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Northern Sea Route Handbook (Practical Edition) Volume Ⅱ

The Japan Association of Marine Safety

Northern Sea Route Handbook, Practical Edition (Volume Two)
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Translation after chapter3 is omitted.

Chapter 1 Rules for Operation of Ships on the Northern Sea Routes

1. Polar Code and Related Conventions

This is an explanation of the Polar Code and related conventions as rules for operation of ships on the Northern Sea routes.

1.1 Summary of Polar Code

The International Maritime Organization (IMO) adopted the International Code for Ships Operating in Polar Waters, the so-called Polar Code[1] as technical standards for hull construction considering the dangers unique to the Polar Waters, restoring force, fire-prevention/life-saving equipment, nautical tools, radio communication, marine pollution prevention, etc. for purposes including securing the safety of ships navigating in the Northern or Southern Seas ("Polar Waters") and protection of the marine environment.

With the adoption of the Polar Code, the following three conventions were partly revised to apply additional requirements to ships and seafarers traveling in the Polar Waters taking into consideration the circumstances unique to the Polar Waters (revised STCW is expected to come into effect on July 1, 2018).

1. International Convention for the Safety of Life at Sea：SOLAS, 1974
2. International Convention on Standards of Training, Certification and Watchkeeping for Seafarers：STCW, 1978
3. International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto)

[1] The Polar Code is not a new convention but a revision of existing conventions to make the additional requirements mandatory. The safety regulations were made mandatory by the SOLAS Convention that was adopted simultaneously. The environmental protection regulations were made mandatory by annexes of the MARPOL Convention.

Chart 1-1-1　Maximum extent of Arctic waters application [2] based on the Polar Code (Source: IMO website)

Table 1-1-1　Polar Code

PAET I-A (Mandatory requirements regarding safety regulations)	
1	General
2	Polar water operational manual
3	Ship structure
4	Subdivision and stability
5	Watertightness and weathertightness integrity
6	Machinery installations
7	Fire/safety protection
8	Life-saving appliances and arrangements
9	Safety of navigation
10	Communication
11	Voyage planning
12	Manning and training
Part I-B recommended requirements regarding safety and guidance for implementation of Part I-A	

PART II-A (Mandatory requirements regarding environmental protection regulations	
1	Prevention of pollution by oil
2	Prevention of pollution by noxious liquid substances in bulk
3	Prevention of pollution by harmful substances carried by sea in packaged form
4	Prevention of pollution by sewage from ships
5	Prevention of pollution by garbage from ships
Part II-B Recommended requirements regarding environmental protection and guidance for implementation of Part II-A	

[2] "Polar Waters" is a term defined by the IMO. Pay attention to the use of a different term, "the water area of the NSR," in Russian domestic laws. See p.21, etc. for the latter.

As shown in Table 1-1-1, the Polar Code is roughly divided into Part I (Safety Measures) and Part II (Pollution Prevention Measures). Part I is further divided into two parts: Part I-A describes the General Rules, Polar Water Operational Manual, Ship Structure, Subdivision and Stability, Watertightness and Weathertightness integrity, Machinery Installations, Fire/safety Protection, Life-saving Appliances and Arrangements, Safety of Navigation, Communication, Voyage Planning and Manning and Training; and Part I-B describes the recommended requirements for implementation of Part I-A.
Part II is divided into Part II-A (Prevention of pollution by oil, Prevention of pollution by noxious liquid substances in bulk, Prevention of pollution by harmful substances carried by sea in packaged form[3], Prevention of pollution by sewage from ships and Prevention of pollution by garbage from ships) and Recommended requirements regarding environmental protection and guidance for implementation of Part II-A.

1.2 Requirements related to SOLAS

The Polar Code's requirements related to the SOLAS Convention are described in Part I (Safety Measures). Key requirements and their outline are as follows:

1.2.1 Covered ships

The Polar Codes applies to cargo ships over 500 gross tons and to all passenger ships on international voyages in Polar Waters. A part of the requirements such as residual stability to sustain ice-related damages apply only to newly constructed ships.

1.2.2 Polar Water Operational Manual

Ships operating in the Polar Waters are required to develop a Polar Water Operation Manual (PWOM) providing procedures, etc. for operation in Polar Waters. The Manual shall include or refer to

[3] At the moment, there are no additional requirements regarding prevention of pollution by harmful substances carried by sea in packaged form covering the Polar Waters.

1. information on the ship-specific capabilities and limitations (including the methods used for determination on the capabilities and limitations on frozen seas);
2. specific procedures to be followed in normal operations and in order to avoid encountering conditions that exceed the ship's capabilities.
3. specific procedures to be followed in the event of incidents in Polar Waters.
4. specific procedures to be followed in the event that conditions are encountered which exceed the ship's specific capabilities and limitations

1.2.3 Ship structure

For ships intended to operate in Polar Waters, materials used shall be suitable for operation at low temperature; and the structure of the ship shall be designed to resist both global and local structural loads anticipated under the foreseen ice conditions.

Table 1-1-2 Ice conditions, season, etc. of ship operation by class (Polar Class)

Polar Class	Ice Condition and Season
PC1	Year-round operation in all Polar Waters
PC2	Year-round operation in moderate multi-year ice conditions
PC3	Year-round operation in second-year ice which may include multi-year ice inclusions
PC4	Year-round operation in thick first-year ice which may include old ice inclusions
PC5	Year-round operation in medium first-year ice which may include old ice inclusions
PC6	Summer/autumn operation in medium first-year ice which may include old ice inclusions
PC7	Summer/autumn operation in thin first-year ice which may include old ice inclusions

In actual procedure, ships for which Polar Class registration is sought must follow the rules of the relevant classification society providing the material,

structure, rigging and other requirements based on the Polar Code. The rules require design with a strengthened hull including backup thickness of the hull outer panel considering possible collision with ice. Ice classes[4] are set up by the IACS[5] consisting of members who are major classification societies in the world based on the guidelines[6] adopted by the IMO as uniform regulations. The guide for determining the structural and other requirements by ice class according to the ice condition and season is shown in Table 1-1-2. Ice classes are intended mainly for ships capable of independent navigating in multi-year ice of Polar Waters. There are seven classes from PC1 to PC7. The smaller the number, the higher is the ice-breaking or ice-resistance performance of the ship.

For ships designed for operation in milder ice conditions or open water[7], ice-resistance is not required in view of the operation schedule of the ship, only if the authority concerned has given approval.

1.2.4 Subdivision and stability

For ships operating in the Polar Waters, when operating in areas and during periods where ice accretion is likely to occur, their stability in intact conditions shall be designed with consideration of ice accretion. It shall be designed to minimize the accretion of ice and be equipped with such means for removing ice as the Administration may require; for example, electrical and pneumatic devices, and/or special tools such as axes or wooden clubs for removing ice from the hull structure.

In addition, information on the icing allowance including the stability calculations shall be given in the PWOM and ice accretion shall be monitored and appropriate measures taken to ensure that the ice accretion does not exceed the values given in the PWOM

Newly constructed ships operating in Polar Waters shall be able to withstand flooding resulting from a certain level of hull penetration due to ice impact.

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[4] Official classes for each classification society to certify that ice breaking or ice-resistance performance of ships is above a certain standard in order to ensure safety of ships in ice sea, environmental protection and other purposes,

[5] International Association of Classification Societies

[6] Guidelines for Ships Operating in Polar Waters/A.1024(26))

[7] Wide sea area with ice concentration 1/10 or under where ships can navigate freely

1.2.5 Watertightness and weathertightness integrity

For ships operating in Polar Waters, all closing appliances and doors relevant to watertightness and weathertightness integrity of the ship ("closing appliances") shall be operable under snow and ice or at low temperature. Such measures include:

1. means to remove or prevent ice and snow accretion around closing appliances; and
2. if the closing appliances are hydraulically operated, means to prevent freezing or excessive viscosity of liquids;
3. closing devices designed to be operated by personnel wearing heavy winter clothing including cold-proof mittens and clothes, if they need to be used on the ocean.

1.2.6 Machinery installations

Machinery installations and associated equipment of ships operating in the Polar Waters shall be designed with consideration of the environmental conditions unique to the Polar Waters. The requirements include:

1. they shall be protected against the effect of ice accretion and/or snow accumulation, ice ingestion from sea water, freezing and increased viscosity of liquids (used for machinery installations, etc.), seawater intake temperature and snow ingestion;
2. working liquids shall be maintained in a viscosity range that ensures operation of the machinery;
3. seawater supplies for machinery systems shall be designed to prevent ingestion of ice, or otherwise arranged to ensure functionality; and
4. for ships intended to operate in low air temperatures, considerations to exposed machinery and electrical installation and appliances.

In actual procedure, ships for which ice class registration is sought must follow the rules of the relevant classification society established for their machinery installations based on the Polar Code.

1.2.7 Fire/safety protection

Firefighting equipment of ships operating in the Polar Waters shall be designed with consideration of the environmental conditions unique to the Polar Waters. The requirements include:

1. firefighting pipe systems, fire pumps, fire extinguishing appliances, etc. shall be maintained above freezing;
2. firefighter's outfits shall be stored in warm locations on the ship

1.2.8 Life-saving appliances and arrangements

Life-saving appliances of ships operating in Polar Waters shall be designed with consideration of the environmental conditions unique to Polar Waters. The requirements include:

1. escape routes shall be secured when the hull is coated with ice;
2. means shall be provided to remove or prevent ice and snow accretion from the launching appliances of survival craft, etc.;
3. for newly constructed ships, exposed escape routes shall be arranged so as not to hinder passage by persons wearing suitable polar clothing; and
4. each survival craft shall be equipped with search lights to identify ice.

1.2.9 Safety of navigation

To provide for safe navigation of ships operating in Polar Waters, requirements including the following are made:

1. secure means to receive up-to-date information including ice information
2. shall have either two independent echo-sounding devices or one echo-sounding device with two separate independent transducers (only for newly constructed ships);
3. secure bridge configuration and clear view astern in compliance with SOLAS regulation;
4. for ships operating in areas, and during periods, where ice accretion is likely to occur, secure means to prevent the accumulation of ice on antennas required for navigation and communication;
5. sensors that project below the hull shall be protected against ice;

6. ships proceeding to latitudes over 80 degrees shall be fitted with at least one GNSS compass[8] or equivalent, which shall be connected to the ship's main and emergency source of power.
7. shall be equipped with two remotely rotatable, narrow-beam search lights controllable from the bridge to provide lighting over an arc of 360 degrees (horizontal total rotation searchlight); and
8. ships involved in operations with an icebreaker escort in convoy[9] shall be equipped with a manually initiated flashing red light visible from astern to indicate when the ship is stopped.

1.2.10 Communication

In order to provide for effective communications during normal operation and in emergency situations, ships operating in Polar Waters shall fulfill requirements including the following:

1. 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.
2. Means for two-way communications for search and rescue purposes including aeronautical frequencies shall be provided.
3. Appropriate communication equipment to enable telemedical assistance in polar areas shall be provided.

1.2.11 Voyage planning

For ships operating in Polar Waters, the voyage plan shall take into account the potential hazards of the intended voyage to ensure that the master and crew are provided with sufficient information to enable operations to be conducted with due consideration to safety of ship and persons on board and environmental protection. The master shall consider a route through Polar Waters, taking into account the following:

1. the procedures required by the PWOM;
2. any limitations of the hydrographic information and aids to navigation available;

[8] Direction sensor using radio signals from satellites based on GNSS (Global Navigation Satellite System). Two antennas are installed fore and aft, a baseline vector between them was obtained and the heading is determined.

[9] Ice breaker escort where one icebreaker is followed by more than two ships in column

3. current information on the extent and type of ice and icebergs in the vicinity of the intended route;
4. statistical information on ice and temperatures from former several years;
5. places of refuge;
6. 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;
7. current information on relevant ship routing systems (SRS)[10], speed recommendations and vessel traffic services[11] relating to known areas with densities of marine mammals, including seasonal migration areas
8. national and international designated protected areas along the route; and
9. operation in areas remote from search and rescue (SAR) capabilities.

1.3 Requirements related to the STCW Convention

Requirements related to the STCW Convention of the Polar Code are described in Part 1 (Safety Measures)

1.3.1 Manning and training

In order to ensure that ships are appropriately manned by adequately qualified, trained and experienced personnel, masters, chief mates and officers in charge of a navigational watch on board ships operating in Polar Waters shall have completed appropriate training and shall be qualified as shown in Table 1-1-3.

The master and chief mate may operate in Polar Waters by having completed basic training and not advanced training, if the ship is additionally manned with a person(s) with qualification of advanced training called an ice pilot or ice advisor and deep experience in ice

[10] Recommendations made by the IMO to create orderly traffic flow in order to prevent marine disasters mainly in congested sea areas, which include separated navigation and designation of deep-water routes

[11] Information provision and traffic control services for navigating ships provided by centers for marine traffic, etc.

navigation. The manning requirements in such case are shown in Table 1-1-4.

Table 1-1-3 Manning requirements in Polar Waters by ice conditions and type of ship

Ice conditions	Tankers	Passenger ships	Other
Ice free	-	-	-
Open water (sea ice is present in concentrations less than 1/10)	Basic training for master, chief mate and mates	Basic training for master, chief mate and mates	-
Other waters (sea ice is present in concentrations more than 1/10)	Advanced training for master and chief mate. Basic training for mates	Advanced training for master and chief mate. Basic training for mates	Advanced training for master and chief mate. Basic training for mates

Table 1-1-4 Manning requirements with an ice pilot on board

Ice conditions	Tanker	Passenger ship	Other
Ice free	-	-	-
Open water (sea ice is present in concentrations less than 1/10)	-	-	-
Open water or sea surface other than surface with land ice	Basic training for master, chief mate and mates	Basic training for master, chief mate and mates	-
Sea surface with sea ice concentration over 2/10			Basic training for master, chief mate and mates

1.3.2 Ability requirements

Masters, chief mates and other mates on board ships operating in Polar Waters are required to have their competence certificate after completing basic training (to learn basic knowledge, etc. for safe navigation in ice waters). Masters and chief mates are also required to have their competence

certificate of completion of advanced training (to learn planning, ship maneuvering, management, life-saving knowledge, etc.).

Table 1-1-5 Ability requirements pertaining to the basic training

Basic training
Contribute to safe operation and maneuvering of vessels operating in Polar Waters – Basic knowledge of ice characteristics and areas where different types of ice can be expected in the area of operation – Basic knowledge of vessel performance in ice and low air temperature – Basic knowledge and ability to operate and maneuver a ship in ice
Monitor and ensure compliance with legislative requirements – Regulatory considerations
Apply safe working practices, respond to emergencies – Basic knowledge of crew preparation, working conditions and safety
Ensure compliance with pollution- prevention requirements and prevent environmental hazards – Basic knowledge of environmental factors and regulations

Table 1-1-6 Ability requirements pertaining to advanced training

Advanced training
Planning and conducting a voyage in Polar Waters – Knowledge of voyage planning and reporting – Knowledge of equipment limitations
Manage the safe operation of vessels operating in Polar Waters – Knowledge and ability to operate and maneuver a ship in ice
Maintain safety of the ship's crew and passengers and the operational condition of life-saving, firefighting and other safety systems – Knowledge of safety

1.4 Requirements related to the MARPOL Convention

Requirements related to the STCW Convention of the Polar Code are described in Part II (Pollution Prevention Measures). Key requirements and their summary are as follows:

1.4.1 Requirements related to Annex I Prevention of pollution by oil

In Arctic waters, any discharge into the sea of oil or oily mixtures from any ship shall be prohibited. However, this shall not apply to the discharge

of clean or segregated ballast from a tanker. Clean ballast refers to ballast loaded in a tanker cargo hold cleaned at least to the following level:

- Sufficiently cleaned so that discharge of water ballast from the cargo hold of a tanker stopping in fair weather into a clean and calm sea does not generate any visible oil film on the sea surface or adjacent coastline.
- The ballast is deemed to be a clean ballast even when visible oil film is generated, under the condition that the water ballast is discharged from the cargo hold of a tanker through oil discharge monitoring control equipment or a concentration monitoring device for ballast approved by the Administration, and there is an evidence that the oil concentration is below 0.15 cubic centimeters per 100,000 cubic centimeters based on the equipment.

Segregated ballast refers to ballast that is loaded in a tank, completely segregated from the cargo hold and fuel oil tank, and permanently installed for loading water ballast.

Ships are encouraged to apply regulation 43 of MARPOL Annex I when operating in Arctic waters.

- The carriage in bulk as cargo or carriage and use as fuel of heavy grade oils by ships in the Antarctic area has been prohibited.

In addition, it is recommended to use biodegradable lubricants or water-based systems in lubricated components located outside the underwater hull with direct seawater interfaces, like shaft seals and slewing seals.

Photo 1-1-1 Seal tank of propeller shaft

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.

1.4.2 Requirements related to Annex II Prevention of pollution by noxious liquid substances in bulk

In Arctic waters, any discharge into the sea of oil or oily mixtures from any ship shall be prohibited.

Operation in Polar Waters shall be taken into account, as appropriate, in the Cargo Record Books, Manuals, Shipboard Oil Pollution Emergency Plan for Noxious Liquid Substances (NL SOPEP) and the Shipboard Oil Pollution Emergency Plan for Noxious Liquid Substances or the Shipboard Marine Pollution Emergency Plan (SOPEP) as required by MARPOL Annex II.

1.4.3 Requirements related to Annex IV Prevention of pollution by sewage from ships

In Arctic waters, any discharge into the sea of sewage from any ship shall be prohibited except when performed in accordance with the Polar Code and satisfying certain requirements.

