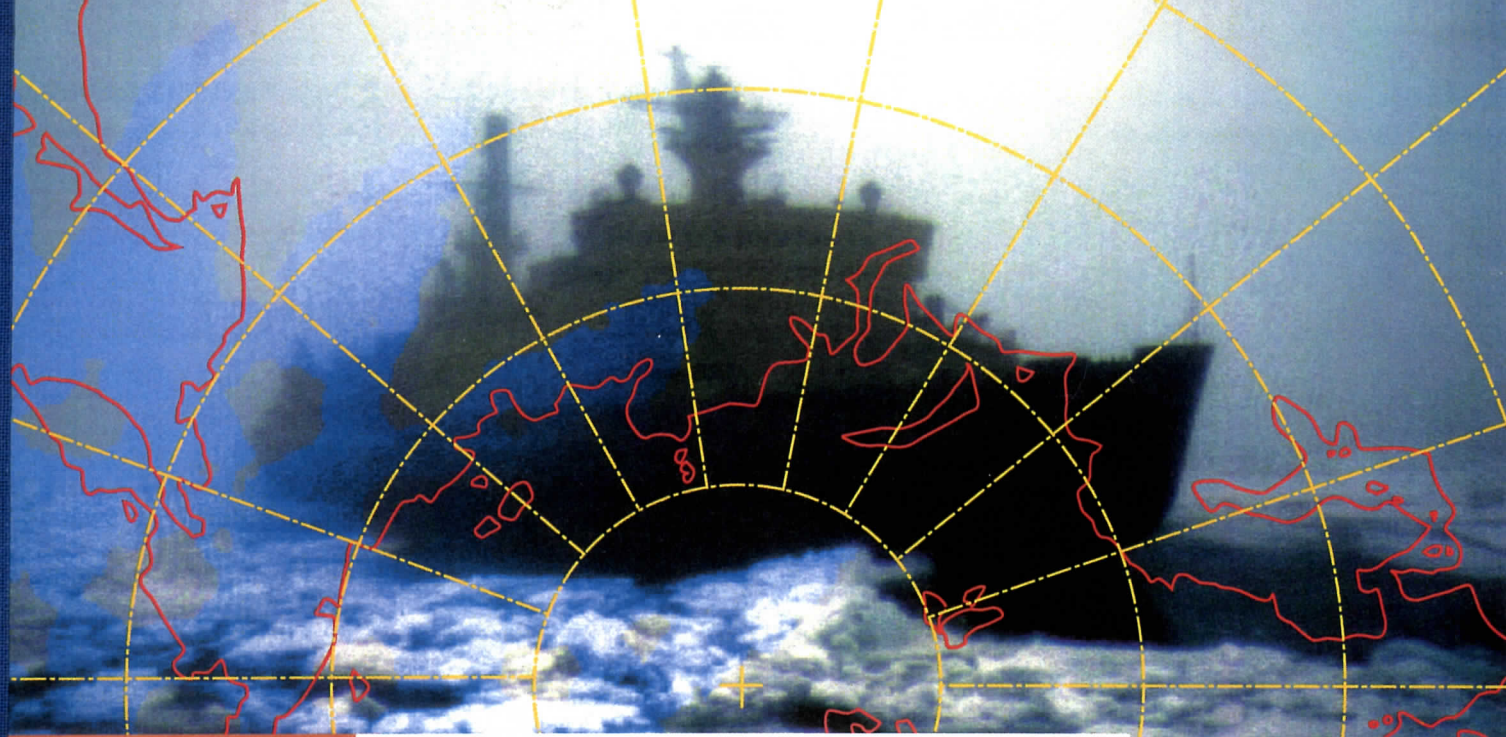
