored and areas where the daily low temperature was above +3° C are ignored and plotted as the darkest blue.

To interpret these figures, the precipitation rates are given by contours of colour. These colours represent areas where the air temperature is cool enough for precipitation to occur, in mm/hr of freezing rain or cm/hr of snow.

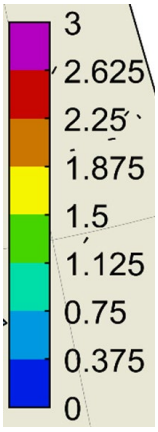


Figure 11: Precipitation Colors used in Analysis [cm/hr – snow], [mm/hr – freezing rain]

SEA SURFACE TEMPERATURE

NOAA has sea surface temperature (SST) data available for download Similar to Air Temperature. The SST data is obtained from ftp://eclipse.ncdc.noaa.gov/pub/OI-daily-v2/NetCDF-uncompress/.

The SST data used herein is at a one fourth degree spatial resolution and on a once per day temporal resolution. This data can be utilized to assess the hazard of low seawater temperature to vessel systems and machinery under the Polar Code. It can also be used for considering immersion of personnel into polar waters.

The significance for sea water temperature is on operation of machinery as well as survival after an abandonment. If water temperatures are cold, the crew may need insulation to enable 5-days survival.

Data shown in the "SST" column of Figure 14 to Figure 18 below represent the 2013 to 2022 minimum surface temperature for the given week in Alaskan waters.

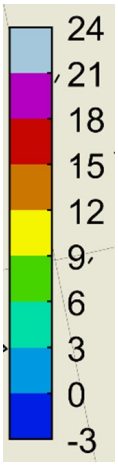


Figure 12: Sea Surface Temperature Colors used in Analysis [°C]

HOURS OF DAYLIGHT

Another hazard considered by the IMO Polar Code is extended periods of darkness or daylight. Limited or extended daylight hours can affect navigation and human performance. This hazard is used as a threshold in the Polar Code for regulations such as the need for multiple search lights, and lighting endurance for survival craft.

The earth's orbit around the sun, atmospheric light refraction and the earth's tilt and rotation are known and can be used to calculate daylight hours for any location on the planet. Using this method, a series of daylight hour plots for various latitudes are developed and given below in Figure 13. The fall equinox is indicated at the point at which daylight hours go above or below 12 hours.

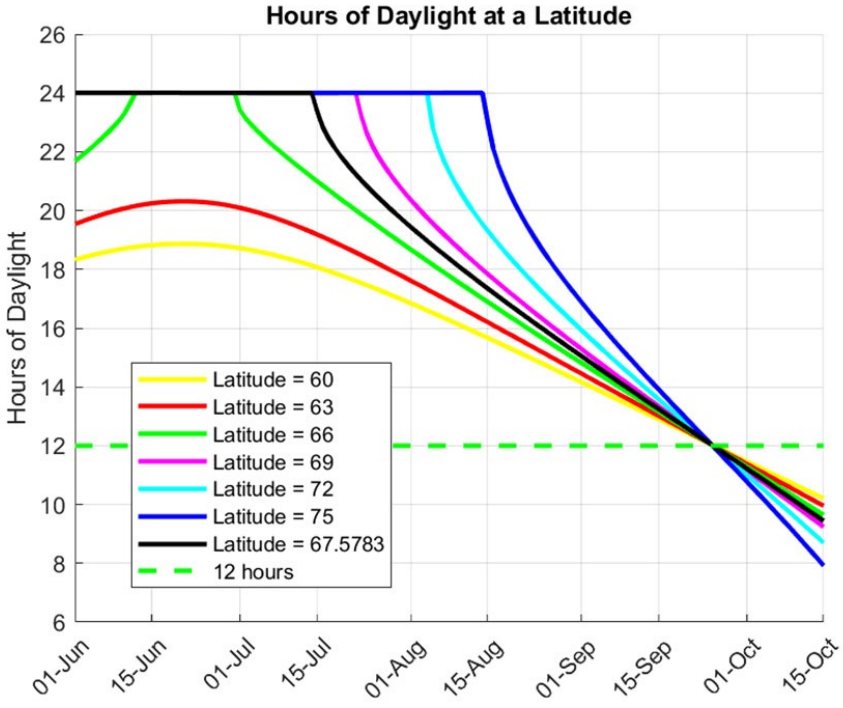


Figure 13: Hours of Daylight per Day at Latitudes 60°N to 75°N

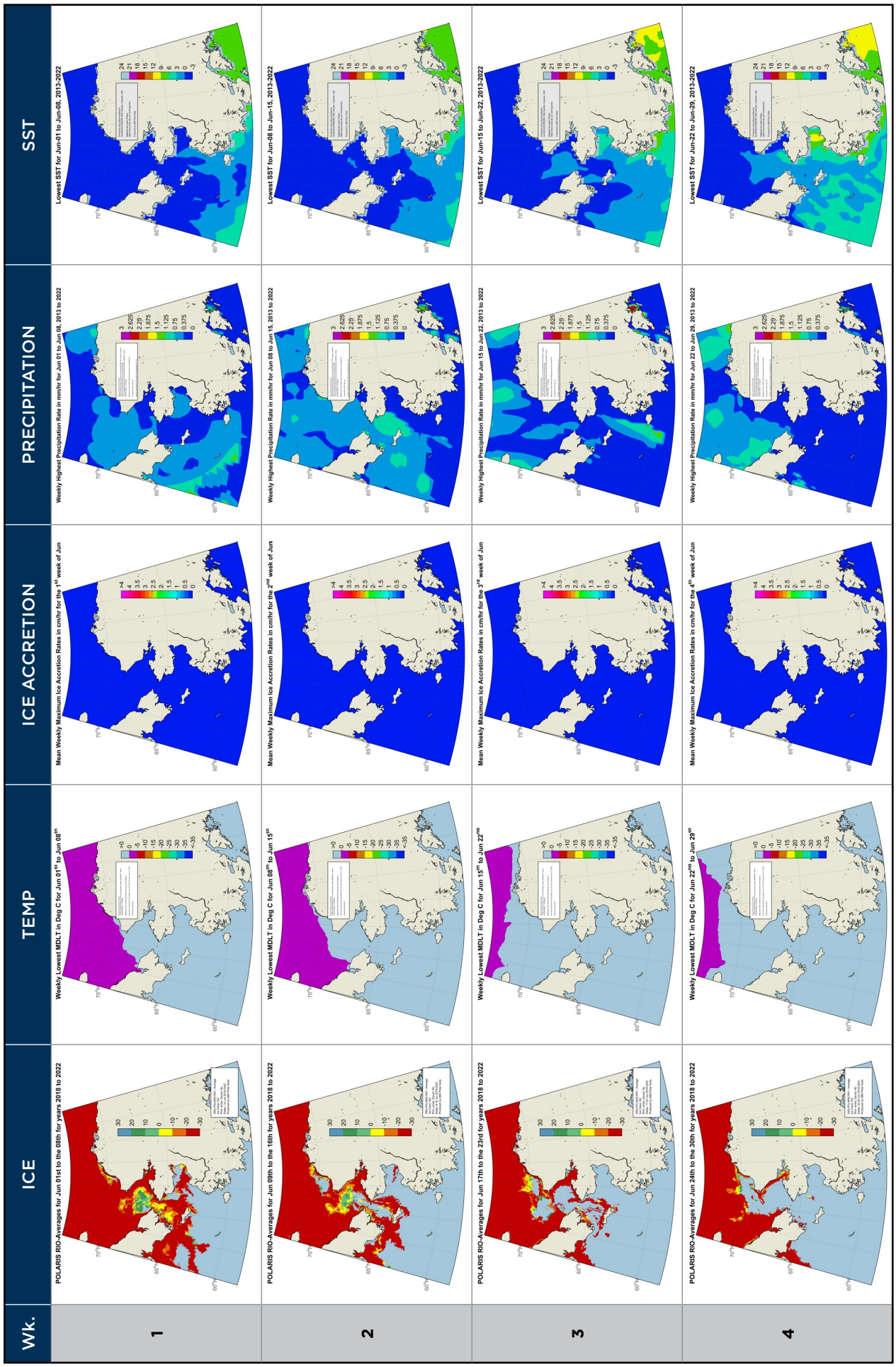


Figure 14: Enviro Hazard Analysis – June

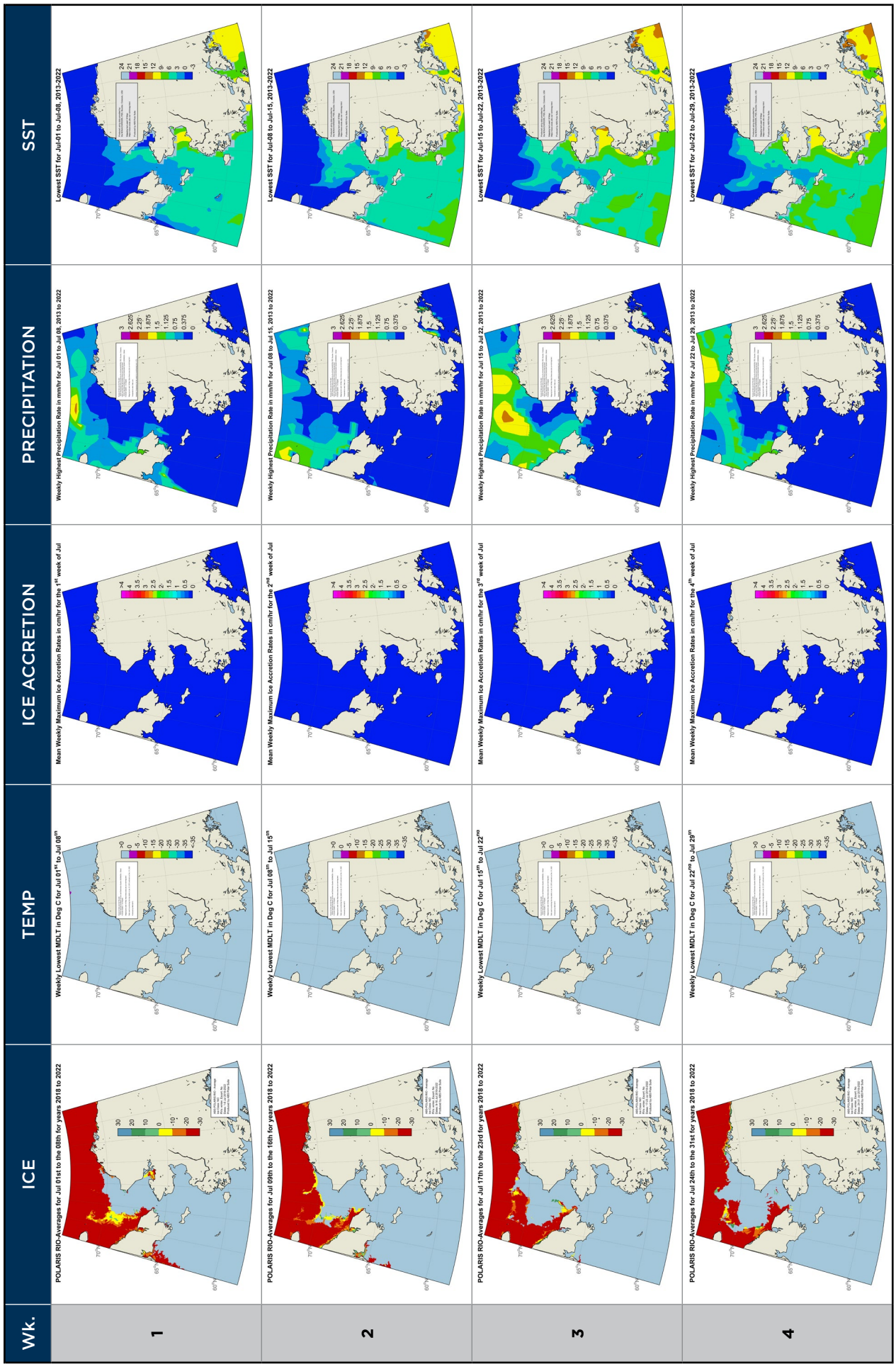


Figure 15: Enviro Hazard Analysis – July

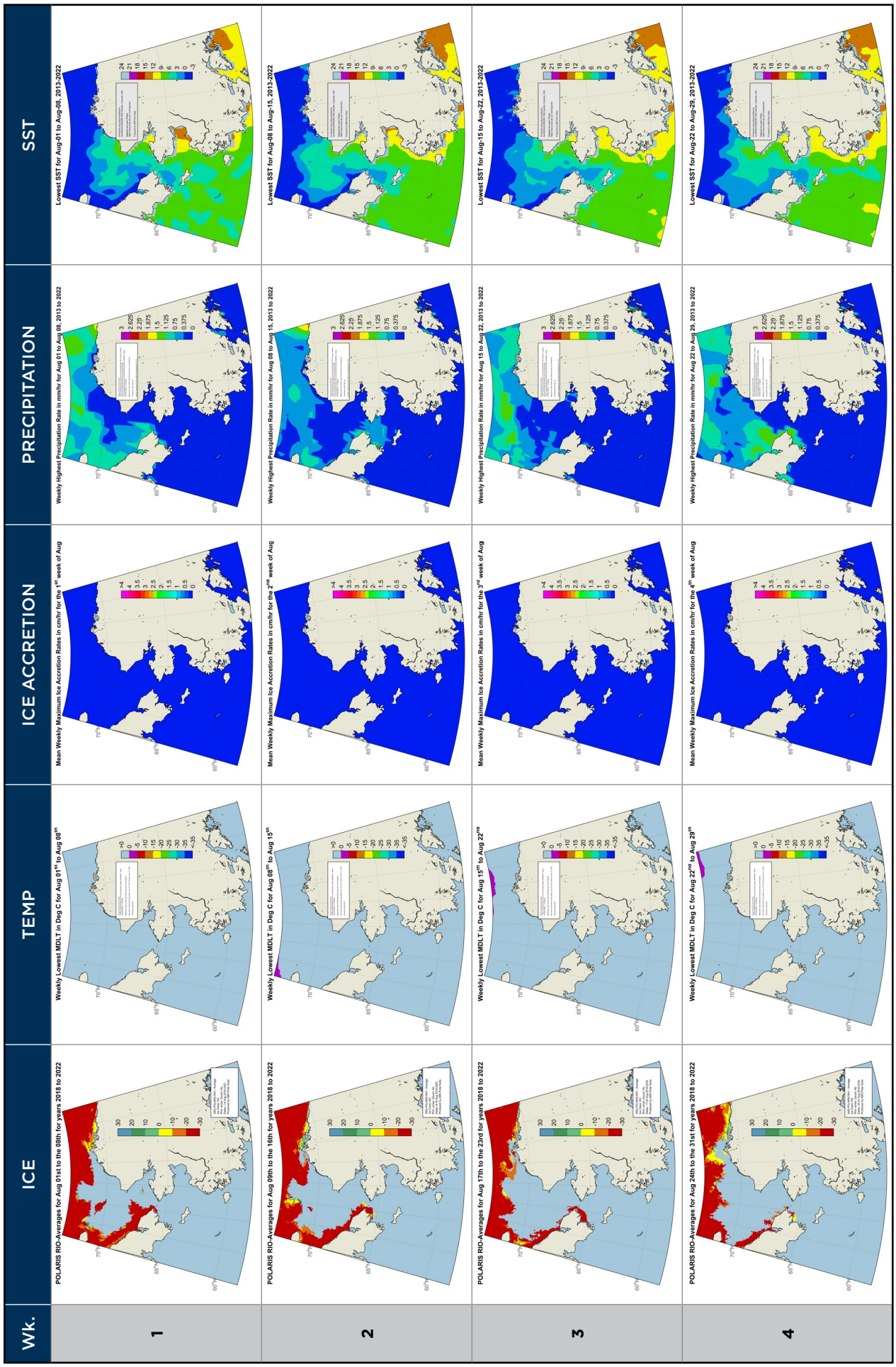


Figure 16: Enviro Hazard Analysis – August

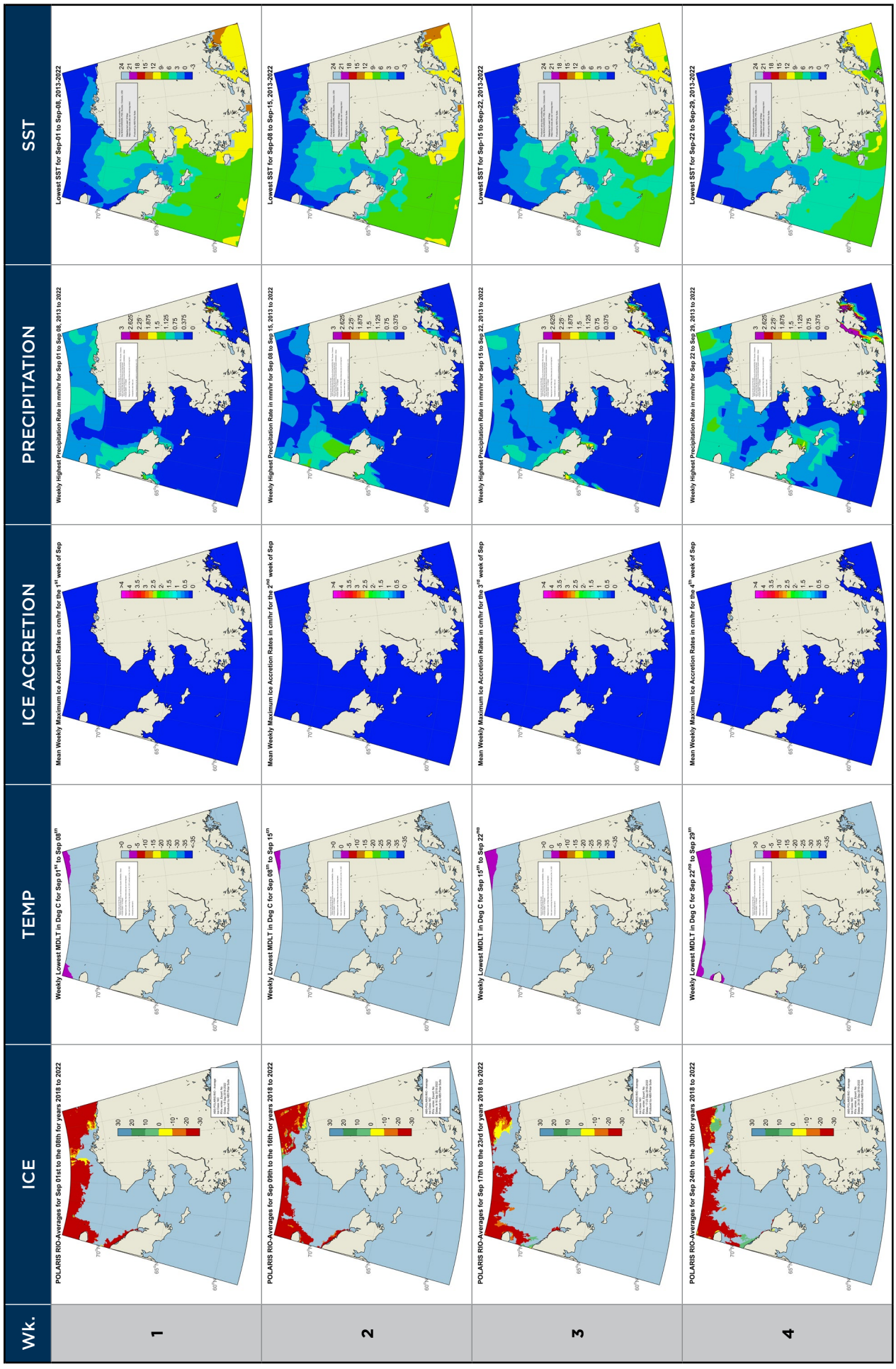


Figure 17: Enviro Hazard Analysis – September

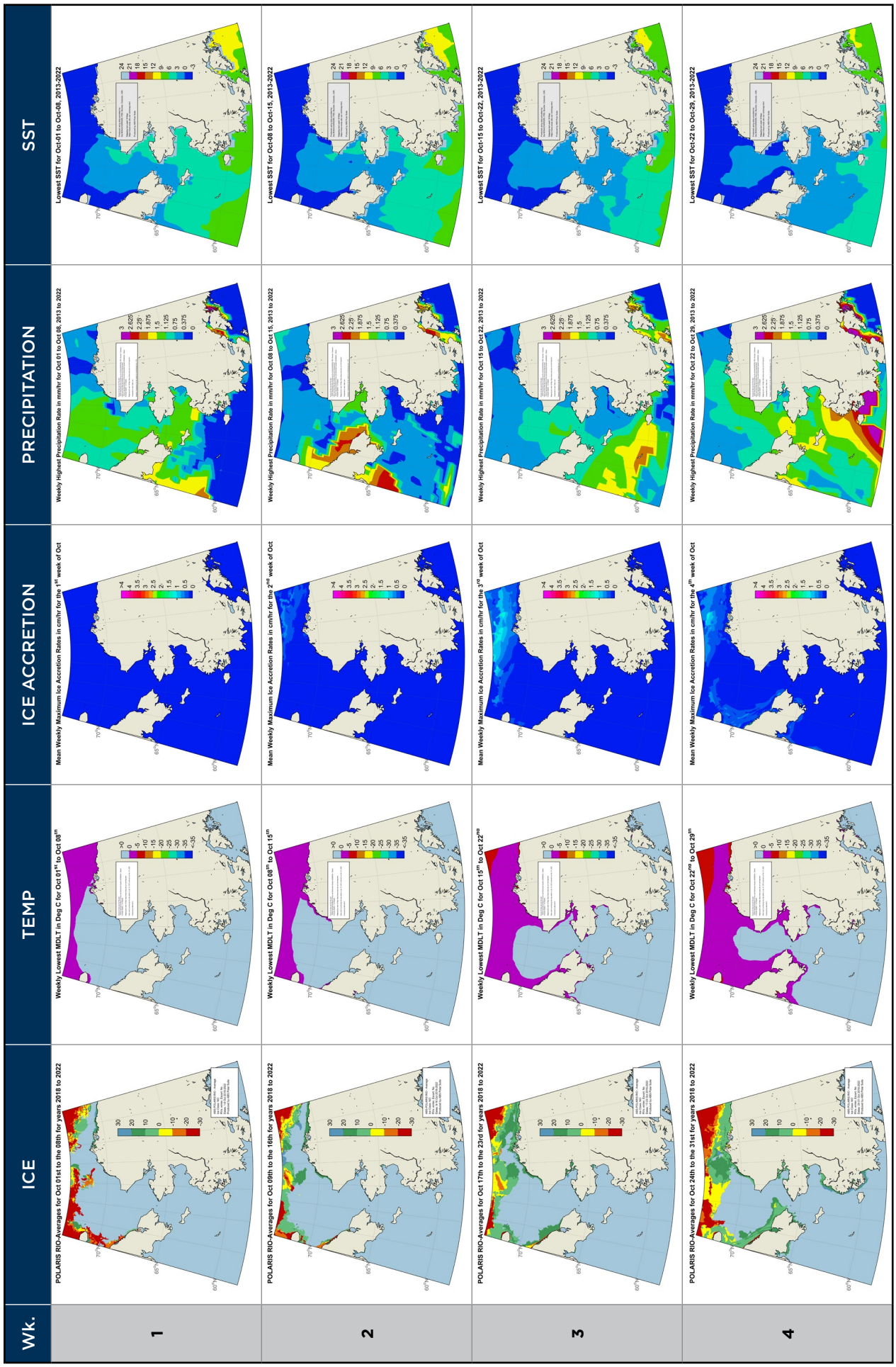


Figure 18: Enviro Hazard Analysis – October

APPENDIX II – EXAMPLE OPERATIONAL ASSESSMENT REPORT

M/V SOME GOOD SHIP – {Call Sign}

Operational Assessment Report

As required under section 1.5 of the IMO Polar Code

OWNER / OPERATOR:

Company's Name
Company's Address

3					
2					
1	Jan. 1, 2023	Initial Issue			
Rev.	Date	Description of Revision	Prepared	Checked	Approved

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1 Operational Assessment Details

1 General

Description of the Operational Assessment	XXX	
Date of Operational Assessment Workshop	XXX	
List of participants	XXX	
Risk assessment methodologies	Name of model or Tool: XXX How have all relevant hazards been identified? XXX How have the risks been evaluated? XXX	
List of reference materials	The ABS Alaska Advisory, ABS LTE Guide, IMO Circ 1519, IMO Circ 1614, XXX	

2 Operational Profile

Geographical region	Alaska
Season of operation (dates)	Summer (July to October)
Description of ice conditions	Ice Free
Description of air temperature	No low air temperatures
Description of ice accretion likelihood	Not expected to occur
Location and availability of SAR resources	US Coast Guard XXX
Polar waters a destination or transit?	Destination
Escorted or non-escorted operation or both	Non-escorted

3 Key Ship Characteristics

Ship name(s)	M.V. SOME GOOD SHIP		Flag name:	The Avalon Republic
IMO Number(s)	9912345		ABSid:	21928374
Ship type	Bulk Carrier			
Keel Lay Date:	January 1, 2020	------>	New or Existing =	**New**
Ice Class Notation	None	------>	Category =	**C**
Ice strengthened draft ranges	N/A			
Polar Service Temperature (PST)	N/A			
Ice accretion (Yes/No)	No			
Highest expected latitude of operation	70°N			
Extended period of darkness	No			
Maximum expected time to rescue	5 Days	(minimum 5 days)		
Is the ship capable of: (Yes/No)	Yes	discharging comminuted and disinfected sewage		
	Yes	discharging sewage that is not comminuted or disinfected		
	Yes	discharging through an approved and certified sewage treatment plant		
Does ship discharge cargo residues: (Yes/No)	Yes			

2 Ship Information

The subject ship as shown in Figure 1, with a list of general characteristics in Table 1, is a Bulk Carrier owned / operated by {Company Name}.

The ship has no ice-strengthening and will therefore be considered a Category C ship under the IMO Polar Code.

The ship has no notation for cold climate operations. The details from the ABS Record are given in Table 1.

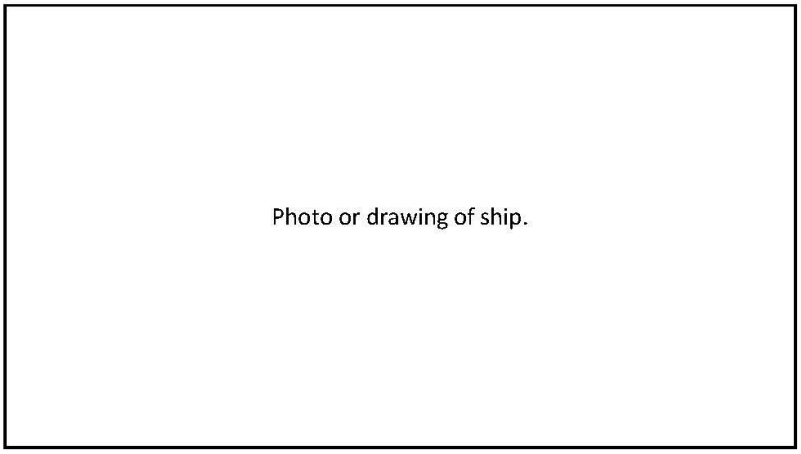

Figure 1: M.V. SOME GOOD SHIP (from ABS Record)

Table 1: General Characteristics for M.V. SOME GOOD SHIP

Name:	M.V. SOME GOOD SHIP
Class Number:	21928374
IMO Number	9912345
Description:	Bulk Carrier
Builder:	Good Yard No. 1
Flag:	The Avalon Republic
Principal Dimensions (LOA, B, D):	229m X 32m X 20m
Keel Laying Date	January 1, 2020
Delivery Date:	January 1, 2021
Class Notations:	ÀA1, Bulk Carrier, BC-A (holds 2, 4 and 6 may be empty), ESP, Á, ÀAMS, ÀACCU, CPS, CSR
Additional Notations:	BWT, CRC (SP), EEDI-Ph3, GRAB (30), IHM, NOx-Tier III, PMA, RW

3 The Ship's Polar Operations

The main area of operation under consideration for this Operational Assessment (OA) is to the Red Dog mine port (see Figure 2). The vessel will approach the port from the North Pacific through the Bering Sea, no operations through the Northern Sea Route or through the Northwest Passage are planned as the planned departure route is a return through the Bering Sea. Operations will occur during the summer months, when the air temperatures are relatively warm (Mean Daily Low Temperature {MDLT} >= -10°C), the waters are ice free, and when ice accretion is not expected to occur.