[Discharging comminuted and disinfected sewage]

In addition to the requirements for discharge to general sea areas including that the ship is discharging sewage comminuted and disinfected using equipment approved by the Administration in accordance with regulation 11.1.1 of MARPOL Annex IV at a distance of more than 3 nautical miles from land and that the ship is navigating at a speed of 4 knots or faster, the following requirements shall be satisfied:

- The ship is discharging comminuted and disinfected sewage at a distance of more than 3 nautical miles from any ice-shelf[12] or fast ice[13] and shall be as far as practicable from areas of ice concentration[14] exceeding 1/10;

[Discharging sewage that is not comminuted or disinfected]

Regarding discharge of sewage that is not comminuted or disinfected using equipment approved by the Administration, in addition to the requirements for discharge in general sea areas including that the ship is discharging using equipment approved by the Administration, in accordance with regulation 11.1.1 of MARPOL Annex IV and at a distance of more than 12 nautical miles from land and that the ship is navigating at a speed of 4 knots or faster, the following requirements shall be satisfied:

- The ship is discharging 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.

[Discharging sewage with operation of an approved sewage treatment plant]

In addition to the requirements for discharge in general sea areas including that 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,

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12 Ice sheet with a significant part (2 to 50 meter) above sea level and adhering to a coast

13 Sea ice formed on a coast. It adheres to a coast, glacier front or ice front, or formed in a shallow or between stranded icebergs

14 Ratio of the area covered by ice to the entire sea area in decile or percentage

and shall not cause visible suspended solids or discoloring in the surrounding sea water in accordance with regulation 11.1.2 of Annex IV, The following requirements shall be satisfied:

- Discharging sewage as far as practicable from the nearest land, any ice-shelf, fast ice or areas of ice concentration exceeding 1/10.

Table 1-1-7 Requirements for sewage discharge

Waters	Type of sewage/ requirements for sea area		Requirements for discharge method	Other requirements
Polar waters	Sewage comminuted and disinfected using equipment approved by the Administration	At a distance of more than 3 nautical miles from land	-The ship is navigating at a speed of 4 knots or faster - Discharging below sea level	The ship is discharging 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.
	Sewage that is not comminuted or disinfected using equipment approved by the Administration	At a distance of more than 12 nautical miles from land	- The ship is navigating at a speed of 4 knots or faster - Discharging below sea level	The ship is discharging 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.
	Ship that has in operation a sewage treatment plant certified by the Administration to meet certain operational requirements	-		Discharging sewage as far as practicable from the nearest land, any ice-shelf, fast ice or areas of ice concentration exceeding 1/10.
General waters	Sewage comminuted and disinfected using equipment approved by the Administration	At a distance of more than 3 nautical miles from land	-The ship is navigating at a speed of 4 knots or faster - Discharging below sea level	-
	Sewage that is not comminuted or	At a distance of	-The ship is navigating at	-

	disinfected using equipment approved by the Administration	more than 12 nautical miles from land	a speed of 4 knots or faster - Discharging below sea level	

[Measures for newly constructed ships]

Discharge of sewage into the sea is prohibited from category A[15] and B [16]ships constructed on or after 1 January 2017 and all passenger ships constructed on or after 1 January 2017, except when such discharges are in compliance with "Discharge of sewage with operation of an approved sewage treatment plant" above while operating a sewage treatment plant certified by the Administration.

[Measures for ships operating in ice sea for extended period of time]

Notwithstanding the requirements of "discharging comminuted and disinfected sewage" and "discharging sewage that is not comminuted or disinfected" above, 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.

[15] Ships designed for operation in first-year ice of medium thickness with some multi-year ice mixed

[16] Ships designed for operation in thin first-year ice with some multi-year ice mixed

Photo 1-1-2 Sewage treatment plant

1.4.4 Requirements related to Annex V "Prevention of pollution by garbage from ships"

In Arctic waters, any discharge into the sea of waste from any ship shall be prohibited. Discharge into the sea permitted in accordance with the Polar Code shall meet the following additional requirements:

[Discharge of food waste]

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:

- 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. for discharge of food waste in Arctic waters, the following additional requirements regarding pretreatment shall be also met:
- Food wastes shall be comminuted or ground to a maximum diameter no greater than 25 mm. Food wastes shall not be contaminated by any other garbage type;
- Food wastes shall not be contaminated by any other garbage type;
- Food wastes shall not be discharged onto the ice;

Table 1-1-8 Requirements for discharge of waste (food waste)

Waters	Requirements for sea area		Other requirements
Polar waters	Food waste	Sea area satisfying the following two requirements: - The ship is as far as practicable from areas of ice concentration exceeding 1/10 - Not less than 12 nautical miles from the nearest land, nearest ice-shelf, or nearest fast ice.	– Discharge under way – Food wastes shall be comminuted or ground to a maximum diameter of 25 mm. Food wastes shall not be contaminated by any other garbage type. – Discharge onto the ice is prohibited
General waters	Food waste	The ship is discharging at a distance of more than 3 nautical miles from any land	– Discharge under way – Food wastes shall be comminuted or ground to a maximum diameter of 25 mm.
		The ship is discharging at a distance of more than 12 nautical miles from any land	-Discharge while navigating

[Discharge of cargo residue[17]]

In Arctic waters, any discharge into the sea of cargo residue from any ship shall be prohibited. However, discharge of cargo residues that cannot be recovered using commonly available methods for unloading shall only be permitted in accordance with the Polar Code while the ship is navigating and where all the following conditions are satisfied:

- 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[18] developed by the Organization;

[17] Sweepings that were not collected by crane or other cargo handling gears and remained on the deck or in a cargo hold after discharge of solid bulk such as coal, iron ore and flour. Cargo residues include the hold washing water used to wash cargo residues.

[18] Guidelines for the Implementation of MARPOL Annex V

- 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;
- No adequate reception facilities are available at those ports taking into account guidelines[19] developed by the Organization; and
- Where all of the conditions above have been fulfilled, discharge of cargo hold washing water containing residues shall be made (discharge of cargo residue only is prohibited) 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.

Photo 1-1-3　Food waste crushing equipment (disposer)

[Discharge of other wastes]

In Arctic waters, discharge of animal carcasses is prohibited, and as in the case of general sea areas, discharge of all other wastes including plastic, chemical fiber rope, fishing equipment, plastic bags,

[19] Consolidated Guidance for Port Reception Facility Providers and Users

incineration ash, waste cooking oil, dunnage, packing materials, paper, cloth, glass, metal, bottles, empty cans, ceramics and Styrofoam is prohibited.

Table 1-1-9 Requirements for discharge of waste (cargo residues, etc.)

Waters	requirements for sea area		Requirements for discharge method	Other requirements
Polar waters	Cargo residues other than those contained in hold washing water	Prohibited	-	-
	Cargo residues contained in hold washing water (including cleaning agents and additives)	Sea area satisfying the following two requirements: - The ship is as far as practicable from areas of ice concentration exceeding 1/10 - Not less than 12 nautical miles from the nearest land, nearest ice-shelf, or nearest fast ice.	Discharge while navigating	-Both the port of departure and the next port of destination are within Arctic waters -The ship will not transit outside Arctic waters between those ports -No adequate reception facilities are available at those ports -Do not include any substances harmful to the marine environment.
General waters	Cargo residue	not less than 12 nautical miles from the nearest land	Discharge while navigating	Do not include any substances harmful to the marine environment.

	Hold washing water	All sea areas	Discharge while navigating	Do not include any substances harmful to the marine environment.

Table 1-1-10 Requirements for discharge of waste (other wastes)

Waters	Requirements for sea area		Requirements for discharge method	Other requirements
Polar waters	Animal carcasses	Prohibited	-	-
	All other wastes including plastic, chemical fiber rope, fishing equipment, plastic bags, incineration ash, waste cooking oil, dunnage, packing materials, paper, cloth, glass, metal, bottles, empty cans, ceramics, Styrofoam	Prohibited	-	-
General waters	Animal carcasses	As far as practicable from areas of land (over 100 nautical miles recommended)	Discharge while navigating	Take measures necessary for settling on the sea bottom as quick as possible
	All other wastes including plastic, chemical fiber rope, fishing equipment, plastic bags, incineration	Prohibited	-	-

	ash, waste cooking oil, dunnage, packing materials, paper, cloth, glass, metal, bottles, empty cans, ceramics, Styrofoam			

2. Domestic Laws of Russia

The Arctic Ocean and other oceans are subject to international laws, including the United Nations Convention on the Law of the Sea. Freedom of navigation and other principles of international law must be respected. Especially in the "ice covered areas"[20] of the Arctic Ocean, it is necessary to cooperate with coastal states to ensure appropriate balance between the freedom and safety of navigation, and the protection and preservation of the marine environment under the principle of international law[21]. On the other hand, domestic laws of Russia provide that regulations approved by its administrative bodies are applicable in order to ensure safety of operation on Northern Sea routes and prevent, minimize and control pollution of the marine environment by ships.

Below is an explanation of the regulations related to operations on the Northern Sea routes based on domestic laws of Russia.

2.1 Northern Sea route navigation requirements

Navigation of the Northern Sea route requires prior application to and permission from the Northern Sea Route Administration (NSRA) that is a government agency of Russia, in accordance with domestic laws of Russia. Below is an explanation of the navigation requirements of the Northern Sea Route.

2.1.1 Northern Sea Route Administration

[20] Waters defined in Article 234 of the United Nations Convention on the Law of the Sea as "ice-covered areas within the limits of the exclusive economic zone, where particularly severe climatic conditions and the presence of ice covering such areas for most of the year creates obstructions or exceptional hazards to navigation, and pollution of the marine environment could cause major harm to or irreversible disturbance of the ecological balance."

[21] Quote from "Japan's Arctic Policy" October 16, 2015, The Headquarters for Ocean Policy

The main purpose of the NSRA is set as navigation safety in the water area of the Northern Sea Route[22] and protection of the environment from pollution by ships. The NSRA has the following functions:

1. Issuing the permissions for navigation through the Northern Sea Route;
2. Issuing the certificates of the pilotage in the water area of the Northern Sea Route;
3. Researching weather, ice, navigational and other conditions on the Northern sea route;
4. Coordination of installation of navigational aids and harmonization of regions to carry out hydrographic survey operations on the Northern Sea Route
5. Assistance in the organization of search and rescue operations in the water area of the Northern Sea Route;
6. Assistance in eliminating the consequences of pollution from vessels of harmful substances, sewage or garbage;
7. Rendering information services in relation to the water area of the Northern Sea Route;
8. Making recommendations about development of routes of navigation and using icebreaking fleets in the water area of the Northern Sea Route;
9. Data retrieval from Russian hydrometeorological service about hydrometeorological forecast and ice analysis.

2.1.2 Procedure for ship navigation

Procedure of ships navigating in the NSR water area ("navigating ships") is handled by the NSRA in accordance with the Rules of navigation in the water area of the Northern Sea Route[23], Code of commercial navigation of

[22] The sea area adjacent to the northern coast of the Russian Federation based on the domestic laws of Russia and consisting of inland waters, territorial waters, contiguous zones and EEZ. The website of NSRA illustrates the water area of the NSR as the sea area from the meridian of Cape Zhelaniya of Novaya Zemlya in the west (68°35'E) to the meridian of Dezhnev Cape of the Bering Strait in the east (168°58'37"W). Pay attention that the area is different from the Arctic sea area defined by Polar Code.

[23] Rules of navigation in the water area of the Northern Sea Route in the Code of commercial navigation of the Russian Federation. Pay attention that they are transitional law as of 2016. Fine (or administrative penalty), etc. are still uncertain.

the Russian Federation established based on the Code of commercial navigation of the Russian Federation[24] and other domestic laws of Russia. Navigation requires permission by the NSRA based on application by the ship owner, etc.

[Application]

The application is to be made not earlier than 120 calendar days and not later than 15 working days before the intended date of the entering of ship into the water area. The applicant fills out the designated form (name and class of the ship, corporate name, IMO identification number, contact information, etc.). in Russian or English. The application with the documents attached is to be sent to the email address designated by the NSRA. The designated attached documents are:

1. Information about ship and voyage
2. Copy of the classification certificate;
3. Copy of the measurement certificate;
4. Copies of documents certifying availability of the insurance
5. Other

Applicants are to fill in the following items in Russian or English in the designated form for attached documents of information about the ship and voyage

1. Name of ship
2. IMO identification number of ship
3. Flag of ship
4. Call sign[25] of ship
5. Port/place of departure of ship (the last port of the call of ship before the navigation in the water area of the Northern Sea Route).
6. Port/place of destination of ship (the first port of the call of ship after the navigation in the water area of the Northern Sea Route).
7. Description of the intended route of navigation (area of operation) of the ship in the water area of the Northern Sea Route.
8. Anticipated dates of the beginning of the navigation of the ship in the water area of the Northern Sea Route.

[24] Code of commercial navigation of the Russian Federation

[25] Address call sign assigned to individual radio stations of ships

9. Anticipated dates of the end of the navigation of the ship in the water area of the Northern Sea Route.
10. Intended number of crew members and passengers aboard.
11. Intended number of passengers
12 Type of cargo to be carried
13 Amount of cargo in metric tons
14 Details of the towed objects
15 Class of dangerous cargo
16 Intended amount of dangerous cargo in metric tons
17 Information on the length of experience with the ship master of the navigation in ice in the water area of the Northern Sea Route as a master or chief mate with the indication of the name of the ship, IMO number and time, where the ship master or chief mate navigated in the water area of the Northern Sea Route.
18 Ship satellite phone number
19 Ship fax number
20 Ship email address
21 Type of ship
22 Category of ice strengthening of ship and the classification society
23 Overall length of ship in meters
24 Overall width of ship in meters
25 Maximum draft of ship in meters
26 Gross tonnage of ship
27 Power of the main power plant of the ship in kW
28 Breadth of ice strake of ship in meters
29 Daily fuel consumption moving at full speed in open water in metric tons
30 Information on the structure of forward end of ship
31 Information on the structure of after end of ship

[Permission]

Examination is made within two weeks after the application. In the case of the decision to grant permission for the ship to navigate in the water area of the Northern Sea Route, the permission is posted on the official site of the NSRA providing the following information:

1. Name of the ship;

2. Flag of the ship;
3. IMO number
4. Date of the beginning and end of the permission validity (time of the validity of permission shall not exceed 365 calendar days);
5. Route of the navigation (area of operation) of the ship in the water area of the Northern Sea Route;
6. Information on the need of icebreaker assistance for the ship in specific sea areas[26] based on the "Criteria of the admission of ships to the Northern Sea Route" in compliance with the category of their ice strengthening provided in Annex 2 of the "Rules of navigation in the water area of the Northern Sea Route."

Navigation may not be permitted for reasons including the following:

1. Information stipulated in the application, attachment or other document is found false or incorrect;
2. Application, attachment or another document has not been submitted or their submission is incomplete;
3. Application is not in accordance with the "Criteria of the admission of ships to the Northern Sea Route" in compliance with category of their ice strengthening provided in the "Rules of navigation in the water area of the Northern Sea Route (Annex)"; and
4. Application is not in accordance with the requirements related to navigation safety and prevention of marine environment pollution by ships as provided by international conventions, laws of the Russian Federation, and the Rules.

In the case of the decision of the NSRA to refuse permission for the ship to navigate in the water area of the Northern Sea Route, a notification shall be sent by email to the applicant signed by the head of the NSRA (or by a substituting person) with the indication of reasons of the refusal to grant the permission. Relevant information is posted on the official site of the NSRA.

[26] Refers to the south-western and north-eastern parts of Kara Sea, western and eastern parts of Laptev Sea, south-western and north-eastern parts of East-Siberian sea and Chukchi Sea

A ship which was granted permission shall not enter the water area of the Northern Sea Route earlier than on the date of the beginning of the term of validity of the permission and shall leave the water area of the Northern Sea Route not later than on the date of the end of the term of validity of the permission. If the ship cannot leave the Northern Sea Route water area before the expiration of the validity of the permission, the shipmaster shall immediately inform the NSRA accordingly indicating the reasons of the violation and act according to the NSRA's instructions.

2.1.3 Criteria of the admission of ships in accordance with category of their ice strengthening

The Criteria of the admission of ships to the Northern Sea Route in compliance with category of their ice strengthening provided in Annex: the Rules of navigation in the water area of the Northern Sea Route spells out the criteria of admission of ships for each section of the water area of the Northern Sea Route (south-western part of the Kara Sea, north-eastern part of the Kara Sea, western part of the East Siberian Sea, eastern part of the East Siberian Sea, western part of the Laptev Sea, eastern part of the Laptev Sea, Chukchi Sea) and by period of navigation, ice class[27] of the ship and ice conditions (light, medium and heavy) announced by the meteorological agency of the Russian Federation.

To ships with sufficient ice strengthening and high ice class, under good ice condition or the like, more liberal criteria are applied including independent navigation without icebreaker assistance. On the other hand, ships without ice strengthening, with insufficient ice strengthening and low ice class, or under unfavorable ice conditions, need icebreaker assistance.

Table 1-2-1 shows admission criteria for ships without ice strengthening and those of ice class Ice1 to Ice3 for the period from July 1 to November 15. Ice class here refers to the ice class defined by the Russian Classification Society. Ice Class Ice1 is given to ice-resistant ships that navigate with

[27] Ice class defined by the Russian Classification Society. This is different from the Polar Class based on the guidelines adopted by the IMO as mentioned above. Russian ice classes Arc9 to Arc4 are mainly intended for icebreakers capable of independent navigation of the Arctic Sea. Ice3 to Ice1 are given to ice-resistant ships that navigate with assistance including icebreaker assistance. The higher the number, the higher the ice-resistance performance.

assistance including icebreaker assistance. The higher the number, the higher the ice-resistance performance.

"No" in the table indicates ships without ice strengthening, "IN" independent navigation, "IS" navigation under icebreaker assistance, "H" heavy ice condition, "M" medium ice condition and "L" light ice condition, according to official information of the meteorological agency of the Russian Federation, "+" navigation permitted and "-" navigation not permitted.