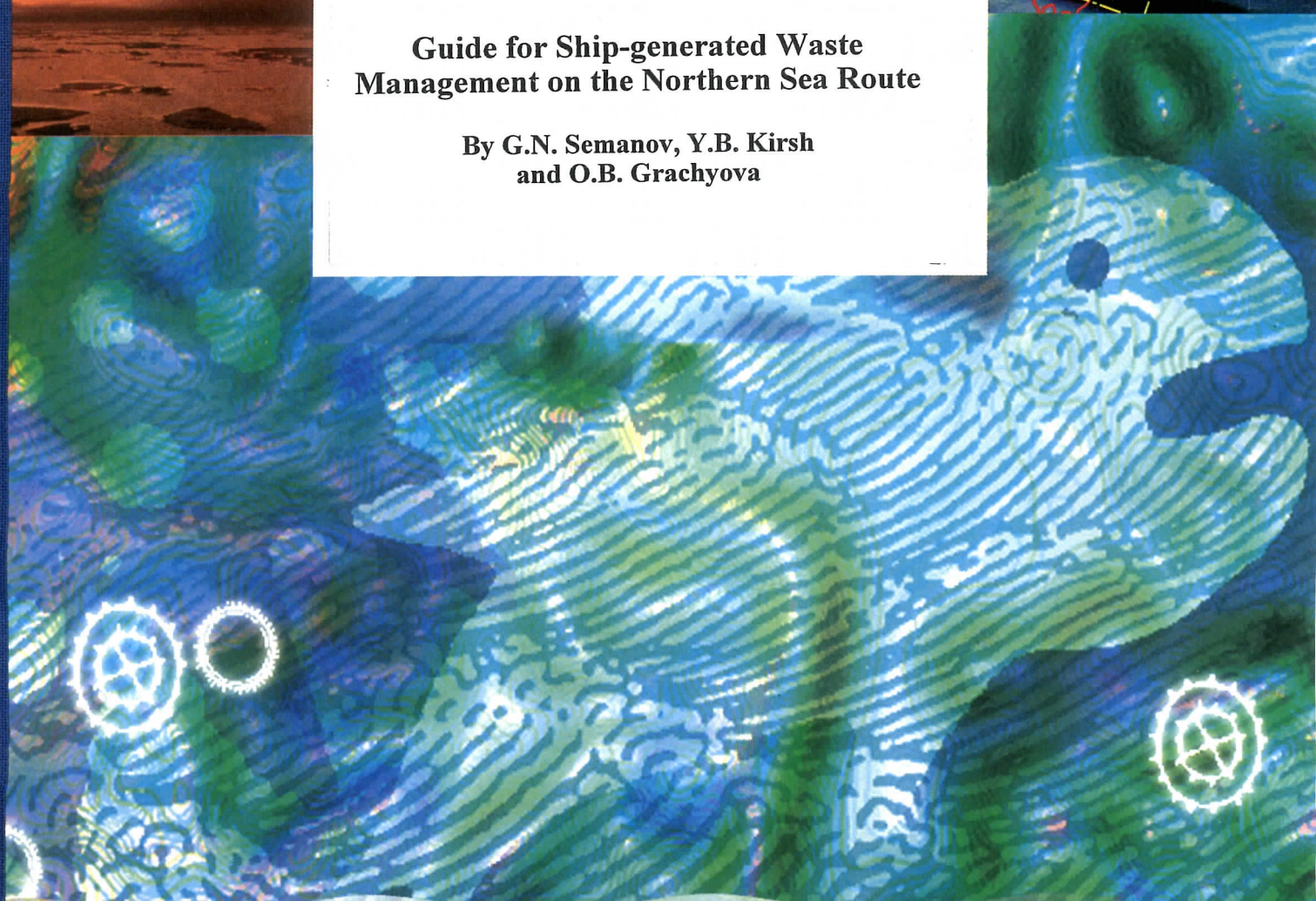