Figure 2: Red Dog Port

4 Operational Limitations

This Operational Assessment Report has been prepared for the M.V. SOME GOOD SHIP to operate in polar waters within the consideration of the following operational limitations. These operational limitations are to be placed on the Polar Ship Certificate (PSC) and will be the focal points for the Polar Waters Operational Manual (PWOM).

Table 2: M.V. SOME GOOD SHIP Operational Limitations

Ice Condition	Limited to Ice Free waters only, and Limited to areas where ice accretion is not expected to occur.
Temperature	Limited to operations in polar waters where the expected lowest MDLT for the area and season of operation is greater than or equal to -10°C.
High Latitude	Limited to operations in Alaskan waters up to an operational latitude of the lesser of: - the limitations of the sea area on the Cargo Ship Safety Radio Certificate, or - the limitations of the systems used to acquire ice/environmental information.
Maximum Expected Time of Rescue	5 days.

5 Risk Assessment Methodology

To determine the effective mitigation measures, the following methodology has been defined to help identify the risk level.

5.1 Categories

The Likelihood Categories and the Consequence Categories are based on the Consequence Index and the Frequency Index given in MSC 72/16 and equated as follows:

Table 3: Consequence Categories

Used here		Consequence Index from Annex 3 of MSC 72/16		
Consequence Categories	**No.**	**Severity**	**Effects on Human Safety**	**Effects on Ship**
No Effect	1	-	-	-
Minor Effect	2	Minor	Single or minor injuries	Local equipment damage
Moderate Effect	3	Significant	Multiple or severe injuries	Non-severe ship damage
Major Effect	4	Severe	Single fatality or multiple severe injuries	Severe damage
Catastrophic	5	Catastrophic	Multiple fatalities	Total loss or oil pollution

Table 4: Likelihood Categories

Used here		Frequency Index from Annex 3 of MSC 72/16	
Likelihood Categories	**No.**	**Frequency**	**Definition**
At no time	1	-	-
Very rare	2	Extremely remote	Likely to occur once in 10 years in a fleet of 1000 ships.
Rare	3	Remote	Likely to occur once per year in a fleet of 1000 ships, i.e. likely to occur in the total life of several similar ships
Sometimes	4	Reasonably probable	Likely to occur once per year in a fleet of 10 ships, i.e. likely to occur a few times during the ship's life
Frequently	5	Frequent	Likely to occur once per month on one ship

5.2 Risk Levels

At all times the risks should be lowered to As Low As Reasonable Practicable (ALARP) levels. This means that the risk should be lowered to the extent possible using the existing resources in place. If the resulting risk remains in the High-risk region (RED in the following matrices) then NO operation is to be initiated unless the risks are lowered to acceptable levels.

Following the definition Risk = Likelihood X Consequence, risk level margins are established as:

Risk Value (Likelihood No. X Consequence No.)	Risk Level	Description
< 7	Low	Unlikely to need any additional procedures or engineering safeguards.
7 – 15	Moderate	Caution required. Possible additional safeguards may be required.
> 15	High	Unacceptable risk levels without significant safeguards.

Table 5: Sample Risk Matrix

Consequence Categories		Likelihood Categories				
		1	2	3	4	5
		At no time	Very rare	Rare	Sometimes	Frequently
1	No Effect	1	2	3	4	5
2	Minor Effect	2	4	6	8	10
3	Moderate Effect	3	6	9	12	15
4	Major Effect	4	8	12	16	20
5	Catastrophic	5	10	15	20	25

5.3 Assessment Process

The assessment process is documented for each considered hazard in risk matrices. The initial assessment considers the vessel's operation and what would be the likelihood and consequence of each hazard if there were no Risk Control Measures (RCMs) applied. In some cases where the vessel has been designed and constructed with RCMs, these are ignored for the initial assessment. When existing RCMs are ignored for the initial assessment, this is described in the comments of each hazard. The likelihood and consequence level for each hazard is established by referencing Table 3 and Table 4 above. The original risk identified, before RCMs are applied, is identified in the matrix by "Original risk". The final risk, after RCMs are applied, is marked with an "X". The details of the assessment is included in the comment box below each matrix. Each assessment is documented with sufficient information to ensure that if the operational profile of the vessel changes, then the risks can be easily re-assessed.

6 Assessment

6.1 Workshop Overview

A one-day workshop was held at {Location} to assess the applicable hazards to the Polar Operation for the M.V. SOME GOOD SHIP. The workshop considered the operational profile of the vessel sailing from the Pacific Ocean, through the Bering Sea to the Port of Red Dog in the summer months when temperatures are not cold and there is no ice.

The workshop began with Mr/Mrs/Ms/Mx. X – {Title} giving all attendees an overview of the ship and any special characteristics the ship has that may be useful in mitigating any of the possible hazards that may be faced in Polar Waters. The vessel's lack of an Ice Class notation was discussed, and it was explained what this means. The vessel's lifesaving appliances, communication, and navigation equipment were briefly discussed. Next Mr/Mrs/Ms/Mx. Y – {Title} gave a short overview of the charter's expectations of the ship's Polar operations. This confirmed the vessel will need to be able to operate to Red Dog between {beginning month} and {end month}. The operation will be loading in Red Dog and discharging in Asian ports therefore the NWP and NSR routes are not considered.

Next the workshop moved to an overview of the environmental data obtained from the ABS Harsh Environment Technology Center (HETC). This session was presented by Mr/Mrs/Ms/Mx. Z – {Title} This confirmed that between {beginning month} and {end month}:

- There is no sea ice
- The statistical air temperatures show an MDLT above -10°
- Ice accretion is not expected to occur
- Snow fall / freezing rain is not expected
- Sea water temperatures are as low as XX°C
- Maximum daily hours of darkness are XX hrs.

At this point the assessment team understood the vessel's operational envelope in Polar waters and proceeded to conduct the initial risk assessments on the hazards identified in the Polar Code and any additional hazards not specifically included in the Polar Code. The initial assessments did not consider any risk control measures (RCMs) and ignored RCMs that are already on the vessel. These are later used as RCMs to show that the risks are being controlled.

After completing the initial risk assessments, the applicable hazards were identified. With the applicable hazards identified the thresholds in the Polar Code's regulations were then identified and the applicable Polar Code regulations were considered for each applicable hazard. This evaluation of the Polar Code's regulations is documented in a matrix format. The matrix confirms compliance with all the applicable Polar Code regulations.

Upon completing the review of the Polar Code's regulations a set of RCMs was determined, the risk assessments were repeated to ensure that the risks were fully controlled to a: As Low As Reasonable Practicable (ALARP) level. The final risk, after all RCMs are applied, is marked with an "X" in the risk matrix.

6.2 Risk Assessments

Important note: The example risk assessments shown here are for reference only and are not intended to represent any real assessment. They may be used for guidance, but the actual risk assessments are the responsibility of the ship operator/owner. The assessments must be specific to the vessel and operation under consideration.

Table 6: Ice (Sea Ice, Floating Ice)

Consequence Categories		Likelihood Categories				
		1	2	3	4	5
		At no time	Very rare	Rare	Sometimes	Frequently
1	No Effect					
2	Minor Effect					
3	Moderate Effect		X			
4	Major Effect			Original Risk		
5	Catastrophic					

Comments:	Original risk considering no operational procedures. Ship's existing projectors are not powerful enough to project light beams ahead of the ship sufficient for identification of sea ice.
Original Likelihood:	Rare: Ice conditions are normally ice-free, but the vessel may encounter sea ice in the shoulders of the season.
Original Consequence:	Major Effect: Damage from colliding with ice would be expected to result in severe damage to the vessel.
Risk Control Measures	Design/Equipment: Existing: Broadband connection for latest sea ice data, Radars. New: High powered searchlights
	Operational: Procedure to check latest ice conditions and not proceed if conditions exceed the operational limit of ice-free waters. =Reduces Likelihood one level. Procedures for slow sailing, use of searchlights and radars with a constant watch at night. During daylight hours, constant watch, and slower speeds while in Polar Waters. = Reduced speed reduces the energy in a collision which reduces the Consequence to non-severe ship damage.

Table 7: Ice Ingestion (Slush and Sea Ice)

Consequence Categories		Likelihood Categories				
		1	2	3	4	5
		At no time	Very rare	Rare	Sometimes	Frequently
1	No Effect					
2	Minor Effect					
3	Moderate Effect		X	Original Risk		
4	Major Effect					
5	Catastrophic					

Comments:	Original risk considered without re-circulating system or monitoring procedures.	
Original Likelihood:	Rare: Ice ingestion is not possible when the water is warm enough to melt the ice. Sea water temperatures for operating season are nearly all above 0°C except for the very beginning of the season. Therefore, ice ingestion is expected to occur rarely while operating to Red Dog.	
Original Consequence:	Moderate Effect: Loss of cooling water has moderate effect but can have very significant carry-on effects such as loss of firefighting water which could be Catastrophic if there was a fire at that time, or a loss of propulsion could be catastrophic if the ship drifted into shallow waters. A loss of cooling water will result in an overheat which could lead to non-severe ship damage.	
Risk Control Measures	Design/Equipment:	The ship's re-circulating system can warm water in sea chest, melting ice and reducing the likelihood.
	Operational:	Procedures to use low sea suction, when possible, in Polar Waters and to monitor sea water intake temperatures and pressures and switch sea intake and re-circulate when a pressure drop occurs. Procedures also help reduce likelihood. Notify Bridge.

Table 8: Topside Icing (Ice Accretion)

Consequence Categories		Likelihood Categories				
		1	2	3	4	5
		At no time	Very rare	Rare	Sometimes	Frequently
1	No Effect					
2	Minor Effect		X			
3	Moderate Effect					
4	Major Effect					
5	Catastrophic			Original Risk		
Comments:	Vessel's stability does not have ice accretion conditions and vessel will be limited to areas and times when ice accretion is not expected to occur.					
Original Likelihood:	Rare: The ice accretion analysis indicates ice accretion historically may have occurred right at the very end of the operating window for Red Dog.					
Original Consequence:	Catastrophic: If the ice accretion exceeded the vessel's stability it would be catastrophic					
Risk Control Measures	Design/Equipment:	As a contingency in the event the vessel experiences light icing the crew will have shovels and wooden mallets to remove ice accretion. This will reduce the consequence significantly. Bringing it from a stability concern to local equipment level concern. Broadband connection for latest weather reports, Weather Fax, NAVTEX.				
	Operational:	Procedures will be written to monitor forecasts and ensure the ship avoids areas and times where ice accretion may occur. If these conditions are unavoidable, procedures will be written for ship handling to minimize or eliminate ice accretion. A contingency procedure will also be added to the PWOM for monitoring and ice. This reduces the likelihood. Removal procedures will give guidance on how to safely remove ice from ship's equipment and structures as well as more delicate systems such as liferafts and lifeboat. Specific equipment for ice removal will be carried and training for ice removal will be included.				

Table 9: Snow Accumulation / Freezing Rain

Consequence Categories		Likelihood Categories				
		1	2	3	4	5
		At no time	Very rare	Rare	Sometimes	Frequently
1	No Effect					
2	Minor Effect			X		
3	Moderate Effect					
4	Major Effect					
5	Catastrophic				Original Risk	

Comments:	Precipitation that may be in the form of snow or freezing rain historically is not present on the route to or from Red Dog or at the port except for early in June and after mid-October. Freezing rain is much less likely to occur than snow as the cold layer of air near the surface must be so thin that the raindrops do not have enough time to freeze before reaching the ship.
Original Likelihood:	Sometimes: The likelihood of any significant freezing rain is nearly neglectable for the Red Dog operation except during a transition from rain to snow or vice-versa. Therefore, likelihood for freezing rain is Very Rare. The likelihood of snow in the shoulder seasons is much more likely than freezing rain and based on historical analysis it is expected to occur once per year for every 10 ships which makes the likelihood sometimes.
Original Consequence:	Catastrophic Effect: The consequence of light freezing rain is expected to be less than heavy snow therefore only the consequence of snowfall is considered. Thin layers of snow will not have the mass/density to adversely affect the ship's stability. Snow is approximately $1/10^{th}$ the density of ice, therefore 10 cm of snow is approximately equal to 1 cm if ice. If snow load exceeds the ship's stability it would be catastrophic. Other than the stability concern deep snow will cause an inconvenience for the crew by burying equipment and make passage more difficult. Ingestion of snow into some machinery intakes could cause minor disruptions in service, considered local equipment damage.
Risk Control Measures	Design/Equipment: Broadband connection for latest weather reports, Weather Fax, NAVTEX, Shovels
	Operational: Procedures will be written to avoid bad weather that may result in heavy snowfall if possible. This will reduce the likelihood by one level. Procedures for when and how to safely remove snow will be included in the PWOM. This will significantly reduce the consequence to the point where only local equipment damage from snow ingestion is a concern. Additional equipment for this likelihood added. Crew training.

Table 10: Low Seawater Temperature: Adverse Effects on Machinery

Consequence Categories		Likelihood Categories				
		1	2	3	4	5
		At no time	Very rare	Rare	Sometimes	Frequently
1	No Effect					X
2	Minor Effect					Original Risk
3	Moderate Effect					
4	Major Effect					
5	Catastrophic					

Comments:	The vessel's machinery is designed to operate on water as cold as -2°C. This is not considered in the original assessment.	
Original Likelihood:	Frequently: It is expected that the M.V. SOME GOOD SHIP will frequently encounter cold seawater.	
Original Consequence:	Minor Effect: Cold seawater may cause excessive thermal contraction and damage coolers. Possibly causing thermal stresses in equipment sufficient to cause failure.	
Risk Control Measures	Design/Equipment:	The systems are designed to operate on cold non-frozen sea water. This reduces the consequence.
	Operational:	N/A

Table 11: Low Seawater Temperature: Survival.

Consequence Categories		Likelihood Categories				
		1	2	3	4	5
		At no time	Very rare	Rare	Sometimes	Frequently
1	No Effect					
2	Minor Effect			X		
3	Moderate Effect					
4	Major Effect					
5	Catastrophic					Original Risk

Comments:	Water has a higher thermal conductivity than air and therefore contact with cold water causes more heat loss that cold air.	
Original Likelihood:	Frequently: It is expected that the M.V. SOME GOOD SHIP will frequently encounter cold seawater, and cold water has a high likelihood of adversely affecting survival.	
Original Consequence:	Catastrophic: Multiple fatalities if crew cannot be insulated from the cold water. Even worse if anyone gets wet.	
Risk Control Measures	Design/Equipment:	M.V. SOME GOOD SHIP has a freefall totally enclosed lifeboat and 2 liferafts. Liferafts have insulated bottoms and canopy covering. The vessel has additional blankets, and everyone has insulated immersion suits. Survival craft are all equipped with towels and sponges. Personal Survival Kits have a change of clothes. Lifeboats inherently insulate people from the cold water and liferafts along with immersion suits and blankets will insulate people from water. Insulation reduces the consequence.
	Operational:	Procedures for primary abandonment based on the scenarios and maximum possibility of survival. PWOM gives guidance to master to prefer the lifeboat in polar waters for enhanced thermal properties which may improve survival chances. This reduces the likelihood of cold-water affecting survival. Crew training.

Table 12: Air Temp - Below Freezing

Consequence Categories		Likelihood Categories				
		1	2	3	4	5
		At no time	Very rare	Rare	Sometimes	Frequently
1	No Effect				X	
2	Minor Effect					
3	Moderate Effect				Original Risk	
4	Major Effect					
5	Catastrophic					

Comments:	Original risk does not consider draining exposed systems or providing crews with warm clothing.	
Original Likelihood:	Sometimes: In the shoulders of the season to Red Dog, especially in the fall the air temperatures can go below freezing this is estimated to occur sometimes.	
Original Consequence:	Moderate Effect: Crews exposed to freezing temperatures without proper protection will experience cold effects (multiple crew members) or systems such as the fire main can become frozen and rupture which would be considered non-severe ship damage.	
Risk Control Measures	Design/Equipment:	Broadband connection for latest weather reports, Weather Fax, NAVTEX, piping system drains, warm work clothes for crew (hats, mittens, jackets, neck warmers, insulated pants, boots)
	Operational:	Procedures to monitor the forecast and prepare the ship and crew if cooler temperatures are expected. Drain all waterlines on the deck. PWOM will have a vessel specific checklist for crew actions when preparing for cooler temperatures. Protection of the crew with warm clothing and removing any freezable liquids from the on-deck piping results in no hazardous effect of cooler air temperatures. Crew training. situation report (Sitrep) to office as may be required.

Table 13: Low Air Temperature (MDLT < -10C)

Consequence Categories		Likelihood Categories				
		1	2	3	4	5
		At no time	Very rare	Rare	Sometimes	Frequently
1	No Effect	X				
2	Minor Effect					
3	Moderate Effect					
4	Major Effect					
5	Catastrophic	Original Risk				

Comments:		
Original Likelihood:		At no time: The M.V. SOME GOOD SHIP is limited to operate where the MDLT is greater than -10°C.
Original Consequence:		Catastrophic: The M.V. SOME GOOD SHIP is not designed or built for low air temperature operation. The hull steel grades have not been evaluated for low temperature service, most of the systems and machinery are not rated for low temperature operation and the life saving appliances are not rated for low temperature service. Possibility of brittle fracture of hull structures could be catastrophic.
Risk Control Measures	Design/Equipment:	N/A
	Operational:	Procedures for voyage planning taking into account historical statistical temperature data and instructions to avoid areas where the MDLT is -10°C or below. Monitor temperatures check latest weather reports, if necessary, move vessel to warmer areas. Crew training. Sitrep to office if experienced.

Table 14: Extended Darkness / Daylight

Consequence Categories		Likelihood Categories				
		1	2	3	4	5
		At no time	Very rare	Rare	Sometimes	Frequently
1	No Effect					X
2	Minor Effect					
3	Moderate Effect					Original Risk
4	Major Effect					
5	Catastrophic					

Comments:	The Red Dog port is approximately 67.6°N which is north of the Arctic Circle (~66.5°N).	
Original Likelihood:	Frequently: From early June to mid July there is 24-hour daylight at the Port of Red Dog, during this time the waters between 60°N and 66.5°N see the sun set but for a very short time. Late in the Red Dog operating season the hours of daylight at the port drop to approximately 10 hour per day. Therefore, the risk of long hours of darkness is negligible but long daylight hours will occur frequently.	
Original Consequence:	Moderate Effect: The long days can create fatigue in the crew due to difficulty sleeping. This can adversely affect multiple crew members likely resulting in minor injuries.	
Risk Control Measures	Design/Equipment:	Dark window coverings for all crew cabins.
	Operational:	Crew will continue to work according to all required hours of rest. Procedures for working in extended hours of daylight will include recommended bedtimes. Appropriate hours of rest will reduce the consequence. Installation of black out curtains in sleeping spaces.

Table 15: High Latitude

Consequence Categories		Likelihood Categories				
		1	2	3	4	5
		At no time	Very rare	Rare	Sometimes	Frequently
1	No Effect					
2	Minor Effect		X			
3	Moderate Effect					
4	Major Effect		Original Risk			
5	Catastrophic					

Comments:		
Original Likelihood:	Very Rare: The ship will operate from the Pacific Ocean to Red Dog and back to the Pacific. Maximum latitude should be less than 70°N. Only unforeseen circumstances would require the vessel to proceed further north.	
Original Consequence:	Major Effect: If ship were to head north beyond its communication and navigation systems abilities the probability of grounding and not being able to signal for help is high, likely resulting in multiple severe injuries.	
Risk Control Measures	Design/Equipment:	GNSS Compass as second non-magnetic means of determining heading. Sea Area A3 radio station and IRIDUM reduce the consequence.
	Operational:	Stay within the operational limitations placed on the Polar Ship Certificate which will keep the vessel within areas where the communication systems and navigational systems will be operational. This would reduce the consequence. Send SitRep in as needed.

Table 16: Poor Hydrographic Data

Consequence Categories		Likelihood Categories				
		1	2	3	4	5
		At no time	Very rare	Rare	Sometimes	Frequently
1	No Effect					
2	Minor Effect					
3	Moderate Effect		X			
4	Major Effect					
5	Catastrophic		Original Risk			

Comments:	Original risk considering no procedures.
Original Likelihood:	Very Rare: Vessel will not operate in areas with poor charts. May need to go into poorly charted areas in emergency situations.
Original Consequence:	Catastrophic: If ship went aground it could result in total loss of the vessel.
Risk Control Measures — Design/Equipment:	Depth sounder, ECDIS, up to date paper charts
Risk Control Measures — Operational:	Procedures for operation only in areas where the Categories of Zone Of Confidence (CatZOC) is high. Voyage planning which includes places of refuge that have high CATZOC. Procedures for continuous use and monitoring of depth sounder when in shallow water depths. Procedures for very slow speeds if in poorly charted areas. This reduces the consequence. Emergency team on standby as may be required.

Table 17: Lack of Crew Experience

Consequence Categories		Likelihood Categories				
		1	2	3	4	5
		At no time	Very rare	Rare	Sometimes	Frequently
1	No Effect					
2	Minor Effect			X		
3	Moderate Effect					
4	Major Effect					
5	Catastrophic					Original Risk

Comments:	The crew's experience before operations is the primary consideration here, but complacency after many event free operations is also considered.
Original Likelihood:	Frequently: Most mariners do not have experience with Polar water operations. Humans can get complacent after repetition of similar tasks.
Original Consequence:	Catastrophic: Lack of experience has led to total loss of vessels in Polar Waters.
Risk Control Measures	Design/Equipment: N/A
	Operational: The hazards with operating in polar waters are considered in this Operational Assessment. Any areas where the crew may be lacking on experience will be either eliminated by limiting the vessel to not operate in those conditions (e.g. sea ice) or by providing procedures and checksheets in the PWOM (e.g. preparation for cooler air temperatures). Keeping the vessel in conditions more in line with the experiences and training of the crew greatly reduce the likelihood of the crew experiencing conditions that exceed their abilities. Limiting the vessel to stay away from hazards that could cause serious damage (e.g. sea ice and temperature) serve to reduce the consequence. Carriage of Ice Navigator/pilot as may be beneficial or safe.

Table 18: Rapid Weather Changes

Consequence Categories		Likelihood Categories				
		1	2	3	4	5
		At no time	Very rare	Rare	Sometimes	Frequently
1	No Effect					
2	Minor Effect			X		
3	Moderate Effect					
4	Major Effect					Original Risk
5	Catastrophic					

Comments:		
Original Likelihood:	Frequently: Polar weather can be very dynamic.	
Original Consequence:	Major Effect: Quick onset of bad weather can be a severe problem with the potential for severe damage if pushed or unknowingly sailed into shallows.	
Risk Control Measures	Design/Equipment:	SOLAS equipment including navigation suite, communications suite, radars, temp monitoring, etc.
	Operational:	Procedures for crew to constantly monitor the weather. Knowing the evolving weather conditions enables the vessel to avoid most bad weather therefore reducing the likelihood. Being able to prepare the crew and the ship for an oncoming storm reduces the consequences. Crew training.

Table 19: Potential Immersion into Polar Water

Consequence Categories		Likelihood Categories				
		1	2	3	4	5
		At no time	Very rare	Rare	Sometimes	Frequently
1	No Effect					
2	Minor Effect		X			
3	Moderate Effect					
4	Major Effect					
5	Catastrophic		Original Risk			

Comments:		
Original Likelihood:	Very Rare: The M.V. SOME GOOD SHIP has a totally enclosed lifeboat and davit launched liferaft, but it is still possible that crew members may end up in the water in an emergency.	
Original Consequence:	Catastrophic Effect: Severe consequence of multiple fatalities within minutes if people end up unprotected in cold polar waters.	
Risk Control Measures	Design/Equipment:	Personal Survival Kits have a towel and a change of clothes sealed in a watertight bag. This will reduce the consequence if someone goes in the water and gets wet by enabling them to get dry for survival. Insulated immersion suits are provided for everyone onboard which also reduce the consequence of someone going into the water.
	Operational:	The PWOM will have procedures for preferred abandonment methods using the lifeboat over the liferafts to help prevent crew from going in the water. This reduces the likelihood of crew going into the water. Crew training.

Table 20: Other Hazard: Fog

Consequence Categories		Likelihood Categories				
		1	2	3	4	5
		At no time	Very rare	Rare	Sometimes	Frequently
1	No Effect					
2	Minor Effect				X	
3	Moderate Effect				Original Risk	
4	Major Effect					
5	Catastrophic					

Comments:		
Original Likelihood:	Sometimes: It is expected that fog will occur when there are temperature differences. Especially if the ice edge is near (early in the season)	
Original Consequence:	Moderate Effect: The only direct effect of fog is that it limits visibility which can result in damages to the vessel if a collision were to occur.	
Risk Control Measures	Design/Equipment:	Radar, AIS
	Operational:	Vessel to follow the Rules of the Road and standard company operation procedure while in fog. Ice information will be carefully reviewed to ensure no ice is present while operating in fog. Procedures to reduce speed while in fog in Polar waters will reduce the consequence.

Table 21: Other Hazard: Polar Bears

Consequence Categories		Likelihood Categories				
		1	2	3	4	5
		At no time	Very rare	Rare	Sometimes	Frequently
1	No Effect					
2	Minor Effect			X		
3	Moderate Effect			Original Risk		
4	Major Effect					
5	Catastrophic					

Comments:		
Original Likelihood:	Rare: Polar bears tend to live around the sea ice. The vessel will be limited to operations in ice free waters only, therefore the likelihood of seeing polar bears will be rare.	
Original Consequence:	Moderate Effect: A Polar Bear attack would likely result in severe injuries.	
Risk Control Measures	Design/Equipment:	Air horn
	Operational:	Procedures to stay onboard the vessel while in Polar Waters will reduce the likelihood of a bear encounter where an attack could occur. Procedures for preferred abandonment into lifeboat instead of liferaft will reduce the consequence of encountering a bear after abandonment. Air horns to drive off the bears will be provided to the ship and procedures to bring these horns to the Lifeboat/liferafts.

6.3 Additional Assessments

The following items are required to be considered in the operational assessment but are considered without the risk assessment approach used in above in section 6.2.

6.3.1 Maximum Expected Time of Rescue (METR)

The Polar Code stipulates a minimum of 5 days for the METR. The estimations herein are based on IMO SSE7/4/1 and SSE7/INF.6.

The M.V. SOME GOOD SHIP has a maximum POB of 24 persons. The METR is assumed to be from the time the M.V. SOME GOOD SHIP transmits a distress signal (just prior to abandonment) to the time that last person is no longer in a survival situation. The primary SAR resource in Alaskan Polar Waters is the United States Coast Guard (USCG).

Many the USCG air assets are stationed at Kodiak, AK. but they also regularly operate out of Nome, AK., especially during the summer season when the M.V. SOME GOOD SHIP will be operating to Red Dog.

The USCG Jayhawks (Sikorsky HH-60) have a range of approximately 1,300 km and are capable of flying at about 330 km/hr (cruise at 250 km/hr) and can accommodate 6 people at a time (4 trips needed to rescue entire crew).

To aid in the search portion of SAR, unmanned aerial drones are used. These unmanned aerial drones pose the least risk to rescue professionals and have been tested in the region and proven to be successful at locating survivors under specific conditions.

Assuming adding an extra day delay in rescue time for bad weather, the incident occurring at the worst location (furthest from the US Coast Guard's resources), and the time spent shuttling people to shore, the rescue time for a Red Dog operation is calculated to be less than 5 days. Therefore, the Polar Code's minimum of 5 days is considered appropriate for this operation.