Table 1-2-1 Criteria of admission for ships without ice strengthening and those of ice class Ice1 to Ice3 [1](from July 1 to November 15)

Ice class	Mode of ice navigation	Kara Sea		Laptev Sea		East-Siberian Sea		Chukchi Sea
		South-western part	North-eastern part	Western part	Eastern part	South-western part	North-eastern part	
		HML	HML	HML	HML	HML	HML	HML
No[2]	IN[3]	---	---	---	---	---	---	---
	IS	--+	--+	--+	--+	--+	--+	--+
Ice1	IN	--+	--+	--+	--+	--+	--+	--+
	IS	--+	--+	--+	--+	--+	--+	--+
Ice2	IN	--+	--+	--+	--+	--+	--+	--+
	IS	-++	-++	--+	--+	--+	--+	--+
Ice3	IN	--+	--+	--+	--+	--+	--+	--+
	IS	+++	+++	--+	--+	--+	--+	-++

1) For ships without ice strengthening and with category of ice strengthening Ice1 – Ice3, navigation in the water area of the Northern Sea Route from November 16 to December 31 and from January to June is prohibited.

2) Oil tankers, gas carriers, and chemical carriers with a gross tonnage of more than 10 000t without ice strengthening are permitted to navigate in the water area of the NSR only in open water assisted by an icebreaker during the period from July 1 to November 15.

3) Ships without ice strengthening are permitted to independently navigate in the water area of the Northern Sea Route only in open water.

Table 1-2-2 shows criteria of admission for ships of ice class Arc4 to Arc9 for the period from July 1 to October 30. Ice classes Arc4 to Arc9 defined by the Russian Classification Society are assigned mostly to ice breakers capable of independent navigation in the Arctic Sea. The higher the number, the higher the ice-breaking performance

Table 1-2-2 Criteria of admission for ships with category of ice strengthening Arc4 – Arc9 (from July 1 to November 15)

Ice class	Mode of ice navigation	Kara Sea		Laptev Sea		East-Siberian Sea		Chukchi Sea
		South-western part	North-eastern part	Western part	Eastern part	South-western part	North-eastern part	
		HML	HML	HML	HML	HML	HML	HML
Arc4	IN	-++	-++	--+	--+	--+	--+	-++
	IS	+++	+++	-++	-++	-++	-++	-++
Arc5	IN	+++	+++	+++	-++	-++	-++	-++
	IS	+++	+++	+++	+++	+++	+++	+++
Arc6	IN	+++	+++	+++	+++	+++	+++	+++
	IS	+++	+++	+++	+++	+++	+++	+++
Arc7	IN	+++	+++	+++	+++	+++	+++	+++
	IS	+++	+++	+++	+++	+++	+++	+++
Arc8	IN	+++	+++	+++	+++	+++	+++	+++
	IS	+++	+++	+++	+++	+++	+++	+++
Arc9	IN	+++	+++	+++	+++	+++	+++	+++
	IS	+++	+++	+++	+++	+++	+++	+++

Table 1-2-3 shows the criteria of admission for ships of ice class Arc4 to Arc9 for the period from November 1 to December 31 and from January 1 to June 30.

Table 1-2-4 shows the criteria of admission for icebreakers of ice class Icebreaker6 to Icebreaker8 for the period from December 1 to December 31 and January 1 to June 30. Ice class Icebreaker defined by the Russian Classification Society is mainly assigned to icebreakers dedicated to ice breaking assistance for navigating ships mainly in the Arctic Sea. The higher the number, the higher the ice-breaking performance.

Table 1-2-3 Criteria of admission for icebreakers of ice class Arc4 to Arc9 (from November 1 to December 31 and January 1 to June 30).

Ice class	Mode of ice navigation	Kara Sea		Laptev Sea		East-Siberian Sea		Chukchi Sea
		South-western part	North-eastern part	Western part	Eastern part	South-western part	North-eastern part	
		HML	HML	HML	HML	HML	HML	HML
Arc4	IN	--+	--+	--+	--+	--+	--+	--+
	IS	--+	--+	--+	--+	--+	--+	--+
Arc5	IN	--+	--+	--+	--+	--+	--+	--+
	IS	--+	--+	--+	--+	--+	--+	--+
Arc6	IN	--+	--+	--+	--+	--+	--+	--+
	IS	-++	-++	--+	--+	--+	--+	-++
Arc7	IN	+++	-++	--+	--+	--+	--+	-++
	IS	+++	+++	+++	+++	+++	+++	+++
Arc8	IN	+++	+++	-++	-++	-++	-++	+++
	IS	+++	+++	+++	+++	+++	+++	+++
Arc9	IN	+++	+++	+++	+++	+++	+++	+++
	IS	+++	+++	+++	+++	+++	+++	+++

Table 1-2-4 Criteria of admission for Ice class Icebreaker6 to Icebreaker8[1)] from December 1 to December 31 and January 1 to June 30.[2)]

Ice class	Mode of ice navigation	Kara Sea		Laptev Sea		East-Siberian Sea		Chukchi Sea
		South-western part	North-eastern part	Western part	Eastern part	South-western part	North-eastern part	
		HML	HML	HML	HML	HML	HML	HML
Icebreaker6	IN	-++	-++	--+	--+	--+	--+	-++
	IS	+++	+++	+++	+++	+++	+++	+++
Icebreaker7	IN	+++	+++	-++	-++	-++	-++	+++
	IS	+++	+++	+++	+++	+++	+++	+++
Icebreaker8	IN	+++	+++	-++	-++	-++	-++	+++
	IS	+++	+++	+++	+++	+++	+++	+++

1) For icebreakers with category of ice strengthening Icebreaker9, there are no restrictions as to independent navigation in the water area of the Northern Sea Route.
2) For icebreakers with category of ice strengthening Icebreaker6 to Icebreaker8, independent navigation is permitted during the period of navigation from July 1 to November 30.

Photo 1-2-1 Russian nuclear breaker “Fiftieth Anniversary of Victory” (provided by Mr. Jin Saijo)

2.2 Regulations concerning ships navigating the Northern Sea Route

Ships navigating in the Northern Sea Route area are under the control of the NSRA as provided by the Rules of navigation in the water area of the Northern Sea Route that are a domestic law of Russia. Below is an explanation of regulations pertaining to ships navigating in the Northern Sea Route.

2.2.1 Reporting entry/leave of the area

When a navigating ship enters or leaves the Northern Sea Route area, the master shall inform the NSRA in the prescribed manner.

[Reporting 72 hours before entering/leaving]

The master of a navigating ship shall inform the NSRA 72 hours before

entering or leaving navigating the Northern Sea Route

- When the ship moves towards the water area of the Route from the west, 72 hours before approaching meridian 33° E ("Western boundary")
- And when the ship moves towards the water area of the Northern Sea Route from the east, 72 hours before approaching parallel 62° N and/or meridian 169°W ("Eastern boundary") or
- Immediately after the departure from sea port (if the navigational period of the ship after the departure from the sea port to the Western or to the Eastern boundary is less than 72 hours)

In addition to the time of arrival of the ship to the Western or Eastern boundary, the ship master shall report to the NSR Administration the following:

1. Name of ship
2. IMO number of ship
3. Port/place of destination
4. Maximum operating draft of ship in meters
5. Type and amount of cargo in metric t carried by ship
6. Presence, amount in metric t and class of dangerous cargo carried by ship
7. Fuel capacity in metric t at the moment of report
8. Fresh water capacity subject to replenishment by fresh water from the ship's distilling plant (if any) at the moment of report (number of days is specified when ship can move without replenishment of fresh water);
9. Subsistence reserve and other types of the ship's supply at the moment of report (number of days is specified when ship can move without replenishment of provision and of other types of supply);
10. Number of crew members and passengers;
11. Information on malfunctions of ship's machinery and/or of maintenance facilities (if any).

[Notice 24 hours before approaching a boundary]

24 hours before approaching the Western or Eastern boundary, the ship master shall notify the NSRA of the planned time of the arrival of ship to the appropriate boundary. In addition, the ship master shall give notice

again on items 1 to 11 of the notice 72 hours before entering.

[Notice before entry]

While entering the Western or Eastern boundary, the ship master shall inform the NSRA of the planned time of the entrance of the ship into the water area of the Northern Sea Route, geographical coordinates, track and speed of the ship at the moment of report.

[Notice of entrance]

At the entrance of the ship into the water area of the Northern Sea Route, the ship master shall inform the NSRA of the actual time of the entrance of the ship into the water area, geographical coordinates, track and speed of the ship at the moment of report.

[Notice of leave]

After the completion of navigation in the water area of the Northern Sea Route, on leaving the water area of the Northern Sea Route, the ship master shall inform the NSRA of the actual time of leaving the water area of the Northern Sea Route, geographical coordinates, track and speed of the ship at the moment of report.

[Notice of arrival]

After the completion of navigation in the water area of the Northern Sea Route, while the ship is calling at a sea port of the Russian Federation situated in the water area of the Northern Sea Route immediately after the call, the ship master shall inform the NSRA of the time of the call of ship at port with the indication of name of the sea port.

2.2.2 Icebreaker assistance

Icebreaker assistance shall be rendered by the icebreakers authorized to navigate under the State flag of the Russian Federation based on the Rules of navigation in the water area of the Northern Sea Route that are a domestic law of Russia. Icebreaker assistance involves ensuring the safety of navigation of a ship in the water area of the Northern Sea Route, with the ship in a zone covered by radio communication with the icebreaker on VHF2, namely ice reconnaissance by icebreaker making channels in ice,

formation of a group of ships and allocation of ships following the icebreaker(s), sailing of ships through the channel behind an icebreaker.

[Basic requirements]

Pay attention to the following basic requirements that have been established for icebreaker assistance:

1. Point and time of the beginning and end of the icebreaker assistance of the ship shall be agreed by the ship owner with the organization rendering service of the icebreaker assistance.
2. While approaching the point of the formation of a group of ships or to the point of meeting with an icebreaker, the ship shall establish radio communication on VHF channel 16 and act in compliance with the instructions of the master of the icebreaker.
3. The ice convoy shall be under the control of the master of the icebreaker.
4. Order of the allocation of ships within the ice convoy shall be specified by the master of the icebreaker rendering the assistance.
5. Ships within the ice convoy, at the command of the icebreaker rendering assistance, change over to the VHF channel of communication indicated by the icebreaker
6. The icebreaker assistance shall be commanded by the master of the icebreaker.

Photo 1-2-2　Russian nuclear breaker Taymyr Russian nuclear breaker (provided by Mr. Jin Saijo)

[Requirements for the ice convoy]

Master of ship while moving in the ice convoy shall ensure:

1. Placing the ship within the convoy in compliance with the instruction of the master of the icebreaker;
2. Abidance by ship of the place within the ice convoy, ship's speed and distance to a ship ahead in compliance with the instruction of the master of the icebreaker;
3. Fulfillment of the instructions of the master of the icebreaker in connection with the icebreaker assistance;
4. Immediate transfer to the icebreaker of the information about the place fixed for ship within the ice convoy, speed and/or distance to other ship in the ice convoy; verification of water level in bilge wells every hour and after powerful impact of ship against ice;
5. Immediate transfer to the icebreaker of the information about damages inflicted on the ship's hull.

The fee rate of the icebreaker assistance shall be determined according to the legislations taking into account the capacity of the ship, ice class of the ship, distance of the escorting and period of navigation.

2.2.3 Pilot assistance

Pilot assistance[28] in the water area of the Northern Sea Route shall be carried out by ice pilots who are Russian nationals certified by the NSRA. They are required to have a service record of not less than three years as ship master or chief mate on sea ships with a capacity of 3000 t and more out of which at least six months of ship navigation under ice conditions and being a worker in the organization rendering services of the pilot ice assistance of ships in the water area of the Northern Sea Route. Ice pilots are staff of an organization rendering the service of icebreaker assistance in the water area of the Northern Sea Route ("organization rendering service of the icebreaker assistance") and carry an ice pilot certificate issued by the NSRA. Their main service is to give appropriate recommendations to masters of navigating ships, while considering the peculiarities of navigation under ice conditions.

[Communication]

Communication between the ice pilot and the master of the navigating ship guided, the ice breaker, or other ships composing the fleet shall be made in Russian or English.

[Boarding and disembarking]

Ice pilot shall be taken aboard at a sea port of the Russian Federation, at a foreign port from which the ship is to move to the water area of the Northern Sea Route or at the point of the reception of an ice pilot.

Ice pilot shall disembark at a sea port of the Russian Federation or a foreign port being the first port of the calling of ship after the transit in the water area of the Northern Sea Route, or at the point of the disembarkation of an ice pilot.

[Notice]

[28] Service rendered by pilots to guide ships safely by indicating the course and speed of the navigating ships while exchanging information with the master at the bridge

24, 12 and 3 hours before approaching the point of taking aboard an ice pilot, the ship master shall inform the organization rendering services of the ice pilot assistance of the intended time of the approach of the ship to the point of taking aboard an ice pilot.

[Receipt]

An ice pilot after having been taken aboard shall present, at a location clearly visible to the ship master, the receipt setting forth the following information:

1) Number of receipt;
2) Name of the ice pilot;
3) Name of the ship;
4) Flag of the ship;
5) IO number of the ship;
6) Call sign of the ship;
7) Type of the ship;
8) Ship's dimensions: overall length, overall width in meters;
9) Forward and aft draft in meters;
10) Last port of the ship's call;
11) Port of destination;
12) Type and amount of cargo in metric tons;
13) Number of passengers;
14) Name of the ship owner;
15) Name of the ship agent;
16) Date and time of the arrival of the ice pilot aboard ship;
17) Date and time of the departure of the ice pilot from ship;
18) Information on initial and final points of the route of the pilot ice assistance;
19) Information on the comments of the ship master (if any);
20) Name of the ship master;
21) Date of the filling of receipt.

The receipt shall be signed by the ship master and certified by the ship's seal. All entries in the receipt shall be duplicated in English.

[Fee of pilot assistance]

The fee rate for the pilot ice assistance shall be determined in accordance with legislation taking into account the capacity and ice class of the ship, distance of the escorting and hours of navigation.

2.2.4 Navigation assistance

Ships navigating in the Northern Sea Route area shall be under the control of the NSRA as provided by the Rules of navigation in the water area of the Northern Sea Route that are a domestic law of Russia and shall follow instructions of the NSRA. With regard to navigation assistance provided by the NSRA on the Northern Sea Route, navigating ships shall observe the following conditions:

[Regular reporting]

When a ship moves on seaways in the water area of the Northern Sea Route after crossing the Western or Eastern boundary and before leaving the water area of the Northern Sea Route, the ship master sends to the NSRA the following information at the moment of reporting once a day at 12.00 Moscow time:

1) Name of the ship and her IMO number;
2) Geographical coordinates of the ship (latitude and longitude);
3) Planned time of the ship leaving the water area of the Northern Sea Route or planned time of the arrival of the ship to the seaport situated in the water area of the Northern Sea Route;
4) Route of the ship with an accuracy of one degree;
5) Speed of the ship in knots with an accuracy of one knot;
6) Type of ice, thickness of ice in meters and concentration of ice;
7) Temperature of ambient air in centigrade degrees with an accuracy of one degree;
8) Temperature of outside water in centigrade degrees with an accuracy of one degree;
9) Direction of wind with an accuracy of 10 degrees;
10) Speed of wind with an accuracy of one meter per second.
11) Visibility in nautical miles with an accuracy of one mile;
12) During the movement of the ship in open water – height of waves in meters with an accuracy of one meter;
13) Amount of fuel aboard in metric tons;
14) Amount of fresh water aboard in metric tons;

15) Information on accidents with crew members, passengers or ships (if any);
16) Information on detected malfunctions or lack of navigational equipment (if any);
17) Other information regarding safety of navigation and protection of the marine environment against pollution from ships (if any).

[Other reporting]

In the case of the detection of pollution of the environment, the ship master shall immediately inform the NSRA of the pollution.

A navigating ship moving towards the place of meeting with icebreaker/icebreakers shall navigate in ice in compliance with her category of ice strengthening. If the ship is approaching ice through which she cannot move independently, the ship master shall inform the organization rendering services of the icebreaker assistance and the icebreaker waiting for the ship at the point of meeting and act further on in accordance with the recommendations of the icebreaker master.

Navigating ships in compliance with the permission to navigate in the water area of the Northern Sea Route without icebreaker assistance, when approaching ice in which they cannot move independently, shall immediately inform the NSRA accordingly and act in compliance with its recommendations.

2.2.5 Navigational-hydrographic support

The navigational-hydrographic support in the water area of the Northern Sea Route involves the investigation of obstacles in the course in order to keep up-to-date navigational nautical charts, guides and manuals for the navigation as well as informing seafarers of changes in the navigational situation and securing safety with navigational aids.

In compliance with the "Code of commercial navigation of the Russian Federation," the navigational-hydrographic support in the water area of the Northern Sea Route is provided by the federal body of execution power performing functions of rendering state services and state property control in the sphere of sea transport (Rosmorrechflot : Federal Agency for Maritime and River Transport of Russia). However, the functions of the agreement of the

installation of navigational aids and areas of carrying out hydrographic works as well as of rendering information services are performed by the NSR Administration.

[Notice to mariners]

The ship master of a navigating ship having detected a malfunction or the lack of the navigational aids indicated on the nautical chart or in the navigational manual shall inform the NSRA of the fact. The information shall be provided to individual ships through notice to mariners after examination of its content.

[hydrometeorological and ice analysis, etc.]

Functions of monitoring hydrometeorological, ice and navigational conditions in the water area of the Northern Sea Route are performed by the NSRA. On the basis of the information received from organizations and institutions of the Federal service on hydrometeorology and monitoring of the environment and the information received from ships through regular reporting, the NSRA daily posts hydrometeorological and ice analysis as well as a hydrometeorological and ice forecast for 72 hours on its official website.

2.2.6 Radio communication

Radio communication between ships, icebreakers and the NSRA in the Northern Sea Route water area shall be carried out with the use of radio equipment designed to satisfy all requirements for the operating water zones A1, A2, A3 and A4 of the Global Maritime Distress and Safety System (GMDSS[29]) in compliance with the Rules of radio communication of the maritime mobile service and maritime mobile satellite service of the Russian Federation[30].