INSROP WORKING PAPER NO. 133 - 1999, II.6.12

Guide for Ship-generated Waste Management on the Northern Sea Route

By G.N. Semanov, Y.B. Kirsh and O.B. Grachyova



INSROP International Northern Sea Route Programme

Central Marine Research & Design Institute, Russia

The Fridtjof Nansen Institute, Norway

Ship and Ocean Foundation, Japan

International Northern Sea Route Programme (INSROP)

Central Marine Research & Design Institute, Russia

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Sub-Programme II: Environmental Factors

Project II.6.12.: Manual on Ship-generated Waste Management

Supervisor: Gennady N. Semanov, CNIIMF

Title: **Guide for Ship-generated Waste Management on the Northern Sea Route**

Authors: **G.N. Semanov, Y.B. Kirsh and O.B. Grachyova**

Address: Central Marine Research and Design Institute (CNIIMF)
Kavalergardskaya Str. 6,
St. Petersburg 193 015,
Russia

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Reviewed by: Regional Director Victor M. Santos-Pedro, Marine, Prairie & Northern Region, Transport Canada, Toronto, CANADA.

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FOREWORD - INSROP WORKING PAPER

INSROP is a five-year multidisciplinary and multilateral research programme, the main phase of which commenced in June 1993. The three principal cooperating partners are **Central Marine Research & Design Institute (CNIIMF)**, St. Petersburg, Russia; **Ship and Ocean Foundation (SOF)**, Tokyo, Japan; and **Fridtjof Nansen Institute (FNI)**, Lysaker, Norway. The INSROP Secretariat is shared between CNIIMF and FNI and is located at FNI.

INSROP is split into four main projects: 1) Natural Conditions and Ice Navigation; 2) Environmental Factors; 3) Trade and Commercial Shipping Aspects of the NSR; and 4) Political, Legal and Strategic Factors. The aim of INSROP is to build up a knowledge base adequate to provide a foundation for long-term planning and decision-making by state agencies as well as private companies etc., for purposes of promoting rational decisionmaking concerning the use of the Northern Sea Route for transit and regional development.

INSROP is a direct result of the normalization of the international situation and the Murmansk initiatives of the former Soviet Union in 1987, when the readiness of the USSR to open the NSR for international shipping was officially declared. The Murmansk Initiatives enabled the continuation, expansion and intensification of traditional collaboration between the states in the Arctic, including safety and efficiency of shipping. Russia, being the successor state to the USSR, supports the Murmansk Initiatives. The initiatives stimulated contact and cooperation between CNIIMF and FNI in 1988 and resulted in a pilot study of the NSR in 1991. In 1992 SOF entered INSROP as a third partner on an equal basis with CNIIMF and FNI.

The complete series of publications may be obtained from the Fridtjof Nansen Institute.

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PROGRAMME COORDINATORS

- **Yuri Ivanov, CNIIMF**
Kavalergardskaya Str.6
St. Petersburg 193015, Russia
Tel: 7 812 271 5633
Fax: 7 812 274 3864
E-mail: cniimf@neva.spb.ru

- **Willy Østreng, FNI**
P.O. Box 326
N-1324 Lysaker, Norway
Tel: 47 67 11 19 00
Fax: 47 67 11 19 10
E-mail: sentralbord@fni.no

- **Hiroyasu Kawai, SOF**
Senpaku Shinko Building
15-16 Toranomon 1-chome
Minato-ku, Tokyo 105-0001, Japan
Tel: 81 3 3502 2371
Fax: 81 3 3502 2033
E-mail: sofkawa@blue.ocn.ne.jp

CONTENTS

Introduction

The main objective of the Guide is to assist vessel operators in complying with requirements set forth in MARPOL 73/78 and national laws.

It can be achieved by developing for arctic ships environmentally safe waste management strategy that should be based on the assessment of the existing waste situation, its analysis and recommendations elaborated on its basis.

"The Guide on ship-generated wastes management in the NSR" is divided into six sections.

The first three sections include objectives and requirements of the Guide, a general description of the policy, assessment of the existing waste situation.