6.3.2 Escort Operations

The M.V. SOME GOOD SHIP will be limited to operate in ice free waters only. Therefore, icebreaker escort is not considered applicable to the operation.

6.3.3 Abandonment onto Ice or Land

The M.V. SOME GOOD SHIP will not be operating in sea ice, therefore abandonment to the ice is not considered applicable to the Red Dog operation.

The abandonment scenarios for the M.V. SOME GOOD SHIP in Polar waters will be no different than for the ship outside of polar waters. Abandonment will be done using the lifeboat primarily and liferafts as a secondary means. If there is a survival advantage in moving from the boats/rafts to land it will be the master's decision. The vessel will not have any special equipment for survival on land (e.g. group survival kits) and the PWOM will indicate this so the master can make more informed decisions.

7 Details for Polar Ship Certificate

The outcomes of this operational assessment are used to establish the details for the Polar Ship certificate and the attached record given below in Table 22 and Table 23.

Table 22: Example Details for the Polar Ship Certificate

2	Category =	C			
	Ice Class and Ice Strengthened Draft Range				
		Maximum Draft		Minimum Draft	
	Ice Class	Aft	Fwd	Aft	Fwd
	None	-	-	-	-
	-	-	-	-	-
2.1	Ship type:	Other			
2.2	Ship restricted to operate in:	Ice Free Waters			
2.3	Ship intended to operate in low air temperature:	No			
2.3.1	Polar Service Temperature:	N/A			
2.4	Maximum expected time of rescue:	5	days		
3	Was the ship subjected to alternative design?	No			
5	Operational Limitations:				
5.1	Ice Conditions	Limited to ice-free waters only and, Limited to areas where ice accretion is not expected to occur.			
5.2	Temperature	Limited to operations in polar waters where the expected lowest MDLT for the area and season of operation is greater than or equal to -10°C			
5.3	High Latitudes:	Limited to operations in Alaskan waters up to an operational latitude of the lesser of: - the limitations of the sea area on the Cargo Ship Safety Radio Certificate or - the limitations of the systems used to acquire ice/environmental information.			
	Comments:				

Table 23: Details for Record of Equipment for the Polar Ship Certificate

2.1	Life-Saving Appliances	
	Item	Actual Provision
1	Total number of immersion suits with insulation:	34
	1.1 for crew	34
	1.2 for passengers	-
2	Total number of thermal protective aids	6
3	Personal and Group Survival Equipment	
	3.1 Personal survival equipment - for number of persons	28
	3.2 Group survival equipment - for number persons	-
	3.3 Total capacity of liferafts in compliance with chapter 8 of the Polar Code	50
	3.4 Total capacity of lifeboats in compliance with chapter 8 of the Polar Code	25
2.2	Navigation Equipment	
	Item	Actual Provision
1	Two independent echo-sounding devices or a device with two separate independent transducers	Provided
2	Remotely rotatable, narrow-beam search lights controllable from the bridge or other means to visually detect ice	Provided
3	Manually initiated flashing red light visible from astern (for ships involved in icebreaking operations)	-
4	Two or more non-magnetic independent means to determine and display heading	Provided
5	GNSS compass or equivalent (for ships proceeding to latitudes over 80 degrees)	Provided
2.3	Communication Equipment	
	Item	Actual Provision
1	Sound signaling system mounted to face astern to indicate escort and emergency manoeuvres to following ships as described in the International Code of Signals (for ships intended to provide ice breaking escort).	-
2	Voice and/or data communications with relevant rescue coordination centres.	Provided
3	Equipment for voice communications with aircraft on 121.5 and 123.1 MHz.	Provided
4	Two-way voice and data communication with a Telemedical Assistance Service (TMAS).	Provided
5	All rescue boats and lifeboats, whenever released for evacuation, have a device (for ships certified to operate in low air temperature):	-
	5.1 for transmitting vessel to shore alerts;	-
	5.2 for transmitting signals for location;	-
	5.3 for transmitting and receiving on-scene communications.	-
6	All other survival craft have a device (for ships certified to operate in low air temperature):	-
	6.1 for transmitting signals for location; and	-
	6.2 for transmitting and receiving on-scene communications.	-

Addendum 1

Polar Code Regulation Matrix

Note: The following matrix is not completed for this example. It is expected that for each line the mandatory and risk control measures columns will be filled in like follows:

Mandatory?

Yes = The operational profile for the vessel meets or exceeds the threshold for this regulation, and it therefore applies to the operational profile for this vessel.

No = The threshold was not met and therefore this regulation is not mandatory for the intended operational profile.

N/A = Not applicable for this ship, age, category, etc.

Risk Control Measures?

Description of any equipment already onboard the ship and/or

Description of any new equipment being added to the vessel, and/or

Description of any existing procedures and/or

Description of any new procedures to be developed (PWOM)

Colours:

Light Grey	Division between chapters
Light Blue	Polar Code Functional Requirements
White	Polar Code Regulations
Yellow	Additional ABS guidance for fulfilling functional requirements
Black	Division between Part I and Part II

#	Chapter	Para.	FR/PR	Description	Mandatory?	Risk control measure?
1	Ship Structure	3.2.1	Funct.	materials used shall be suitable for operation at the PST		
2	Ship Structure	3.3.1	Reg.	materials of exposed structures approved according to IACS UR S6 or UR I or equivalent level of safety		
3	Ship Structure	3.2.1	Funct.	structure shall be designed to resist both global and local structural loads anticipated under the foreseen ice conditions		
4	Ship Structure	3.3.2.1	Reg.	scantlings of Category A ships - approved according to IACS PC1 - PC5 or equivalent level of safety		
5	Ship Structure	3.3.2.2	Reg.	scantlings of Category B ships - approved according to IACS PC6 - PC7 or equivalent level of safety		
6	Ship Structure	3.3.2.3	Reg.	scantlings of ice strengthened Category C ships - approved taking into account acceptable standards adequate for the ice types and concentrations encountered in the area of operations		
7	Ship Structure	3.3.2.4	Reg.	scantlings of Category C ships need not be ice strengthened if, in the opinion of the Admin, the ship's structure is adequate for the intended operation		
8	Subdivision and Stability	4.2.1	Funct.	shall have sufficient stability in intact condition when subject to ice accretion		
9	Subdivision and Stability	4.3.1.1.1 - 4.3.1.1.3	Reg.	ice allowance for stability calculations - exposed weather decks and gangways, projected lateral areas of ship sides, projected lateral areas of discontinuous surfaces		

#	Chapter	Para.	FR/PR	Description	Mandatory?	Risk control measure?
10	Subdivision and Stability	4.3.1.2.1	Reg.	designed to minimize the accretion of ice		
11	Subdivision and Stability	4.3.1.2.2	Reg.	equipped with such means for removing ice - e.g. electrical and pneumatic devices, special tools such as axes or wooden clubs for removing ice from bulwarks, rails and erections		
12	Subdivision and Stability	4.3.1.3	Reg.	PWOM to include information on icing allowances included in the stability calculations		
13	Subdivision and Stability	4.3.1.4	Reg.	ice accretion shall be monitored and appropriate measures taken to ensure ice accretion does not exceed values given in the PWOM		
14	Subdivision and Stability	4.2.2	Funct.	sufficient residual stability to sustain ice-related damages		
15	Subdivision and Stability	4.3.2.1, 4.3.2.2.1 - 4.3.2.2.3	Reg.	able to withstand flooding resulting from hull penetration due to ice contact and prescribed ice damage extents		
16	Watertight and Weathertight Integrity	5.2	Funct.	all closing appliances and doors relevant to watertight and weathertight integrity shall be operable		
17	Watertight and Weathertight Integrity	5.3.1	Reg.	means provided to remove or prevent ice and snow accretion around hatches and doors		
18	Watertight and Weathertight Integrity	5.3.2.1	Reg.	if hatches or doors are hydraulically operated, means provided to prevent freezing or excessive viscosity of liquids		

#	Chapter	Para.	FR/PR	Description	Mandatory?	Risk control measure?
19	Watertight and Weathertight Integrity	5.3.2.1	Reg.	exposed hatches and closing devices designed to be operated by personnel wearing heavy winter clothing including thick mittens		
20	Machinery Installations	6.2.1.1	Funct.	machinery installations shall provide functionality under the anticipated environmental conditions, taking into account		
21	Machinery Installations	6.3.1.1	Reg.	machinery installations and associated equipment shall be protected against the effect of ice accretion and/or snow accumulation, ice ingestion from sea water, freezing and increased viscosity of liquids, seawater intake temperature and snow ingestion		
22		6.3.1.1		functionality of cooling water/ballast water systems		
23		6.3.1.1		machinery air intake systems		
24		6.3.1.1		exposed machinery systems		
25	Machinery Installations	6.3.1.2	Reg.	working liquids shall be maintained in a viscosity range that ensures operation of the machinery		
26	Machinery Installations	6.3.1.3	Reg.	seawater supplies for machinery systems shall be designed to prevent ingestion of ice, or otherwise arranged to ensure functionality		
27	Machinery Installations	6.2.1.2	Funct.	machinery installations shall provide functionality under the anticipated environmental conditions, also taking into account - cold and dense inlet air, loss of performance of battery or other stored energy device, and materials shall be suitable for PST		

#	Chapter	Para.	FR/PR	Description	Mandatory?	Risk control measure?
28	Machinery Installations	6.3.2	Reg.	In addition, for ships intended to operate in low air temperatures, the following apply:		
29	Machinery Installations	6.3.2.1	Reg.	exposed machinery and electrical installations and appliances shall function at PST		
30	Machinery Installations	6.3.2.2	Reg.	means shall be provided to ensure that combustion air for internal combustion engines driving essential machinery is maintained at a temperature in compliance with criteria from engine manufacturer		
31	Machinery Installations	6.3.2.3	Reg.	materials of exposed machinery and foundations shall be approved to acceptable standards or equivalent (UR I3)		
32	Machinery Installations	6.2.1.3	Funct.	machinery installations shall provide functionality under the anticipated environmental conditions, taking into account - loads imposed directly by ice interaction		
33	Machinery Installations	6.3.3.1	Reg.	scantlings of propeller blades, propulsion line, steering equipment and other appendages of category A ships shall be approved to acceptable standards (UR I3, PC1-PC5)		
34	Machinery Installations	6.3.3.2	Reg.	scantlings of propeller blades, propulsion line, steering equipment and other appendages of category B ships shall be approved to acceptable standards (UR I3, PC6-PC7)		
35	Machinery Installations	6.3.3.3	Reg.	scantlings of propeller blades, propulsion line, steering equipment and other appendages of ice-strengthened category C ships shall be approved to acceptable standards adequate with the ice types and concentration encountered in the area of operation		

#	Chapter	Para.	FR/PR	Description	Mandatory?	Risk control measure?
36	Fire Safety/Protection	7.2.1.1	Funct.	all components of fire safety systems and appliances if installed in exposed positions shall be protected from ice accretion and snow accumulation		
37	Fire Safety/Protection	7.3.1.1	Reg.	isolating and pressure/vacuum valves in exposed locations are to be protected from ice accretion and remain accessible at all time		
38	Fire Safety/Protection	7.3.1.2	Reg.	all two-way portable radio communication equipment shall be operable at the polar service temperature		
39	Fire Safety/Protection	7.2.1.2	Funct.	local equipment and machinery controls shall be arranged so as to avoid freezing, snow accumulation and ice accretion and their location to remain accessible at all time		
40				All local firefighting system controls are to be protected from ice accretion and snow accumulation.		
41	Fire Safety/Protection	7.3.2.1	Reg.	fire pumps including emergency fire pumps, water mist and water spray pumps shall be located in compartments maintained above freezing		
42	Fire Safety/Protection	7.3.2.2	Reg.	fire main arranged so that exposed sections can be isolated and means of draining of exposed sections shall be provided.		
43	Fire Safety/Protection	7.3.2.3	Reg.	firefighter's outfits shall be stored in warm locations on the ship		
44	Fire Safety/Protection	7.3.2.4	Reg.	where fixed water-based firefighting systems are located in a space separate from the main fire pumps and use their own independent sea suction, this sea suction is to be also capable of being cleared of ice accumulation		

#	Chapter	Para.	FR/PR	Description	Mandatory?	Risk control measure?
45	Fire Safety/Protection	7.2.1.3	Funct.	the design of fire safety systems and appliances shall take into consideration the need for persons to wear bulky and cumbersome cold weather gear, where appropriate;		
46		7.2.1.3		The temperature of the actual operational area should be considered. The gloves and other cold weather clothing expected to be worn should not hinder the operation of the firefighting systems.		
47	Fire Safety/Protection	7.2.1.4	Funct.	means shall be provided to remove or prevent ice and snow accretion from accesses;		
48				All doors and escape routes are to be protected from ice accretion and snow accumulation.		
49	Fire Safety/Protection	7.2.1.5	Funct.	extinguishing media shall be suitable for intended operation		
50	Fire Safety/Protection	7.2.2.1	Funct.	all components of fire safety systems and appliances shall be designed to ensure availability and effectiveness under the polar service temperature;		
51	Fire Safety/Protection	7.3.3.1	Reg.	portable and semi-portable extinguishers shall be located in positions protected from freezing temperatures, as far as practical. Locations subject to freezing are to be provided with extinguishers capable of operation under the polar service temperature.		
52	Fire Safety/Protection	7.2.2.2	Funct.	materials used in exposed fire safety systems shall be suitable for operation at the polar service temperature.		

#	Chapter	Para.	FR/PR	Description	Mandatory?	Risk control measure?
53	Fire Safety/Protection	7.3.3.2	Reg.	materials of exposed fire safety systems shall be approved by the administration, or a recognized organization accepted by it, taking into account standards acceptable to the Organization or other standards offering an equivalent level of safety based on the polar service temperature		
54	LSA - Escape	8.2.1.1	Funct.	Exposed escape routes shall remain accessible and safe, taking into consideration the potential icing of structures and snow accumulation		
55	LSA - Escape	8.2.1.2	Funct.	Survival craft and muster and embarkation arrangements shall provide safe abandonment of ship, taking into consideration the possible adverse environmental conditions during an emergency		
56	LSA - Escape	8.3.1.1	Reg.	for ships exposed to ice accretion, means shall be provided to remove or prevent ice and snow accretion from escape routes, muster stations, embarkation areas, survival craft, its launching appliances and access to survival craft		
57	LSA - Escape	8.3.1.2	Reg.	in addition, for ships constructed on or after 1 January 2017, exposed escape routes shall be arranged so as not to hinder passage by persons wearing suitable polar clothing		

#	Chapter	Para.	FR/PR	Description	Mandatory?	Risk control measure?
58	LSA - Escape	8.3.1.3	Reg.	in addition, for ships intended to operate in low air temperatures, adequacy of embarkation arrangements shall be assessed, having full regard to any effect of persons wearing additional polar clothing		
59	LSA - Evacuation	8.2.2	Funct.	All life-saving appliances and associated equipment shall provide safe evacuation and be functional under the possible adverse environmental conditions during the maximum expected time of rescue		
60	LSA - Evacuation	8.3.2.1	Reg.	ships shall have means to ensure safe evacuation of persons, including safe deployment of survival equipment, when operating in ice-covered waters, or directly onto the ice, as applicable		
61	LSA - Evacuation	8.3.2.2	Reg.	where the regulations of this chapter are achieved by means of adding devices requiring a source of power, this source shall be able to operate independently of the ship's main source of power		
62	LSA - Survival	8.2.3.1	Funct.	Adequate thermal protection shall be provided for all persons on board, taking into account the intended voyage, the anticipated weather conditions (cold and wind), and the potential for immersion in polar water, where applicable		
63	LSA - Survival	8.3.3.1.1	Reg.	for passenger ships, a proper sized immersion suit or a thermal protective aid shall be provided for each person on board		
64	LSA - Survival	8.3.3.1.2	Reg.	where immersion suits are required, they shall be of the insulated type.		

#	Chapter	Para.	FR/PR	Description	Mandatory?	Risk control measure?
65	LSA - Survival	8.2.3.2	Funct.	Life-saving appliances and associated equipment shall take account of the potential of operation in long periods of darkness, taking into consideration the intended voyage		
66	LSA - Survival	8.3.3.2	Reg.	for ships intended to operate in extended periods of darkness, searchlights suitable for continuous use to facilitate identification of ice shall be provided for each lifeboat		
67	LSA - Survival	8.2.3.3	Funct.	Taking into account the presence of any hazards, as identified in the assessment in chapter 1, resources shall be provided to support survival following abandoning ship, whether to the water, to ice or to land, for the maximum expected time of rescue. These resources shall provide		
68	LSA - Survival	8.3.3.3.1	Reg.	no lifeboat shall be of any type other than partially or totally enclosed type		
69	LSA - Survival	8.3.3.3.2	Reg.	taking into account the assessment referred to in chapter 1, appropriate survival resources, which address both individual (personal survival equipment) and shared (group survival equipment) needs, shall be provided, as follows:		
70				.1 life-saving appliances and group survival equipment that provide effective protection against direct wind chill for all persons on board;		
71				.2 personal survival equipment in combination with life-saving appliances or group survival equipment that provide sufficient thermal insulation to maintain the core temperature of persons;.		

#	Chapter	Para.	FR/PR	Description	Mandatory?	Risk control measure?
72				.3 personal survival equipment that provide sufficient protection to prevent frostbite of all extremities;		
73	LSA - Survival	8.3.3.3.3	Reg.	whenever the assessment required under paragraph 1.5 identifies a potential of abandonment onto ice or land, the following apply:		
74				.1 group survival equipment shall be carried, unless an equivalent level of functionality for survival is provided by the ship's normal life-saving appliances;		
75				.2 when required, personal and group survival equipment sufficient for 110% of the persons on board shall be stowed in easily accessible locations, as close as practical to the muster or embarkation stations;		
76				.3 containers for group survival equipment shall be designed to be easily movable over the ice and be floatable;		
77	LSA - Survival	8.3.3.3.4		whenever the assessment identifies the need to carry personal and group survival equipment, means shall be identified of ensuring that this equipment is accessible following abandonment;		
78	LSA - Survival	8.3.3.3.5		if carried in addition to persons, in the survival craft, the survival craft and launching appliances shall have sufficient capacity to accommodate the additional equipment;		
79	LSA - Survival	8.3.3.3.6		passengers shall be instructed in the use of the personal survival equipment and the action to take in an emergency;		

#	Chapter	Para.	FR/PR	Description	Mandatory?	Risk control measure?
80	LSA - Survival	8.3.3.3.7		the crew shall be trained in the use of the personal survival equipment and group survival equipment.		
81	LSA - Survival	8.3.3.4	Reg.	adequate emergency rations shall be provided, for the maximum expected time of rescue		
82	Navigation - Nautical Information	9.2.1	Funct.	Ships shall have the ability to receive up-to-date information including ice information for safe navigation.		
83	Introduction/3.1.9			Rapidly changing and severe weather: The vessel should have sufficient means of acquiring weather forecasts or making measurements to predict weather.		
84	Navigation - Nautical Information	9.3.1	Reg.	ships shall have means of receiving and displaying current information on ice conditions in the area of operation.		
85	Navigation - Equipment Functionality	9.2.2.1	Funct.	The navigational equipment and systems shall be designed, constructed, and installed to retain their functionality under the expected environmental conditions in the area of operation.		
86	Navigation - Equipment Functionality	9.3.2.1.1	Reg.	ships constructed on or after 1 January 2017, ice strengthened in accordance with chapter 3, shall have either two independent echo-sounding devices or one echo-sounding device with two separate independent transducers;		
87	Introduction/3.1.6			How will the operation take into account poor charts and or navigational aids		

#	Chapter	Para.	FR/PR	Description	Mandatory?	Risk control measure?
88	Navigation - Equipment Functionality	9.3.2.1.2	Reg.	ships shall comply with SOLAS regulation V/22.1.9.4, irrespective of the date of construction and the size and, depending on the bridge configuration, a clear view astern		
89	Navigation - Equipment Functionality	9.3.2.1.3	Reg.	for ships operating in areas, and during periods, where ice accretion is likely to occur, means to prevent the accumulation of ice on antennas required for navigation and communication shall be provided		
90	Navigation - Equipment Functionality	9.3.2.1.4	Reg.	in addition, for ships ice strengthened in accordance with chapter 3, the following apply:		
91				.1 where equipment required by SOLAS chapter V or this chapter have sensors that project below the hull, such sensors shall be protected against ice; and		
92				.2 in category A and B ships constructed on or after 1 January 2017, the bridge wings shall be enclosed or designed to protect navigational equipment and operating personnel		
93	Navigation - Equipment Functionality	9.2.2.2	Funct.	Systems for providing reference headings and position fixing shall be suitable for the intended areas.		
94	Navigation - Equipment Functionality	9.3.2.2.1	Reg.	ships shall have two non-magnetic means to determine and display their heading. Both means shall be independent and shall be connected to the ship's main and emergency source of power		

#	Chapter	Para.	FR/PR	Description	Mandatory?	Risk control measure?
95	Navigation - Equipment Functionality	9.3.2.2.2	Reg.	ships proceeding to latitudes over 80 degrees shall be fitted with at least one GNSS compass or equivalent, which shall be connected to the ship's main and emergency source of power.		
96	Navigation - Additional Equipment	9.2.3.1	Funct.	Ships shall have the ability to visually detect ice when operating in darkness.		
97	Navigation - Additional Equipment	9.3.3.1	Reg.	with the exception of those solely operating in areas with 24 hours daylight, shall be equipped with two remotely rotatable, narrow-beam search lights controllable from the bridge to provide lighting over an arc of 360 degrees, or other means to visually detect ice.		
98	Navigation - Additional Equipment	9.2.3.2	Funct.	Ships involved in operations with an icebreaker escort shall have suitable means to indicate when the ship is stopped.		
99	Navigation - Equipment Functionality	9.3.3.2	Reg.	ships involved in operations with an icebreaker escort shall be equipped with a manually initiated flashing red light visible from astern to indicate when the ship is stopped. This light shall have a range of visibility of at least two nautical miles, and the horizontal and vertical arcs of visibility shall conform to the stern light specifications required by the International Regulations for Preventing Collisions at Sea.		

#	Chapter	Para.	FR/PR	Description	Mandatory?	Risk control measure?
100	Communication - Ship Communication	10.2.1.1	Funct.	Two-way voice and/or data communications ship-to-ship and ship-to-shore shall be available at all points along the intended operating routes		
101	Communication - Ship Communication	10.3.1.1	Reg.	communication equipment on board shall have the capabilities for ship-to-ship and ship-to-shore communication, taking into account the limitations of communications systems in high latitudes and the anticipated low temperature		
102	Communication - Ship Communication	10.2.1.2	Funct.	Suitable means of communications shall be provided where escort and convoy operations are expected		
103	Communication - Ship Communication	10.3.1.2	Reg.	ships intended to provide icebreaking escort shall be equipped with a sound signaling system mounted to face astern to indicate escort and emergency manoeuvres to following ships as described in the International Code of Signals.		
104	Communication - Ship Communication	10.2.1.3	Funct.	Means for two-way on-scene and SAR coordination communications for search and rescue purposes including aeronautical frequencies shall be provided		
105	Communication - Ship Communication	10.3.1.3	Reg.	two-way on-scene and SAR coordination communication capability in ships shall include: .1 voice and/or data communications with relevant rescue coordination centres; .2 equipment for voice communications with aircraft on 121.5 and 123.1 MHz		

#	Chapter	Para.	FR/PR	Description	Mandatory?	Risk control measure?
106	Communication - Ship Communication	10.2.1.4	Funct.	Appropriate communication equipment to enable telemedical assistance in polar areas shall be provided		
107	Communication - Ship Communication	10.3.1.4	Reg.	the communication equipment shall provide for two-way voice and data communication with a Telemedical Assistance Service (TMAS)		
108	Communication - Survival Craft & Rescue Boat	10.2.2.1	Funct.	For ships intended to operate in low air temperature, all rescue boats and lifeboats, whenever released for evacuation, shall maintain capability for distress alerting, locating and on-scene communications		
109	Communication - Survival Craft & Rescue Boat	10.3.2.1	Reg.	all rescue boats and lifeboats, whenever released for evacuation, shall:		
110				.1 for distress alerting, carry one device for transmitting ship to shore alerts		
111				.2 in order to be located, carry one device for transmitting signals for location;		
112				.3 for on-scene communications, carry one device for transmitting and receiving on-scene communications.		
113	Communication - Survival Craft & Rescue Boat	10.2.2.2	Funct.	For ships intended to operate in low air temperature, all other survival craft, whenever released, shall maintain capability for transmitting signals for location and for communication		
114	Communication - Survival Craft & Rescue Boat	10.3.2.2	Reg.	all other survival craft shall:		
115				.1 in order to be located, carry one device for transmitting signals for location		

#	Chapter	Para.	FR/PR	Description	Mandatory?	Risk control measure?
116				.2 for on-scene communications, carry one device for transmitting and receiving on-scene communications.		
117	Communication - Survival Craft & Rescue Boat	10.2.2.3	Funct.	Mandatory communication equipment for use in survival craft, including liferafts, and rescue boats shall be capable of operation during the maximum expected time of rescue.		
118	Communication - Survival Craft & Rescue Boat	10.3.2.3	Reg.	recognizing the limitations arising from battery life, procedures shall be developed and implemented such that mandatory communication equipment for use in survival craft, including liferafts, and rescue boats are available for operation during the maximum expected time of rescue		
119	Voyage Planning	11.2	Funct.	The voyage plan shall take into account the potential hazards of the intended voyage.		
120	Voyage Planning	11.3	Reg.	In order to comply with the functional requirement of paragraph 11.2 above, the master shall consider a route through polar waters, taking into account the following:		
121	Voyage Planning	11.3.1	Reg.	the procedures required by the PWOM;		
122	Voyage Planning	11.3.2	Reg.	any limitations of the hydrographic information and aids to navigation available;		
123	Voyage Planning	11.3.3	Reg.	current information on the extent and type of ice and icebergs in the vicinity of the intended route;		
124	Voyage Planning	11.3.4	Reg.	statistical information on ice and temperatures from former years;		
125	Voyage Planning	11.3.5	Reg.	places of refuge;		

#	Chapter	Para.	FR/PR	Description	Mandatory?	Risk control measure?
126	Voyage Planning	11.3.6	Reg.	current information and measures to be taken when marine mammals are encountered relating to known areas with densities of marine mammals, including seasonal migration areas;		
127	Voyage Planning	11.3.7	Reg.	current information on relevant ships' routing systems, speed recommendations and vessel traffic services relating to known areas with densities of marine mammals, including seasonal migration areas;		
128	Voyage Planning	11.3.8	Reg.	national and international designated protected areas along the route; and		
129	Voyage Planning	11.3.9	Reg.	operation in areas remote from search and rescue (SAR) capabilities.		
	Part II-A - Pollution prevention measures					
119	Prevention of Pollution by Oil - Operational requirements	1.1	Reg.	.1 In Arctic waters any discharge into the sea of oil or oily mixtures from any ship shall be prohibited.		
120		1.1.1		The allowable oil discharge in Arctic water is 0 PPM. Does the ship have adequate waste storage capacity or planed ports along the route that will accept the waste?		
121				.2 The provisions of paragraph 1.1.1 shall not apply to the discharge of clean or segregated ballast.		