[International VHF]

While moving in an ice convoy, icebreaker/icebreakers and ships shall keep continuous radio watch on VHF channel 16. While moving in the ice convoy, radio communication between ships and between ships and

[29] Global Maritime Distress and Safety System is a radio communication system introduced to ensure quick and certain rescue request to search and rescue organizations and ships navigating in the vicinity, regardless of the marine area of the distress.

[30] The Rules of radio communication of the maritime mobile service and maritime mobile satellite service of the Russian Federation

icebreaker/icebreakers shall be carried out on the VHF communication channel established by the icebreaker master supervising the movement of the ice convoy. Radio talks not related to the movement of the ice convoy or safety of navigation on the VHF channel are prohibited.

[High latitude reporting]

In the independent sailing of a ship within the sea region A4 of GMDSS (outside the coverage zone of the INMARSAT[31] system, to the north of parallel 75° N) the ship master shall inform the NSRA accordingly and receive its instruction.

The ship master shall report the planned geographical coordinates of points of the intersection of parallel 75° N during the movement of the ship from the south to the north or from the north to the south. The NSRA shall inform the ship master of the ships used as mediators for communication by radio (ships – mediators) and the scheme of communication of the ship with the NSRA using the ships-mediators. The NSRA shall send the information on the assigned ships-mediators also to appropriate search and rescue organizations[32].

2.2.7 Other requirements

Ships navigating in the Northern Sea Route area shall satisfy the following requirements for navigation safety and protection of the marine environment from pollution by ships based on the Rules of navigation in the water area of the Northern Sea Route that are a domestic law of Russia.

[Having aboard of sea nautical charts, etc.]

Ships when navigating the water area of the Northern Sea Route should have aboard:

1. Present Rules (Rules of navigation in the water area of the Northern Sea Route);
2. Sea nautical charts and manuals along the entire route of movement through the water area of the Northern Sea Route;
3. Supplementary emergency equipment including:
   During polar night navigation – one searchlight with power of at

[31] A private service providing telephone, fax, data communication, Internet connection and other services using four geostationary satellites

[32] The State Maritime Rescue Coordination Center (SMRCC), the Maritime Rescue Coordination Center (MRCC) and the Maritime Rescue Sub-Center (MRSC)

least two kW with a set of spare lamps which can be installed in the forebody of ship or at one of the wings of the conning bridge;
One set of warm clothes for each person on board and three spare sets in addition; and
Hydrosuits in a number matching the maximum admissible number of persons who can be on board during the navigation.

[Equipment, machinery, etc.]

The following requirements concerning equipment, machinery, etc. shall be met on a ship navigating in the water area of the Northern Sea Route:

1) A tank or tanks for the collection of oil residues (the capacity shall be sufficient taking into consideration the type of ship power plant and duration of voyage in the water area of the Northern Sea Route);
2) Storage tanks of sufficient capacity for the collection of waste (sludge) [33] produced in the operation of the ship taking into consideration the duration of voyage in the water area of the Northern Sea Route;
3) Amount of fuel, fresh water and provisions on the ship should be sufficient for the navigation in the water area of the Northern Sea Route without replenishment taking into consideration the maximum possible duration of navigation; and
4) During the period from November to December and from January to June, heating appliances for ballast tanks adjoining the external side above the operating waterline

[Power plant]

When a ship is following an icebreaker alone or in an ice convoy, the power plant of the ship shall be prepared to immediately change the mode of ship movement.

[Mariner on watch duty]

On the conning bridge of the ship navigating in the water area of the Northern Sea Route under ice conditions of ice concentration exceeding point three, the master or chief mate shall be present.

[33] Impurities in fuel oil and also muddy deposits of oil and rust in tank

[Prohibition of discharge of oil residues]

Discharge of oil residues into the water area of the Northern Sea Route is prohibited.

Photo 1-2-3 Waste oil tank

Chapter 2 Life and Occupational Safety on the Northern Sea Route

1. Life on the Northern Sea Route

When winter is at its coldest, air temperatures on the Northern Sea Route (NSR) drop as low as -30-35°C. On the other hand, in summer, when use of the NSR reaches a peak, the temperature rises to around +5-10°C and can even rise above +20°C if the weather is mild. However, conversely, it is not unusual for temperatures to fall below zero in cold weather.

In winter, the temperature of the seawater across a large expanse of the NSR drops below zero, falling as low as -2°C. On the other hand, in summer, sea surface temperatures vary a lot due to ice conditions and the effects of warm currents. In the Barents Sea, which is affected by warm currents originating in the Gulf Stream, the temperature can rise above +10°C. In other waters, the temperature increases to around +5°C if the sea ice disappears quickly, but if it remains, the temperature will be between freezing point and 0°C. In the waters of the Northeast Passage other than the Barents Sea, sea temperatures suddenly drop in the latter half of September or thereafter, causing sea ice to grow.

In daily life on the NSR, it is necessary to take care all year round regarding various issues that can arise because of the low air and sea temperatures, in addition to the general precautions required in ordinary waters.

1.1 Daily Life

Low air and sea temperatures can affect daily life on board ship in various ways. The following explains important points concerning daily life on the NSR.

1.1.1 Laundry

The temperature of freshwater[34] and drinking water[35] stored in the ship's freshwater or drinking water tanks varies according to the temperature of the air or seawater to which the tank in question is exposed. On the NSR, air and sea temperatures drop in the depths of winter, so freshwater and drinking water can be very cold, below +5°C, and might even be frozen in a worst-case scenario. Even in summer, if the weather is cold and air or sea temperatures drop significantly, freshwater and drinking water could be as cold as +5-7°C.

[34] Freshwater used for laundry, bathing, cleaning, and toilets, etc.
[35] Freshwater used for drinking and cooking, etc.

Consequently, the freshwater and drinking water tanks on ice-going vessels sailing the NSR are usually equipped with heating cables or other heating systems to heat the water or an air bubbling system that creates bubbles in the water, in order to prevent damage to the tank due to freezing. However, the purpose of these systems is to prevent freshwater and drinking water from freezing and they are not powerful enough to turn cold water into warm water. Consequently, on the NSR, the freshwater and drinking water provided on board ship is likely to be cold water all year round. The first thing that this is likely to affect in daily life is laundry.

Photograph 2-1-1 Using powder detergent in cold water can leave a residue (Image courtesy of photo AC)

Ordinary households frequently use synthetic liquid or powder detergents for laundry. To protect the environment or for health reasons, some people use soap powder made from natural animal or vegetable fats and oils. Others use a laundry detergent called complex soap, which combines the features of synthetic detergents and soap.

The surfactants that are the principal component of all of these laundry detergents are generally most effective, with high cleansing power, when the water is +30-40°C, but tend to become less effective as the water temperature drops, losing their ability to cleanse. The loss of cleansing power is particularly pronounced when the water temperature is less than +8°C, falling to about half of the level achieved when the water is +30-40°C. Because the tap water supplied to many Western homes is hard water, laundry rooms in such countries are usually fitted with a hot water tap and it is usual to wash laundry in warm water. Consequently, laundry detergents available in those countries are said to perform comparatively poorly in cold water. In contrast, it is rare

for laundry rooms in Japanese homes to be fitted with a hot water tap and laundry is usually washed in cold water, even in winter. Consequently, Japanese laundry detergents are said to perform comparatively well in cold water.

Either way, when using washing machines on board ship, it is preferable to avoid using cold water as far as possible and to wash laundry in warm water, to ensure the best cleansing power. However, if you have no choice but to use cold water because the laundry room is not equipped with warm water, you could use a product containing sodium carbonate or another alkaline chemical, because the reduction in their surfactant effect in cold water is less pronounced than that of other detergents. In general, powder detergents contain a lot of these alkaline chemicals, while liquid detergents contain comparatively little. On the other hand, liquid detergents contain more of the surfactants that boost cleansing power than powder detergents.

Incidentally, powder detergents tend to leave a residue on laundry and in the washing machine drum when used in cold water, because they do not dissolve fully. You can prevent residues on your laundry and in the washing machine drum by placing the detergent in a small quantity of warm water in the washing machine drum and agitating it to dissolve it before putting your laundry in the machine. Alternatively, you can prevent this by carefully sprinkling the detergent evenly over your laundry, rather than putting in all of the detergent at once.

After washing, using the washing machine's drying function, or the dryers installed in the laundry room, or the ship's drying room is the most efficient way of drying your clothes in a short time. However, you could also hang them up in your cabin, which would enable them to dry naturally, while also preventing your cabin from becoming too dry.

1.1.2 Toilets

In low temperatures on the NSR, toilets located in parts of the ship not served by the air conditioning system, such as toilets for cargo handlers that face onto exposed decks, could be damaged if freshwater freezes. If the toilet is designed specifically for use in cold climates, with a space heater or other heating device inside the bowl, do not forget to activate this in order to prevent freezing.

In the case of toilets not equipped with such devices, ensure that you take appropriate preventive measures, such as draining all of the freshwater from the bowl and the pipes before the temperature falls.

Photograph 2-1-1 Activate the heating device in toilets designed for use in cold climates

1.1.3 Bathing

Taking a bath is an extremely effective means of warming up when temperatures fall on the NSR, as well as being a way to relax after a day of hard physical work, ensuring that you get a good night's sleep and wake up refreshed and energized the next day, so it is something to look forward to.

In cold weather, the ideal temperature for bathwater is +37-40°C, just a little higher than normal body temperature, to ensure the right level of blood circulation and activate the parasympathetic nervous system. You should spend no longer than 15 minutes in the bath and avoid soaking in the bath for longer than that. Bathing in water hotter than +42°C raises the risk of heart or cerebrovascular disease due to a sudden rise in blood pressure or blood clot formation; it also stimulates the sympathetic nervous system and causes a state of excitement, so the relaxation effect of the bath is lost.

One way to enhance the effects of bathing is to use a bath additive. Foaming bath additives containing sodium carbonate are particularly effective at promoting blood circulation and warming the body, while additives containing natural remedies derived from herbs used in traditional Chinese or Western herbal medicine are said to enhance the body's ability to retain heat as well as preventing you from feeling chilly after your bath. Some bath additives have moisturizing and relaxing effects.

To avoid feeling chilly after your bath, you should close the pores opened up by your bath, thereby preventing your body temperature from dropping. You can do this before leaving the bathroom by showering in tepid water (+25°C), splashing cold water on your legs from the knees down in the shower, or wiping your body with a towel soaked in cold water and then wrung out. Going to bed straight after a bath can cause you to feel chilly, because your body temperature drops as a result of heat dissipation due to sweating or dilation of the blood vessels. Avoid going straight to bed, wherever possible; it is better to wait an hour or so until your body temperature stabilizes.

Photograph 2-1-3 Ensure a good night's sleep by means of the right bathing method and bath additives (Image courtesy of photo AC)

Even if you do not have a bathtub in your cabin and can only take a shower, you can devise ways to achieve a similar effect to a bath. Specifically, these include (1) filling the handbasin or other container with hot water and splashing the hot water on your feet while you shower; (2) taking a hot shower with a bath towel covering your shoulders or wrapped around your waist; and (3) letting the hot water run in the shower for a while to warm the room before you get into the shower and then showering while the room is still steamy.

If there is too great a difference in temperature between the changing room and the bathroom, you will be at risk of suffering a heart problem such as a heart attack or cerebrovascular problem such as a brain hemorrhage, due to a rise in blood pressure

brought about by the sudden temperature change. In low temperatures while sailing cold seas, when using changing rooms with a low room temperature due to being located in a part of the ship not served by the air conditioning system, it is preferable to place a fan heater in the room in advance and activate it before using the room, in order to warm it up. In addition, when using a bathroom or shower room with a low room temperature, you must take appropriate steps before getting undressed, such as splashing the floor with hot water to warm up the room.

1.2 Diet

In frozen waters and other cold seas, your day-to-day diet is very important, because it warms your body from the inside, thereby preventing chills, and also boosts your immunity, helping to ensure that you do not catch colds, bronchitis, or other respiratory diseases. The following explains important points concerning diet when sailing cold seas.

1.2.1 Meals to Prevent Chills

Cold weather can occur at any time on the NSR and low cloud or fog is particularly common in summer, due to warm air from the continent coming into contact with ice. Accordingly, there can be long spells of weather with little hope of seeing the sun. In this kind of environment, even those who have previously had no problems can feel the cold. Particular care is required in the case of Southeast Asian seafarers, as they are accustomed to warm environments where the sun is very strong. In the olden days, there was a saying: coldness is the root of all diseases. If you fail to take steps to deal with it, not only will your circulation deteriorate, but stress will build up, creating a risk of insomnia and a whole host of other diseases. There is a tendency to think of susceptibility to coldness as a symptom unique to women, but the number of men complaining of it has been growing of late.

An effective way to prevent chills or alleviate symptoms is to eat meals containing ingredients that warm your body from the inside, as well as taking moderate exercise. On the other hand, the problem of obesity due to lack of exercise and overeating is prevalent worldwide among seafarers, so lower-calorie meals are recommended, whether you are in frozen waters or elsewhere. Consequently, it would be fair to say that the ideal meal is one that uses ingredients which not only warm the body from the inside, preventing chills and alleviating symptoms, but also contribute to a healthy diet.

Let us look at examples of ingredients that warm the body from the inside and are also lower in calories. In the case of cereals, these include black rice, brown rice, black soybeans, and adzuki beans. Black bread and the like, which is made from rye and other grains with black or dark surfaces, also falls into this category. Nutritious vegetables of

this nature include root vegetables, such as burdock, lotus root, and ginger, as well as garlic and winter vegetables such as leaks, carrots, and garlic chives. Healthy and warming fish, shellfish, and meat include goat, chicken, chicken liver, pork liver, salmon, sardines, bonito, and oysters. Of course, you must not eat too much of anything, even if it is low in calories and effective against the cold. The key thing is to eat meals with a good nutritional balance, featuring appropriate combinations of these ingredients, in amounts suitable for your basal metabolic rate.

Photograph 2-1-4 Brown rice and black soybeans are effective in preventing chills (Image courtesy of photo AC)

1.2.2 Meals to Boost Your Immunity

In cold seas such as the NSR, crew members' resistance to bacteria is weakened by the dry air in their living quarters, so they are prone to colds, bronchitis, and other respiratory diseases. Eating meals that boost immunity and contribute to a healthy diet is effective in preventing colds and the like, as is taking steps to stop your cabin becoming too dry.

The immune cells that increase your immunity are active during the daytime, but not very active at night. It is important for you to take care regarding your meals, so as not to disturb this rhythm. In other words, to boost your immunity through diet, it is vital that you regularly eat three meals a day at the appointed times. It is particularly important to eat a good breakfast, as this has the effect of raising your body temperature and engaging the switch that activates your immune cells. However, a full stomach actually reduces your immunity, so it is best to stop eating before you are full (in Japanese, we talk about eating until your stomach is 80% full). You must be particularly careful about overeating before going to bed, because it not only leads to reduced immunity due to a full stomach, but can also result in obesity.

Imbalanced nutritional intake reduces immunity. Consequently, to boost immunity through your diet, it is important to take care not to eat too much of any one thing, and to try to eat as many different types of ingredient as possible to achieve a good nutritional balance. In general, they say that eating at least 30 different ingredients per day is ideal.

Photograph 2-1-5 Aim to eat at least 30 different ingredients per day (Image courtesy of photo AC)

Disruption to your gut environment also reduces immunity. Consequently, to boost immunity through your diet, it is important to maintain a healthy gut environment by actively consuming ingredients that regulate the functions of the intestines, thereby increasing the number of enteric bacteria with an immunity-boosting effect.

Immune cells are mainly made from protein, so a diet deficient in protein will result in lower immunity. Consequently, to boost immunity through your diet, it is also important to actively consume ingredients that contain high-quality protein.

Incidentally, a percentage of the oxygen in the human body turns into highly oxidative substances called free radicals. Some free radicals are highly toxic and, when generated to excess, cause the body's cells to age. They are also said to trigger various diseases, such as the proliferation of cancer cells and hardening of the arteries. Consequently, to boost immunity through your diet, it is also important to actively consume ingredients with an antioxidant action, which help to remove free radicals.

Table 2-1-1 Types of Immunity-boosting Ingredients and Their Effects

Effects of Ingredients	Types of Ingredient						
Ingredients that regulate intestinal functions	Yogurt, natto (fermented soybeans), miso, and other fermented foods *Please note that these should be eaten along with foods containing oligosaccharides and plant fiber.						
Ingredients containing high-quality protein	Pulses, soy products, meat, fish, dairy products, etc.						
Ingredients with antioxidant action	Rich in vitamins A, C, and E	Rich in beta-glucan	Rich in polyphenols	Rich in isothiocyanates	Rich in allicin	Rich in selenium	Rich in zinc, copper, and manganese
	Strawberries, persimmons, lotus root, pumpkin, kiwifruit, komatsuna (mustard spinach) leaves, garlic chives, etc.	Shiitake mushrooms, enoki mushrooms, eringi mushrooms, nameko mushrooms, etc.	Soybeans, shungiku (*Glebionis coronaria*) leaves, grapes, blueberries, etc.	Broccoli, cabbage, turnips, etc.	Garlic, leeks, garlic chives, onions, etc.	Bonito, tarako (Alaska pollack roe), sunflower seeds, etc.	Oysters, beef and pork, dried shrimp, cocoa, liver, pulses, seaweed, etc.