The fourth section of the Guide provides recommendations for minimizing oil wastes quantity and their sources on board ship, oily mixtures processing technology and their discharge into shore reception facilities.

The fifth section of the Guide contains information concerning collection, on-board processing technology for sewage which is regulated by national legislation on shipping marine pollution prevention.

The sixth section of the Guide gives recommendations for garbage handling, including technology of its collection, storage, processing and utilization on board ship. Recommendations are given for reducing garbage quantity generated on board.

Taking into account the shortage of shore reception facilities [1] along the Northern Sea Route, their capacity for reception and recycling of ship-generated wastes, it should be admitted that in the Arctic there are very restricted possibilities of taking advantage of the experience related to handling of wastes which is used in other regions. For example, there is no possibility of reuse of lubricating oils. In this connection there is no need to collect separately different kinds of oily residues and wastes.

All sections of the Guide point out the necessity to utilize wastes to maximum extent and provide their reuse on board. The Guide gives an example of a matrix form of inspection of existing ship's practices.

The Guide does not include recommendations for bulk chemical waste management. The wastes are usually handled in loading and unloading ports and terminals.

1. Objectives and requirements

Such a guide is not required as mandatory either by MARPOL-73/78 or by Russian legislation on environment protection. However, it is quite useful for the ship's crew as it can help them to "open their eyes to the problems of wastes", to reduce environment pollution and eventually to avoid expenditures on paying fines for violating nature protection legislation, reduce expenditures on the services of shore-based reception stations. The Guide should include the following information:

1. Company's management policy.
2. Provisions of international and Russian legislation on environment protection with indication of documents titles, references to appropriate items and chapters of the documents.
3. Responsibility and Control.
4. Training and education.
5. Assessment of the existing waste situation:
   - List of all wastes generated by the ship during normal operation.
   - List of equipment intended for collection, processing, storage and discharge of wastes.
   - Waste management technology.
   - Documentation.
   - Coordination of port and ship requirements.

2. General

2.1. Company's management policy statement

The Company should proclaim its adherence and gives priority primarily to ensuring safety and pollution prevention. The Company should apply the "Guide for ship-generated management on the Northern Sea Route".

The Company should ensure:

- compliance with the international and national Regulations and Standards relating to maritime safety and pollution prevention;
- immediate response to any environmental accidents;
- use of advanced facilities and technologies aboard ships for preventing sea pollution by waste.

Essential factors concerning mitigation of adverse environmental impact produced by discharge of waste into sea from ships and on-board disposal of waste are to be as follows:

- decrease of on-board wastes-generating sources;
- efficient use of waste processing and disposal equipment;
- strict observance of international and national regulations for discharge of waste from ships.

2.2. Russian national rules and international conventions and provisions on prevention of pollution from ships.

In general the main part of the NSR is situated within the territorial waters of Russia and partly in waters of the economic area of Russia. Ships sailing along the NSR must abide by the "Regulation for navigation on the sea ways on the Northern Sea Route".

While on the NSR every ship must comply with Russia's requirements and international regulations concerning prevention of pollution from ships.

Concerning the Arctic seas the international requirements and regulations are described in MARPOL-73/78 and in the draft "Code of Arctic Navigation", while the Russian requirements are stated in the Law of Environment Protection, Code of Waterways, Law of Continental Shelf, Regulations for Navigation on the seaways of the Northern Sea Route, "Rules of Protection from Pollution of Coastal Sea Waters" and Sanitary Rules and Regulations of Protection of Coastal Sea Waters from Pollution No 4631-88 (further referred as "Regulation 4631-88" [3]).

With the purpose of protecting water consumption areas against pollution, ensuring safety of their use for recreation, medical and sanitation, domestic and drinking needs of population and creating safe conditions for the production of aquatic plants, protected areas of sea water consumption, zones of their sanitary protection as well as a protected coastal land belt are defined in the Regulation 4631-88.