#	Chapter	Para.	FR/PR	Description	Mandatory?	Risk control measure?
122				.3 Subject to the approval of the Administration, a category A ship constructed before 1 Jan 2017 that cannot comply with paragraph 1.1.1 for oil or oily mixtures from machinery spaces and is operating continuously in Arctic waters for more than 30 days shall comply with paragraph 1.1.1 not later than the first intermediate or renewal survey, whichever comes first, one year after 1 Jan 2017 . Until such date these ships shall comply with the discharge requirements of MARPOL Annex I regulation 15.3.		
123				.4 Operation in polar waters shall be taken into account, as appropriate, in the Oil Record Books, manuals and the shipboard oil pollution emergency plan or the shipboard marine pollution emergency plan as required by MARPOL Annex I.		
124	Prevention of Pollution by Oil - Structural requirements	1.2	Reg.	.1 For category A and B ships constructed on or after 1 Jan 2017 with an aggregate oil fuel capacity of less than 600 m^3, all oil fuel tanks shall be separated from the outer shell by a distance of not less than 0.76 m. This provision does not apply to small oil fuel tanks with a maximum individual capacity not greater than 30 m^3.		
125				.2 For category A and B ships constructed on or after 1 Jan 2017, all cargo tanks constructed and utilized to carry oil shall be separated from the outer shell by a distance of not less than 0.76 m.		

#	Chapter	Para.	FR/PR	Description	Mandatory?	Risk control measure?
126				.3 For category A and B oil tankers of less than 5,000 tonnes deadweight constructed on or after 1 January 2017, the entire cargo tank length shall be protected with: .1 double bottom tanks or spaces complying with the applicable requirements of regulation 19.6.1 of MARPOL Annex I; and .2 wing tanks or spaces arranged in accordance with regulation 19.3.1 of MARPOL Annex I and complying with the applicable requirements for distance referred to in regulation 19.6.2 of MARPOL Annex I.		
127				.4 For category A and B ships constructed on or after 1 Jan 2017 all oil residue (sludge) tanks and oily bilge water holding tanks shall be separated from the outer shell by a distance of not less than 0.76 m. This provision does not apply to small tanks with a maximum individual capacity not greater than 30 m^3.		
128	Control of Pollution by Noxious liquid substances in bulk	2	Reg.	Intentionally left blank. See Polar Code if applicable to subject vessel(s).		

#	Chapter	Para.	FR/PR	Description	Mandatory?	Risk control measure?
129	Prevention of Pollution by Sewage from Ships - Definitions	4.1	Def.	.1 Constructed means a ship the keel of which is laid or which is at a similar stage of construction. .2 Ice-shelf means a floating ice sheet of considerable thickness showing 2 to 50 m or more above sea-level, attached to the coast. .3 Fast ice means sea ice which forms and remains fast along the coast, where it is attached to the shore, to an ice wall, to an ice front, between shoals or grounded icebergs.		
130	Prevention of Pollution by Sewage from Ships - Operational requirements	4.2.1	Reg.	Discharges of sewage within polar waters are prohibited except when performed in accordance with MARPOL Annex IV and the following requirements:		
131				.1 the ship is discharging comminuted and disinfected sewage in accordance with regulation 11.1.1 of MARPOL Annex IV at a distance of more than 3 nautical miles from any ice-shelf or fast ice and shall be as far as practicable from areas of ice concentration exceeding 1/10; or		
132				.2 the ship is discharging sewage that is not comminuted or disinfected in accordance with regulation 11.1.1 of MARPOL Annex IV and at a distance of more than 12 nautical miles from any ice-shelf or fast ice and shall be as far as practicable from areas of ice concentration exceeding 1/10; or		

#	Chapter	Para.	FR/PR	Description	Mandatory?	Risk control measure?
133				.3 the ship has in operation an approved sewage treatment plant certified by the Administration to meet the operational requirements in either regulation 9.1.1 or 9.2.1 of MARPOL Annex IV, and discharges sewage in accordance with regulation 11.1.2 of Annex IV and shall be as far as practicable from the nearest land, any ice-shelf, fast ice or areas of ice concentration exceeding 1/10.		
134	Prevention of Pollution by Sewage from Ships - Operational requirements	4.2.2	Reg.	Discharge of sewage into the sea is prohibited from category A and B ships constructed on or after 1 Jan 2017, and all passenger ships constructed on or after 1 Jan 2017, except when such discharges are in compliance with paragraph 4.2.1.3 of this chapter.		
135	Prevention of Pollution by Sewage from Ships - Operational requirements	4.2.3	Reg.	Notwithstanding the requirements of paragraph 4.2.1, category A and B ships that operate in areas of ice concentrations exceeding 1/10 for extended periods of time, may only discharge sewage using an approved sewage treatment plant certified by the Administration to meet the operational requirements in either regulation 9.1.1 or 9.2.1 of MARPOL Annex IV. Such discharges shall be subject to the approval by the Administration.		

#	Chapter	Para.	FR/PR	Description	Mandatory?	Risk control measure?
136	Prevention of Pollution by Garbage from Ships - Definitions	5.1	Def.	.1 Ice-shelf means a floating ice sheet of considerable thickness showing 2 to 50 m or more above sea-level, attached to the coast. .2 Fast ice means sea ice which forms and remains fast along the coast, where it is attached to the shore, to an ice wall, to an ice front, between shoals or grounded icebergs.		
137	Prevention of Pollution by Garbage from Ships - Operational requirements	5.2.1	Reg.	In Arctic waters, discharge of garbage into the sea permitted in accordance with regulation 4 of MARPOL Annex V, shall meet the following additional requirements:		
138		5.2.1.1	Reg.	discharge into the sea of food wastes is only permitted when the ship is as far as practicable from areas of ice concentration exceeding 1/10, but in any case not less than 12 nautical miles from the nearest land, nearest ice-shelf, or nearest fast ice;		
139		5.2.1.2	Reg.	food wastes shall be comminuted or ground and shall be capable of passing through a screen with openings no greater than 25 mm. Food wastes shall not be contaminated by any other garbage type;		
140		5.2.1.3	Reg.	food wastes shall not be discharged onto the ice;		
141		5.2.1.4	Reg.	discharge of animal carcasses is prohibited; and		

#	Chapter	Para.	FR/PR	Description	Mandatory?	Risk control measure?
142		5.2.1.5	Reg.	discharge of cargo residues that cannot be recovered using commonly available methods for unloading shall only be permitted while the ship is en route and where all the following conditions are satisfied:		
143				.1 cargo residues, cleaning agents or additives, contained in hold washing water do not include any substances classified as harmful to the marine environment, taking into account guidelines developed by the Organization;		
144				.2 both the port of departure and the next port of destination are within Arctic waters and the ship will not transit outside Arctic waters between those ports;		
145				.3 no adequate reception facilities are available at those ports taking into account guidelines developed by the Organization; and		
146				.4 where the conditions of subparagraphs 5.2.1.5.1, 5.2.1.5.2 and 5.2.1.5.3 of this paragraph have been fulfilled, discharge of cargo hold washing water containing residues shall be made as far as practicable from areas of ice concentration exceeding 1/10, but in any case not less than 12 nautical miles from the nearest land, nearest ice shelf, or nearest fast ice.		

#	Chapter	Para.	FR/PR	Description	Mandatory?	Risk control measure?
147	Prevention of Pollution by Garbage from Ships - Operational requirements	5.2.2	Reg.	In the Antarctic area, discharge of garbage into the sea permitted in accordance with regulation 6 of MARPOL Annex V, shall meet the following additional requirements:		
148				.1 discharges under regulation 6.1 of MARPOL Annex V shall be as far as practicable from areas of ice concentration exceeding 1/10, but in any case not less than 12 nautical miles from the nearest fast ice; and		
149				.2 food waste shall not be discharged onto ice.		
150	Prevention of Pollution by Garbage from Ships - Operational requirements	5.2.3	Reg.	Operation in polar waters shall be taken into account, as appropriate, in the Garbage Record Book, Garbage Management Plan and the placards as required by MARPOL Annex V.		

APPENDIX III – EXAMPLE OF POLAR WATER OPERATIONAL MANUAL (PWOM)

M.V. SOME GOOD SHIP – {Call Sign}

Polar Water Operational Manual (PWOM)

As required by Part I-A/Ch. 2 of the IMO Polar Code

OWNER / OPERATOR:

Company's Name
Company's Address

Rev.	Date	Description of Revision	Prepared	Checked	Approved
3					
2					
1	Mar. 1, 2023	Initial Issue			

Notice to readers:

This PWOM is an example only. It is offered for guidance, to provide only an idea of what a PWOM for an Alaskan Operation for a Bulk Carrier intending to go to Red Dog may contain. All text given under "Example Content" is strictly for guidance purposes only. It is the responsibility of the ship owner/operator to create or refer to procedures that are specific to the vessel under consideration.

ABS does not warrant or guarantee the contents of this example as a means for the basis of obtaining satisfactory review status of a PWOM. Alteration of the example PWOM's contents to make it ship and operation specific are solely the owner/operator's responsibility.

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Part 1. ABS Engineering and Survey related portions

ABS Guidance: This is the portion of the PWOM added to make engineering review and survey easier and more efficient. Everything contained here in Part 1 is to be taken as guidance from ABS.

1.1 Revision Log:

Revision No.	Date	Changes
1	Mar. 1, 2023	Initial Issue
2		
3		

1.2 General Statement for the Master and Crew of the M.V. SOME GOOD SHIP

This manual and its contents are intended to aid safe operations in Polar Waters, and assist in complying with regulatory requirements for Polar operations. This manual is to be reviewed and assessed to ensure the risks applicable for the intended voyage are adequately managed by the procedures contained herein. If improved procedures to enhance safety or environmental protection are conceived before, during or after operations, it is your responsibility to report and recommend these updates to the PWOM.

1.3 The Ship – M.V. SOME GOOD SHIP

The subject ship, pictured in Figure 1 with a list of general characteristics in Table 1, is the M.V. SOME GOOD SHIP, a Bulk Carrier XXX.

The ship has no ice class notations and was not designed or intended for low temperature operations. As such the vessel does not have any special notations for low temperature service.

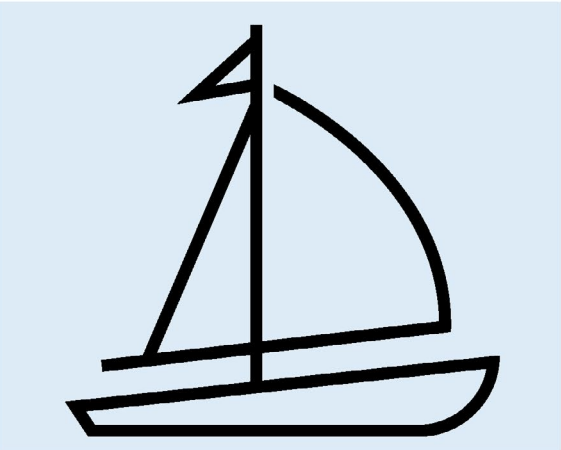

Figure 1: The M.V. SOME GOOD SHIP

Table 1: General Characteristics for M.V. SOME GOOD SHIP (from ABS Record)

Name:	M.V. SOME GOOD SHIP
Class Number:	21928374
IMO Number	9912345
Description:	Bulk Carrier
Builder:	Good Yard No. 1
Flag:	The Avalon Republic
Principal Dimensions (LOA, B, D):	229m X 32m X 20m
Keel Laying Date	January 1, 2020
Delivery Date:	January 1, 2021
Class Notations:	✠A1, Bulk Carrier, BC-A (holds 2, 4 and 6 may be empty), ESP, Ⓔ, ✠AMS, ✠ACCU, CPS, CSR
Additional Notations:	BWT, CRC (SP), EEDI-Ph3, GRAB (30), IHM, NOx-Tier III, PMA, RW

1.4 Operational Assessment Outcomes Summary

See the Polar Water Operational Assessment Report, dated January 1, 2023. A summary of the Operational Assessment outcomes in included in Table 2, Table 3, and Table 4.

Table 2: Operational Profile

Geographical region	From North Pacific through Bering Sea to Red Dog
Season of operation (dates)	Summer/Fall only, mid July to late October
Description of ice conditions	No ice of any kind (Ice Free waters only)
Description of air temperature	Area and Times where Lowest MDLT is above -10°C
Description of ice accretion likelihood	Areas and times where ice accretion is not expected to occur.
Location and availability of SAR resources	Entire route in Alaskan Polar waters is covered by the United States Coast Guard.
Polar waters a destination or transit?	Destination, Loading at Red Dog
Escorted or non-escorted operation or both	Non-escorted.

Table 3: Operational Limitations Section of Polar Ship Certificate

Ice Conditions	Limited to ice-free waters only, and Limited to areas where ice accretion is not expected to occur.
Temperature	Limited to operations in polar waters where the expected lowest MDLT for the area and season of operation is greater than or equal to -10°C
High Latitudes:	Limited to operations in Alaskan Polar waters up to an operational latitude of the lesser of: - the limitations of the sea area on the Cargo Ship Safety Radio Certificate, or - the limitations of the systems used to acquire ice/environmental information.

Table 4: Applicable Hazards

Hazard	Is hazard applicable to ship?	OA Report Reference
Ice (sea ice, icebergs)	Yes	Table 6
Ice ingestion (slush and sea ice)	Yes	Table 7
Topside icing (ice accretion)	Yes	Table 8
Snow Accumulation	Yes	Table 9
Low seawater temperature: Adverse effects on machinery	Yes	Table 10
Low seawater temperature: Survival.	Yes	Table 11
Air temp. below freezing	Yes	Table 12
Low air temperature (MDLT < -10C)	No	Table 13
Extended darkness / daylight	Yes	Table 14
High latitude	Yes	Table 15
Poor hydrographic data	Yes	Table 16
Lack of crew experience	Yes	Table 17
Rapid weather changes	Yes	Table 18
Potential Immersion into polar water	Yes	Table 19
Any additional hazards	No	Tables 20 and 21

Green means Operational Limitation

Hazards marked as "Yes" were initially identified as being a possible hazard but are controlled by provided systems and equipment already installed or to be fitted prior to entering Polar waters, or by procedures in this PWOM. Hazards marked as "No" were of very low probability of occurrence and there for not applicable to the vessel's operation, no RCMs are needed for these hazards.

1.5 Additional Equipment

As a result of the Operational Assessment and consideration of the applicable hazards the following items are to be added to the M.V. SOME GOOD SHIP for Polar Water operations.

Table 5: Additional Equipment

#	Description	Location	Reason
1	GNSS Compass	Wheelhouse	2nd non-magnetic means of determining heading Polar Code Part I-A/9.3.2.2.1
1	Handheld airband radio	Wheelhouse	Communications on aircraft emergency channels Polar Code Part I-A/10.3.1.3.2
2	High power searchlights (2,000 W Xenon)	Bridgewings	Means to visually detect ice well beyond the bow. Polar Code Part I-A/9.3.3.1
27	Personal Survival Kits (in waterproof bag)	Each cabin and spares at muster station	Ensure survival for 5 days (See ISO/DIS 24452) Polar Code Part I-A/1.2.7
	Full head covering		
	Neck warmer		
	Thermal underwear		
	Socks		
	Long sleeve shirt		
	Trousers		
	2L water & 5,000 kJ food		
	Towel		
4	Air horns	Wheelhouse	Polar bear defense
5	Narrow blade aluminum Shovels	Bosun's Store	Managing snow/ice
5	Wide blade snow shovels	Bosun's Store	Managing snow
5	Wooden mallets	Bosun's Store	Contingency for managing ice accretion
5	Ice Chippers	Bosun's Store	Contingency for managing ice accretion
1	5m long aluminum pole	Bosun's store	Contingency for managing ice accretion
5	Ice scrappers	Bridge	Clearing windows and easily damaged items.
10	10kg bags of rock salt	Bosun's store	Contingency for managing ice accretion
2	Rubber mallets	Bosun's store	Checking vent heads
24	Low temp work cloths	Various	Protection for crew assigned outside duties
24	Dark curtains	Each cabin	Block out daylight to ensure hours of rest.
x	Additional food and water (2L / Person / day and 5,000 kJ / person / day)	In lifeboat	Ensure survival for 5 days (See IMO MSC.1/Circ.1614)
2	Temporary Heaters and designated outlets	Engine room workshop.	Contingency for low temperature.
	XXX	XXX	XXX

1.6 Alternative Designs or Arrangements

The M.V. SOME GOOD SHIP complied with the regulations of Polar Code Chapters 3, 6, 7, and 8, therefore no Alternative Designs or Arrangements are required for the intended polar waters operation.

Part 2. PWOM

ABS Guidance: This Part is heavily based on the Polar Code Appendix II. Each section within this part will be written with IMO Guidance where the Polar Code Appendix II offers guidance, ABS Guidance to give additional assistance with writing the section, and Example Content. The Example Content is intended for the imaginary bulk carrier M.V. SOME GOOD SHIP operating to Red Dog in the summer months. It is expected that a PWOM will not have the IMO or ABS Guidance as this is only intended to assist in writing a PWOM. Including this will make the PWOM appear to be generic (i.e. not ship specific) and possibly make the PWOM unclear.

Division 1. Operational Capabilities and Limitations

ABS Guidance: This division of the PWOM is used to clearly define the capabilities of the vessel.

Chapter 1 Operation in ice

1.1 Operator guidance for safe operation

IMO Guidance: The PWOM should establish the means by which decisions as to whether ice conditions exceed the ship's design limits should be made, taking into account the operational limitations on the Polar Ship Certificate. An appropriate decision support system, such as POLARIS, the Canadian Arctic Ice Regime Shipping System, and/or the Russian Ice Certificate as described in the Rules of Navigation on the water area of the Northern Sea Route, can be used... Bridge personnel should be trained in the proper use of the system to be utilized. For ships that will operate only in ice-free waters, procedures to ensure that will keep the ship from encountering ice should be established.

ABS Guidance: This is the area where it is expected to cover the ship's capabilities for encountering sea ice with the hull/machinery, ice ingestion as well as ice accretion.

Sea Ice: For operations to Red Dog with a ship that has an operational limitation of ice-free waters only this section should clearly state that the ship is not to operate in ice conditions. This is also where the PWOM gives the crew guidance on how to avoid operating in waters where ice may occur. Statements like "The crew are to review historical ice data as part of voyage planning and ensure the time and area of operation has historically been ice free. During the voyage the crew are to monitor local ice service reports, ice reports from the port and other ships in the area. If ice conditions are found on the intended route the vessel should not proceed with the voyage as planned and alternatives to avoid ice are to be explored." As of the time of publishing this advisory the Alaska Sea Ice Program { https://www.weather.gov/afc/ice} offers daily ice conditions in Alaskan waters. ABS can provide historical ice analysis as needed. Contacts to request data are found on the back page of this advisory. A connection should be made between this section and the risk control measures in the sea ice risk matrix like the one shown in Table 6 of the example OA Report.

Ice Ingestion: This is also the place where guidance is to be given to the crew for the vessel's capability to operate with ice ingestion. It is very difficult to quantify how much ice ingestion the vessel can withstand, and ABS does not expect to see this. What is expected here is guidance for the crew on how concerned they should be if ice ingestion may be possible. A connection should be made to ice ingestion risk assessment such as the one shown in Table 7 of the example OA report.

Ice Accretion: This is linked with the vessel's approved intact stability. If ice accretion is included in the stability, those limits should be referenced here. If not taken into consideration in the approved stability letter alternate guidance should be included. A connection should be made to ice accretion risk assessment such as the one shown in Table 8 of the example OA report.

Example Content:

Sea Ice:

The M.V. SOME GOOD SHIP has no ice strengthening, and the Polar Ship certificate has an operational limitation of "Ice Free Waters Only". Therefore, the vessel is not to sail in areas where ice, of any kind, is present.

To ensure the latest ice data is available onboard the master is to use the ship's broadband connection to the internet and obtain ice data from the Alaska Sea Ice Program {https://www.weather.gov/afc/ice} daily. If the ice data shows anything other than ice free conditions the M.V. Some Good Ship is not to operate in those areas.

Ice Ingestion:

Ice ingestion can block or reduce water intakes and/or strainers resulting in loss of power and loss of firefighting water. The M.V. SOME GOOD SHIP has an approved water re-circulating system that can be used to manage the ice ingestion, therefore the M.V. SOME GOOD SHIP does have a limited capacity to withstand ice ingestion in both high and low seachests. Guidance on the use of the re-circ system as well as sea water monitoring procedures are in Division 2, Chapter 5, Paragraph 5.2 of this manual.

Ice Accretion:

The M.V. SOME GOOD SHIP's stability does not have conditions for ice accretion; therefore, the vessel has a limitation of no ice accretion permitted. For contingency plans see Part 2 - Division 2 - Chapter 5, Paragraph 5.1 – Icing prevention and de-icing.

1.2 Icebreaking capabilities

IMO Guidance: The PWOM should provide information on the ice conditions in which the ship can be expected to make continuous progress. This may be drawn, for example from numerical analysis, model test or from ice trials. Information on the influence of ice strength for new or decayed ice and of snow cover may be included.

ABS Guidance: Icebreaking is normally the act of using the vessel's hull form and power to ride up onto the ice, break it down in flexure, and then clearing the ice to either side of the vessel so that the track behind the icebreaker is clear. Normal cargo ships are not icebreakers, and this section typically does not apply.

Example Content: The M.V. SOME GOOD SHIP does not have a hull intended for icebreaking, the vessel does not have any level of ice strengthening and the operational limitation in ice is "ice free waters only", therefore the M.V. SOME GOOD SHIP has no icebreaking capabilities, and this section does not apply. M.V. SOME GOOD SHIP is to avoid ice of any nature and shall not plan for icebreaking capabilities in voyage planning.

1.3 Manoeuvring in ice

IMO Guidance: None.

ABS Guidance: For operations in Ice Free waters this section does not apply. Contingencies can be added but it should be clear that these are operations outside the normal operation for the vessel.

Example Content: The M.V. SOME GOOD SHIP is limited to Ice Free waters only, therefore maneuvering in ice does not apply.

As a contingency plan, if the master encounters unexpected ice conditions with total concentrations less than 1/10th (10% of the ocean surface), {enter contingency plans here}

If conditions are experienced where total concentrations exceeds 1/10th, the master is to stop the ship, if it is safe to do so, and contact the office.

1.4 Special features

IMO Guidance: Where applicable, the PWOM should include the results of any equivalency analyses made to determine Polar Ship category/ice class. The manual should also provide information on the use of any specialized systems fitted to assist in ice operations.

ABS Guidance: This section is more so intended for icebreakers that are often fitted with systems to aid their progress through ice. These may be things such as air bubbler systems, low friction hull coatings, healing systems, azimuthing podded propulsion etc.

Example Content: The M.V. SOME GOOD SHIP is a modern and efficient bulk carrier, but it is not intended for operations in ice conditions and therefore no special features are added for operations in ice. This section does not apply.

Chapter 2 Operation in low temperatures

2.1 System design

IMO Guidance: The PWOM should list all ship systems susceptible to damage or loss of functionality by exposure to low temperatures, and the measures to be adopted to avoid malfunction.

ABS Guidance: This paragraph is to be very ship specific with ratings for systems, equipment, structures etc. If the ship is not intended for low air temperature service, this must be clearly stated in this paragraph. LSA (2017) Chapter I/1.2.2.2 requires lifesaving appliances to be able to survive -30°C but be fully functional at -15°C. A connection should be made between this section and the risk assessments conducted in the OA such as Tables 12 and 13 in the example OA report. In the risk assessments the likelihood of experiencing low temperatures was assessed and documented. This paragraph should be in line with the contents of the risk assessment.

This is also a good section to give guidance for the vessel's capability for snow or freezing rain since these only occur in cooler air temperatures. For this purpose, a link should be made to the OA risk assessment for snow/freezing rain like the one shown in Table 9 of the example OA report.

Low seawater temperature is a hazard to be considered and is covered in Tables 10 and 11, and in Table 19 of the example OA report. The capacity for low seawater temperature operations should be given here as guidance for the crew.

Example Content:

Air Temperatures:

The M.V. SOME GOOD SHIP is not designed and built for low air temperature operation. The Polar Ship Certificate has an operational limitation stating the vessel can not operate in places and times when the MDLT is below -10°C. The following systems and equipment ratings are provided for the master and crew's reference and consideration for safe operations of the M.V. SOME GOOD SHIP in Polar Waters.

Table 6: M.V. SOME GOOD SHIP - Temperature Capabilities

System	Rated Temperature [°C]	Comment
Lifesaving appliances (lifeboats, launching appliances, etc.)	-15	LSA (2017) Chapter I/1.2.2.2
Liferaft inflation system	-30	LSA (2017) Chapter IV/4.2.2.3
Liferaft hydrostatic release	-30	Hydrostatic release spec sheet
Fire main	-2	Freezing temperature of sea water
AFFF Foam extinguishers	-15	See ABS Approved Fire and Safety plan # DWG-0007-FSP-01
CO2 fire extinguishers	-30	
GMDSS radio	-25	Radio specification sheet
Radars	-32	Radar technical manual
EPIRB	-20	IMO Resolution A810(19)
EPIRB hydrostatic release	-30	IMO Resolution A662(16)
…	…	…
Vessel's Hull structures	-10	Vessel not designed for Low Temperature service (MDAT)

Snow/Freezing Rain:

The M.V. SOME GOOD SHIP does not have ice accretion conditions included in the approved stability therefore freezing rain build up and snow accumulation must be kept to a minimum and avoided if possible (See Division 2, Chapter 2, Paragraph 2.2 - Meteorological information). Snow can cause difficulties for the crew to move around the vessel, especially in an emergency. Therefore, all snow and ice must be safely removed from escape routes, survival craft, embarkation stations, and fire fighting appliances.

Low Seawater Temperature:

Sea water normally freezes at approximately -1.8°C. The machinery installation onboard the vessel is fully functional at this temperature.

Low seawater temperatures can be detrimental to survival if immersion into Polar waters occurs without adequate thermal protection. An unprotected human in cold water, ~0°C, will lose dexterity (the ability to make coordinated hand and finger movements) in less than 2 minutes and lose consciousness in under 15 minutes. Without dexterity a survivor must rely on others for survival and can offer very little in terms of self rescue.

Chapter 3 Communication and navigation capabilities in high latitudes

IMO Guidance: The PWOM should identify any restrictions to operational effectiveness of communications and navigational equipment that may result from operating in high latitudes.

ABS Guidance: This section should give the crew guidance on the systems installed onboard the specific vessel for which this PWOM is written. This section of the PWOM should make a connection with the High Latitude risk assessment, as shown in Table 15 of the example OA report.

Example Content: The M.V. SOME GOOD SHIP is not equipped with any special equipment for communications or navigation in Polar Waters. The only exception to the above is the GNSS Compass. The vessel's communication systems are given in Table 7 and the navigation equipment is given in Table 8.

Table 7: M.V. SOME GOOD SHIP - Communication Systems Capabilities

Make	Model	Type	Location	Limitation		
				Lat	Temp[1]	Ice[2]
Brand X	Model A	SOLAS VHF-FM #1	Bridge	None	-30°C	None
Brand X	Model A	SOLAS VHF-FM #2	Bridge	None	-30°C	None
Brand X	Model A	SOLAS VHF-FM #3	Bridge	None	-30°C	None
Brand X	Model C	Airband Transceiver	Bridge	None	-30°C	None
Brand Y	Model 1	INMARSAT-C	Bridge	~70°	-25°C	None
Brand Z	Model α	EPIRB	Bridge Deck	None	-20°C	None
XXX[3]	XXX	XXX	XXX	XXX		

Table 8: M.V. SOME GOOD SHIP – Navigation Systems Capabilities

Make	Model	Type	Limitation		
			Lat	Temp[1]	Ice[2]
Brand α	T1000	Chart Monitor	See note 1	N/A	N/A
Brand A	RDR1000	RADAR X-Band	See note 2	-30°C	See note 3
Brand A	RDR1000S	RADAR S-Band	See note 2	-30°C	See note 3
Brand A	GPS1	DGPS	None	-25°C	None
Brand B	Plot1	ECDIS	See Note 1	N/A	N/A
Brand C	GPSC1	GNSS Compass	None	-30°C	None
XXX	XXX	XXX	XXX		

Notes:

1) Details of limitations of charts in Polar waters are XXX.
2) Details of limitations of radar in Polar waters are XXX.
3) Heated rotating element to melt ice. If there is concern about freezing, consideration is to be given for keeping the scanners rotating but need not be transmitting.