1.2.3. Examples of Meals

Japanese hot pot is a good example of a meal which uses ingredients that prevent chills, alleviate symptoms, and boost immunity. When talking about a typical dish for a cold winter's day, the first thing that springs to mind for Japanese people is hot pot. No matter how harsh the cold or intense the blizzard outside might be, one of the greatest pleasures for Japanese people is to sit around a hot pot with their family. It is also the best way to ward off the cold. The term "hot pot" encompasses a diverse array of dishes involving meat, seafood and/or tofu cooked with vegetables in a broth that may or may not be flavored with miso or soy sauce, depending on the variety of hot pot. These include *yose-nabe*, *mizutaki*, *oden*, *sukiyaki*, *shabu-shabu*, *yudofu*, *kimchi-nabe*, *chanko-nabe*, *motsu-nabe*, and *kani-nabe*. Hot pot is an excellent dish, because as well as making it possible to eat a good nutritional balance of various ingredients in a single dish, stewing the ingredients aids digestion and absorption, and the nutrients infused into the soup from the ingredients are also consumed.

hotograph 2-1-6　Hot pot is an ideal meal for the NSR (Image courtesy of photo AC)

Photograph 2-1-7 *Samgyetang* is an ideal meal for the NSR (Image courtesy of photo AC)

Other Asian countries have their own dishes which, like Japanese hot pot, use ingredients that prevent chills, alleviate symptoms, and boost immunity. The Korean dish *samgyetang* is a soup made from a whole chicken stuffed with ginseng, jujubes, pine nuts, garlic, and glutinous rice. It was originally a nutritious dish eaten to ward off summer fatigue, but is now eaten all year round, because it contains ingredients that warm the body from the inside, as well as many ingredients that boost immunity. There is also *jjigae*, a typical Korean hot pot featuring kimchi, meat, fish and shellfish,

vegetables, and tofu simmered in a broth seasoned with *gochujang*[36] and chili peppers. Both of these dishes are familiar parts of the Korean diet, used for warding off summer fatigue and winter cold. They are both excellent candidates for dishes for keeping out the cold on the NSR.

Photograph 2-1-8 *Jjigae* is an ideal meal for the NSR (Image courtesy of photo AC)

The Filipino dish chicken adobo consists of chicken seasoned with garlic and other spices, which is then simmered in vinegar and coconut milk. Just as *nikujaga* (stewed meat and potatoes) is a popular item on the menu in Japanese homes, chicken adobo is a familiar dish that typifies Filipino home cooking and is well-loved by most Filipinos. It contains many ingredients that warm the body and boost immunity, such as chicken, garlic, and pepper, so it is an excellent dish for keeping out the cold on the NSR.

[36] Spicy miso paste from Korea.

Photograph 2-1-9 Adobo is an ideal meal for the NSR (Image courtesy of Fomaa/PIXTA)

1.3 Air Conditioning

In frozen waters and other cold seas, maintaining an appropriate temperature and humidity level inside the ship is a very important part of managing the health of crew members by preventing disease. The following explains important points concerning air conditioning when sailing cold seas.

1.3.1 Temperature and Humidity Settings

As shown in Table 2-1-2, the appropriate temperature setting for heating during winter is usually considered to be between +18°C and +22°C, but the Japanese Ministry of the Environment (MOE) recommends that it be set at +20°C to conserve energy. On the other hand, the appropriate temperature setting for cooling during summer is usually considered to be +25°C to +28°C, but the MOE recommends that it be set at +28°C to conserve energy.

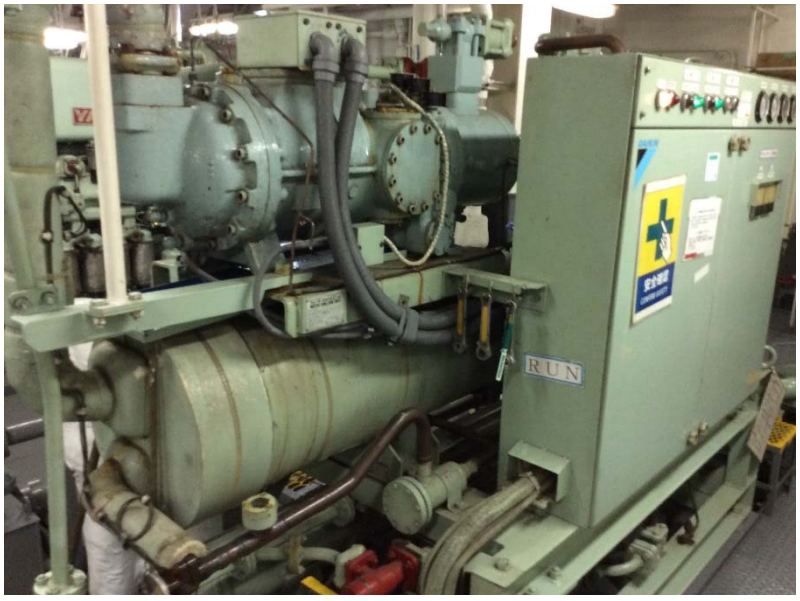
On the NSR, the heater functions of the air conditioning equipment keep the temperature in the living quarters on the ship at a constant level, even in cold weather. However, in many cases, ships use a central air conditioning system powered by a large unit, so unlike the individual air conditioning systems found in hotel rooms, the temperature in each cabin cannot be finely adjusted to suit personal preferences.

People's perceptions of temperature differ according to not only gender, ethnicity, age, and region of residence, but also the humidity and wind speed in that particular location. Consequently, there is no categorical rule about what temperature is the appropriate one when using a central air conditioning system for heating in cold seas. Start by setting the heater temperature at around 20°C and if any crew members complain of feeling cold,

provide them with individual guidance on taking steps to keep out the cold, such as wearing warm underwear or other clothing, or using neck warmers and legwarmers. If crew members still complain of feeling cold even after taking such steps, it is desirable to raise the temperature in small increments, watching how the situation changes, up to a limit of +23°C.

Table 2-1-2 Guide to Temperature Settings for Air Conditioning Equipment

	Usual temperature setting	MOE-recommended temperature setting	Example of temperature settings on the NSR
While heating	18°C–22°C	20°C	20°C–23°C (if crew members are feeling the cold, provide them with individual guidance on measures to keep out the cold and raise the temperature if necessary)
While cooling	25°C–28°C	20°C	—



Photograph 2-1-10 Ship's air conditioning system

Striking just the right balance of temperature and humidity alters the apparent temperature even when the room temperature is the same and makes the apparent humidity more comfortable. When the heater is running, if the air conditioning equipment enables you to adjust the humidity on board ship by mixing in steam from the miscellaneous steam feed, you can alter the apparent temperature by adjusting not only

the temperature setting, but also the humidity level if any crew members complain of feeling cold.

In general, a comfortable humidity range for people is, as shown in Table 2-1-3, between 40% and 60%. The range is 45% to 60% when the heater is running and 55% to 60% when the cooler is running; in both cases, a level of around 50% is considered ideal. Above this level, the apparent temperature rises and there is a risk of harmful effects, such as condensation and the growth of mold. Below this level, the apparent temperature falls and there is a risk of harmful effects, such as greater viral activity.

Table 2-1-3 Guide to Humidity Settings for Air Conditioning Equipment

Humidity	Status	Remarks
100–60%	Too high	As well as raising the apparent humidity, this will result in such harmful effects as condensation and the growth of mold
40–60%	Appropriate	While heating: 45–60% While cooling: 55–60% (50% is ideal)
0–40%	Too low	As well as lowering the apparent humidity, this will result in such harmful effects as greater viral activity.

1.3.2 Measures to Prevent Dryness

When using the air conditioning system's heating function in cold seas, there can be times when it is difficult to adjust the humidity and the air in the cabins becomes unusually dry, leading to various health problems, including nose or throat problems, respiratory diseases such as colds and bronchitis, and chapped skin. To prevent such health problems from occurring, it is important to carefully manage the humidity levels of the air conditioning equipment and to provide crew members with guidance about individually taking the following steps to prevent dryness.

1. Fill the bathtub or basin in the bathroom of your cabin with hot or cold water.
2. Hang your laundry up to dry naturally in your cabin.
3. Soak a bath towel or face towel in water, then wring it out to ensure that it does not drip and hang it on a clothes hanger or the back of a chair.
4. Wear a mask over your mouth and nose when you go to bed. If you find it hard to breathe, you could use a scarf or neck warmer instead.
5. Place a mug or open jug of water at the head of your bed.

6. Install a humidifier in the cabin and switch it on before going to bed.
7. Take appropriate steps to prevent chapped skin, such as applying body lotion.

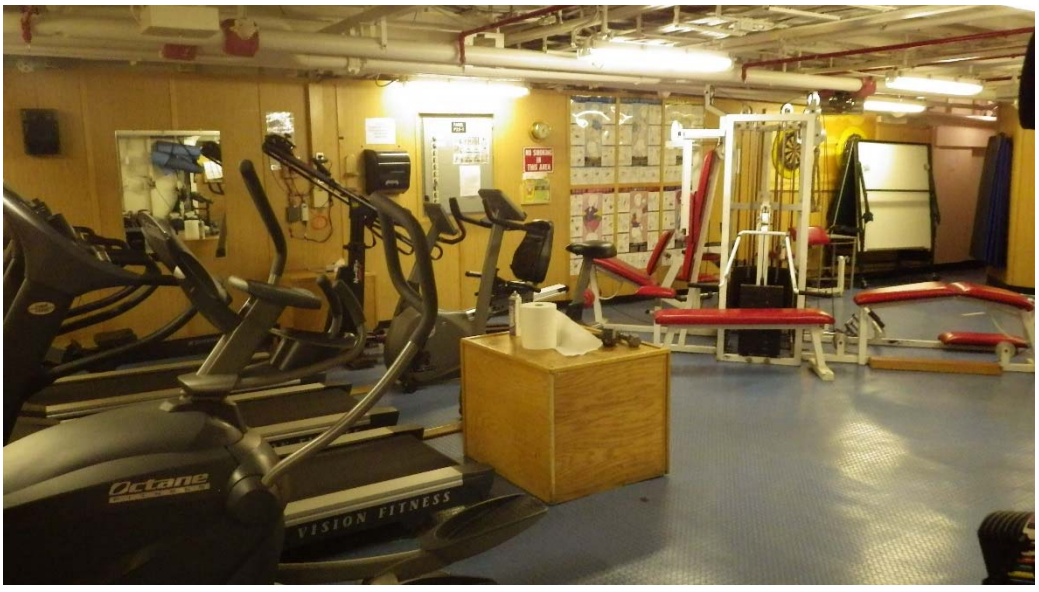
1.4 Exercise and Hydration

Cold weather can occur even in summer on the NSR and safety concerns such as the risk of freezing means that it is often not possible to exercise by walking or jogging on exposed decks. Accordingly, the quality of daily life could become worse and worse for crew members, who, it has been noted, are already prone to a lack of exercise even in other seas. In frozen waters and other cold seas, people sweat less and tend to become careless about hydration, because they do not feel thirsty.

Taking moderate exercise and ensuring proper hydration while on board ship is very important in maintaining the health of crew members sailing the NSR. The following explains important points concerning exercise and hydration when sailing cold seas.

1.4.1 Exercise

Even if exposed decks cannot be used in cold seas, if the ship has a gym on board, it is desirable for crew members to make effective use of it to take regular moderate exercise in order to care for their health.



Photograph 2-1-11 Care for your health through moderate exercise (Image courtesy of Hiroki Shibata)

Exercise can be broadly classified into two categories: aerobic exercise, which burns

sugar and fat with the body's oxygen over a comparatively long period, and anaerobic exercise, which uses short, large bursts of energy, without using much of the oxygen in the body. Examples of aerobic exercise that can be taken using equipment in the ship's gym include jogging or walking on a running machine and cycling on an exercise bike. Examples of anaerobic exercise include resistance training using weights and the like. Aerobic exercise can help to reduce body fat and lower blood pressure, while anaerobic exercise is effective in building muscle and improving basal metabolism.

If the ship has no gym or no appropriate equipment is available, there are aerobic exercises that can easily be done in your cabin, such as stepping on and off a step of some kind. Some shops sell 10–15cm-high steps designed specifically for such exercises. Anaerobic exercises that you can easily do in your cabin include squats (an exercise done standing up, in which you repeatedly bend and straighten your knee joints, taking your weight on the lower half of your body), which build muscle strength, as well as promoting weight loss. Whatever exercise you take, it is imperative that you take care to ensure that it is moderate and does not impose an excessive burden on your body.

Photograph 2-1-12 Hydration is important, even in cold seas (Image courtesy of photo AC)

1.4.2 Hydration, etc.

In cold seas, people sweat less, so they tend to become careless about hydration. While the exact amount depends on basal metabolic rate as determined by age and weight, it is said that people need at least around 2.5L of liquid per day. Given that the water content of meals generally provides around 1L, this means that people need to drink at least around 1.5L of liquid in addition to their meals.

If the weather turns cold while sailing the NSR, the temperature of the drinking water supplied throughout the ship may fall significantly, reaching a temperature of less than +5°C in some cases. Care is required because drinking large amounts of very cold water can have an impact on the body: for example, it causes the movement of the stomach to slow, impairing gastric emptying (the emptying of stomach contents into the duodenum). It is preferable to avoid drinking chilled water, as far as possible, and to maintain hydration using drinking water that has been placed in a jug beforehand and left to reach room temperature, or by drinking hot drinks.

Impaired gastric emptying can also have an effect on pharmacokinetics (the body's absorption, distribution, metabolism, and excretion of administered medications). When taking oral medications, it is preferable to avoid using too much cold water, as far as possible, instead taking them with drinking water at room temperature or warm water at around body temperature.

Photograph 2-1-13 Take care to manage the health of crew members at all times (Image courtesy of photo AC)

1.5 Waste Management

The waters of the Arctic are vulnerable to environmental change and the ability of its ecosystem to recover is slower than that of other marine areas, so the discharge of waste into this ocean is prohibited in principle. However, there is an exception for the discharge of food scraps and similar waste into the ocean, as long as it meets a set of specific requirements, in accordance with the Polar Code. Ships sailing the NSR needs to manage onboard waste properly and rigorously, to ensure that marine pollution does

not result from the discharge of waste due to an accident, or from its discharge due to a deliberate act or an error arising from lack of knowledge. The following explains important points concerning waste management on the NSR.

1.5.1 Basic Principles

The crew members of ship sailing the NSR must prevent the pollution of Arctic waters due to the deliberate or accidental discharge of waste; should an accident result in the discharge of waste, they must take steps to minimize marine pollution. Furthermore, they must rigorously abide by the following basic principles (the 3Rs) at all times and strive to reduce the absolute quantity of waste generated on board ship as far as possible, to proactively contribute to the formation of a resource recycling-based society worldwide.

1. Reduce the amount of waste generated
2. Reuse waste
3. Recycle waste

The following are examples of specific measures that can be taken to reduce the absolute quantity of waste generated on board ship.

[Loading supplies]

1. Selecting suppliers that will assist in minimizing the quantity of waste generated.
2. Selecting suppliers that will provide refills or exchanges for products loaded on previous occasions.
3. Asking suppliers to load the largest containers possible, taking into account the period of storage after opening.
4. Removing unnecessary packaging from supplies immediately and asking suppliers to take it away with them. Asking suppliers to avoid packaging items in plastic, wherever possible.
5. Asking suppliers to avoid the use of disposable kitchenware, tableware, towels, etc. and to load items that can be reused or recycled, as far as possible.
6. Handing over explosives and chemicals that have expired or are close to their expiry dates to producers or retailers that are willing to reuse, recycle, or refill them.

Photograph 2-1-14 Adjust portion sizes to suit the preferences of crew members

[Diet]

1. To minimize leftovers after meals, the cook should ensure that meal portion sizes are adjusted to suit the preferences and physique of each crew member.
2. When preparing ingredients, the cook should take care not to over-peel vegetables or remove too much fat from the meat, in order to ensure that nothing edible is discarded as waste, as far as possible.
3. The cook should pay attention to the expiry dates of ingredients and do their utmost to eliminate waste resulting from items stored in refrigerators, etc. passing their expiry dates without being used.
4. The cook should take care to ensure that ingredients do not lose their freshness, rot, or develop mold and do their utmost to eliminate waste resulting from items having to be discarded as waste without being cooked.

Photograph 2-1-15 Use covers made from reusable material for deck machinery, etc.

[Onboard tasks]

1. Completely use up the contents of containers such as cans, tubes, and bottles.
2. Review work processes from the perspective of minimizing waste.
3. Gain an accurate understanding of the quantity of waste generated by each item of materials and equipment and devise effective means of minimizing this waste.
4. Use materials and equipment with as long a usage/storage life as possible.
5. Avoid materials and equipment that require replacement with new items, as far as possible, and use items that can be repaired.
6. Avoid using covers made from disposable plastic sheets for deck machinery, etc. and use covers made from reusable material instead.
7. Use reusable dunnage, braces, ceilings, and packaging to secure cargo.

Photograph 2-1-16 Separated collection of waste in the designated location

1.5.2 Collection, Separation, and Storage of Waste

You must bear the following matters in mind regarding the separation, collection, and storage of waste on the NSR.

[Separation and collection]

1. Crew members should separate waste into the predetermined types[37]at the location where the waste is generated or at the predetermined separation point.
2. The waste manager appointed by the captain should regularly collect and transfer separated waste to the predetermined storage area.

[37] Food scraps, plastics, metal and cans, glass and bottles, PET plastic bottles, paper, cloth, etc.

Photograph 2-1-17 Storage of waste in the designated location

Photograph 2-1-18 Subcategories of recyclable waste

[Storage]

1. The waste manager must store the collected waste separated by type in the storage area.
2. Separate storage containers for each type of waste must be installed in the storage area and must be labeled in an easily identifiable way, such as a color coding system.

[Ensuring appropriate means of transfer]

1. The waste manager must ensure that an appropriate means is used to transfer waste from the place where it is generated to the storage area.
2. In transferring waste, the waste manager must take the necessary steps to prevent marine pollution, such as measures to prevent waste falling into the sea.

[Ensuring appropriate storage methods]

1. In the case of food scraps liable to rot and items of waste with food scraps attached that are likely to give off an unpleasant smell, the waste manager must take appropriate hygiene measures, such as rinsing or draining the items concerned, making them as compact as possible, and storing them in an airtight container.