Boundaries of water consumption areas of sea coastal waters protected against pollution are specified by territorial, regional or town municipal councils on the submission of local bodies and organizations of Goskomsanepidnadzor of the Russian Federation.

Boundaries for the coastal area of seawater consumption are defined by the distance seaward being not less than two miles from the water edge (3.9 km).

Depending on particular sanitary, hydrophysical, topographic and hydrological features as well as on the conditions of national-economic use of the sea coast, the coastal area of sea water consumption may be ex-

tended seaward on the demand of sanitary and epidemiological service of Goskomsanepidnadzor of the Russian Federation and agreed upon with local territorial administrative bodies.

Boundary of the zone of sanitary protection of the area of water consumption of population is defined seaward by the boundaries of territorial waters and towards both sides of the area of water consumption by the water edge line at a distance of 10 km.

Discharge of non-processed and processed sewage is forbidden in the breeding areas of mammals and fish, except for comminuted food wastes, oily waters when oil content in the effluent without dilution does not exceed 15 ppm, the coli index of processed sewage shall not exceed 1000. In the Arctic seas it is not prohibited to discharge into the sea the so-called "grey waste waters" – drains from galleys and showers. The conditions of waste discharge into the sea over the Northern Sea Route are stated in Annex 2.

Discharge of any non-processed industrial, domestic and other wastes and garbage is forbidden. It is also prohibited to store garbage and other wastes on ice and coast in places not agreed upon with bodies responsible for control of using and protection of waters in the system of the Russian Federation Ministry of Nature, and bodies exercising State sanitary supervision and protection of fish reserves.

Ships sailing along the NSR should comply with all applicable provisions of current international conventions on prevention of pollution, to which Russia is a participant. Permissible participated by Russia. Allowable norms and conditions of discharge of dangerous substances from ships therewith are determined by international conventions, depending on different parameters characterizing the ship and its position in relation to the nearest land.

International convention on prevention of pollution from ships adopted in I973 and modified by the Protocol of I978 (MARPOL 73/78) came into force in October I983 together with Annex I (Regulations for the Prevention of Pollution by Oil). Then Annex II (Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk), Annex III (Regulations for the Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form), and Annex V (Regulations for the Prevention of Pollution by Garbage from Ships) also came into force (as of I September, I994).

Annex IV of MARPOL 73/78 (Regulations for the Prevention of Pollution by Sewage from Ships) was adopted by the Council of Ministers of the USSR as of 6 July, I987.

By the order of Merchant Marine Minister No I6I-np as of October 8, I987, issued in lieu of the above decision of the Council of Ministers of the USSR, indisputable compliance with the requirements of Annex IV of MARPOL 73/78 becomes the duty of the Responsible Persons.

With regard for the above mentioned, sailing along all the length of the NSR falls into the category of sailing in "a special area", and all the corresponding regulations of MARPOL 73/78 on the prevention of pollution of the sea by wastes are compulsory. Such provisions are included in the draft Code of Arctic Navigation.

2.3. Responsibility and Control

The Master of any ship is responsible for fulfilling the whole complex of measures aimed at prevention of pollution from ships.

He is responsible for:

- implementation of the ship owner policy on providing safety and environment protection based on international conventions, codes and national legislation;
- impelling the crew to implement this policy;
- issuing corresponding orders and regulations in a simple and clear form;

- controlling procedures on providing safety and preventing pollution;
- in matters of safety and prevention of pollution the Master is vested with all the powers to exercise any actions which in his opinion suit passengers' and crew interests, the ship and sea environment safety;
- the Master should inform the ship owner about such faults and other problems which may influence the safe operation of the ship or may bring about pollution and which require cooperation with the ship owner to be eliminated.

Coordination of activities related to prevention of sea pollution by waste is to be provided by the Chief Officer.