[1] Temperature of exposed components, marked as N/A if system is internal, None if no rating given.
[2] Ice accretion. Items marked N/A are all internal, equipment with external antennae limits are given. If no limitations for ice accretion are given by manufacturer it is considered that no ice accretion is permitted. (None)
[3] Communications equipment listed should include all communications systems such as SARTs, EPIRBs, SSAS, AIS, LRIT, Iridium, mobile phone etc.

Chapter 4 Voyage duration

IMO Guidance: The PWOM should provide information on any limitations on ship endurance such as fuel tankage, freshwater capacity, provision stores, etc. This will normally only be a significant consideration for smaller ships, or for ships planning to spend extended periods in ice.

ABS Guidance: This is the section where the vessel's specifications are stated or referenced. It should include capacities that may lead to time limits such as fuel capacity but also have information such as consumption rates in various conditions such as at cruse speed, max economical speed, at anchor (hotel load only) etc... The Polar Code Part II-A mandates that all ships have 0 PPM oil discharge, therefore oily residues production and retention capacities should be stated or referenced in this section. There are other discharge limits in Part II-A of the Polar Code that may be indicated here.

Example Content:

The M.V. SOME GOOD SHIP has the following tank capacities:

Table 9: M.V. SOME GOOD SHIP – Tank and Holding Capacities

Tank/Compartment	Location	Capacity [m^3]
Potable Water P	Deck 2, P-side	XXX
Potable Water S	Deck 2 P-side	XXX
MGO bunker P	Fr 35 – 68, P-side upper wing	XXX
MGO bunker S	Fr 35 – 68, S-side upper wing	XXX
Dirty water tank	Port side	XXX
Garbage storage	Stbd side, main deck	XXX
Sewage holding tank	E/R, upper flat, stbd	XXX
XXX	XXX	XXX

The intended operation for the M.V. SOME GOOD SHIP is from the northern Pacific to the port of Red Dog and back down south to the Pacific Ocean and out of Polar Waters. The maximum expected time in Polar Waters is XXX days.

Potable water: The M.V. SOME GOOD SHIP has a flash evaporator that can produce approximately XXX m^3 of potable water per day while operating in seawater, the temperatures expected off the coast of Alaska. This production rate should match the consumption rate for the crew of XXX. Therefore, if reasonable freshwater conservation is applied, in this case reasonable means X m^3/person/day (X m^3 = XXX Liters), there should be no endurance limits for freshwater. If the evaporator fails, the two XXX m^3 tanks is sufficient to sustain the crew of XXX for XXX days if reasonable freshwater conservation is applied. Standard company water conservation procedures are to be implemented if the evaporator goes offline.

Provisions: The M.V. SOME GOOD SHIP is well equipped for extended sea voyages with a large dry food storage room, cold room, and cool room. The storage capacity for food is enough for voyages exceeding XXX days, considering that additional calories are required by personnel working or exposed to polar waters. Prior to entering Polar waters, provisions are to be replenished with at least a surplus of XXX days.

Fuel: The M.V. SOME GOOD SHIP has modern propulsion and power generation machinery which is designed to be as efficient as possible. Table 10 gives the ships approximate fuel consumption for three operating conditions.

Table 10: M.V. SOME GOOD SHIP – Fuel Consumption

Operating Condition	MGO Consumption [m^3/24 hr]	Endurance [days]
Sailing at max speed (17 knots)	XXX	XXX
Sailing at economical speed (12 knots)	XXX	XXX
Harbour (with heating)	XXX	XXX

Note: It is the chief engineer's responsibility to review and update this table as needed before every Polar waters voyage.

Spares: The M.V. SOME GOOD SHIP is equipped with the spare parts recommended in ABS MVR 4-2-1/A11 – Guidance for Spare Parts. This should be sufficient for any intended Polar waters voyage. The Chief Engineer is to assess the vessel's need for spare parts considering the intended voyage and duration prior to the Polar water voyage. The spare parts deemed necessary by the Chief Engineer, vessel superintendent, and the ABS Surveyor are to be onboard the vessel prior to entering Polar waters.

Oily water: See Part 2, Division 5, Chapter 1 - Prevention Of Pollution By Oil. The M.V. SOME GOOD SHIP has very low daily oily water production but varies based on ongoing machinery service. In Polar Waters there is zero PPM oil discharge, therefore while in Polar waters machinery servicing and maintenance shall be deferred as possible/practicable to minimize oily water production. Prior to crossing the Polar waters boundary, the chief engineer is to closely monitor (and record in the Oil Record Book) oily water volumes. These volumes are to be used to estimate a current oily water production. The estimated maximum voyage duration in Polar waters based on oily water production and tank capacity are to be reported to the bridge for recording into the bridge logbook.

Garbage: See Part 2, Division 5, Chapter 5 - Prevention Of Pollution By Garbage From Ships. While in Polar Waters the M.V. SOME GOOD SHIP will retain all garbage. This will be sorted and stored in the garbage storage room located on the starboard side of the accommodation on the main deck. Garbage production is highly variable depending on the ongoing work and activities onboard the vessel as well as the meals being prepared. Prior to entering into Polar Waters the chief engineer is to inspect the garbage storage compartment and ensure there is sufficient capacity for the intended voyage plus a buffer of at least 5 days. Arrangements to unload garbage prior to entry into Polar waters shall be made if necessary. As a contingency plan, dry garbage can be stored in the empty cabin located on the port side, main deck.

Sewage: See Part 2, Division 5, Chapter 4 - Prevention Of Pollution By Sewage From Ships. In Polar waters all sewage is to be processed through the treatment plant prior to discharge, the company does not permit discharge of untreated sewage in Polar Waters. Early in the voyage the Chief Engineer is to estimate the daily sewage production in case the sewage treatment plant fails. This estimate is to be compared with the holding tank capacity at reasonable intervals to estimate the possible max duration in Polar Waters. The Polar Code does permit some discharge of sewage in Polar waters but there are restrictions. If an emergency arises and discharge of untreated sewage is necessary, the M.V. SOME GOOD SHIP is to discharge as needed for safety but shall be as far from shore or any ice as possible. The emergency discharge must be in accordance with Polar Code Part II-A/Chapter 4, documented and the Company and subject jurisdiction notified as may be required.

Division 2. Ship operations

ABS Guidance: This division of the PWOM is used to give guidance to the crew. The guidance should be aimed at how to safely operate the specific vessel described in Division 1 of the PWOM while operating within the intended operational envelope. This division gives guidance on how to obtain information, use it to make good decisions in Polar Waters and avoid conditions that may exceed the vessel's capability.

Example Content:

None

Chapter 1 Strategic planning

IMO Guidance: Assumptions used in conducting the analyses referred to below should be included in the Manual.

ABS Guidance: This section should connect well with the Operational Assessment report and most PWOMs refer to the company's normal voyage planning procedures which are usually in accordance with IMO Resolution A.893(21), adopted on 25 November 1999 and Flag State additional requirements if any. This is also the chapter where most PWOM authors meet many of the requirements set out in Polar Code Part I-A/Chapter 11.

Example Content:

None

1.1 Avoidance of hazardous ice

IMO Guidance: For ships operating frequently in polar waters, the PWOM should provide information with respect to periods during which the ship should be able to operate for intended areas of operation. Areas that pose particular problems, e.g., chokepoints, ridging, as well as worst recorded ice conditions should be noted. Where the available information is limited or of uncertain quality, this should be recognized and noted as a risk for voyage planning.

ABS Guidance: A connection should be made between this section and the risk control measures in the sea ice risk matrix like the one shown in Table 6 of the example OA Report. It should also refer to Division 1 Chapter 1 of this PWOM for the vessel's capabilities to operate in ice. The intention for this paragraph is to give the crew guidance on how assess conditions as compared to the vessel's ability while voyage planning. With this information the crew should be able to make sure the intended voyage does not exceed the vessel's capacity or limitations. If the vessel is to operate with an ice limitation greater than ice free, it is recommended that this paragraph make reference to guidance for POLARIS in Part 2, Division 3, Chapter 1, paragraph 1.1 - Measures to be considered in adverse ice conditions.

Example Content:

Sea Ice:

M.V. SOME GOOD SHIP has an operational limitation of Ice-Free Waters only, therefore any ice is considered hazardous ice.

For seasonal voyage planning, historical sea ice data such as the data available from the ABS HETC are to be obtained and studied. As per Division 1, Chapter 1, paragraph 1.1 the M.V. SOME GOOD SHIP has an operational limitation of ice-free waters only. Therefore, any areas where ice has been

historically present shall be carefully considered. Statistical data can have conservativism built into the analysis; therefore, historical ice presence does not mean a no-go operation. It means that planning for that time frame should be done carefully. Sea ice data from ABS HETC is given in Appendix 1 along with explanations of how to read and interpret the data.

For more short-term voyage planning the latest available sea ice data must be obtained and studied. See Division 2, Chapter 2, paragraph 2.1 for details on obtaining sea ice information. If any sea ice is present in the ice charts blocking the route, the voyage north to Red Dog should not be undertaken until the ice clears or there is a clear route through ice free waters. Likewise, the master should not plan a voyage to Red Dog if historical year by year ice data shows sea ice blocking the route for the planned voyage timeframe and the current conditions generally correspond to the historical ice data that shows the route blocked. For example, if the charter requests the ship in Red Dog in the 2nd week of June, the averaged ABS POLARIS data shows it's a no-go for the M.V. SOME GOOD SHIP. But looking at the year-by-year data, 2018 and 2019 were clear to Red Dog. Examine the current ice conditions (See Division 2, Chapter 2, paragraph 2.1) enroute to Red Dog resemble 2018 or 2019, and the historical ice data shows improvement in the conditions than the voyage is possible but must be done with elevated caution.

Using the data, radars and other safety measures including lookouts, other vessel reports, etc. as described in Division 2 - Chapter 2 – Paragraph 2.1 Ice information, Part 2.Chapter 2if ice is detected a safe distance is to be maintained, the safe distance is at the discretion of the master for the given situation but company policy is to try to stay at least XXX nm away from the ice to keep M.V. SOME GOOD SHIP in ice free waters. If the concentration of ice targets increases to the point where XXX nm range from each floe cannot be maintained, it is considered that the ship is beginning to approach waters above ice free and therefore beyond the operational limitations of the vessel. The master should contact the greater support team in the company office in this situation.

If the above plans still fail to avoid sea ice, the contingency plans given in Division 3, Part 2.Chapter 1, paragraph 1.1 are to be followed.

Ice Ingestion:

See Division 2, Chapter 5, paragraph 5.15.1.

Ice Accretion:

See Division 2, Chapter 5, paragraph 5.1.

1.2 Avoidance of hazardous temperatures

IMO Guidance: For ships operating frequently in polar waters, the PWOM should provide information with respect to, the mean daily low temperature as well as the minimum recorded temperature for each of the days during the intended operating period. Where the available information is limited or of uncertain quality, this should be recognized as a risk for voyage planning.

ABS Guidance: Reference to data is key to this section. The data source given below in Division 2, Chapter 2, paragraph 2.2, but this is where the connection between the vessel's limitations and the data is made and interpreted. The master must have access to historical temperature data to avoid areas where the MDLT is below the vessel's limitation.

Example Content:

M.V. SOME GOOD SHIP has an operational limitation to avoid operations in areas and times where low air temperature occurs. (See Division 1, Chapter 2, paragraph 2.1 for the limitations)

For seasonal voyage planning, historical temperature data such as the data available from the ABS HETC are to be obtained and studied (see and Division 2, Chapter 2, paragraph 2.2 for temperature data sources). In the ABS Temperature analysis figures (See Appendix 2), the colour change from red to brown indicates the MDLT = -10°C, also highlighted by a black line in the figures. The M.V. Some Good Ship is not to plan voyages into regions where the MDLT is at or below -10°C.

For more short-term voyage planning, the master and crew shall avoid voyages to areas where the forecasted daily low air temperature is below -10°C. Some minor exceedances of a few degrees below -10°C may be temporarily acceptable but it should be avoided wherever possible. If the forecasted daily low is below freezing (0°C) than procedures contained in Division 3, Part 2.Chapter 1, paragraph 1.2 shall be followed.

1.3 Voyage duration and endurance

IMO Guidance: Procedures to establish requirements for supplies should be established, and appropriate safety levels for safety margins determined taking into account various scenarios, e.g., slower than expected steaming, course alterations, poor weather, adverse ice conditions, places of refuge and access to provisions. Sources for and availability of fuel types should be established, taking into account long lead times required for deliveries.

ABS Guidance: This section should make reference to Part 2 Division 1 Chapter 4 which should give the reader details on the ship's capabilities for endurance as well as Part 1 paragraph 1.4 Operational Assessment Outcomes Summary for general information on the intended area(s) of operation. This paragraph is located under Division 2 Ship operations, Chapter 1 Strategic planning, therefore this paragraph should give the operators guidance on how to use the information on the vessel's capabilities and apply it to making good safe decisions to prepare for the Polar voyage.

Example Content: The M.V. SOME GOOD SHIP is limited to operations in ice free waters only therefore the likelihood of the vessel becoming entrapped in ice is very low. Environmental conditions in Polar Waters can change rapidly, and there is a small probability that the vessel could become surrounded with sea ice and need to wait for assistance. For this eventuality and as a contingency plan, all voyages into Polar waters shall have an additional reserve suitable for XXX days. This reserve includes fuel, potable water, provisions, and any other consumables the master and chief engineer deem necessary for the safety of the ship and crew as well as the retention of oily waters and garbage. For easy reference capacities are referenced in Table 9: M.V. SOME GOOD SHIP – Tank and Holding Capacities.

As described in Part 1, paragraph 1.4, Table 2: Operational Profile, the intended Polar waters operational profile for the M.V. SOME GOOD SHIP is from the northern Pacific Ocean to the port of Red Dog and back south to the Pacific. This voyage is approximately 520 NM each way into Polar waters. As referred to in Table 10: M.V. SOME GOOD SHIP – Fuel Consumption, economical speed is 12 knots, at this speed the master can expect approximately XXX days of sailing. Assume XXX days at anchorage waiting to load, and XXX days loading. Therefore, the master and crew are to plan the voyage accordingly considering sailing to and from Polar waters following standard company procedures plus at least XXX days.

1.4 Human resources management

IMO Guidance: The PWOM should provide guidance for the human resources management, taking into account the anticipated ice conditions and requirements for ice navigation, increased levels of watch keeping, hours of rest, fatigue and a process that ensures that these requirements will be met.

ABS Guidance: Operating a vessel in areas where sea ice may be present can be stressful, especially in situations where visibility is limited, such as in fog or at night. This paragraph should give the master and crew some assistance with scheduling additional watches, shortening working hours, or requesting additional human resources. This is also the place where many PWOMs refer to the training of those standing watch if there is any STCW required training as well as any company preparation training. Company training is usually documented with a checklist in an appendix of the PWOM. This is also the paragraph where most PWOM authors insert guidance for the crew on managing the effects of a Polar environment on the crew, long hours of daylight/night, cool temperatures, remoteness, isolation, lack of communication etc. This paragraph is where guidance can be given to the master and crew for minimizing complacency.

Example Content: The M.V. SOME GOOD SHIP has an operational limitation of ice-free waters only, therefore in accordance with Polar Code Part I-A / Chapter 12, there is no mandatory training for the crew before entering Polar Waters. All watch keepers are to undergo Polar Familiarization training with the master. This is to be directed and documented using the form given in Appendix 5 of this PWOM.

There is a small possibility of some sea ice drifting into the operational area. This is most likely in the shoulders of the operating window. If sea ice is expected the M.V. SOME GOOD SHIP is to depart as soon as possible to avoid the ice since the vessel has an operational limitation of Ice-Free waters only. When the master has any reason to believe there is any possibility of sea ice in the area that cannot be avoided safely, watches are to be reduced in length and more frequent change of watch keepers. There should also be an increase in the number of watch keepers from normal ship operations as specified in the company safety policy. Regardless of the scheduled watchkeeping hours the master and all officers are to pay very careful attention to human factors that may affect their duties, such as fatigue, this is especially important during hours of poor visibility.

Watch keepers are to be aware of the specific Polar Hazards for which they are to be on the lookout. These include but not limited to:

- Sea Ice
- Ice of Land origin
- Marine Mammals or wildlife which the M.V. SOME GOOD SHIP may pose a risk
- Indigenous people

Working in temperatures that are below a person's normal comfort level can have significant implications on the human capabilities. These temperatures need not be what some people would consider cold but just cooler than normal can cause difficulties. For example, +18°C is not cold, but if a crewmember needs to type on a computer keyboard, the effects of that cool temperature will arise fairly quickly. The master and offices are to ensure that all necessary precautions are in place to keep the crew warm. This is to be done on a case-by-case basis but hours in the cooler temperatures shall be limited and everyone assigned duties outside are to be provided with appropriate clothing. (See Polar Operations Planning Aid Checklist in Appendix 6).

Nutritional needs of the crew in colder climates must be considered. Lower temperatures result in higher calorie intake requirements due to the increased physical and mental demands. Company allowance is made for an increase in crew provisioning while preparing for a Polar waters operation.

The planned operation to Red Dog will not expose the vessel to long hours of darkness but the vessel will experience long hours of daylight. Prior to departing for Polar Waters, each cabin's window/porthole light block out curtains are to be inspected and renewed if not adequate at darkening the room. While in long hours of daylight, the crew may have a difficult time resting. For this reason, the crew are recommended to assign themselves personal bedtimes to ensure the sufficient sleep hours during the mandatory hours of rest. Required hours of sleep may vary greatly from person to person. The master and officers are to monitor each other and the crew for signs of fatigue.

Most seafarers onboard the M.V. SOME GOOD SHIP are accustomed to the isolation that comes with sailing, in Polar waters, the feeling of isolation may be exaggerated. The normal and familiar passing ship in the distance is rare, the land scape had little or no signs of human activity, and normal communications with loved ones back home may be limited. For these reasons the crew's wellbeing is something that the master and officers need to be aware of. The M.V. SOME GOOD SHIP has a well-equipped recreational room with movies and books as well as a gym. It is recommended that before departing for Polar waters the master restock the media library with films of the crew's choice. It has been proven that a regular and group movie showing of recent releases can help morale. It has also been proven effective to have physical fitness challenges, such as steps per day. The company has blanket authorized the master to order minor prizes (e.g. prepaid calling cards) for these challenges in accordance with the company policy. The Master can develop a morale booster program to suit the crew onboard the M.V. SOME GOOD SHIP. (See Polar Operations Planning Aid Checklist in Appendix 6).

1.5 Voyage Planning

IMO Guidance: None

ABS Guidance: This paragraph is not included in the table of contents contained in Appendix II of the Polar Code, but this is a way that many PWOM authors add in the requirements from Polar Code Part I-A/Chapter 11 which are not covered above. This is the paragraph where planning for any limitations of hydrographic information and aids to navigation is included. Places of refuge is part of normal voyage planning but the lack of places in Polar waters is often covered here. One of the more challenging parts to add in here is the planning to avoid marine mammals. Other topics to cover in this paragraph are the national and international designated protected areas and the available SAR resources along the route. The voyage plan is to conclude the list of SAR resources along the route as well as emergency contact information.

Example Content:

The M.V. SOME GOOD SHIP is to enroll in the Marine Exchange of Alaska before entering Polar Waters.

https://www.mxak.org/services/mda/tracking/

This service links a vessel with the US Coast Guard, further enhancing the safety of the vessel and its crew but also providing the vessel with information services with respect to marine wildlife in the area.

Planning for marine mammals: The latest data and information on marine mammal locations and migratory patterns are to be referenced during planning. The following links will provide information on potential mammals in the intended area of operation in Alaska:

https://www.adfg.alaska.gov/index.cfm?adfg=viewing.marinemammals

https://ak.audubon.org/conservation/ecological-atlas-bering-chukchi-and-beaufort-seas

If at all possible, the routing should try to avoid dense populations of marine mammals. If this avoidance is not possible, the M.V. SOME GOOD SHIP is to transit at a reduced speed while in areas where mammals may be present, and a constant watch for signs of marine mammals in the area. If mammals are spotted, their presence are to be reported to the Marine Exchange of Alaska. The vessel's speed is to be reduced proportionally to the distance between the M.V. SOME GOOD SHIP and the mammals. The decision for selecting operational speeds is the master's responsibility and there are many factors to consider. The chances of a mammal-vessel strike is one consideration when mammals are present. The master should also consider the Under Water Radiated Noise (URN) the M.V. SOME GOOD SHIP produces. URN can block mammals' ability to communicate and can cause injury. Sound propagates very quickly underwater and carries long distances. The mammals may not be able to escape the noise. To reduce the level of URN when mammals are present, it is recommended that the M.V. SOME GOOD SHIP operate at approximately 50% of economical speed where appropriate.

Possible places of refuge are to be included in the Voyage Plan. Resources for possible places of refuge along the planned voyage to Red Dog may be found at:

https://dec.alaska.gov/spar/ppr/response-resources/ppor/nw-arctic/

The M.V. SOME GOOD SHIP has a 12.2 m (about 40 foot or 6.67 fathoms) draft but may be deeper if damages have occurred. Caution is issued to consider other factors such as tides, waves, and swells.

Updates on the Aids to Navigation (ATON) are reported from the US Coast Guard's District 17 Notice to Mariners. Information can be obtained from the following link:

https://www.navcen.uscg.gov/broadcast-notice-to-mariners-search?district=17

Hydrographic information and guidance on shipping lanes are included in Division 2, Chapter 3 of this PWOM. This is to be considered and referenced during the voyage planning for any Polar Voyages.

Voyage planning is to minimize the impact of the M.V. SOME GOOD SHIP's voyage when sailing near communities and areas of cultural heritage and cultural significance. The master and crew are to utilize all resources at their disposal (company office, ship's agents etc.) to ensure impact is minimized and to contact specific villages that may be affected by their voyage. There are special conservation areas in Alaskan waters the master and crew must be aware of such as the shipping exclusion zones around Nunivak Island, St. Lawrence Island, and King Island. See IMO NCSR 5/3/8 - ROUTEING MEASURES AND MANDATORY SHIP REPORTING SYSTEMS, Establishment of three new areas to be avoided in the Bering Sea.

Routing should follow the guidance in IMO NCSR 5/3/7 - ROUTEING MEASURES AND MANDATORY SHIP REPORTING SYSTEMS, Establishment of two-way routes and precautionary areas in the Bering Sea and Bering Strait.

Chapter 2 Arrangements for receiving forecasts of environmental conditions

IMO Guidance: The PWOM should set out the means and frequency for provision of ice and weather information. Where a ship is intended to operate in or in the presence of ice, the manual should set out when weather and ice information is required and the format for the information.

When available, the information should include both global and localized forecasts that will identify weather and ice patterns/regimes that could expose the ship to adverse conditions.

The frequency of updates should provide enough advance notice that the ship can take refuge or use other methods of avoiding the hazard if the conditions are forecast to exceed its capabilities.

The PWOM may include use of an approved land-based support information provider as an effective method of sorting through available information, thereby providing the ship only with information that is relevant, reducing demands on the ship's communications systems. The manual may also indicate instances in which additional images should be obtained and analysed, as well as where such additional information may be obtained.

ABS Guidance: There is no requirement to have any text under this main section, many PWOMs leave this section blank and include all the details under the following subsections. This is the location where some PWOM authors include details on crewing to ensure functionality of the equipment, such as electrical engineer and GMDSS officers. This is also a place where some authors place a pre-Polar waters communications procedure or reference to a checklist. A key part of the IMO guidance is "…means and frequency …". The means of obtaining the data and how often to get it should be included in this chapter.

Example Content:

Prior to entering Polar Waters, the ship's communications systems are to be tested and documented following checklist provided in Appendix 7.

2.1 Ice information

IMO Guidance: The PWOM should include or refer to guidance on how radar should be used to identify ice floes, how to tune the radar to be most effective, instructions on how to interpret radar images, etc. If other technologies are to be used to provide ice information, their use should also be described.

ABS Guidance:

This is under Division 2 - Ship operations. It should make reference to Part 2, Division 1 - Operational Capabilities and Limitations, Chapter 2 - Operation in low temperatures, and Chapter 3 - Communication and navigation capabilities in high latitudes. Access to historical statistical sea ice data should be referenced here as required in Polar Code Part I-A/11.3.4. This paragraph should make a connection to any risk control measures mentioned in the Operational Assessment report, tables 6 to 9 in the example OA report.

Example Content:

The sea ice data is to be obtained in several ways. The longer-term statistical ice data for seasonal voyage planning is to be obtained from the office. The office will contact the ABS HETC (Polar@eagle.org) and obtain the updated data yearly for the fleet. An example of this data is given in Appendix 1 with details on how to read and interpret the data. This data is transferred to the ship using any of the data communication systems available onboard, see Part 2, Division 1, Chapter 3 -

Communication and navigation capabilities in high latitudes for further details of the vessel's communications systems and their limitations, although this data is expected to be transferred to the vessel well before entering Polar Waters.

For a much broader view of Polar sea ice conditions, the US National Snow and Ice Data Center have global scale sea ice extent maps. A link to the Arctic charts is given below.

{https://nsidc.org/arcticseaicenews/charctic-interactive-sea-ice-graph/}

In this figure the total sea ice extents are charted, which by itself is not entirely useful but clicking on the lines for the years ice extent will display an Arctic Stereographic map with sea ice extents. Often sea ice formations will mimic past years. Therefore, looking for a historical year that resembles the current ice coverage may give an idea of how the ice may recede or form. This analysis is a data intensive process and best performed by the office and provided to the vessel as needed. It is also advisable to look at temperature data for the intended area of operation. Cold air creates ice and warm air melts it, and therefore the air temperature can be loosely used to estimate if the ice is going to grow. Colder air will freeze the water faster, therefore colder conditions will create worse ice conditions quicker.

For shorter duration planning, the Alaska Sea Ice Program (ASIP) {https://www.weather.gov/afc/ice} as mentioned in Part 2, Division 1, Chapter 1, paragraph Operation in ice1.1 - Operator guidance for safe operation have 5 day sea ice forecasts. This should be used for short term voyage planning, 5 days or less prior to expected entry into Polar Waters. The colour codes used are given below in Figure 2. The crew are to access this data using the broadband internet connection.

Figure 2: ASIP Colour Coding

The ASIP also have current ice charts. These ice charts are normally available daily. It is company procedure while sailing in Alaskan waters that these ice charts will be reviewed at the beginning of each bridge watch. The colour code used on the standard Ice Analysis & Forecast Maps is given in Figure 2 (Ice free shows as an ocean blue on the "Zoomable Map", but these colours should be verified on the actual website by clicking on "Legend".

The M.V. SOME GOOD SHIP is limited to ice free waters only, therefore operations are limited to areas coloured with white. The actual zoomable figure may not show as white for Ice Free but may be a light blue. Hovering the mouse pointer over the region gives more information as to the ice total concentration or stage of development. Checking ice data and ensuring conditions are within

the vessel's capabilities are a risk control measure identified in Table 6 of the Operational Assessment.

In the event that ASIP service is unavailable, the master is to contact the company office, local authorities, port agent etc. to obtain the necessary information.

2.1.1 Use of Radar for Ice Detection

IMO Guidance: None

ABS Guidance:

This subparagraph is not in the PWOM model table of contents found in Appendix II of the Polar Code. It is here as a special section to focus on the specific radars on the specific ship and how to best use them to identify ice. It is common to see statements here such as "the X-Band, set to lower ranges (3-6nm) with adjusted gain is best for detecting ice."

Example Content:

The M.V. SOME GOOD SHIP is fitted with the standard X-band and S-band radars and does not have any specialized ice detection radars. Radars serve as a key instrument while navigating and can offer invaluable info for safe navigation of the vessel, but the radars are no replacement for good watch and visibility.

Marine radars are designed to detect targets with relatively good radar reflections such as other vessels. Radars are very useful for detecting large icebergs but signal returns from all forms of ice are much lower than from ship targets. Smaller pieces of ice such as growlers or bergy bits may be difficult to detect due to the low freeboard and smooth ice floes. An undetectable piece of an iceberg can easily be hundreds of tonnes and a threat to the M.V. SOME GOOD SHIP's structure. Therefore, visual observations from the watch officers and crew remains mandatory and may need to be supplemented with additional lookouts while in waters where ice may be present as per the SMS.