1.5.3 Pretreatment of Food Scraps

In Arctic waters, the discharge of food scraps into the ocean is permitted on an exceptional basis, as long as a set of specific requirements are met, in accordance with the Polar Code. Ships discharging such waste must first use a grinder or similar device to grind or crush food waste into pieces with a diameter no greater than 25mm. The following points must be borne in mind when using a grinder.

1. The waste manager should prepare a usage manual that describes the key points of the grinder's capabilities, how to use it, and precautions for use, and place it close to the grinder so that crew members can refer to it at any time.
2. As well as ensuring that crew members are fully conversant with how to use the grinder at all times, the waste manager must not neglect to inspect and maintain the device to ensure that it functions appropriately.
3. The waste manager should put up signs, etc. to warn crew members that placing other waste in the grinder is prohibited, to ensure that waste other than food scraps does not get mixed in.

1.5.4 Exceptional Discharge of Food Scraps

When discharging food scraps into Arctic waters on an exceptional basis in accordance with the Polar Code, the waste manager must liaise closely with the navigational watchkeeper and carefully check that the following requirements regarding the ship's current position and surroundings are met, to ensure that discharge of the waste is permissible.

1. The ship must currently be as far away as possible from areas where the ice concentration exceeds 1/10 and, in all cases, must be no less than 12 nautical miles from the nearest land, nearest ice shelf, or nearest fast ice.
2. The ship must be under way.
3. There must be no risk that the food waste discharged will fall onto the ice.

Photograph 2-1-19 Food waste must be discharged as far as possible from areas where ice concentration exceeds 1/10

If even one of these requirements is not met, food scraps must not be discharged into Arctic waters under any circumstances. The waste manager should store the food scraps on board ship for the time being and then discharge them in Arctic waters where all of these requirements can be met. Alternatively, the waste manager should discharge them in ordinary waters outside the Arctic, in accordance with Annex V Regulation 4 of the MARPOL Convention. The waste manager could instead store the waste on board until the ship reaches its destination, where it should be unloaded and disposed of at an onshore reception facility.

1.5.5 Exceptional Discharge of Cargo Residues

The marine discharge of all cargo residues into Arctic waters is prohibited in principle. However, there is an exception for the discharge into the ocean of water used for washing out the cargo hold that contains cargo residues and the like, as long as it meets a set of specific requirements, in accordance with the Polar Code. The captain of a ship in Arctic waters whose cargo hold has been washed must check the requirements

below and carefully determine whether or not to discharge the hold washing water into Arctic waters.

1. Cargo residues, detergents, or additives do not contain any substances classified as harmful to the marine environment, taking into account guidelines developed by the IMO.
2. The ship's ports of departure and destination are both located in Arctic waters and the ship will not pass through waters other than the Arctic when sailing between these two ports.
3. No adequate waste reception facilities are available at these ports, taking into account guidelines developed by the IMO.

[Disposal of hold washing water whose discharge is not permitted in Arctic waters]

If even one of these requirements is not met, the washing water must not be discharged into Arctic waters under any circumstances. The captain should store the hold washing water on board ship for the time being and then discharge it in ordinary waters outside the Arctic, in accordance with Annex V Regulation 4 of the MARPOL Convention. The captain could instead store the water on board until the ship reaches its destination, where it should be unloaded and disposed of at an onshore reception facility.

[Disposal of hold washing water whose discharge is permitted in Arctic waters]

If all of the requirements listed above are met, it might be possible to discharge cargo hold washing water containing cargo residues, etc. into Arctic waters. When discharging hold washing water, liaise closely with the navigational watchkeeper and carefully check that the following requirements regarding the ship's current position and surroundings are met, to ensure that discharge of the waste is permissible.

- The ship must be as far away as possible from areas where the ice concentration exceeds 1/10 and, in all cases, must be no less than 12 nautical miles from the nearest land, nearest ice shelf, or nearest fast ice.

If this requirement is not met, the hold washing water must not be discharged into Arctic waters under any circumstances. The captain should have the hold washing water stored on board ship for the time being and then have it discharged in Arctic waters where this requirement can be met. Alternatively, the captain should have it discharged in ordinary waters outside the Arctic, in accordance with Annex V Regulation 4 of the MARPOL Convention. The

captain could instead have it stored on board until the ship reaches its destination, where it should be unloaded and disposed of at an onshore reception facility.

1.5.6 Unloading of Waste

Food scraps and cargo residues unable to be discharged into Arctic waters because they do not meet Polar Code requirements must be discharged in ordinary waters outside the Arctic, in accordance with Annex V Regulation 4 of the MARPOL Convention, or unloaded and disposed of at an onshore reception facility.

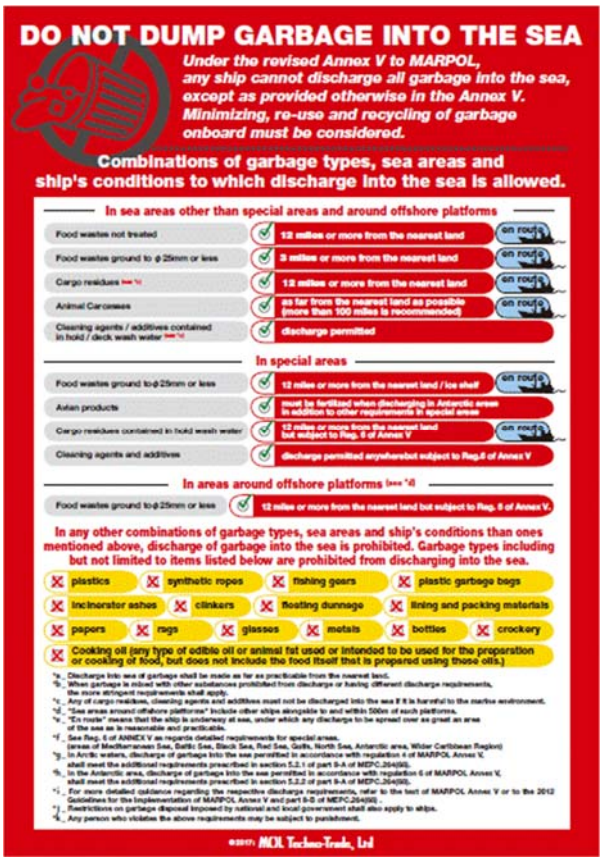
Animal carcasses may not be discharged into Arctic waters. Consequently, they must be discharged in ordinary waters outside the Arctic, in accordance with Annex V Regulation 4 of the MARPOL Convention, or unloaded and disposed of at an onshore reception facility.

Furthermore, in Arctic waters, just as in ordinary waters, the discharge of all other waste is completely prohibited. This includes plastics, synthetic rope, fishing equipment, plastic bags, incinerator ash, waste cooking oil, dunnage, packaging materials, paper, cloth, glass, metals, bottles, empty cans, ceramics, and expanded polystyrene. This waste must be stored on board until the ship reaches its destination, where it must be unloaded and disposed of at an onshore reception facility.

Before unloading this waste at an onshore reception facility, the waste manager should first meet with a staff member from the onshore facility for a detailed discussion of the date and time of unloading; the types, forms, and quantity of waste to be unloaded; and the unloading methods to be used, among other matters. When unloading waste, the captain should obtain documentary evidence from the manager, etc. of the onshore reception facility concerning the unloading.

The waste manager must bear the following matters in mind when unloading waste.

- Ensure that an appropriate means is used to transfer waste from the storage area to the unloading point.
- In transferring waste, take the necessary steps to prevent marine pollution, such as measures to prevent waste falling into the harbor.



Photograph 2-1-20 Ship's notice to ensure awareness (Image courtesy of MOL Techno-Trade)

1.5.7 Ensuring Awareness on Board Ship

The ship's captain must use bulletin boards, booklets or similar means to ensure that all crew members are fully aware of the basic rules concerning waste management in Arctic waters; the procedures for the collection, separation, storage, pretreatment, exceptional discharge, and unloading of waste; and how to use the food waste grinder.

On passenger and observation ships, the captain must also ensure that not only crew members, but also passengers/observers, etc. are fully aware of the rules and procedures with which they must comply to prevent inappropriate discharge of waste into Arctic waters.

Photograph 2-1-21 Separation of waste in the galley (kitchen)

1.5.8 Onboard Education

If there has been a change in crew members, the ship's captain must educate the new crew members concerning the basic rules concerning waste management in Arctic waters; the procedures for the collection, separation, storage, pretreatment, exceptional discharge, and unloading of waste; and how to use the food waste grinder.

On passenger and observation ships, the captain must also ensure that any new passengers/observers, etc. who have boarded are educated concerning the rules and procedures with which they must comply to prevent inappropriate discharge of waste into Arctic waters.

2. Occupational Safety on the Northern Sea Route

Cold weather can occur even in summer on the NSR and the temperature can drop below zero, so you cannot rule out the possibility of ship icing in certain circumstances. When carrying out onboard tasks in cold seas such as those on the NSR, it is necessary to take care all year round regarding the various effects specific to cold seas that can arise from low air and sea temperatures, icing, falling snow, and freezing, in addition to the general precautions required in ordinary waters. The following provides an explanation of occupational safety in cold seas, which is part of the basic knowledge required on the NSR.[38]

2.1 The Basics of Preventing Industrial Accidents

You must comply with the following to prevent accidents when working outdoors in cold seas in low temperatures, strong winds, or when rain or snow is falling; when working on exposed decks; when carrying out tasks in areas where there has been icing or freezing; and when carrying out other outdoor work for long periods (hereafter "working outdoors in cold seas").

2.1.1 Human Effects and Basic Principles

Working outdoors in cold seas can have the following effects on the human body.

1. Skin sensation can be disrupted, leading to reduced ability to judge cold and heat.
2. Circulation of blood to fingers and toes, earlobes, the tip of the nose, and tissue at other extremities can fail.
3. Body temperature can drop, leading to reduced caution and impaired ability to think logically, as well as memory loss, apathy, and other symptoms.
4. Skin and corneas exposed to ultraviolet (UV) rays reflected off fallen snow or sea ice can become inflamed.
5. Inhaling a large volume of cold air can make bronchi more prone to inflammation.
6. There is a huge difference between indoor and outdoor temperatures, so going outside unprepared can result in capillaries contracting, causing blood pressure to rise.
7. People can become careless about hydration, resulting in dehydration.

[38]See also the guide to preventing industrial accidents during winter storms published by the U.S. Occupational Safety and Health Administration (US-OSHA): https://www.osha.gov/dts/weather/winter_weather/index.html.

8. Poor circulation can reduce muscle flexibility, impairing movement and making it harder to carry out manual tasks requiring dexterity.
9. Thick clothing is required, which restricts the movement of the body and makes it harder to move, thereby sapping your strength.

Consequently, the following diseases and injuries are a concern when working outdoors in cold seas.

1. Chilblains and frostbite
2. Hypothermia
3. Snowburn and superficial keratitis (from UV rays reflected off the snow)
4. Colds and bronchitis, etc.
5. Cardiac problems (heart attacks, etc.) or cerebrovascular problems (brain hemorrhages, etc.) due to heat shock
6. Dehydration
7. Tripping over, slipping, falling off or down from somewhere, falling overboard, etc.
8. Other, low temperature burns from disposable pocket hand warmers, etc.

Photograph 2-2-1 Watch out for heart problems due to heat shock

Accordingly, outdoor work should not be carried out in cold seas in principle, unless absolutely unavoidable. All possible steps must be taken to prevent illness or injury when carrying out unavoidable tasks of this nature, including measures to keep out the

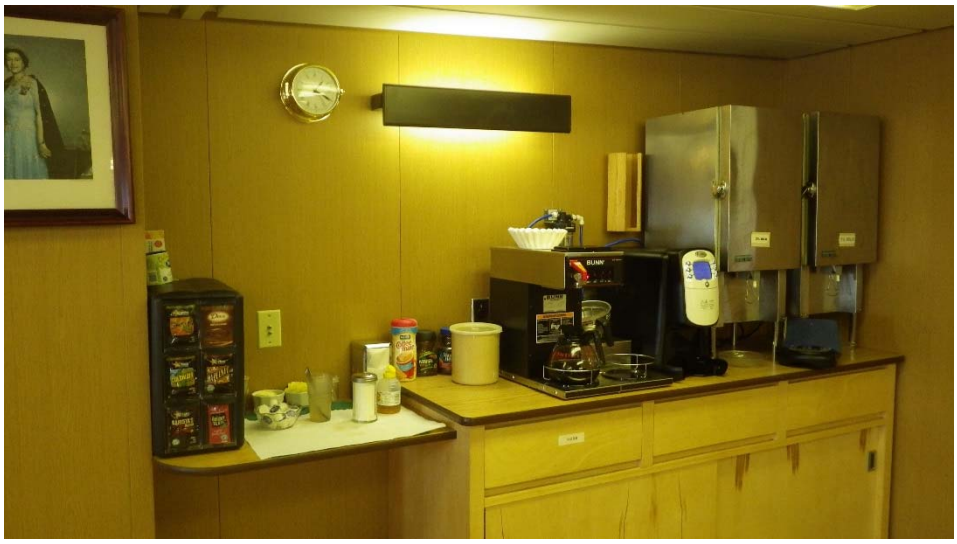
cold suitable for the apparent temperature, using appropriate protective equipment, and taking steps to prevent falls, including falls overboard.

2.1.2 Meals

Working outdoors in cold seas saps the strength easily and consumes a lot of energy. To obtain energy and prevent chills and other symptoms, you must always eat nutritionally balanced meals. There is a basic principle that meals for workers working outdoors in cold seas need to be higher in calories than those for workers in ordinary waters, and hot meals should be provided wherever possible.

2.1.3 Hydration

In general, people need to drink around 1.5L of liquid per day, in addition to what they consume via their meals. However, when working outdoors in cold seas, not only do people sweat less, but they also feel less thirsty, so they tend to become careless about hydration. In addition, many people intentionally restrict their intake of liquid, because wearing thick clothes and thermal underwear to keep out the cold makes going to the toilet more troublesome.



Photograph 2-2-2 Be conscientious about drinking hot drinks to stay hydrated in cold seas (Image courtesy of Hiroki Shibata)

When working outdoors in cold seas, consuming enough liquids to prevent dehydration is also very important from the perspective of preventing accidents. Even if you do not feel very thirsty or going to the toilet is troublesome because of your thick

clothing, it is preferable to be as conscientious as possible about staying hydrated by drinking hot drinks.

2.1.4 Clothing

When working outdoors in cold seas, it is important to wear clothing to keep out the cold (coat, thermal underwear, earmuffs, etc.) that is appropriate to your physical condition and the apparent temperature. In addition, it is vital to take care to keep fingers, toes, and other extremities particularly well insulated, to prevent chilblains and frostbite. Fingertip pain, numbness, and loss of sensation are not only the first signs of chilblains and frostbite, but also significantly reduce operational efficiency, so they can be the cause of handling errors and accidents. Wearing a neck cover, face cover, and arm covers on exposed parts of your neck, face, and arms is an effective means of keeping out the cold, as are applying a warming cream and using pocket hand warmers.

You must take care, because if sweat, rain, or snow causes your clothing to become damp, you will quickly lose body heat, putting you at risk of hypothermia. If your clothing becomes damp, you need to move to a warm place immediately and change into dry clothing. The body's heat-regulating mechanism is particularly weak in elderly people and those with diabetes or other underlying conditions, making them vulnerable to losing body heat, so extra care is required, because even relatively moderate exposure to the cold can put them at risk of developing hypothermia.

2.1.5 Protective Equipment

To prevent accidents when working outdoors in cold seas, you must always use the appropriate protective equipment (arctic cap, heavy winter clothing, thermal gloves, safety helmet, thermal safety boots, safety belt, and protective eyewear, etc.) correctly, taking into account environmental conditions specific to cold seas. In addition, to protect your eyes from the strong UV rays peculiar to the polar region and prevent glare[39]and snowburn,[40] it is important to use sunglasses effectively.

If necessary, take safety measures such as stringing up a lifeline over the deck, to prevent falls, including falls overboard.

2.1.6 Rest Breaks

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[39]The phenomenon that occurs when something much brighter than its surroundings is in your field of view, causing discomfort, or the phenomenon that occurs when you are confused by this, making it harder or impossible to see your target.

[40] Redness and inflammation of the skin caused by UV rays from sunlight reflected off fallen snow or sea ice, which subsequently causes acute symptoms such as black pigmentation of the skin.

Thick clothing is required when working outdoors in cold seas, which restricts the movement of the body and makes it harder to move, thereby sapping your strength. In addition, people tend to become careless about hydration, leading to the risk of dehydration. Consequently, it is necessary to take more frequent breaks and be more conscientious about adequate hydration than when working outdoors on ships in other waters.

The lengths and intervals of work and rest periods must be adjusted to suit the air temperature, wind situation, workers' proficiency level, and workers' health. For example, even if the air temperature is no less than around -10°C, the wind is relatively weak, there is hardly any drop in apparent temperature, and the workers are healthy and proficient in working outdoors in cold seas, it is desirable for a work period of around 50 minutes to be followed by a break of at least 30 minutes or thereabouts. Carrying out work in strong winds or in the rain or snow is particularly exhausting and body temperature can drop within a very short time, so adequate care must be taken.

You must take care when finishing a break in a warm indoor environment and moving outdoors into the cold again, because the rise in blood pressure resulting from the contraction of capillaries can cause heat shock. Those who smoke during their breaks must take particular care, because nicotine promotes the contraction of blood vessels.

2.1.7 Metal Items

When working outdoors in cold seas, you must wear safety gloves without fail, to ensure that your hands do not come into direct contact with tools and other metal items. If damp skin comes into direct contact with metal tools, etc. exposed to the air outdoors in low temperatures, it will stick fast to the metal; trying to pull the skin away again too forcefully can result in injury.