Operating in areas and times where visibility will be reduced, such as at night or in fog, the radars will be needed, but the information provided must be taken in carefully by the navigation crew.

Due to the low reflectivity of ice, the gain will have to be adjusted to detect ice.

The M.V. SOME GOOD SHIP has a {make and model} X-band radar and a {make and model} S-band radar. It has been found to maximize ice detection to adjust the radar settings to {Insert guidance here for the specific radar installed}.

See Division 2- Chapter 1- Paragraph 1.1 Avoidance of hazardous ice for application of this ice data to keep the M.V. SOME GOOD SHIP in ice free waters.

2.2 Meteorological information

IMO Guidance: None

ABS Guidance: This section is where the crew can go to learn:

- what data should be gathered,
- where to obtain the data and
- how often to gather it.

Vessels generally have documentation or reference material onboard or a link to an online service for metrological information. These reference materials should be mentioned in this section. Reference should also be made to historical statistical data, which can be obtained from ABS. When examining the historical air temperature data (using the MDLT temperature definition) the dates when it drops below 0°C and -10°C should be of significance. Below 0°C is about the time when things begin to freeze, below -10° is when the Polar Code's low temperature operation requirements commence. For operations to Red Dog, low temperature operation (MDLT <-10°C) is not generally a consideration.

The list of details to ensure are covered in this section are:

- Air Temperature, historical statistical, current, and forecast
- Polar storms, historical and forecast
- Precipitation, historical and forecast
- Fog, historical and forecast
- Ice accretion conditions, historical and forecast (freezing air temperatures, cold water and high winds/waves)

Example Content:

Historical temperature data:

Prior to embarking on a voyage to Red Dog the historical metrological information is to be obtained and carefully considered as described above in Part 2, Division 2, Chapter 1, paragraph 1.2 - Avoidance of hazardous temperatures. The Master is to ensure the latest updated copy of the historical air temperature analysis from the ABS HETC is aboard prior to commencing and monitoring voyage planning.

Forecasted data:

The M.V. SOME GOOD SHIP will receive automated weather reports through the NAVTEX. It is the master's responsibility to ensure that the NAVTEX stations are properly set to ensure that reports and warnings are properly received.

Using the ship's broadband connection, the current conditions and near future forecast for Alaska marine zones can be obtained from:

https://www.weather.gov/afc/marine

For every voyage to Red Dog the most recent and forecasted weather information shall be obtained and updated during the voyage as often as practical but at least XXX. When weather is changing the frequency of weather updates is to be increased to at least once every XXX. In any case the frequency of updates should provide sufficient notice that the ship can take refuge or use other methods of avoiding the hazard if the conditions are forecast to exceed the vessel's capabilities. See Part 2, Division 1 for the vessel's capabilities.

The forecasted temperatures for the planned route should be obtained, along with winds and precipitation. For using this information and using this to remain within the vessel's capabilities see Part 2, Division 2, Chapter 5.

Realtime weather for some coastal locations is available through the Marine Exchange of Alaska.

https://www.mxak.org/services/mda/tracking/

Precipitation Data:

The link given above for Alaska marine zones, will usually only give forecasted precipitation for the current day. The ABS produces historical precipitation data as seen in Appendix 3. This data can be used to estimate the amount of freezing rain and or snow fall the M.V. SOME GOOD SHIP may experience enroute to Red Dog. The weather data provided from the local weather services and the above link for Alaska marine zones can be used to identify areas where precipitation may occur. Linking this with forecasted temperatures can be used to determine if freezing rain or snow fall are likely. If the air temperature is below +3°C, snow or freezing rain are possible.

Fog data:

In the marine environment fog is difficult to forecast. Typically, weather services only provide this for the current day. From the US National Weather service: (https://www.weather.gov/safety/fog-water) "Fog that forms over water is commonly referred to as sea fog. It forms when warm, moist air flows over relatively colder waters. Fog is common along the U.S. Pacific coastline year round because the water is typically much colder than the nearby land. The National Weather Service issues Dense Fog Advisories when fog over water reduces visibility to 1 mile or less".

Ice Accretion data:

The ABS produces historical ice accretion estimates as seen in Appendix 4. This data can be used to estimate if ice accretion is likely for the M.V. SOME GOOD SHIP while enroute to Red Dog. Noting that the M.V. SOME GOOD SHIP does not have ice accretion conditions in the approved stability, the vessel has an operational limitation of "Limited to areas where ice accretion is not expected to occur".

The US National Weather Service Environmental Modeling Center, in the recent past, used a Marine Icing forecast model based on a formulation developed by Overland in 1986 (Overland, Pease, Preisendorfer, & Comiskey, 1986). As of 6 November 2019, this service was retired and is no longer available (https://polar.ncep.noaa.gov/marine.meteorology/).

The US Ocean Prediction Center has an experimental freezing spray guidance, based on a modified Overland. The experimental short range ice accretion forecasts are available at:

https://ocean.weather.gov/icing_rates/compare.php?area=ak&fhour=012

Since these are experimental, they should be used with caution. Other more reliable forecasts are to be used to predict ice accretion conditions, and the references in the ABS *Guide for Vessels Operating in Low Temperature Environments* (LTE Guide), Appendix 3/Table 1 are referenced.

The Sea Surface Temperature (SST) is a factor in ice accretion. Warmer waters are less likely to create ice accretion. SST information is available on the Alaska Sea Ice Program (ASIP) {https://www.weather.gov/afc/ice} website under the "Standard Ice Analysis & Forecast Maps" tab.

See Division 2, Chapter 5, Paragraph 5.1 - Icing prevention and de-icing for guidance on managing ice accretion.

Chapter 3 Verification of hydrographic, meteorological, and navigational information

IMO Guidance: The PWOM should provide guidance on the use of hydrographic information as further described in the additional guidance to chapter 10.

ABS Guidance: The guidance from IMO refers to the Polar Code Part I-B/10 – Additional guidance to chapter 9 (Safety of navigation).

Many PWOMs, ABS receive use this section for multi purposes:

i) To answer Polar Code Part I-A/11.3.2 by discussing how the vessel's operation will manage poor hydrographic info.
ii) Give guidance for the crew on verifying data received onboard as far as practical
iii) Give guidance to crew for avoidance of marine mammals (Polar Code Part I-A/11.3.6 and 11.3.7)

This chapter should contain text on the following:

- A Link to Table 16 of the Operational Assessment Report
- Guidance on avoidance of Marine Mammals
- Guidance on navigational aids or limit thereof
- Methods for receiving hydrographic survey, charting, chart corrections and forecasts.
- Frequency for obtaining updates

Example Content:

During the operational assessment, only operations to the port of Red Dog were considered. The routing to and from Red Dog is from the north Pacific to the port and back down south to the Pacific. This route shall keep the vessel in well charted areas at all times. Charts are to be checked prior to entry into Polar Waters and any corrections applied. The M.V. SOME GOOD SHIP is to only operate where the CATZOC is high (XXX or above) or only where the water depth is significantly more than the vessel's draft. Whenever the M.V. SOME GOOD SHIP must enter shallow waters, (<XXX m beneath the keel), the echo sounder must be turned on, actively monitored by a qualified officer or crewmember assigned by the Master, and the vessel transit speed limited to no more than XXX knots or the minimum speed to maintain steering. While enroute to and from the port the M.V. SOME GOOD SHIP will follow the ROUTEING MEASURES AND MANDATORY SHIP REPORTING SYSTEMS established in IMO NCSR 5/3/7.

Navigational Aids in Alaska are serviced by the U.S. Coast Guard's Aids to Navigation Team in Kodiak. The aids used follow the U.S. Aids to Navigation System. Information on the navigational aids in Alaska are available from the latest version of the US Coast Guard Light List Volume VI, Pacific Coast and Pacific Islands.

Before crossing the polar waters boundary, 60°N in the Bering Sea, the master is to ensure that all charts, chart corrections, and publications pertaining to navigational aids are up to date. The Master shall also arrange for updates to be provided to the vessel.

While in Polar waters, the master and crew of the M.V. SOME GOOD SHIP are to be especially vigilant and on the lookout for any marine mammals. The Bearing Sea is home to or occasionally used by many marine mammals. The focus will be for whales, as Polar bears, and ice-dependent pinnipeds (Pacific walrus, ribbon seal, bearded seal, spotted seal and ringed seal) seasonally move through the Straits following the seasonal ice movements. The M.V. SOME GOOD SHIP is limited to ice free waters only, therefore should not encounter these pinnipeds. If any are found, the master and crew are advised to notify the authorities in the area and avoid the mammal as far as is safe to do so. The main whales to look for are: Grey Whale, Minke Whale, Killer Whale, Humpback Whale,

and the North Pacific Right Whale. More information on spotting, identifying, and avoiding whales can be found at XXX.

More info can be found at the following links:

https://www.fws.gov/program/alaska-marine-mammals-management-office/what-we-do

https://pame.is/images/03_Projects/AMSA/AMSA_Background_Research_Docs/Scenarios/5.5-Bering-Strait-Region-Case-Study.pdf

Identifying Guide:

https://media.fisheries.noaa.gov/dam-migration/marine-mammals-alaska-arctic.pdf

Chapter 4 Operation of Special Equipment

ABS Guidance: Most vessels operating in Alaska in the summer will have no special equipment. If the ship is fitted with equipment to control any of the risks identified in the Operational Assessment, this is where guidance would be given to the crew. Paragraphs 4.1 and 4.2 are included in Polar Code Appendix II, and therefore should be included, even if they are not applicable to the specific ship. If special equipment is added other than navigational (4.1) or communications (4.2), additional paragraphs can be added (4.3, 4.4, etc.).

4.1 Navigation systems

IMO Guidance: None.

ABS Guidance: The Polar Code Part I-A/9.3.2.2.1 requires all ships to have two non-magnetic means to determine heading. As most SOLAS vessels only have a single gyro compass an additional means is needed. Common solutions to this are a second gyro compass, or a GNSS compass. It has been found that the addition of a GNSS compass is the more common solution to comply with this requirement. If the new secondary non-magnetic means has any specific user requirements, this paragraph is usually where that is contained. The heading device's connection to the integrated bridge system should be mentioned here.

Example Content:

The M.V. SOME GOOD SHIP is equipped with all the navigation equipment required by SOLAS. This equipment has the same operational procedures in Polar waters as they do in non-Polar waters. The only exception is the addition of a GNSS Compass (GPS Compass) as a secondary non-magnetic means of determining heading. The GPS compass differs from a normal GPS receiver as it has two antennas that are spaced apart a distance specified by the manufacturer. These dual positions enable the GPS Compass to produce accurate headings while at very low speeds. The GPS compass as well as the gyro compass are connected to the main and emergency source of power. For detailed operation of the GPS Compass refer to compass operation manual.

The GPS compass is a navigational system installed for Polar water operations to meet the redundant non-magnetic means of determining heading. It is not connected to the integrated bridge system.

4.2 Communications systems

IMO Guidance: None.

ABS Guidance: If the ship is upgraded to sea area A4, there is usually mention of it in this paragraph. Most ships are also fitted with an Air Band radio to comply with Polar Code Part I-A/10.3.1.3.2, guidance for use of this communications equipment is often entered here. This is also usually where it is made clear how the ship will meet the ship to shore and ship to ship communication requirements in Polar Code Part I-A/10.3

Example Content:

GMDSS Equipment: The M.V. SOME GOOD SHIP is equipped with a GMDSS installation suitable for Sea Area A3. The operations in Alaska will not go beyond area A3.

Airband Radios: The ship is fitted with a single handheld VHF radio that can transmit and receive on 121.5 MHz and 123.1 MHz. 121.5 MHz is the only frequency to be used in case of emergency and is to only be used to draw attention of commercial aircraft. It is to be recognized and understood that airband VHF channels are highly regulated, therefore these are to only be used in case of an actual emergency.

There are standard terms used for aviation radio communications such as:

"MAYDAY, MAYDAY, MAYDAY" – The start of an emergency call.
"AFFIRMATIVE" = Yes
"NEGATIVE" = No
"ACKNOWLEDGE" = Confirmation of the message.
"BLOCKED" = Transmission was distorted or interrupted
"SAY AGAIN" = Please repeat the last message
"STAND BY" = Indication of a pause in transmission to take care of other tasks.

The M.V. SOME GOOD SHIP's standard communications equipment will permit ship to ship and ship to shore communications along the entire planned voyage to Red Dog. The telemedical communications capabilities will be primarily met by the ship's satellite telephone with other GMDSS suite equipment used as necessary.

Chapter 5 Procedures to maintain equipment and system functionality

5.1 Icing prevention and de-icing

IMO Guidance: The PWOM should provide guidance on how to prevent or mitigate icing by operational means, how to monitor and assess ice accretion, how to conduct de-icing using equipment available on the ship, and how to maintain the safety of the ship and its crew during all of these aspects of the operation.

ABS Guidance:

Ice accretion can originate from sea spray or atmospheric (freezing rain, fog etc.). The difference between the two sources is the location on the ship and the thickness. Normally sea spray icing forms on or near the bow, whereas atmospheric occurs everywhere on the vessel. Sea spray icing is often much thicker and heavier than atmospheric icing but usually not as high, therefore safely dealing with the two forms may differ slightly.

To minimize sea spray and therefore ice accretion, guidance is usually given here for handling the ship in a way that will reduce the icing rates.

Many PWOM authors refer to a checklist for areas and systems to check for ice accretion, acceptance limits and required actions. The checklists usually include:

- Stability
- Navigation and Communication equipment
- Navigation lights, alarms, horns etc.
- Lifesaving appliances
- Fire fighting equipment
- Escape routes
- Machinery and accommodation air intakes
- Tank vent pipes
- Ship specific safety systems, e.g., P/V valves
- Anchor and mooring equipment

Example Content:

The M.V. SOME GOOD SHIP has an operational limitation of "Limited to areas where ice accretion is not expected to occur", therefore icing prevention is of the upmost importance.

Ice Accretion Prevention:

Ice Accretion data and metrological information to estimate the possibility of ice accretion is described in Division 2, Chapter 2, Paragraph 2.2 - Meteorological information. For ice accretion to form, there needs to be a source of water and temperatures sufficient to freeze. If the water is warm, or if the air temperatures are above freezing ice accretion will likely not occur. If the sea surface temperature is near freezing and the air temperature is below freezing, the water still needs to get from the ocean surface onto the ship's structures for ice accretion to occur. In conditions where the temperatures are sufficient for freezing, sea spray from breaking waves on the bow is a major source. Another major transporter of sea water to the ship's structure is wind whipped wave tops. Alaskan waters in June and October, it should be assumed that the sea surface temperature is cold enough to form ice accretion. Therefore, the driving factors for the master to be aware of are wind and air temperature during these months.

Reference is made to the ABS *Guide for Vessels Operating in Low Temperature Environments* (LTE Guide), Appendix 3/Table 1. This table indicates that if air temperatures are below freezing and the sea surface temperature is near freezing, for a ship of 150m in length, ice accretion may start when the significant wave height is 6.0 m, and the wind speed is 20 m/s (38.9 knots). The M.V. SOME GOOD SHIP is 229m in length, therefore ice accretion is expected to occur at slightly worse conditions (larger waves / higher winds) than for a 150m vessel.

If conditions are found that meet or exceed the criteria for ice accretion to occur, it is advisable to steer the ship towards warmer waters if safe to do so. Reference to a Sea Surface Temperature (SST) map may be used here. If sailing into warmer waters (or air temperatures) or more sheltered waters is not possible or safe, it has been found that spray can be reduced to a minimum by heading into the wind and sea at the slowest speed possible.

When the vessel is transiting through freezing air temperatures, safety rounds shall be carried out at least every XXX hours, provided it is safe to conduct the rounds. If any ice accretion is detected, it is to be reported to the master and de-icing operations commenced as described below to keep the ship within the operational limitation.

De-Icing:

See Division 1, Chapter 1, Paragraph 1.1 - Operator guidance for safe operation for the M.V. SOME GOOD SHIP's ice accretion limitations.

Reference to the check sheet in Appendix 6 is to be made. The following gives expanded details of the specific arrangements for the M.V. SOME GOOD SHIP.

Ice build up can increase the distance from the keel to the center of gravity (KG) by added mass on the main deck. If the ice mass becomes too large, it can exceed the safe margins of the vessel and result in a loss of stability. The M.V. SOME GOOD SHIP is a large vessel at 229m long, therefore it is expected that it can withstand a significant amount of ice accretion, however the vessel's stability has not been assessed for ice accretion. If any ice accretion begins to build on the upper decks, super structure, bulwarks, rails, or other erections de-icing measures must be implemented immediately provided it is safe to do so. The M.V. SOME GOOD SHIP is equipped with the following tools for de-icing purposes:

Quantity	Description	Location
5	Narrow blade aluminum shovels	Bosun's store
5	Wide blade snow shovels	Bosun's store
5	Wooden mallets	Bosun's store
5	Ice chippers	Bosun's store
1	5m long aluminum pole	Bosun's store
5	Ice scrappers	Bridge
10	10kg bags of rock salt	Bosun's store
2	Rubber mallets	Bosun's store

Caution is advised, overhead ice can be a significant hazard for de-icing crews. For example, the forward mast on M.V. SOME GOOD SHIP is 12 m tall. Ice accretion is not expected at the top of the mast, but any ice halfway up is still 4 m over the heads of the crew.

Care should be taken when de-icing any part of the vessel or it's equipment, as a hard mallet strike could render sensitive parts/components inoperable. This is especially true for electronic components, hydraulic lines, and equipment controls.

The navigation and communications equipment on M.V. SOME GOOD SHIP is mostly located on top of the wheelhouse. Therefore, it should not experience ice accretion from the sea but can experience atmospheric icing. It is not advisable to send crew up unless it is deemed necessary. All dangerous radio transmissions from {insert radio equipment to shut off here} are to be shut down and secured before anyone goes up top. The navigational lights on the M.V. SOME GOOD SHIP are energy efficient LED lights, and therefore produce very little residual heat. If ice build-up occurs, they will not melt the ice on their own. Therefore, the nav lights need to be manually de-iced. This can be done using the window ice scrapers provided on the bridge.

The bridge windows are provided with heated rotating clear views facing forward as well as an air blown defrosting system. The aft facing windows are to be manually cleared using the ice scrapers provided on the bridge.

The vessel's escape routes are to be always maintained ice free. When any conditions that may create icing on the escape routes is encountered the surfaces are to be covered with a sprinkling of rock salt.

All the lifesaving appliances are well aft and therefore should be well protected from sea spray icing but may be susceptible to atmospheric icing or mild sea spray in the event of beam on or following seas. The lifeboat release mechanism should be de-iced with extreme caution. The boat is to be secured to ensure an accidental launch does not happen and the de-icing procedure is to be made while no one is in the boat or in the line of fire if the boat is accidently released. The hydrostatic releasees for the liferafts are susceptible to ice accretion and therefore need to be kept completely ice free. The rescue boat is covered with a canvas cover, this can easily be jostled to remove ice. Care is to be applied to the davit in way of the wire conduits, sensors, and controls.

Lifebuoys including ropes, lights, and/or smoke shall be maintained sufficiently ice free to be readily releasable at any time.

EPIRB and its hydrostatic release are to be maintained ice free.

Fire fighting equipment such as fire main valves and hydrants are to be kept ice free.

All fire dampers are to be kept ice free. Accommodation HVAC intakes should also be cleared of any ice accretion.

Tank vent heads on fuel tanks and ballast tanks are to be checked and de-iced frequently if icing occurs. (at least every XXX hours when freezing conditions are experienced). To check the vent heads {insert inspection procedure here}

Snow should be removed from the ship's decks and walkways where the crew will be working, as well as from systems and appliances located near to the deck such as flush sounding tubes for the ballast tanks. Snow removal is to be performed using the shovels provided in the bosun's store.

5.2 Operation of seawater systems

IMO Guidance: The PWOM should provide guidance on how to monitor, prevent or mitigate ice ingestion by seawater systems when operating in ice or in low water temperatures. This may include recirculation, use of low rather than high suctions, etc.

ABS Guidance: This paragraph must be very ship specific. What systems does the ship have to monitor and manage ice ingestion/blockage?

Example Content:

Using the Sea Surface Temperature data (see Division 2, Chapter 2, 2.2 - Meteorological information) the engine room is to be notified when sea water temperatures below +3°C are expected. Below these temperatures the water temperature may be insufficient to melt ice as it flows through the strainers.

M.V. SOME GOOD SHIP has a re-circulating system that can discharge from 0% to 100% of the cooling water to either sea chest. When the bridge notifies the engine room of the plan to enter cool waters (<+3°C), the intake temperatures and pressures are to be monitored frequently. The frequency is the Chief Engineer's decision depending on the situation, but it is recommended to be at least every XXX hours. When entering cooler waters, the suction should be switched to the lower sea chest if safe to do so and the re-circ system activated to send some water back to the low sea chest and the remainder to the high sea chest. The percentage of water to each sea chest is at the

discretion of the chief engineer to ensure functioning of the machinery. The intake temperature should be maintained above +3°C to ensure melting of any ice blockage.

Monitoring of the pressures is the best indicator of a blockage. If the intake pressure drops to XXX bar, then a blockage is occurring, and remedial action is needed. If the pressure drop is in way of the strainer, the strainer may need to be pulled and cleared out. This could be from ice ingestion or from biological material in the waters. Regardless of the blockage type, switching the strainer and clearing shall follow the standard procedure detailed in standard company procedures. If the blockage is before the strainer (e.g. in the sea chest), it is important to switch to the other sea chest quickly to keep cooling water flowing. The blocked sea chest can be cleared by directing the majority of the re-circ water to the blocked sea chest or by closing the valves and blowing compressed air into the sea chest. Some recirc water should remain flowing to the operating sea chest to ensure it does not become blocked.

The M.V. SOME GOOD SHIP has an emergency fire pump located forward. This fire pump has its own independent sea suction located near the keel (12.2 m deep when loaded, 5.5 m in ballast) between frames 251 and 252. This sea chest is not normally in operation, is near the keel and is not expected to be needed if the ship is sailing. Therefore, should not experience clogging. In the very unlikely event that the pump looses suction due to ice clogging, stop the pump, close the pump discharge valve, open the sea chest valve. Using a long hose running down from the boson's store, connect a ship service air line to the connection near the suction of the pump and air blow the sea suction for a few seconds. Disconnect the air hose, open the discharge valve and restart the pump.

5.3 Procedures for low temperature operations

IMO Guidance: The PWOM should provide guidance on maintaining and monitoring any systems and equipment that are required to be kept active in order to ensure functionality, e.g., by trace heating or continuous working fluid circulation.

ABS Guidance: This paragraph should have multiple levels considered as applicable to the vessel's intended operation. The term "Low Temperature" in the Polar Code is for ships intended to operate where the MDLT is <-10°C. Problems with cool air can be experienced in much warmer temperatures. This paragraph should address polar code low air temperatures (MDLT <-10°C) as well as 'freezing' temperatures.

Example Content:

As per Division 1, Chapter 2, Paragraph 2.1 - System design, the M.V. SOME GOOD SHIP "The M.V. SOME GOOD SHIP is not designed and built for low air temperature operation." For operating the vessel in air temperatures below freezing, see the above paragraph 5.1 and the standard company procedures for Cold Temperature Operations (SMM-yy-xxx)

Division 3. Risk management

ABS Guidance: This division of the PWOM is used to give guidance to the crew for operating the vessel near its limitations. This division also contains contingency plans for the event the vessel's limitations are slightly exceeded.

Chapter 1 Risk mitigation in limiting environmental condition

1.1 Measures to be considered in adverse ice conditions

IMO Guidance: The PWOM should contain guidance for the use of low speeds in the presence of hazardous ice. Procedures should also be set for enhanced watchkeeping and lookout manning in situations with high risks from ice, e.g., in proximity to icebergs, operation at night, and other situations of low visibility. When possibilities for contact with hazardous ice exist, procedures should address regular monitoring, e.g., soundings/inspections of compartments and tanks below the waterline.

ABS Guidance: For vessels intended to operate in Ice Free conditions, the hazardous ice is simply any ice.

For ship intended to operate in Open Waters the hazardous ice is any ice of land origin or any other form of ice that could be a risk to the structure such as multi-year or concentrations exceeding $1/10^{th}$. Crews on Tankers and Passenger vessels will have some basic training and therefore should be better able to identify hazardous ice types. For other ship types, the crew may have no training or experience with ice and be unable to identify ice types, therefore the PWOM of other ships should have detailed guidance for identifying hazardous ice and ice concentrations above $1/10^{th}$.

For ships limited to Other Ice Conditions a risk-based approach to assessing ice conditions is to be included in this section. ABS highly recommends using IMO POLARIS (IMO MSC.1/Circ. 1519) and including a solved example of using POLARIS.

Example Content:

As per Division 1, Chapter 1, Paragraph 1.1 - Operator guidance for safe operation, the M.V. SOME GOOD SHIP has an operational limitation in ice of "Ice-Free waters only". Therefore, ice of any kind at any concentration is considered hazardous.

If ice conditions are between the vessel and the port of Red Dog while enroute to load, the voyage is to be rerouted through ice free waters (if possible) or otherwise delayed or postponed until the ice conditions clear. If the voyage is near the end of the season, the M.V. SOME GOOD SHIP should not proceed with the voyage as the conditions will worsen.

For the unlikely event that some ice has formed while the vessel was in port the following contingency procedures are to be followed:

- {Insert ship specific contingency procedures here}

1.2 Measures to be considered in adverse temperature conditions

IMO Guidance: The PWOM should contain guidance on operational restrictions in the event that temperatures below the ships polar service temperature are encountered or forecast. These may include delaying the ship, postponing the conduct of certain types of operation, using temporary heating, and other risk mitigation measures.

ABS Guidance: Ships that are not intended to operate in low air temperatures have an operational limitation on their certificate that states the vessel will operate in areas and times where the MDLT is above a temperature specified by the owners/operators (usually -10°C but can be warmer). For these ships there is no Polar Service Temperature specified. The normal practice for these ships is to give the crew directions to avoid areas and times where the temperature is below the specified temperature with contingency plans for possibilities of experiencing short time temperatures as cold as 10°C below the specified temperature. For example, a ship with a limitation of an MDLT = -10°C may have guidance for contingencies down to -20°C.

Example Content:

Division 1, Chapter 2, Paragraph 2.1 - System design indicates the temperature limitations for the M.V. SOME GOOD SHIP including the rated temperatures for the vessel's hull, systems, and equipment. For normal operations of the M.V. SOME GOOD SHIP in temperatures above the rated temperatures but below freezing see Division 2, Chapter 5, Paragraph 5.3 - Procedures for low temperature operations.

One of the highest temperatures given in Division 1, Chapter 2, Paragraph 2.1 / Table 6 is for the hull steel grades. Hull steel grades are selected based on Part 3 of the ABS Marine Vessel Rules (IACS UR S6). Below a MDAT of { XXX }°C steel grade requirements commence which the M.V. SOME GOOD SHIP does not comply. Steel will not immediately fail when the temperature goes below the rated temperature. The hull steels may become more brittle than they are in warmer temperatures which means they can fail abruptly when loaded. Heavy weather hull stresses during such colder temperatures may further increase the chances of such failures. If temperatures experienced are below {XXX }°C, the hull loads are to be minimized. The colder the temperature the more brittle the hull steel may become therefore colder temperatures require more careful load restrictions. Loadings on the hull to reduce are bending moments from loading or ballast and avoiding areas with seas that induce a wave bending moment on the hull.

The crew are one of the parts of the ship that are highly susceptible to cold temperatures. The standard company procedures for Cold Temperature Operations (SMM-yy-xxx) has guidance for protecting the crew from cold temperatures. Below { XXX }°C exceeds the limits in those procedures, therefor below { XXX }°C, all non-essential on deck operations is to be reduced to minimums. Anyone working outside should regularly return to the accommodation for a warmup break at least XXX minutes every hour.

The M.V. SOME GOOD SHIP's external emergency lighting that is a type that may not illuminate when cold should be energized before the temperature drop below { XXX }°C. Most of the lighting is fluorescent lights that will likely not illuminate below { XXX }°C. Incandescent and LED lights used in navigation systems need not be activated due to the cold temperatures.

As temperatures drop below the rated temperatures given in Table 6 the individual piece of equipment should be deactivated or not used while the temperature is below it's rated temperature. If a critical piece of equipment (lifesaving, firefighting, environmental protection,

navigational, communications equipment) exceeds its rated temperature, then all operations shall stop and all efforts to safely return the vessel to warmer temperatures shall be made.

If temperatures drop below { XXX }°C while loading at Red Dog, cargo operations are to be postponed, hatch covers are to be closed and deck equipment not used unless for the safety of the vessel. Air temperatures within the accommodation, including everyone's cabin is to be checked twice daily. It has been found that the four cabins in the corners on C deck get the coldest. If either of these get too cold for crew comfort, the crew can be temporarily reassigned to one of the cabins on A deck. The crew rec room and mess are communal spaces that are to be kept at least { XXX }°C. If the HVAC is unable to maintain this temperature in these spaces, temporary heaters are to be activated. The heaters are stored in the engine room workshop. The heaters are to be plugged into outlet #XXX in the mess and # XXX in the rec room, and securely fixed using the bulkhead mount near the outlets.

Normal exterior operation should only be resumed after the temperature has returned to above { XXX }°C for at least XXX hours.

1.3 Measures to be considered in adverse visibility conditions

IMO Guidance: None

ABS Guidance: This is linked with Table 20 in the Operational Assessment report. Fog is a very common occurrence in Polar Waters. Fog itself has very little effect on the ship but the lack of visibility with the possibility of dangerous ice in the water is the main concern to be addressed here. Most companies have standard procedures in their SMS to deal with low visibility situations. This section normally references those procedures but raises the additional concern of ice.

Example Content:

Fog is a common phenomenon in Polar waters, with the highest frequency occurring in in the timeframe the M.V. SOME GOOD SHIP will be sailing to Red Dog. Fog can linger for several days and stretch great distances, making it difficult to avoid. Fog may be an indicator of being near the ice edge, so extra caution is warranted in fog in Polar waters. The normal company procedures and the Rules of the Road for operating in reduced visibility is to be followed (See SMM-yy-xxx) with the following additional items for Polar waters operations:

- Notify the master
- Before entering fog, obtain and review the latest sea ice data (see Division 2, Chapter 2, Paragraph 2.1 - Ice information) If any ice is reported in the vicinity (about XXX nm of the planned track), the area should not be entered.
- Post an extra lookout
- Commence radar plotting (if not already being done)

Chapter 2 Emergency response

IMO Guidance: In general, where the possibility of encountering low air temperatures, sea ice, and other hazards is present, the PWOM should provide guidance on procedures that will increase the effectiveness of emergency response measures.

ABS Guidance: This chapter of the POWM is where the crew can go to get information on using the ship and its system to deal with emergencies in Polar Waters. This should contain or refer to procedures for control of flooding in case of damage, salvage, and places of refuge as well as escape

and evacuation procedures (possibly with ice in the water). Many PWOMs refer to an internal company training and familiarization program specific for Polar Operations. The training manual required by SOLAS Chapter III, Regulation 35, may be updated for Polar operations and referenced here or the training material can be included in the PWOM in appendices.

Example Content:

None

2.1 Damage control

IMO Guidance: the PWOM should consider damage control measures arrangements for emergency transfer of liquids and access to tanks and spaces during salvage operations.

ABS Guidance: This paragraph should raise the reader's awareness of the possible sources of damage such as ice, grounding etc... Consideration for the operational limitations should be applied but awareness of what can go wrong if the limits are exceeded may also be included here.

Example Content:

The most obvious source of damage in Polar Waters is from contact with ice. Ice has been known to cause major structural damage to ship's hulls, in some cases resulting in uncontrollable flooding and loss of the vessel. More common is hull coatings being removed due to ice abrasion, shell plating indentation and frames being damaged. This usually results in a dry-docking for repairs.

A relatively common damage in ice is bent or broken propeller blades. This can result loss of propulsion efficiency (higher fuel consumption), excessive vibrations or oil leakage of the stern tube seal. M.V. SOME GOOD SHIP has a non-ice strengthened fixed pitch propeller that is cast from a single block of bronze. Damages to the propeller could result in the need for a new propeller.

Damages to the steering gear is also common when the rudder strikes ice. The load creates a high torque in the rudder stock, often exceeding the relief valves. A hard stop against the locks can result in a twisted rudder stock or damaged hydraulics. The contact may also result in a distorted rudder blade which can dramatically affect the vessel's steering ability.

As per Division 1, Chapter 1, Paragraph 1.1 - Operator guidance for safe operation, the M.V. SOME GOOD SHIP has a limitation of ice free waters only. Therefore, ice related damages should not occur.

Another possible source of damage in Polar Waters is from grounding. This is not a Polar waters specific occurrence, but it is exaggerated due to factors that are specific to Polar Waters such as poorly charted areas, or poor navigational aids. As per Division 2, Chapter 3, M.V. SOME GOOD SHIP shall not sail in poorly charted areas, therefore the risk of grounding damages should be minimized.

If damages to the hull do occur in Polar waters the extent of the damage should be assessed as far as is safe to do so. The vessel is to be stopped if safe to do so. The tanks in way of the suspected damages are to be sounded and an external visual inspection as far as is safe to do so should be made. If tank soundings remain unchanged after XXX hours, the tank shall be entered following the company's confined space entry procedures (SMM-xxx), by trained and qualified individuals. If the Master deems it is unsafe to enter the space, the internal examination may be deferred. Visual inspections of the structures within the tanks are to be made and documented. The company office is to be consulted during and after the inspections, a repair plan if needed will be developed.

If the tank is taking on water, the damage control procedures in the M.V. SOME GOOD SHIP's Emergency Response Manual for grounding is to be followed. The M.V. SOME GOOD SHIP is enrolled in the ABS Rapid Response Damage Assessment (RRDA) program. They are to be consulted immediately upon determination of hull breach. Breached tanks are not to be opened or accessed without further consultation with the office.

In cases where damages were found and if possible and safe to do so, the vessel's ballast should be adjusted to elevate the damaged area out of the water to avoid further damage or to minimize water ingress. In order to assist the master to determine if ballasting is safe in this situation the company's emergency response team and the ABS RRDA team are to be consulted.

If damages occur anywhere the office is to be consulted immediately. Such damages are not restricted to the propeller, rudder, or steering gear. Unless the damages are deemed minor the master shall proceed to a Place of Refuge where divers will be consulted to conduct an underwater inspection.

After damages occur and have been identified it may be necessary for the M.V. SOME GOOD SHIP to take shelter in a Place of Refuge to wait for repair or assistance. Places of refuge should be detailed on the voyage plan, see Division 2, Chapter 1, Paragraph 0 -

Voyage Planning.

When a place of refuge is intended to be used it is to be confirmed with the local authorities, contact details for the authorities can be found in the Global Maritime Distress and Safety System (GMDSS) documentation.

If the voyage cannot be safely continued and a place of refuge cannot be called, salvage operations must be considered in consultation with the office. See also Division 3, Chapter 3, Paragraph 3.2 - Salvage. The company has a salvage agreement with XXX and can be contacted, contact info is given in Appendix 9. In a salvage situation, transfer of tank contents shall be done carefully and with consultation with ABS RRDA. Access to damaged tanks for assessment and/or repairs is to be carefully considered with all personnel involved. Personnel involved is expected to include ship's master and crew, ABS Surveyor, ABS RRDA, the salvor representative, and the repair company representative.

2.2 Firefighting

IMO Guidance: None.

ABS Guidance: This paragraph is to address the special firefighting considerations for Polar waters. It is expected that the company's normal procedures for firefighting will be referenced. For ships that are limited to warmer temperatures and/or no ice accretion may not have any additional guidance required in this paragraph. Things to consider are: freezing of firefighting water both on deck and in lines, slippery decks due to ice or snow, bulky clothing for cold temperatures, temperature sensitive extinguishing media, temperature sensitivity of equipment such as lights, radios, or instrumentation, firefighter exhaustion and preparation of ship's medical team. If the emergency pump has it's own sea suction, this paragraph should reference Division 2, Chapter 5, Paragraph 5.2 for keeping it from becoming blocked with ice.

Example Content:

As per Division 1, Chapter 1, paragraph 1.1 and Chapter 2, paragraph 2.1, the M.V. SOME GOOD SHIP is limited to areas and times where ice accretion is not likely to occur and limited to operations in areas where the MDLT is above -10°C. Therefore, there is no special firefighting appliance onboard for Polar water operations. The vessel is fully in compliance with the ABS class rules, SOLAS, and the flag requirements, therefor all firefighting appliances are covered in the Safety Training Manual as required under SOLAS Chapter III, Regulation 35.

Some additional firefighting considerations in Polar Waters are:

- The emergency fire pump located forward has its own sea suction that may be blocked by ice ingestion. See Division 2, Chapter 5, Paragraph 5.2 - Operation of seawater systems.
- Any snow or ice on the deck surfaces may result in slippery conditions. This could be a challenge for fire crews while managing firefighting equipment, e.g., pressurized hoses. The decks shall be cleared of ice and snow as far as is safe to do so for the fire fighting crews.
- Run off fire fighting water can freeze on the deck resulting in heavy build up. This is to be removed as is safe to do so in accordance with Division 2, Chapter 5, paragraph 5.1 - Icing prevention and de-icing.

2.3 Escape and evacuation

IMO Guidance: Where supplementary or specialized lifesaving equipment is carried to address the possibilities of prolonged durations prior to rescue, abandonment onto ice or adjacent land, or other aspects specific to polar operations, the PWOM should contain guidance on the use of the equipment and provision for appropriate training and drills.

ABS Guidance: The Polar Code has guidance for Personal and Group Survival Equipment (also known as Personal and Group survival kits or PSKs, GSKs). But does not have a mandatory requirement for contents or even carriage of kits. ISO 24452 contains guidance that may be useful in determining the contents of kits. In many cases owners/operators opt to give their crews some equipment to help ensure their survival for the Maximum Expected Time of Rescue (at least 5 days). When any kits are provided, this paragraph is where procedures are provided to help ensure the survival equipment is available after abandonment. Quantities of supplies such as rations and water supplies are to be considered, IMO MSC.1/Circ.1614 contains guidance. Vessels fitted with freefall lifeboats and operating in areas where any ice may be present are to address the method of abandonment when ice may interfere with launching the lifeboat.

Example Content:

The decision and order to abandon the vessel can only be given by the Master. Abandoning in Polar waters should be very carefully considered given the remoteness of polar waters and the possible harsh environment. Abandonment should generally follow the procedures in the Emergency Plan (SMM-xx-yyy) with some additional considerations for polar waters:

Personal Survival Kits (PSKs) are stored in cabins along with the immersion suits. During an abandonment crew should bring their immersion suits and PSKs to the muster station. In the event that crew members cannot make it to their cabins, there are several generic PSKs as spares located at the muster station. The required contents for each individual PSK is given in Appendix 8 along with instructions on assembling the PSKs before a Polar waters voyage.

The freefall lifeboat should not be launched normally if there is any chance there is ice in the water. Before boarding and launching the boat, a thorough survey of the water surface is to be conducted. If the surface cannot be seen from deck due to poor visibility (e.g. fog or snow) than it should be

assumed that there is ice on the water. In the event there is ice in the water, the recovery davit can lower the lifeboat to the water. This system is not powered from the emergency generator, so if main power is out non-freefall lowering will not be available. If main power is out, {ship specific instructions here for launching freefall lifeboat with ice in the water}.

To ensure that maximum resources are available (water and rations) if possible and safe to do so, all lifesaving appliances are to be deployed during an abandonment. Once in the water the craft shall all be lashed together to maximize the target for detection of search and rescue. (See Division 3, Chapter 3, Paragraph 3.3 - Search and rescue).

The preferred survival craft is dependent upon the abandonment situation. Normally in open waters the lifeboat will be the preferred survival craft for its superior protection against the elements. Liferafts may be preferred if light weight and easy mobility is required such as a transfer to land for survival. (See Division 3, Chapter 3, Paragraph 3.1 - Ship emergency response).

During an abandonment it is normal practice to try to keep people out of the water, in Polar waters this is significantly more important. Polar waters are normally very cold compared to the more temperate climates where M.V. SOME GOOD SHIP normally operates. Water will very quickly remove heat when contact is made. This heat loss will dramatically reduce the likelihood of survival. If anyone gets wet during an abandonment, the PSKs contain a dry towel and a dry change of clothes. Getting people quickly dried off and into dry cloths will be essential for survival.

During an abandonment the master is to ensure that the essential polar survival equipment is brought to the lifesaving appliances. This includes:

- All normal abandonment equipment plus
- Airband radio
- Air Horns
- Personal survival kits
- Calibrated gas detector

Chapter 3 Coordination with emergency response services

IMO Guidance: None.

ABS Guidance: In many PWOMs this chapter is where the crew can go to get information on polar survival for the METR after abandonment. In this example PWOM, Polar Survival is broken out to into its own Chapter. In this chapter the crew are given guidance on search and rescue resources, including an up-to-date list of contacts. Many PWOMs also include oil spill response in polar waters in this chapter.

Example Content: None

3.1 Ship emergency response

IMO Guidance: The PWOM should include procedures to be followed in preparing for a voyage and in the event of an incident arising.

ABS Guidance: This paragraph has a significant resemblance to Division 3, Chapter 2 - Emergency response. Reference to the procedures required for ISM as well as the last chapter are normally

included here. This is a normal location for PWOM authors to insert or refer to the emergency communication contact list.

Example Content:

Appendix 9 of this PWOM contains a list of Emergency Contacts. This list is to be normally updated as needed and posted in normal communication locations around the vessel while in Polar Waters. These locations are to include:

- Bridge (near the radio station)
- Master's office
- Hospital (Telemedical assistance)

The ship's normal safety management procedures for response to incidents are to be followed with additional information provided in Division 3, Chapter 2 - Emergency response of this manual.

3.2 Salvage

IMO Guidance: The PWOM should include procedures to be followed in preparing for a voyage and in the event of an incident arising.

ABS Guidance: Division 3, Chapter 2, Paragraph 2.1 - Damage control, typically contains some references to salvage with respect to transfer of liquids. Paragraph 2.1 should be referenced here. Reference to Division 2, Chapter 1 should also be made for voyage planning with this paragraph adding any special considerations for salvage operations.

Example Content:

In order to avoid a situation where salvage is necessary, the procedures given in Division 2, Chapter 1 of this PWOM are to be followed.

The company has a salvage agreement with XXX and can be contacted by the phone number listed in Appendix 9.

Depending on the situation, salvage operations can be complex. The master, the emergency response team from the office, the salvage provider, and the ABS RRDA will need to work closely. Risk assessment guidelines as specified in the company's Safety Management System are to be used for each step of the salvage operation. Some guidance on tank entry and fluid transfers is given in Division 3, Chapter 2, Paragraph 2.1 - Damage control or this manual.

3.3 Search and rescue

IMO Guidance: The PWOM should contain information on identifying relevant Rescue Coordination Centres for any intended routes and should require that contact information and procedures be verified and updated as required as part of any voyage plan.

ABS Guidance: Refer to the Maximum Expected Time of Rescue (METR) calculation, for example see paragraph 6.3.1 of the operational Assessment report.

Example Content:

The Maximum Expected Time of Rescue (METR) was calculated during the operational assessment and determined to be within the required 5 days anywhere along the planned route to Red Dog. Therefore the M.V. SOME GOOD SHIP's survival equipment is equipped for survival for 5 days in

Polar Waters. During voyage planning the Search and Rescue (SAR) resources are to be identified and the METR calculation to be re-confirmed as valid for the current available SAR resources.

Appendix 9 of this PWOM contains a list of Emergency Contacts for the route to Red Dog. This list is to be updated as needed during voyage planning and the appropriate contacts are to be documented in the voyage plan (see Division 2, Chapter 1, Paragraph 0 -

Voyage Planning). The latest Global Maritime Distress and Safety System (GMDSS) documentation contains information on search and rescue capabilities.

Chapter 4 Procedures for maintaining life support and ship integrity in the event of prolonged entrapment by ice.

IMO Guidance: Where any ship incorporates special features to mitigate safety or environmental risks due to prolonged entrapment by ice, the PWOM should provide information on how these are to be set up and operated. This may include, for example, adding additional equipment to be run from emergency switchboards, draining systems at risk of damage through freezing, isolating parts of HVAC systems, etc.

ABS Guidance: For ships that are limited to Ice Free or Open Waters, this chapter is most likely not applicable, unless the operational plan is to push the end of the season as much as possible. If prolonged entrapment is possible the consideration for extremes must be included in this chapter. Experience has shown that the duration can approach an entire year as the vessel will likely have to wait for the ice to break up the next summer before it gets freed.

Example Content:

The M.V. SOME GOOD SHIP has the following operational profile in Polar Waters:

- From the northern Pacific Ocean through the Bering Strait to the port of Red Dog
- Operations in ice free waters only
- Operations in areas and times where the MDLT is above -10°C

The identified risks for this operational profile do not include prolonged entrapment in ice.

4.1 System configuration

IMO Guidance: None.

ABS Guidance: This paragraph gives details (or refers to details elsewhere) of all the systems and features of the vessel that will be used to sustain the persons onboard while trapped in the ice. This may include such things as helicopter deck or winching area for the delivery of provisions and crew changes. Emergency heating systems and fuel supplies. The resources for damage control if the ice pressure exceeds the vessel's capability to resist, and references to systems to be used for survival on the ice after abandonment.

Example Content:

Not applicable to the M.V. SOME GOOD SHIP.

4.2 System operation

IMO Guidance: None.

ABS Guidance: This paragraph is used to give the crew guidance on how to use all the systems detailed or referenced in paragraph 4.1.

Example Content:

Not applicable to the M.V. SOME GOOD SHIP.

Chapter 5 Survival in Polar Waters

IMO Guidance: None

ABS Guidance: This chapter is not in the model table of contents in the Polar Code Appendix II. It is added here to give a place for guidance for Polar Waters survival after an abandonment. This chapter is typically printed and included in the PSKs, as the "Polar survival guidance" recommended in for PSKs in the Polar Code Part I-B\9.1. In this chapter it is customary for authors to reference provided equipment and give guidance on how that equipment may be used to enable survival for the METR. Guidance should cover all probable modes of survival such as in lifeboat(s) on the water, in liferaft(s) on the water, survival on the ice, moving from on water to land etc. The key aspects of Polar survival is keeping people warm, dry, and hydrated. Secondary aspects are considerations for CO2 levels, battery life, and predator defense. Reference is often made to IMO MSC.1/Circ.1185 – GUIDE FOR COLD WATER SURVIVAL, and this guide also included with the PSK "Polar Survival Guidance".

For vessels that have very little or no additional hazards for Polar water operations, this section may simply reference the company's normal procedures for survival in the vessel's provided lifesaving appliances. In those cases, consideration should still be given here for how the crew are to survive in the craft for the METR.

Example Content:

M.V. SOME GOOD SHIP has no GSKs, moving to land is an unlikely option after abandonment in the Bering Sea. The Master and crew must be aware that there is no special equipment on the M.V. SOME GOOD SHIP to support survival on land. See OA report 6.3.3.

The M.V. SOME GOOD SHIP has a Maximum Expected Time of Rescue (see the Polar Ship Certificate) of 5 days. The lifesaving appliances in association with these guidelines and a knowledgeable/trained crew are to be able to support survival for the METR.

During an abandonment, all efforts to launch all survival appliances should be made to ensure maximum resources are available. As with survival after abandonment in any waters, grouping all the survival craft together will enhance detection and rescue efforts.

The IMO Guide for Cold Water Survival (MSC.1/Circ.1185/Rev.1) is a good reference to be reviewed during training/familiarization.

Training:

As per Division 2, Chapter 1, Paragraph 1.4 - Human resources management, all watch keepers are to undergo Polar Familiarization training with the master. This is to be directed and documented using the form given in Appendix 5 of this PWOM. Part of that training is to include a review of this chapter.

EPIRB battery:

The EPIRB installed on the M.V. SOME GOOD SHIP has a 48 hour (@-20°C) battery life. This is insufficient for the 5 day METR (120 hours). During an abandonment the EPIRB is one of the communications systems to be brought to the survival craft as per procedure XXX in the Safety Management System. To achieve the METR, the EPIRB will be cycled off-on in a manner that will stretch the 48 hours to the required 120 hours, with a heavier focus on the hours immediately following an abandonment. The Master or his/her delegate will assign a crew member the task of monitoring the time and switching the EPIRB following this schedule, the left column is intended for check marks to indicate the line has been completed (days of monotony in a survival craft can make it difficult to keep track):

Complete	Hours after abandonment	EPIRB Power	Hours of battery consumption
	0 to X_1	On	X_1
	X_1 to X_2	Off	X_1
	X_2 to X_3	On	$X_1 + (X_3 + X_2)$
	X_3 to X_4	Off	$X_1 + (X_3 + X_2)$
	…	…	…
	X_n to 120 hrs	On	48 hrs

SART battery:

The M.V. SOME GOOD SHIP is equipped with two Search and Rescue Transponders (SARTs). Each SART has a rated standby battery life of 96 hours. Battery life is much less once the unit is interrogated but that means there is a radar nearby, therefore battery life is no longer a concern. To ensure the SARTs last for the METR, one unit will be activated first. After 4 days (96 hours) the second one will be activated.

Handheld GMDSS Radio batteries:

With the survival craft secured together the three separate handheld radios will not be needed for communication from craft to craft. Therefore, all radios are to be turned off except for one (1) radio. This one will be used to monitor incoming communications. The battery level is to be checked every XXX hours. Three radios and XXX spare batteries for each radio for a total of XXX batteries. Each battery is a XXX mAh battery which the manufacturer states will last for XXX hours on standby and battery saving turned on, therefore achieving the 5 day (120 hour) METR.

Airband Radio battery:

To conserve battery power, the handheld aircraft emergency channel radio provided on the M.V. SOME GOOD SHIP will be always kept off after abandonment except for when a commercial aircraft is expected to be in the area. Aircraft detection can be visual or from the jet engine sounds.

Personal Survival Kits (PSK):

Personal survival kits (Personal Survival Equipment) are intended to increase the chances of survival after an abandonment in Polar Waters. ISO 24452 can be referenced for guidance on the PSK contents. The only abandonment scenarios applicable for the M.V. SOME GOOD SHIP's planned voyage to Red Dog is via the standard SOLAS life saving appliances and await rescue on the water.

Crew of the M.V. SOME GOOD SHIP are responsible for assembling their own PSK prior to entry into Polar Waters. The ship will provide the carrying bag and the following contents:

- Thermal protective aid,
- Drinking mug/bottle,
- Polar Survival Guidance,
- Food rations for 1 day (5,000 kJ) and fresh water for 2 days (4 L)
- Towel

PSKs are to be packed with a clean and dry change of cloths, that fit well and would be comfortably worn under an immersion suit. The clothing to include is:

- Socks,
- Underwear,
- Trousers,
- Long sleeve shirt,
- Gloves, and
- A warm hat
- Gloves/mittens.

To comply with the Polar Code's required 110% of PSKs, there are to be a total of XXX PSKs prepared. Each crew member is to assemble their own. The balance to make up XXX are to be packed with generic one size fits all clothing.

The PSK in intended to be used to help crew get dry after abandonment and in survival mode in the lifeboat of a liferaft. Once dry, the contents of the PSK in association with the lifeboat/liferaft and the immersion suit is intended to help keep crew warm while awaiting rescue.

Group Survival Kits:

The M.V. SOME GOOD SHIP does not have GSKs as there is no intention to abandon the ship onto ice or onto land. In a survival situation, the master can decide to move from a water-based survival to land based if he/she believes it will enhance survival. If this scenario is contemplated it should be considered that the vessel is not fitted with Group Survival Kits intended for land or ice-based survival, therefore the water-based survival supplies as per SOLAS are what is available to support survival.

Food and Water Rations:

The lifeboat is a XXX-person freefall lifeboat with the standard SOLAS equipment. This means it has 10,000 kJ per person. This is sufficient for XXX days in accordance with the guidelines in IMO MSC.1/Circ.1614. The M.V. SOME GOOD SHIP has two liferafts, each has a XXX -person capacity, and each one has 10,000 kJ per person. There is also a 6-person raft forward that is not included here. With the lifeboat, both liferafts and the PSK, each person has sufficient rations for XXX days.

The lifeboat is provided with 3 L of fresh water per person and the liferafts are provided with 1.5 L per person. This totals XXX L of fresh water or XXX L per person, plus the 4 L in each PSK. This is enough for 5 days in accordance with the guidelines in IMO MSC.1/Circ.1614.

Human factors:

The ABS Guide for Vessels Operating in Low Temperature Environments (LTE Guide) has an appendix section describing the effects of cold on the human body.

Recent discussions at IMO are in regards of CO_2 levels in lifesaving craft. This is especially true for operations in Polar waters where the hatches and doors will be closed more due to the cooler air temperatures. The M.V. SOME GOOD SHIP has a calibrated gas detector for use while doing ballast tank inspections. This meter is to be brought into the lifeboat during an abandonment and used to test the air in the lifeboat every XXX hours. If CO_2 levels are found to be rising, the hatch and door for the lifeboat should be opened for a few minutes to allow fresh air into the lifeboat.

Predator Defence:

Polar bears can be a serious threat to survivors on land or ice. In the water a bear is a threat to anyone in the water and can be a threat to liferafts. Their teeth and claws can puncture the chambers of a raft, although it is unlikely, they would attack a raft, so if a bear is spotted while in the raft remain calm and stay inside the raft. Polar Bears are not afraid of humans, but they can be driven off with loud noises. The rescue boat should be used to tow the rafts away from the bear. Anyone in the rescue boat should be careful not to have arms of legs over the sides and stay as far away from the bear as possible.

Polar Bears pose little to no danger to the lifeboat when in the water and not near an ice edge. While in the lifeboat and a polar bear is swimming nearby, make sure everyone remains completely inside the lifeboat make sure there are no arms out through the hatch or door. Start the motor and try to carefully move away from the animal, making sure not to strike it with the lifeboat especially the propeller.

Air horn are provided as a means of defence against the bears.

Division 4. Joint operations

IMO Guidance: None

ABS Guidance: This division of the PWOM is used to give master and crew guidance on how to work with other vessels in close quarters. If the ship is limited to Ice-Free or Open waters this section is usually not applicable. If this section is applicable than details of the manually initiated flashing red stern light and/or and the sound signalling system is to be given here.

Example Content:

No joint operations are planned with the M.V. SOME GOOD SHIP, therefore the vessel is not fitted with the manually activated flashing red stern light or a sound signaling system.

Chapter 1 Escorted operations

IMO Guidance: The PWOM should contain or reference information on the rules and procedures set out by coastal States who require or offer icebreaking escort services. The manual should also emphasize the need for the master to take account of the ship's limitations in agreeing on the conduct of escort operations.

ABS Guidance: This chapter is used to describe (or refer to descriptions of) operations with an icebreaker such as:

- Guidance for how to request icebreaker escort.
- Descriptions of expected communications with the icebreaker,
- Guidance on how to maneuver the vessel to avoid colliding with the icebreaker,
- Guidance for towed operations,
- Guidance on the use of POLARIS, while under escort,
- Any necessary guidance for local escort

Example Content:

Not applicable to the M.V. SOME GOOD SHIP.

The M.V. SOME GOOD SHIP is not ice strengthened and is intended for ice free water operations only, as such the master shall not plan or execute operations requiring icebreaker escort services unless required by authorities or in emergency situations at the direction of the local authorities.