In addition, metal spectacles, wristwatches, and jewelry can also stick to the skin or partially lower the skin's temperature, so these must be avoided as far as possible. Furthermore, it is preferable for the whistles used for giving work signals to be made from wood or plastic, avoiding metal whistles wherever possible. The heat conduction of aluminum whistles in particular is too good, so care is required, because your lips will freeze to the whistle the instant they touch it.

Photograph 2-2-3 Take care when using metal tools in cold seas

2.1.8 Teamwork

In principle, when working outdoors in cold seas, you should form a team of several workers and ensure that they check each other's safety or post a watcher while carrying out tasks. If having a crew member carry out a task alone is unavoidable, the worker's safety should be monitored remotely from the bridge, etc. and arrangements made to ensure that the worker can contact the navigational watchkeepers at all times.

2.1.9 Frozen Decks

In cold seas, exposed decks can freeze and become like ice skating rinks if they are splashed with spray or it snows. Working outdoors under these conditions entails a risk of falls, including falling overboard, as well as causing lost body heat and exhaustion. Avoid working outdoors under such conditions, as far as possible, unless absolutely unavoidable.

2.1.10 Heaters

When working outdoors in cold seas, electric stoves or heaters fueled by briquettes, etc. must not be used in the on-deck storerooms, due to the risk of fire or carbon monoxide poisoning.

2.2 Precautions for Specific Tasks

The following explains important points concerning typical outdoor tasks when sailing cold seas.

2.2.1 De-icing

Icing refers to the phenomenon that occurs in cold seas when the ship is exposed to sea spray, which freezes on contact with deck structures. In the event of significant icing, small vessels in particular can be destabilized by the weight of the ice, leading to a risk of a capsize or other marine accident. Accordingly, it is necessary to carry out de-icing (removing the ice) promptly, before such a dangerous situation develops. The usual method of de-icing is to use a hose to spray seawater onto deck structures to which ice has adhered, while knocking the ice off with a wooden, rubber or plastic hammer. Some ships are fitted with a de-icing system, which mechanically removes ice, but these are few in number.

In most cases, if icing has occurred, exposed decks will also have frozen, leaving them as slippery as an ice skating rink. When carrying out de-icing, as well as taking steps to keep out the cold by wearing clothing appropriate to your physical condition and the apparent temperature (coat, thermal underwear, earmuffs, etc.), taking into account the environmental conditions at the time, you should wear appropriate protective equipment that keeps out the cold (arctic cap, heavy winter clothing, thermal gloves, thermal safety boots, etc.) In addition, always wear a safety helmet, personal flotation device, and safety belts, due to the risk of slipping or falling, including falling overboard, as well as the risk of ice or snow falling off deck structures. You must also do your utmost to prevent accidents, bearing the following matters in mind.

1. Always check the situation at the work site in advance.
2. If, having checked the situation, you discover that gaps between handrails, openings in high places, or other points that present a risk of falling from a height or falling overboard are obscured by icing, place markers at those points in advance to indicate the hazard and notify workers about them in advance.
3. Check the state of health of workers in advance and exclude any who complain of feeling fatigued or unwell.
4. Clearly indicate the person in charge and the team structure.
5. Hold a meeting before starting the work and ensure all workers are aware of how to carry out de-icing and the precautions that should be taken, as well as making sure that protective equipment is used without fail.
6. When starting the work, carry out hazard prediction training based on near-miss incidents that have occurred during de-icing.

7. When starting the work, ensure that everybody does stretches or calisthenics to prevent lower back pain and sluggish movement due to muscle stiffness.
8. Predict where ice and snow that has broken away from or been knocked off deck structures is likely to fall and always maintain a safe posture, carrying out work while avoiding any ice and snow that might hit you directly or rebound onto you.
9. Take particular care regarding ice and snow jutting out from deck structures and carry out work in a safe place with enough space for you to avoid it if it breaks away or is knocked off.
10. When swinging the hammer, check the safety of your surroundings and maintain a crouched posture to ensure that you do not fall or injure your lower back stop
11. If necessary, as well as using attachable spikes on your thermal safety boots to prevent slipping, use removable protectors to protect the upper surface of your feet.
12. If necessary, take safety measures such as scattering an antislipping agent to prevent falls, including falls overboard.
13. When moving about, take small steps and slowly place the whole sole of your foot down at the same time, to prevent falls.
14. Do not carry out de-icing work at night, except in an emergency.
15. Avoid using portable ladders and stepladders as far as possible, to prevent falls. If their use is unavoidable, ensure that they are secured with a rope, etc. without fail.

Photograph 2-2-4 Take care to avoid falls on exposed decks

2.2.2 Watchkeeping on Exposed Decks, etc.

When sailing in areas with sea ice, a watchkeeper may be posted on the flying bridge above the wheelhouse or on a mast equipped with a special shielded watch platform, in order to spot ice quickly from a high vantage point. On ships navigating through areas of sea ice under the guidance of an icebreaker, a watchkeeper may be posted on an exposed deck at the stern to check ice obstruction in the channel to the rear or prevent damage to the propeller and rudder due to contact with the ice floe. On ships being towed by an icebreaker through waters where ice conditions are extremely bad, a watchkeeper may be posted on an exposed deck at the stern to monitor the movement of the icebreaker or check the towline.

When carrying out watchkeeping of this nature, ensure that you keep out the cold with appropriate clothing and protective equipment, taking into account the environmental conditions, and also wear a safety helmet, personal flotation device, and safety belt at all times, in case of slipping or falling, including falling overboard. You must also do your utmost to prevent accidents, bearing the following matters in mind.

1. In cold seas, watchkeeping for long periods in particularly low temperatures or strong winds entails physical risks. In such conditions, especially in the case of watchkeeping from high vantage points, watchkeepers should be alternated at appropriate intervals, rather than continuously keeping watch.

2. Watchkeeping is often carried out alone. The safety of watchkeepers should be continuously monitored from the bridge by means of a monitoring camera and walkie-talkies or other equipment should be provided to allow communication with the navigational watchkeeper at any time.
3. When keeping watch in cold seas, it is preferable to use waterproof binoculars with vibration reduction, given that they will be used outdoors in the wind and snow and that the user's hands are likely to tremble in such conditions. However, battery-powered binoculars are best avoided, because of the risk of accidents due to fluid leakage.
4. If the ship is being guided by an icebreaker, take care not to look directly at the icebreaker's searchlight for too long when lit, due to the risk of glare.
5. As well as causing symptoms such as sensitivity to light, glare can give rise to the illusion that a previously visible object on which you were keeping watch has suddenly disappeared. In this situation, contact the navigational watchkeeper immediately, then suspend your watchkeeping duties and move to a dark place, where you should rest until the symptoms subside.

Photograph 2-2-5 A view of frozen waters from an exposed deck

2.2.3 Stand by the Bow

When sailing through narrow waters while navigating the NSR, an order may be issued to stand by the bow, to enable the anchor to be dropped in an emergency to

prevent a marine accident, such as the ship running aground. In addition, if the ship suffers an engine failure requiring repairs to be carried out, an order may be issued to stand by the bow so that the ship can seek an emergency mooring at the nearest port. In the event of an order to stand by the bow, the Chief Officer and several deck hands will generally be deployed on the exposed deck at the bow. Mooring is a task involving a variety of risks, so serious accidents resulting from steering errors or defective maintenance frequently occur even outside frozen waters. Such accidents include the death or injury of crew members, grounding, and loss of the anchor and chain. When standing by the bow in areas with see ice, ensure that you keep out the cold with appropriate clothing and protective equipment, and also wear a safety helmet, personal flotation device, and safety belt at all times, in case of slipping or falling, including falling overboard. You must also do your utmost to prevent accidents, bearing in mind not only matters common to all marine areas, but also the following matters associated with low temperatures, icing, and freezing.

Photograph 2-2-6 Standing by the bow in cold seas

1. Ice or snow on exposed decks at the bow or deck structures can hinder smooth operations, as well as giving rise to the risk of falls and other accidents. Ensure that you carry out de-icing or snow removal in advance.
2. Icing of the windlass and other anchoring equipment can impair its functionality or cause it to malfunction. Ensure that you carry out de-icing in advance.

3. If the lining (friction material) attached to the inner surfaces of the brake bands of the windlass, etc. freezes, the brake's effectiveness may be impaired. Check in advance whether or not the brake has any abnormalities.
4. When de-icing a windlass, etc. that has malfunctioned, do not touch any moving parts with your hands while the power is still switched on, as injury could occur if the machinery suddenly starts moving. Always switch the power supply off and then carry out this work using tools.
5. Ensure that the power supply to the motor of the windlass, etc. is switched on and fully warmed up before the order to stand by the bow is given.
6. If the motor of the windlass, etc. is equipped with a space heater, etc., use this as needed to warm up the motor.

Photograph 2-2-7 Warm up the motor of the windlass, etc. as needed

7. If the windlass, etc. is hydraulic and the hydraulic oil tank is equipped with a heater, use this as needed to ensure that the hydraulic oil has the right consistency.
8. If the hydraulic windlass, etc. is equipped with an oil cooler and cooling is taking place using seawater, sherbet-like sea ice or ice fragments can cause overheating if they get in through the seawater inlet, causing an emergency shutdown. Pay attention to changes in the temperature of the oil.
9. If water accumulated in the oil pan under the windlass, etc. has frozen, take care not to step into it.

Photograph 2-2-8 When operating the windlass, ensure that the plug is fitted to the oil pan to keep it dry

2.3 Health Care

Appropriate health care on board ship is vital to ensure the health of crew members, create a comfortable working environment, and prevent accidents. The following highlights some illnesses to which seafarers can be prone when sailing cold seas and explains important points about caring for your health.

2.3.1 Sensitivity to the Cold

An imbalanced diet, lack of exercise, disruption to the body's temperature regulation mechanism due to the use of air conditioning, stress, and attempts to lose weight by restricting calorie intake can impair circulation in peripheral blood vessels in the limbs and cause hands, feet, and other parts of the body to feel cold. This is generally referred to as sensitivity to the cold. On the NSR, not only cold weather, but also excessive stress due to encountering various situations that differ from those in other marine areas can cause even those who are not usually sensitive to the cold to experience these symptoms.

It goes without saying that proper clothing and disposable pocket hand warmers help to keep the body warm, but there are also unexpectedly effective ways to prevent chills and alleviate symptoms by means of bathing, diet, and even stretching. It is wise to equip yourself with a number of ways of warding off the cold that you can practice easily in your cabin and which suit your physical make-up.

For example, Bhastrika breathing is said to be effective in preventing chills and

improving symptoms by raising the body temperature and stimulating the internal organs. Bhastrika means “bellows,” the ventilator used by the blacksmiths of yore to keep the iron hot while they worked it. Sit quietly, maintaining a good posture, and breathe deeply through your nose at intervals of 1-2 seconds, repeating this 20-30 times in succession. It is essential to breathe out strongly and rhythmically through your mouth, using your voice to make a sound and consciously engaging the abdominal muscles, just like using a bellows. It goes without saying that you must not overdo it and people with high blood pressure must take particular care. Stretching is also effective. Flapping your hands and feet, or repeatedly curling and stretching your fingers and toes helps to boost circulation to the extremities of your limbs. You can do these exercises while sitting on the edge of a chair or bed, or while soaking in the bath.

Drinking ginger tea—a pinch of grated ginger in black tea made with boiling water—is another simple way to ward off the cold while in your own cabin. Ginger is not only a condiment or spice, but has also been used in traditional Chinese medicine since ancient times. Ginger not only boosts the metabolism, raising body temperature, but also stimulates the appetite and promotes sweating. The most effective type of ginger for making ginger tea is said to be the dried variety, like that used in traditional Chinese medicine, but the fresh variety and the type you can buy ready-grated in a tube are also adequate substitutes. You can also make it more effective by using brown sugar or honey instead of white sugar.

Staying hydrated is another important factor in preventing chills and alleviating symptoms. However, it is preferable to avoid drinking cold water, as far as possible; instead, drink water at room temperature or warm drinks.

Photograph 2-2-8 Ginger tea makes it easy to ward off the cold (Image courtesy of photo AC)

2.3.2 Sleep Disorders

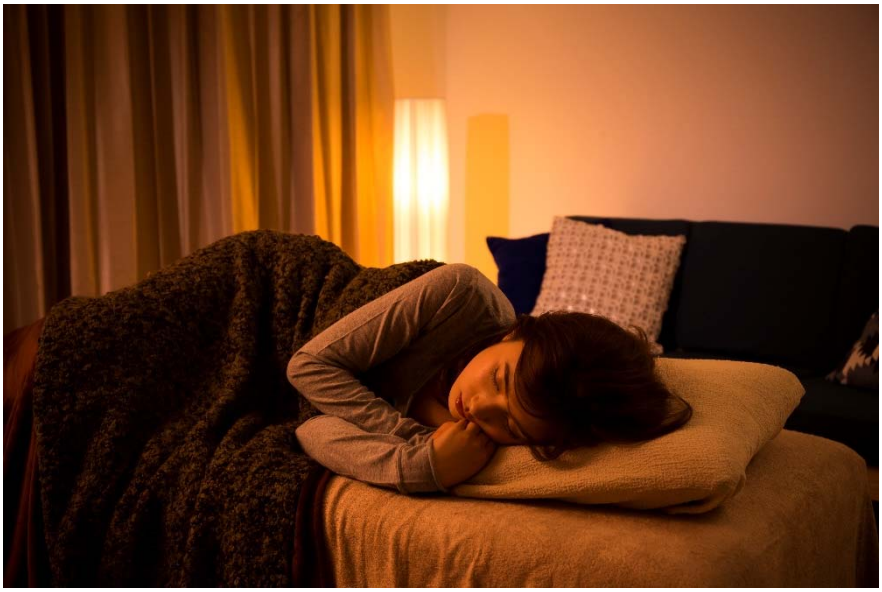
When the weather turns cold on the NSR, some people find the centrally controlled temperature inside the ship too cold, which can lead to stress, creating a risk of sleep disorders (insomnia, excessive sleepiness during the day, abnormal behavior or movement while sleeping, or other sleep-related problems) that reduce the quality of sleep.

Taking a bath or exercising before going to bed is said to be effective in preventing or alleviating reduced sleep quality arising from cold-induced stress. However, if taking a bath, it is best to do so about an hour before going to bed, relaxing in fairly tepid water of around +38-40°C for 15-20 minutes. Taking a bath immediately before going to bed or bathing in hot water of +42°C or above stimulates the sympathetic nervous system, which actually risks reducing the quality of sleep. Moreover, any exercise before going to bed should be confined to light exercise, such as stretching or walking. Warming your bed beforehand with an electric blanket or hot water bottle is also effective.

On the NSR in summer, there are days when the sun does not set at all (polar days, or white nights) and days when the daytime is much longer than the night. The polar days last for about 90 days each year at around latitude 73° north. Some people find that this disrupts the cycle of day and night and upsets the rhythm of their body clock, leaving them unable to sleep during the hours when they want to. This kind of sleep disorder is called circadian rhythm sleep disorder.

During the polar days, the body is constantly exposed to sunlight, which is said to cause melatonin secretion to fall, disrupting the body's balance and making it harder to sleep. The function of melatonin, which is a hormone secreted in the pineal gland in the brain, is to regulate the body clock. Consequently, to ensure high-quality sleep, it is necessary to take appropriate preventive measures, such as using thick curtains to block out all light from your cabin from a few hours before you want to go to sleep, in order to consciously increase melatonin secretion and adjust your body clock to a condition conducive to sleep.

Do not take pharmaceutical sleep aids or sleep-inducing drugs at your own judgment; consult a physician and follow their directions.



Photograph 2-2-9 Blocking out all light from your room is an effective way to ensure high-quality sleep (Image courtesy of Ushico/PIXTA)

2.3.3 Seasonal Affective Disorder

Seasonal affective disorder (SAD)—also known as winter depression—is a condition affecting sufferers only at a certain time of the year, which is characterized by symptoms such as low mood, loss of appetite, sleep disorders, apathy, lethargy, and tiring easily.

The cause is still not properly understood, but it is said to result from over-secretion and delays in the timing of secretion of the sleep hormone melatonin at a time when the hours of daylight are shorter, resulting in disruption to the body clock. It is also said that the shorter daylight hours reduce the effect of the neurotransmitter serotonin, which promotes melatonin secretion.

Either way, the shortage of daylight means that neurotransmitters in the brain are not activated, so the body's "reset switch" is not pressed, causing the near-sleep-like state characteristic of this disorder. The incidence of this disorder is known to be comparatively high in areas located at high latitudes, where the hours of daylight are short, such as the Tohoku and Hokkaido regions of Japan, as well as northern parts of North America, the Nordic countries, and Russia. Insufficient daylight undoubtedly seems to have some kind of relationship to this condition, because bathing the body in strong light similar to sunlight is an effective means of treating it.

On the NSR in winter, there are days when the sun does not come up at all (polar nights) and days when the night is much longer than the daytime. Even in summer, the

NSR is prone to fog and low cloud called Arctic stratus clouds, which have a ceiling of less than 500m, so the weather can be overcast, with little or only weak sunshine for long periods. In waters like these, seasonal affective disorder can occur, regardless of the season. Particular care is required at all times in the case of Southeast Asian seafarers, as they are accustomed to warm environments where the sun is very strong.

The most effective means of preventing seasonal affective disorder is sunbathing. If the sun comes out while sailing the NSR, you should actively do your best to sunbathe, as long as the situation on deck makes it safe to do so. Good lifestyle habits are also effective, such as getting up straight away and taking a hot shower, which will leave you feeling refreshed, rather than lying around in bed in the morning. In addition, it is a good idea to eat foods rich in amino acids and tryptophan, which are believed to play a major role in the metabolism of serotonin and melatonin, such as meat, nuts, dairy products, and seeds, and also foods rich in B vitamins, which are said to increase sensitivity to the light, such as oily fish and liver.

Do not take drugs that stimulate melatonin receptors at your own judgment; consult a physician and follow their directions. In addition, although it is possible to buy supplements containing large doses of tryptophan, do not resort to these at your own judgment; seek detailed advice from a physician and follow their directions.