Chapter 2 Convoy operations

IMO Guidance: None.

ABS Guidance: This chapter is only applicable if the vessel is intended to operate in areas where convoy operations are likely to occur. In addition to the guidance above in Chapter 1 for Escorted operations, this chapter expands that to having a non-icebreaker in front and behind. Guidance on how to read the convoy operations, monitor communications and be prepared to stop quickly meanwhile alerting the vessel directly behind.

Example Content:

Not applicable to the M.V. SOME GOOD SHIP.

Division 5. Pollution Prevention

IMO Guidance: None

ABS Guidance: This division is intended to give the crew information on the requirements of the pollution prevention chapters of the Polar Code (Part II-A). Part II-A is prescriptive requirements and can be generally stated in this part of the PWOM to give the crew guidance on what is needed to comply. Copying and pasting the Polar Code's operational requirements that are applicable to the vessel is common practice for PWOM authors.

Example Content: None

Chapter 1 Prevention Of Pollution By Oil

IMO Guidance: None

ABS Guidance: None

Example Content:

See Part 2, Division 1, Chapter 4 - Voyage duration.

The following is the regulations from Part II-A that are applicable to the M.V. SOME GOOD SHIP:

> *1.1.1 In Arctic waters any discharge into the sea of oil or oily mixtures from any ship shall be prohibited.*
>
> *1.1.4 Operation in polar waters shall be taken into account, as appropriate, in the Oil Record Books, manuals and the shipboard oil pollution emergency plan or the shipboard marine pollution emergency plan as required by MARPOL Annex I.*

The M.V. SOME GOOD SHIP is to retain all oil and oily mixtures while in Polar Waters. The Oil Record book is to include an entry for whenever the vessel crosses into Polar Waters and exits Polar Waters.

Chapter 2 Control Of Pollution By Noxious Liquid Substances In Bulk

IMO Guidance: None

ABS Guidance: None

Example Content:

The M.V. SOME GOOD SHIP does not carry NLS, therefore this chapter is not applicable.

Chapter 3 Prevention Of Pollution By Harmful Substances Carried By Sea In Packaged Form

IMO Guidance: None

ABS Guidance: None

Example Content:

This chapter is blank in the Polar Code; therefore, this is not applicable to the M.V. SOME GOOD SHIP.

Chapter 4 Prevention Of Pollution By Sewage From Ships

IMO Guidance: None

ABS Guidance: None

Example Content:

See Part 2, Division 1, Chapter 4 - Voyage duration.

The following is the regulations from Part II-A that are applicable to the M.V. SOME GOOD SHIP:

4.1 Definitions

4.1.2 Ice-shelf means a floating ice sheet of considerable thickness showing 2 to 50 m or more above sea-level, attached to the coast.19

4.1.3 Fast ice means sea ice which forms and remains fast along the coast, where it is attached to the shore, to an ice wall, to an ice front, between shoals or grounded icebergs.

4.2 Operational requirements

4.2.1 Discharges of sewage within polar waters are prohibited except when performed in accordance with MARPOL Annex IV and the following requirements:

.1 the ship is discharging comminuted and disinfected sewage in accordance with regulation 11.1.1 of MARPOL Annex IV at a distance of more than 3 nautical miles from any ice-shelf or fast ice and shall be as far as practicable from areas of ice concentration exceeding 1/10; or

.2 the ship is discharging sewage that is not comminuted or disinfected in accordance with regulation 11.1.1 of MARPOL Annex IV and at a distance of more than 12 nautical miles from any ice-shelf or fast ice and shall be as far as practicable from areas of ice concentration exceeding 1/10; or

.3 the ship has in operation an approved sewage treatment plant certified by the Administration to meet the operational requirements in either regulation 9.1.1 or 9.2.1 of MARPOL Annex IV, and discharges sewage in accordance with regulation 11.1.2 of Annex IV and shall be as far as practicable from the nearest land, any ice-shelf, fast ice or areas of ice concentration exceeding 1/10.

The sewage treatment plant on the M.V. SOME GOOD SHIP is a certified plant. All sewage discharged from the M.V. SOME GOOD SHIP will be done through the treatment plant. If the plant is offline for any reason, the sewage is to be retained onboard until out of Polar Waters. Prior to discharge of any sewage the bridge is to be contacted and requested information of any ice in the area, and notification of the discharge. An entry into the {deck/engine} logbook is to be made indicating ice conditions/locations and the time of discharge commencement and completion and estimated volume.

Chapter 5 The M.V. SOME GOOD SHIP is to Prevention Of Pollution By Garbage From Ships

IMO Guidance: None

ABS Guidance: None

Example Content:

See Part 2, Division 1, Chapter 4 - Voyage duration.

The following is the regulations from Part II-A that are applicable to the M.V. SOME GOOD SHIP:

5.1 Definitions

5.1.1 Ice-shelf means a floating ice sheet of considerable thickness showing 2 to 50 m or more above sea-level, attached to the coast.

5.1.2 Fast ice means sea ice which forms and remains fast along the coast, where it is attached to the shore, to an ice wall, to an ice front, between shoals or grounded icebergs.

5.2 Operational requirements

5.2.1 In Arctic waters, discharge of garbage into the sea permitted in accordance with regulation 4 of MARPOL Annex V, shall meet the following additional requirements:

.1 discharge into the sea of food wastes is only permitted when the ship is as far as practicable from areas of ice concentration exceeding 1/10, but in any case not less than 12 nautical miles from the nearest land, nearest ice-shelf, or nearest fast ice;

.2 food wastes shall be comminuted or ground and shall be capable of passing through a screen with openings no greater than 25 mm. Food wastes shall not be contaminated by any other garbage type;

.3 food wastes shall not be discharged onto the ice;

.4 discharge of animal carcasses is prohibited; and

.5 discharge of cargo residues that cannot be recovered using commonly available methods for unloading shall only be permitted while the ship is en route and where all the following conditions are satisfied:

.1 cargo residues, cleaning agents or additives, contained in hold washing water do not include any substances classified as harmful to the marine environment, taking into account guidelines developed by the Organization;

.2 both the port of departure and the next port of destination are within Arctic waters and the ship will not transit outside Arctic waters between those ports;

.3 no adequate reception facilities are available at those ports taking into account guidelines developed by the Organization; and

.4 where the conditions of subparagraphs 5.2.1.5.1, 5.2.1.5.2 and 5.2.1.5.3 of this paragraph have been fulfilled, discharge of cargo hold washing water containing residues shall be made as far as practicable from areas of ice concentration exceeding 1/10, but in any case not less than 12 nautical miles from the nearest land, nearest ice shelf, or nearest fast ice.

...

5.2.3 Operation in polar waters shall be taken into account, as appropriate, in the Garbage Record Book, Garbage Management Plan and the placards as required by MARPOL Annex V.

Prior to any otherwise allowable discharge of any garbage the bridge is to be contacted and requested information of any ice in the area, and notification of the discharge. An entry into the {deck/engine} logbook is to be made indicating ice conditions/locations and the time of discharge.

Chapter 6 Other Prevention Of Pollution

IMO Guidance: None

ABS Guidance: This is an additional section intended for new upcoming regulations or any additional guidance the owners/operators want to give to the crew.

Example Content:

Resolution MEPC.329(76) amends MAPROL Annex I, prohibiting the use and carriage for use as fuel of heavy fuel oil by ships in Arctic waters. Heavy fuels are banned from Antarctic waters by MARPOL Annex I, Chapter 9. The ban for Arctic waters comes into effect on 1 July 2024 unless the ship is a Polar Code Category A or B ship (Ice Class PC7 up to Ice Class PC1) or was designed and built-in accordance with MARPOL Regulation 12A, "Oil Fuel Tank Protection". In these cases, the prohibition of use and carriage of heavy fuel comes into effect on 1 July 2029. The M.V. SOME GOOD SHIP was designed and built in accordance with MARPOL Regulation 12A, therefore the heavy fuel ban comes into effect on 1 July 2029.

Appendix 1

Sea ice data from ABS and explanations of how to read the data.

This appendix is intentionally left blank as the data should be up to date and specific for the vessel and the intended operation. Example data is provided in the Advisory Appendix I.

Appendix 2

ABS Temperature analysis figures

This appendix is intentionally left blank as the data should be up to date and specific for the vessel and the intended operation. Example data is provided in the Advisory Appendix I.

Appendix 3

ABS HETC historical precipitation data

This appendix is intentionally left blank as the data should be up to date and specific for the vessel and the intended operation. Example data is provided in the Advisory Appendix I.

Appendix 4

ABS HETC historical ice accretion estimates

This appendix is intentionally left blank as the data should be up to date and specific for the vessel and the intended operation. Example data is provided in the Advisory Appendix I.

Appendix 5

Polar Familiarization form

This appendix is intentionally left blank as the subject document is to be ship and operation specific.

Appendix 6

Polar Operations Planning Aid Checklist

This appendix is intentionally left blank as the subject document is to be ship and operation specific.

Appendix 7

Communications systems test checklist

This appendix is intentionally left blank as the subject document is to be ship and operation specific.

Appendix 8

Personal Survival Kits

This appendix is intentionally left blank as the contents of the Personal Survival Kits this is to be specific to the vessel and the operations. See Polar Code Part I-B or ISO/DIS 24452 for guidance.

Appendix 9

List of Emergency Contacts

This appendix is intentionally left blank as this is to be specific to the vessel and the operations.


Company's
Logo Here

APPENDIX IV – EXAMPLE OF POLAR WATER OPERATIONAL MANUAL CHECKLIST

Guidance notes for the development of Polar Waters Operational Manual (PWOM) along with an Operational Assessment (OA):

This checklist is intended for Category C shipowners who are nearly ready to submit a Polar Waters Operational Manual (PWOM) to ABS for review. The checklist isn't guaranteed to be all inclusive but this checklist will cover all of the critical and important points for ABS' review.

The checklists are broken into 4 separate sections:

Section 1 is exactly what ABS first looks at before the review even begins. If these items are not readily available in the Operational Assessment report or the PWOM, the documents will be returned. These are very high level items and are required as part of the Operational Assessment. Making these items clear and obvious will greatly enhance the review time.

Section 2 is the closer PWOM review items. These are the aspects of the PWOM that ABS will actually review. Most comments arise from these items.

Section 3 includes the items of information that ABS must have in order to complete the certificate. This information is typically in the PWOM as a mock certificate, for the information of the crew. This mock certificate can be replaced with the actual certificate once it's issued. ABS has specific terminology to be used on the certificate and the review engineer can help/provide you with this.

Section 4 is the systems and equipment on the ship. The ship's system must match what is being said in the PWOM, as well as there are a few Polar Code required items that are prescriptive. These details are not typically included in a PWOM but it is information that ABS requires and often forms the basis of comments requesting more information. There are questions in this section that will be redundant with section 2, but in this section is considering the actual installations on board the ship whereas section 2 was referring only to the PWOM.

Questions	*Reg.*	*Yes*	*No*	*N/A*	*PWOM reference*
1. PWOM/OA - High level					
Does PWOM/Operational Assessment report follow Flag Administration's Guidelines?	-	☐	☐	☐	
Does the PWOM contain at least the items in Appendix II of the Polar Code?	Appendix II	☐	☐	☐	
Does the Operational Assessment report and/or PWOM clearly define the applicable Hazards?[1] Hazards to be addressed include:	Introduction/3				
a. Sea ice	Introduction/3.1.1	☐	☐	☐	
b. Ice accretion/Snow accumulation	Introduction/3.1.2	☐	☐	☐	
c. Low air temperature	Introduction/3.1.3	☐	☐	☐	PST = °C
d. Extended periods of darkness/light	Introduction/3.1.4	☐	☐	☐	
e. High latitude	Introduction/3.1.5	☐	☐	☐	
f. Remoteness, Lack of hydrographic data, reduced navigational aids, limited SAR, delays in time of rescue	Introduction/3.1.6	☐	☐	☐	
g. Lack of crew experience	Introduction/3.1.7	☐	☐	☐	
h. Lack of suitable emergency response equipment	Introduction/3.1.8	☐	☐	☐	
i. Rapidly changing weather	Introduction/3.1.9	☐	☐	☐	
j. Sensitive environment	Introduction/3.1.10	☐	☐	☐	
k. Any additional hazards identified in the operational assessment	Part I-A/1.5.3	☐	☐	☐	
l. Abandonment onto ice or land	Part I-A/1.5.1.4	☐	☐	☐	
m. Low sea water temperature	Introduction/3.1.3	☐	☐	☐	
n. The maximum expected time of rescue	Part I-A/1.2.7	☐	☐	☐	
Does the OA identify the anticipated need for individual or group survival equipment?	I-A/8.3.3.3.2	☐	☐	☐	

[1] All hazards are to be addressed. Hazards that were considered to be low risk during the Operational Assessment are also to be clearly stated, indicating why they are considered low risk. tems a thru n are marked "Yes" if the hazard is applicable to the operational profile. "N/A" if hazard was considered but not applicable to the operational profile and "No" if not in compliance.

Question	Reg	Yes	No	N/A	PWOM reference
2. PWOM/OA - Lower level (Detailed)					
Does the PWOM include information on ship specific capabilities and limitations?	Part I-A/2.2.2	☐	☐	☐	
a. *Does the PWOM contain the methodology used to determine capabilities and limitations in ice? (e.g. POLARIS)*	Part I-A/2.3.2 Part I-A/2.3.6	☐	☐	☐	
Does the PWOM contain procedures for normal operations and in order to avoid encountering conditions that exceed the ship's capability? Including risk based procedures for:	Part I-A/2.2.3	☐	☐	☐	
a. *Voyage planning (avoid ice and temperatures exceeding the capability)*	Part I-A/2.3.3.1	☐	☐	☐	
b. *Receiving forecasts*	Part I-A/2.3.3.2	☐	☐	☐	
c. *Means of addressing limitations to hydrographic, metrological and navigational information*	Part I-A/2.3.3.3	☐	☐	☐	
d. *Operation of any equipment required by the Polar Code.*	Part I-A/2.3.3.4	☐	☐	☐	
e. *Implementation of special measures to maintain equipment and system functionality in Low temperatures, Ice accretion, and presence of sea ice.*	Part I-A/2.3.3.5	☐	☐	☐	
Does the PWOM contain (or refer to) procedures for dealing with incidents in Polar Waters? Including risk based procedures for:	Part I-A/2.2.4	☐	☐	☐	
a. *Contacting emergency response providers.* Does the PWOM contain, or reference, contact info and instructions for Maritime Rescue Coordination Centers (MRCC)	Part I-A/2.3.4.1	☐	☐	☐	
b. *Maintaining life support and ship integrity in the event of prolonged entrapment in ice. (Only for ships with an ice class notation)*	Part I-A/2.3.4.2	☐	☐	☐	
What is the maximum expected time of rescue (METR) and is selection of this METR justified?	Part I-A/1.2.7	☐	☐	☐	
Does the PWOM contain (or refer to) procedures to be followed if conditions encountered exceed the ship's capability?	Part I-A/2.2.5	☐	☐	☐	
a. *Does the PWOM contain risk based procedures for measures to be taken in the event of encountering ice and/or temperatures that exceed the ship's design capabilities?*	Part I-A/2.3.5	☐	☐	☐	

Question	Reg	Yes	No	N/A	PWOM Reference
2. PWOM/OA - Lower level – (Detailed) continued					
If the ship will operate with ice breaker assistance. The PWOM is to contain procedures for such operations.	Part I-A/2.2.5	☐	☐	☐	
If Ice accretion / Snow accumulation is considered a hazard:	Part I-A/2.3.3.5 Part I-A/8.3.1.1				
a. *PWOM is to have procedures for monitoring ice accretion and snow accumulation on escape routes, LSA, firefighting equipment, exposed machinery, doors and hatches.*	I-A/7.2.1.1 I-A8.3.1.1 Part I-A/5.3.1 Part I-A/6.3.1.1	☐	☐	☐	
b. *PWOM is to have procedures for safe ice and snow removal using equipment provided.*	I-A/7.2.1.1 & 7.2.1.4 I-A8.3.1.1	☐	☐	☐	
c. *PWOM is to have procedures when ice/snow removal procedures are to be activated. (Limitations)*	I-A/2.3.3.5	☐	☐	☐	
d. *PWOM is to have guidance for navigation to minimize ice accretion (voyage planning).*	I-A/2.3.3.1 I-A/11.1	☐	☐	☐	
e. *PWOM is to have procedures for ensuring the isolation and P/V valves are available at all times?*	Part I-A/7.3.1.1	☐	☐	☐	
If Low Air Temperature is considered a hazard:	Part I-A/1.4.3				
a. *Is a Polar Service Temperature (PST) defined?*	I-A/1.2.11 I-A/2.2.2	☐	☐	☐	
b. *PWOM is to have procedures for monitoring LSA in low temperatures.*	I-A/1.4.3 I-A/2.3.3.5 I-A/8.2.1.2 I-A/8.2.2	☐	☐	☐	
c. *PWOM is to have procedures for actions to take to prevent or remedy the effects of low temperatures.*	I-A/2.3.3.5 I-A/2.3.5	☐	☐	☐	
d. *PWOM is to have procedures for when crew action is required.*	I-A/2.3.3.5	☐	☐	☐	
e. *Does the PWOM contain procedures to ensure the LSA are operational at the PST for the maximum expected time of rescue?*	Part I-A/1.4.3	☐	☐	☐	
f. *Does the PWOM have procedures for the prevention of freezing or excessive viscosity of liquids used in closing devices for hatches and doors*	Part I-A/5.3.2.1	☐	☐	☐	

Question	*Reg*	*Yes*	*No*	*N/A*	*PWOM Reference*
2. PWOM/OA - Lower level – (Detailed) continued					
If the assessment identified the anticipated need for individual or group survival equipment:	-				
a. Does the PWOM contain or refer to procedures for instructing passengers on the use of the personal survival equipment?	I-A/8.3.3.3.6	☐	☐	☐	
b. Does the PWOM contain or refer to procedures for training crew on the use of all survival equipment?	I-A/8.3.3.3.7	☐	☐	☐	
If the assessment identified low sea water temperature or sea ice as a hazard	Intro/3.1.3 or 3.1.1				
a. Does the PWOM have procedures for clearing sea suctions and strainers feeding fire pumps?		☐	☐	☐	
b. Does the PWOM include information on sea water intake temperature and procedures to maintain the water temp?	Part I-A/6.3.1.1				
If the assessment identified Abandonment onto ice or land is possible:	Intro/3.1.1 I-A/1.5.1.4	☐	☐	☐	
a. Does the PWOM indicate how the survival equipment is to be made accessible following abandonment?	I-A/8.3.3.3.3.4	☐	☐	☐	
b. Does the PWOM contain procedures to instruct passengers on the use of survival equipment?	I-A/8.3.3.3.3.6	☐	☐	☐	
c. Does the PWOM contain procedures to instruct crew on the use of survival equipment?	I-A/8.3.3.3.3.7	☐	☐	☐	

Question	Reg	Yes	No	N/A	PWOM Reference
3. Details for Certificate					
Is the following information available?	Appendix I				
a. Ice Class and Ice Strengthened Draft Range	-	☐	☐	☐	
b. Ship restrictions (ice free, open waters, other ice conditions)	-	☐	☐	☐	
c. Polar Service Temperature	-	☐	☐	☐	
d. Maximum expected time of rescue	-	☐	☐	☐	
e. Alternative design and arrangements	-	☐	☐	☐	
f. Operational Limitations:	-	☐	☐	☐	
a. Ice Conditions	-	☐	☐	☐	
b. Temperature	-	☐	☐	☐	
c. High Latitudes	-	☐	☐	☐	
g. Equipment to be listed on the supplement	-	☐	☐	☐	

	Question	Reg	Yes	No	N/A	
4. Ship's Systems, Equipment, and Arrangements						
A.	ALL SHIPS					
1.	Firefighter outfits stored in warm location?	I-A/7.3.2.3	☐	☐	☐	
2.	Location of extinguishers vs rated temperatures	I-A/7.3.3.1	☐	☐	☐	
3.	For new ships: Are exposed escape routes arranged so as not to hinder passage by persons wearing polar clothing?	I-A/8.3.1.2	☐	☐	☐	
4.	Are immersion suits of the insulated type?	I-A/8.3.3.1.2 LSA 2.3.2.2	☐	☐	☐	
5.	Are lifeboats partially or totally enclosed?	I-A/8.3.3.3.1	☐	☐	☐	
i	*Are sufficient food rations provided for the ETR?*	I-A/8.3.3.4	☐	☐	☐	
ii	*Is there 2L/person per day of drinking water?*	-	☐	☐	☐	
6.	If the OA identifies the need for survival equipment:		☐	☐	☐	
i	*Are life-saving appliances and/or group survival equipment effective protection against wind?*	I-A/8.3.3.3.2.1	☐	☐	☐	
ii	*Does group and individual survival equipment provide sufficient insulation to maintain core temperature of persons?*	I-A/8.3.3.3.2.2	☐	☐	☐	
iii	*Does personal survival equipment protect against frostbite of extremities?*	I-A/8.3.3.3.2.3	☐	☐	☐	
iv	*Are sufficient food rations in group survival equipment provided for the ETR?*	I-A/8.3.3.4	☐	☐	☐	
7.	Verify the ship complies with SOLAS V/22.1.9.4?	Part I-A/9.3.2.1.2	☐	☐	☐	
8.	Verify the ship has a clear view astern?	Part I-A/9.3.2.1.2	☐	☐	☐	
9.	Verify the ship has sufficient oil or oily mixtures holding capacity for the intended operational profile.	Part II-A/1.2.2	☐	☐	☐	
10.	Are fire pumps located in compartments maintained above 0°C?	Part I-A/7.3.2.1	☐	☐	☐	
11.	Confirm that exposed fire main is:					
i)	*Arranged so exposed sections can be isolated*		☐	☐	☐	
ii)	*Effectively drained*		☐	☐	☐	
12.	Is the ship provided with the means necessary to obtain ice information as per the PWOM?	Part I-A/9.3.1	☐	☐	☐	
13.	Two non-magnetic means to determine and display heading	Part I-A/9.3.2.2.1	☐	☐	☐	
14.	Remotely rotatable, narrow-beam search lights	Part I-A/9.3.3.1	☐	☐	☐	

	Question	*Reg*	*Yes*	*No*	*N/A*	
4. Ship's Systems, Equipment, and Arrangements						
B.	ALL SHIPS - continued					
15.	Two-way on-scene and SAR coordination communication capability	Part I-A/10.3.1.3	☐	☐	☐	
16.	Two-way voice and data communication with a Telemedical Assistance Service (TMAS)	Part I-A/10.3.1.4	☐	☐	☐	
C.	ALL SHIPS – ICEBREAKER ESCORT					
17.	Manually initiated flashing red light visible from astern (escorted)	Part I-A/9.3.3.2	☐	☐	☐	
18.	Sound signaling system mounted to face astern (if vessel is providing the escort)	Part I-A/10.3.1.2	☐	☐	☐	
D.	NEW SHIPS WITH ICE CLASS NOTATIONS					
19.	Redundant echo-sounding device(s)	Part I-A/9.3.2.1.1	☐	☐	☐	
E.	HIGH LATITUDES					
20.	At least one GNSS compass or equivalent	Part I-A/9.3.2.2.2	☐	☐	☐	
21.	Communication equipment on board has the capabilities for ship-to-ship and ship-to-shore communication	Part I-A/10.3.1.1	☐	☐	☐	
F.	ICE ACCRETION / SNOW ACCUMULATION					
22.	Are all exposed components of fire safety systems and appliances protected from ice accretion and snow accumulation?	I-A/7.2.1.1	☐	☐	☐	
23.	Are all escape routes, muster stations, embarkation areas, survival craft, their launching appliances, and access to the survival craft protected from snow accumulation and ice accretion?	I-A/8.3.1.1	☐	☐	☐	
24.	Is the ship equipped with the means for removing snow and ice in accordance with the PWOM procedures?	I-A/7.2.1.1 & 7.2.1.4 I-A8.3.1.1	☐	☐	☐	
25.	Are fire main isolation valves and P/V valves protected from ice accretion at all times?	I-A/7.3.1.1	☐	☐	☐	
26.	Is Independent sea suction used capable of being cleared of ice accumulation?	I-A/7.3.2.4	☐	☐	☐	

	Question	*Reg*	*Yes*	*No*	*N/A*	
4. Ship's Systems, Equipment, and Arrangements - continued						
G.	LOW AIR TEMPERATURE					
27.	Are exposed portable and semi-portable extinguishers operable at the PST?	I-A/7.3.3.1	☐	☐	☐	
28.	Is all components and materials of exposed fire safety systems available and effective at the PST?	I-A/7.2.2.1, 7.2.2.2 &7.3.3.2	☐	☐	☐	
29.	Has LSA been tested or proven to be fully functional to the PST?	I-A/1.4.3	☐	☐	☐	
30.	Have embarkation arrangements been assessed for persons wearing polar clothing?	I-A/8.3.1.3	☐	☐	☐	
31.	Do all survival craft have the required communication equipment available?	I-A/10.3.2	☐	☐	☐	
32.	Extinguishing media shall be suitable for the intended operation?	I-A/7.2.1.5	☐	☐	☐	
33.	Can fire main exposed sections be isolated and means of draining is provided?	I-A/7.3.2.2	☐	☐	☐	
34.	Verify that the hull structural materials are suitable for service at the PST.	Part I-A/3.2.1	☐	☐	☐	
35.	Are exposed essential machinery installations functional at the PST?	Part I-A/6.3.2.1	☐	☐	☐	
36.	Is a means provided to maintain combustion air at compliant temperature?	Part I-A/6.3.2.2	☐	☐	☐	
37.	Are materials of exposed machinery and foundations approved for PST?	Part I-A/6.3.2.3	☐	☐	☐	
38.	Communication devices for **rescue boats and lifeboats**	Part I-A/10.3.2.1	☐	☐	☐	
39.	Communication devices for **other survival craft**	Part I-A/10.3.2.2	☐	☐	☐	
40.	Verify the two-way portable radios for firefighting are suitable for use at the PST.	Part I-A/7.3.1.2	☐	☐	☐	

	Question	Reg	Yes	No	N/A	
4. Ship's Systems, Equipment, and Arrangements - continued						
H.	SEA ICE					
41.	Does the ship have a means of safe evacuation of persons and survival equipment in ice covered waters, including onto ice as applicable?	I-A/8.3.2.1	☐	☐	☐	
I.	ABANDONMENT ONTO ICE OR LAND					
42.	Is group survival equipment provided, or equivalent functionality from normal life-saving appliances?	I-A/8.3.3.3.3.1	☐	☐	☐	
43.	If the OA identifies the need for survival equipment.		☐	☐	☐	
i	*Is equipment (personal and group) sufficient for 110% of persons onboard?*	I-A/8.3.3.3.3.2	☐	☐	☐	
ii	*Is survival equipment stowed in easily accessible locations?*	I-A/8.3.3.3.3.2	☐	☐	☐	
iii	*Are the containers for group survival equipment designed for easily movable over ice and floatable?*	I-A/8.3.3.3.3.3	☐	☐	☐	
iv	*Are arrangements in place to ensure availability of survival equipment following abandonment?*	I-A/8.3.3.3.4	☐	☐	☐	
v	*If survival equipment is carried in addition to persons in survival craft. Is the craft and launching appliances rated to accommodate the extra load?*	I-A/8.3.3.3.5	☐	☐	☐	
J.	EXTENDED PERIODS OF DARKNESS					
44.	Is each lifeboat equipped with a searchlight suitable for the identification of ice?	I-A/8.3.3.2	☐	☐	☐	
45.	Is the searchlight capable of operation for the expected duration of darkness?	-	☐	☐	☐	
K.	LOW SEA WATER TEMPERATURE					
46.	Are manufacturer's ratings for minimum sea water temperature available?		☐	☐	☐	
47.	Are arrangements available to maintain cooling water at a temperature compliant with equipment manufacturer's ratings? As per the PWOM.	Part I-A/6.3.1.1	☐	☐	☐	

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