Photograph 2-2-10 Follow the guidance of a physician concerning the use of drugs to treat seasonal affective disorder (Image courtesy of photo AC)

2.3.4 Low-temperature Burns

Carrying out outdoor tasks, etc. in low temperatures for long periods can disrupt the skin's sensory balance, dulling the ability to sense heat and cold. In such situations,

using a warm water bidet toilet seat for long periods when the seat heater has been set to high or applying a disposable pocket hand warmer directly to the skin can cause low-temperature burns.

Low-temperature burns are caused by skin coming into contact with a comparatively low-temperature source of heat; as well as warm water bidet toilet seats and disposable pocket hand warmers, they can be caused by electric blankets, kotatsu table heaters, and electric carpets. In general, the people at highest risk of such burns are those who are drunk, elderly people, newborn infants, and patients, etc. suffering from numbness. The potential for low-temperature burns is determined by the temperature to which the skin's surface is heated and the length of time for which the skin is in contact with the heat. Roughly speaking, at a temperature of +40°C, the onset time is said to be 3-4 hours; this decreases to 30 minutes to an hour at a temperature of +45°C and just 5 minutes at a temperature of 50°C.

The word "low-temperature" might make one think that the resultant injury is minor, but this is in fact not the case. These burns do not only affect the epidermis, but can reach the dermis and even the subcutaneous tissue, causing necrosis and resulting in trauma of life-threatening severity, so you must take great care. In the event of a severe low-temperature burn, the patient must be transported to an emergency and critical care center without hesitation or delay. If the patient cannot be seen by a physician because the ship is out to sea, take the appropriate steps, such as administering drugs or applying external preparations, in accordance with guidance provided by a physician via the medical radio system, etc.

Photograph 2-2-11 Transport patients with severe low-temperature burns to an emergency and critical care center without delay (Image courtesy of photo AC)

2.3.5 Chilblains and Frostbite

Working outdoors in low temperatures for long periods in cold seas can lead to chilblains or frostbite.

Chilblains—also known as pernio or perniosis—is the term used to refer to circulatory failure in the skin in low temperatures. The main symptoms are redness and swelling in the extremities, such as the fingers and toes, earlobes, and tip of the nose, accompanied by pain, itchiness, or heat.

Frostbite is the term used to refer to localized tissue injury resulting from the freezing of or circulatory failure in the tissues of the extremities, such as the fingers and toes, earlobes, and tip of the nose, due to exposure of the body to low temperatures for long periods. The damage not only affects the skin, but also extends to subcutaneous tissue, muscles, and even bone; in a worst-case scenario, it can result in necrosis of the subcutaneous tissue or affected fingers or toes dropping off. In mild frostbite, the skin turns white, as well as suffering loss of sensation. In moderate frostbite, the skin becomes swollen and blistered. In severe frostbite, the affected area loses all sensation, becoming cold and hard, and necrosis turns the tissue black.

In general, frostbite is said to occur when the skin's temperature drops below -4°C, but circulatory failure is a symptom that can quite easily occur even at temperatures above zero. The severity of frostbite injury is not only determined by the temperature of the skin; the wind speed and humidity in the location where the injury was incurred, the duration of exposure to low temperatures, and the patient's clothing also have a major influence. Those who have previously suffered frostbite, smokers, those with Type O blood, those with heart disease or diabetes, and people of color are said to be more prone to frostbite.

The best way to prevent chilblains and frostbite is to avoid spending long periods working outdoors in low temperatures, unless absolutely unavoidable. When working outdoors in unavoidable circumstances, ensure that you use the prescribed protective equipment without fail and also take steps to keep out the cold, according to the apparent temperature and your physical condition (for example, wearing heavy winter clothing, thermal underwear, thermal gloves, an arctic cap, earmuffs, etc.) When working outdoors, you must also take care to ensure that your thermal gloves and arctic cap, etc. are not blown away by strong winds. In addition, it is important to take care at all times to ensure that your thermal gloves and socks do not get wet; if they do get wet, it is vital that you stop what you are doing immediately and take steps to remedy the

situation without delay, such as going to a warm room and replacing the wet items with dry ones.

Patients with chilblains should be moved to a warm place, where the affected area should be warmed up in water at around +42°C; once circulation has improved, the affected area should be wiped with a dry cloth and covered with a clean piece of cloth. The patient should then seek medical attention from a dermatologist, etc. If the patient cannot be seen by a physician because the ship is out to sea, take the appropriate steps, such as massaging the affected area, administering drugs that will dilate the capillaries, or applying external preparations to minimize the inflammation, in accordance with guidance provided by a physician via the medical radio system, etc.

Patients with frostbite should be moved to a warm place, where the affected area should be quickly warmed up in water at around +38-40°C to improve the circulation. To keep the water at a constant temperature, it should be topped up with warm water as needed. Please note that medical advice used to be that the affected area should be warmed up slowly at a low temperature, but this method is now said to actually make the injury worse. Once the circulation has improved, use a dry cloth to gently and carefully wipe the affected area, taking care not to cause injury, cover it with a clean piece of cloth, and transport the patient to an emergency and critical care center as quickly as possible.

If the patient has symptoms of hypothermia, it is vital to prioritize treatment aimed at restoring their body temperature to a normal level, as hypothermia is a life-threatening condition. If the patient cannot be seen by a physician because the ship is out to sea, warm the patient up and take other appropriate steps, such as administering painkillers, antiplatelet drugs, or antibiotic preparations, in accordance with guidance provided by a physician via the medical radio system, etc.

Photograph 2-2-12 Transport patients with frostbite to an emergency and critical care center with as little delay as possible (Image courtesy of photo AC)

2.3.6 Hypothermia

Hypothermia refers to the situation in which the human body's core temperature (rectal temperature, bladder temperature, esophageal temperature, etc.) falls below +35°C,[41] causing abnormalities in nerve, muscle, and heart functions, which makes it impossible to maintain normal body processes. Just like frostbite, there is a risk of suffering hypothermia when working outside for long periods in low temperatures in cold seas, or in the event of an emergency requiring evacuation into frozen waters in a lifeboat, etc. Hypothermia caused by accidents or emergencies in cold environments is called accidental hypothermia, to distinguish it from secondary hypothermia, in which the body's heat-regulating mechanism steadily deteriorates due to aging, medical conditions, or malnutrition, etc.

The human body cannot maintain normal functions once its core temperature drops below +35°C. Hypothermia begins with severe trembling and weakness, followed by such symptoms as reduced caution and impaired ability to think logically, as well as memory loss, apathy, and confusion. At +30°C, arrhythmia (irregular pulse) and impaired consciousness occurs. Symptoms such as muscular rigidity, reduced heart rate, and hallucinations also occur, eventually leading to complete collapse. At +25°C, muscles begin to relax and the individual enters a state of apparent death. At +20°C, breathing ceases and death follows shortly thereafter. If, in the cold, a person starts trembling violently, complains of coldness or sleepiness, and develops delirium, you should assume that there is a strong possibility that they are in a state of hypothermia.

[41]Source: Japanese Association for Acute Medicine, *Dictionary of Medical Terminology*.

The body's heat-regulating mechanism is weak in elderly people and those with diabetes, cardiovascular disorders, or other underlying conditions, so extra care is required, because even relatively moderate exposure to the cold can put them at risk of developing hypothermia.

Photograph 2-2-13 Warm up and rehydrate patients with hypothermia (Image courtesy of photo AC)

The best way to prevent hypothermia is to avoid spending long periods working outdoors in low temperatures, unless absolutely unavoidable. If working outdoors is unavoidable, it is vital to ensure that the prescribed protective equipment is used without fail and that you also take steps to keep out the cold, according to the apparent temperature and your physical condition, by wearing appropriate clothing, as well as taking steps to keep your clothing dry. Keeping hydration and energy levels up is also very important.

Drinking alcohol is not an appropriate means of preventing hypothermia: while it temporarily raises body temperature, alcohol dilates the blood vessels, causing you to lose more heat and disrupting the body’s heat-regulating mechanism. You must also avoid giving someone tobacco to calm them down, as nicotine can make blood vessels contract.

If a patient has hypothermia, it is imperative to transfer them to a warm place, out of the cold, and to remove all precious metal items and wet clothing before warming up their whole body. Specific ways of doing so include wrapping them in a blanket, placing them in a bath at a temperature of +40°C, or giving them hot drinks.

When warming up the patient with hyperthermia, it is advisable to warm them up slowly by placing a hot water bottle or portable hand warmer in their underarm or groin area, to ensure that the heat reaches their core. You must under all circumstances avoid abruptly warming up the body's surface or moving the patient's body too suddenly, as this can cause a rush of cold blood to return to the heart, giving rise to the possibility of rewarming shock. Drinks should only be given if the patient is conscious and drinks with a diuretic effect, such as coffee and tea, must be avoided wherever possible, as they could cause dehydration. You must instead provide hot water without anything in it.

If the patient shows no sign of recovery as a result of emergency measures or if they demonstrate impaired consciousness, you must assume that their life is at risk and transport them to an emergency and critical care center without hesitation or delay. If the patient cannot be seen by a physician because the ship is out to sea, warm the patient up and take the appropriate steps, such as administering drugs, in accordance with guidance provided by a physician via the medical radio system, etc.

2.3.7 Snowburn

Snowburn refers to redness and inflammation of the skin caused by UV rays from sunlight reflected off fallen snow or sea ice, which subsequently causes acute symptoms such as black pigmentation of the skin; in other words, it is sunburn suffered in snowy environments. On the NSR, it can occur while working on a snow-or ice-covered deck for long periods when the sun is shining, if you do not take proper precautions. It is said that up to 90% or more of the sunlight shining on to fallen snow is reflected off it, so it is easier to get sunburnt in the snow than on a beach in the middle of summer, regardless of the temperature.

Snowburn is unquestionably a type of burn and is classed as either first- or second-degree, depending on the symptoms. In first-degree snowburn, the symptoms are comparatively mild, just pain and itchiness of the skin's surface; this type of snowburn usually heals naturally in about a week. Second-degree snowburn is a burn that extends to the dermis, below the surface, causing severe pain and blistering. If the burn is shallow, it takes two to three weeks to heal, but if it is deep, it can take three weeks or more. If the symptoms are severe, the patient may experience an intense burning sensation, accompanied by general symptoms such as nausea and fever. If the burn extends over a wide area, the patient may be debilitated and require inpatient treatment. You must not assume that it is "just snowburn."

Photograph 2-2-14 Protect yourself against snowburn due to UV rays (Image courtesy of Koji Shimada)

The best way to prevent snowburn is to avoid spending long periods working outdoors on decks covered with snow or ice, unless absolutely unavoidable. If this is an unavoidable, it is vital to ensure that the prescribed protective equipment is used without fail, such as wearing sunglasses to protect your eyes from UV rays, and that you do not neglect to take appropriate preparations, such as wearing a cap with a visor, a neck cover, a face cover, and arm covers, etc. to cover exposed areas of skin on the neck, face, and arms as well as applying sunscreen.

There are two types of UV rays: UV-A and UV-B. It is the latter that causes sunburn and skin cancer. Sun exposure leads to both sunburn, which makes the skin red and inflamed, and sun tanning, which causes melanin pigment to be deposited on the surface of the skin, turning it darker. In general, people with white skin are highly sensitive to UV rays, so sunburn causes their skin to go bright red, but sun tanning either does not occur or they only experience light pigmentation. People with black or brown skin are only slightly or not at all sensitive to UV rays and their skin rarely or never turns red due to sunburn, while sun tanning causes strong pigmentation. People with yellow or light brown skin are moderately sensitive to UV rays and their skin turns mildly or very slightly red due to sunburn, while sun tanning causes their skin to gradually darken or become permanently pigmented. Thus, the effects of exposure to the same amount of sunlight and UV rays differ according to the ethnic skin type of the individual. Caution is therefore required, because a uniform set of precautions will not necessarily be effective for all crew members.

Table 2-2-1 Sunburn/Suntan Status by Skin Color

Skin Color	Sensitivity to UV Rays	Effects	
		Sunburn	Suntan
White	Highly sensitive	Always turns red	Does not tan or just colors very slightly
Yellow/light brown	Moderately sensitive	Moderate or slight reddening	Gradually darkens or becomes permanently pigmented
Brown/black	Slightly sensitive / Not sensitive	Rarely or never turns red	Becomes strongly pigmented

Patients with snowburn should be moved indoors, away from UV rays; once there, the most important thing to do first is to use cold water to cool the affected area, preventing the information from progressing. If the burn covers an extensive area, bathing in cold water is effective, but you must take care, because excessive cooling lowers the body temperature. Washing in the shower and friction from towels can cause abrasions, so caution is required. After that, it is essential to ensure that the patient is properly hydrated and takes plenty of rest, as far as possible.

If the patient develops blisters due to snowburn, it is a sign that the burn is severe and means that there is a risk of infection, so the patient should be seen by a dermatologist, etc. without delay. If the patient cannot be seen by a physician because the ship is out to sea, take the appropriate steps, such as disinfecting the affected area, preventing infection and dehydration, and administering drugs, in accordance with guidance provided by a physician via the medical radio system, etc.

2.3.8 Superficial Keratitis

Superficial keratitis—also known as photokeratitis or snow blindness—occurs when UV rays in sunlight reflecting off ski fields or swimming areas, etc. cause inflammation of the cornea and abrasion of the outer layer of the cornea, leading to symptoms such as eye pain and bloodshot eyes. On the NSR, it can occur while working outdoors for long periods when the sun is shining, if you do not take proper precautions and your eyes are directly exposed to UV rays for a long time. Similar symptoms can occur in places where welding work is being carried out and in factories equipped with germicidal lamps, due to the UV rays in welding sparks and the light emitted by germicidal lamps. Patients with superficial keratitis do not experience very pronounced subjective symptoms immediately after the eyes have been exposed to UV rays, but the eyes become bloodshot and painful about 6-10 hours afterward. In serious cases, the patient

may be unable to keep their eyes open and may suffer temporarily reduced vision, resulting in things appearing blurred. It may also be too painful to sleep.

Patients with superficial keratitis should be told to keep their eyes closed; then, it is important to provide treatment to minimize the inflammation by having them rest with a cold towel over their eyes. Painkilling drugs may be effective in alleviating the pain. Commercially available eyedrops will keep the eyes moist, but cannot be expected to have any dramatic therapeutic effect. Irrigation of the eyes should not be carried out unless instructed by a physician via the medical radio system, etc. In general, the pain of superficial keratitis will subside the following day and the condition will eventually heal naturally, but if intense pain continues, the patient should consult an ophthalmologist without delay. If the patient cannot be seen by a physician because the ship is out to sea, take the appropriate steps, such as administering drugs, in accordance with guidance provided by a physician via the medical radio system, etc.

Photograph 2-2-15 Superficial keratitis can also occur while welding (Image courtesy of photo AC)

2.3.9 Other Illnesses

In cold seas, you must always be conscious of the risk of illnesses to which the human body is prone in low temperatures and in areas with snow and ice, and take steps to prevent them. These illnesses include respiratory illnesses, heart disorders, and cerebrovascular disorders.

On the NSR, air conditioning systems maintain a constant temperature in the cabins. However, some people may find it cold, leading to stress, which can result in their developing sleep disorders, sapping their strength. In addition, if the air conditioning is heating the ship, the air in the living areas can easily become dry, impairing the functions of the nose and throat mucosa of crew members and weakening their resistance to bacteria. Inhaling a large volume of cold air while working outdoors can make bronchi more prone to inflammation. This results in greater susceptibility to respiratory illnesses, such as colds and bronchitis.

If the weather turns cold on the NSR, there can be a huge difference—30°C or more at times—between the temperature in the living area, which is heated by the air conditioning system, and the outdoor air temperature. Going from the warm living area to the cold outdoors without proper preparation causes the capillaries on the surface of the skin to contract to prevent heat dissipation, increasing the resistance to the flow of blood and causing blood pressure to rise sharply. This phenomenon, commonly known as heat shock, causes considerable stress on the heart and can cause circulatory failure due to the contraction of the coronary artery supplying blood to the heart, leading to fainting or arrhythmia. It can even cause such severe heart problems as a heart attack. Sudden changes in blood pressure due to heat shock can also lead to cerebrovascular problems, such as a brain hemorrhage.

If working outdoors in low temperatures is unavoidable, it is imperative to ensure that the prescribed protective equipment is used without fail and that you also take steps to keep out the cold by wearing appropriate clothing, according to the apparent temperature and your physical condition. Take appropriate steps in respect of toilets located in parts of the ship not served by the air conditioning system, such as toilets for cargo handlers that face onto exposed decks. These steps include placing a fan heater in the room in advance and activating it before using the room, in order to warm it up. In addition, if a warm water bidet toilet seat is available, switch it on to heat up in advance.

In general, as well as elderly people, those most at risk of heat shock are people who are obese and people with longstanding conditions, such as high blood pressure, diabetes, and hardening of the arteries, so you should take adequate care if you fall into any of those categories. Care is also required when moving into the warm living area from the cold outdoor air, because this entails a risk of heat shock, too.

People often feel less thirsty in cold seas, so they tend to become careless about staying hydrated and can be prone to dehydration, so caution is required.

2.3.10 Preparing Medical Supplies

The NSR is a sea lane that passes along remote coastal areas with little or no infrastructure, so there are few ports. Moreover, the number of hospitals and other medical institutions is limited, as are the capabilities of those that do exist. Consequently, if you have a patient requiring emergency treatment while out at sea, this could affect your ability to ensure swift, appropriate medical attention.

More than in any other waters, you must take great care to manage the health of crew members at all times and prevent accidents while sailing the NSR, doing your utmost to ensure that no emergencies arise which require transport to a medical institution. Ships sailing the NSR should ensure that they are equipped with a bigger stock and wider range of good-quality medical supplies than ships sailing in other waters.

Photograph 2-2-16 Drugs kept on board the ship