The duties of the Chief Officer in managing waste handling operations should include:

- ensuring that the crew be trained in the wastes collecting, storing, processing and disposal procedures;
- ensuring treatment of wastes aboard the ship;
- liaison with shore authorities regarding possible disposal of wastes from the ship;
- control over keeping the Oil Record Book, Sewage Record Book and Garbage Record Book

2.4. Training and education

All relevant staff and those using equipment for the first time, should be trained in the purpose and operation of the system and the relevant equipment.

All relevant staff should have drills' and training in the operation of the waste management systems and the equipment, as part of a formal training schedule. Training should include the fundamentals of piping, pumping, tank arrangements, tank cleaning methods and constraints, equipment operation, monitoring and emergency response procedures. Personnel using the equipment should not only monitor its output performance, but also control the proper function of the equipment to be sure of its operating capacity, so that overloads resulting in incidents causing potential environmental harm, do not occur. Such training should be reviewed annually.

Ship's personnel should be aware of all the problems connected with environmental protection to avoid penalties for unproper functioning of the equipment in compliance with the Port Authorities' requirements.

Instruction, training and education of the ship's personnel should be conducted under the supervision of the Chief Officer.

The training programme should include:

- familiarization of each member of ship's personnel with the requirements of MARPOL 73/78, relating to disposal of waste within and outside special areas, the boundaries of special areas;
- familiarization of members of ship's personnel with wastes collecting, storing and disposal procedures under this Guide;
- familiarization with areas of ship-generated wastes storing and processing equipment;
- accumulation of information on regulations and practices of waste delivery in ports visited by the ship on a regular basis.

The main methods of training ship's personnel for implementing the waste management procedures are:

- individual instructions,
- education and training,
- exercises.

The Chief Officer or immediate superior, prior to ship's departure should ensure familiarization with ship-generated wastes management regulations for each member of personnel joining the ship.

3. Assessment of the existing waste situation

3.1. General

In order to develop an efficient environmentally safe strategy of managing waste it is necessary in the first turn to make an analysis of practices available of handling wastes generated on a ship, to determine the amount, composition and sources of wastes generated and existing practices of waste treatment on board a ship.

It is expedient to make the analysis by dividing the wastes into several groups, taking as a basis the classification given in the International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978 relating thereto (MARPOL-73/78). According to MARPOL-73/78 ship-generated wastes are divided into 5 groups [2]:

1. Oily wastes which include bilge, washing and ballast waters, fuels and oils separation wastes, residues after oil-containing waters filtration, oil-contaminated sludge from cargo tanks of oil-tankers and fuel tanks of vessels, as well as oily rags. The term "oil" means crude oil, oil products including fuels and lubricating oils.
2. Residues after carriage of bulk liquid and dry cargoes other than oil.
3. Residues of chemical cargoes other than oil, carried in packing, as well as fragments of packing contaminated with chemicals. This group also includes residues of chemicals carried in containers, rail wagon tanks and truck tanks.
4. Sewage from toilets, urinals, medical premises, spaces containing living animals, etc. It does not apply to drainage from galleys, showers, wash basins, laundries.
5. Garbage that includes solid domestic and operational wastes, fragments of packages, separation materials, food wastes included.

The Guide does not include recommendations for groups 2 and 3 waste management. The wastes are usually handled in loading and unloading ports and terminals.

3.2. Assessment of ship-generated wastes

The quantitative and qualitative assessment of ship-generated wastes is an important component of the analysis. It is recommended to carry it out during a voyage and/or on the basis of shipboard reports for a certain period of time (day, voyage, month, year). The matrix form of inspection is given in Annex 1. In this case the quantity of waste should be estimated in kg and/or cu m in all groups with categorizing the wastes within the groups.

3.3. Waste processing on board the ship

Nowadays there are four approaches to the waste management that are universally recognized in practice: source reduction, reuse and recycling, discharge into the sea, transfer to shore reception facilities. The appropriate approach and combination of waste handling techniques are required for each type of waste.

The analysis of waste handling techniques should result in identifying the techniques that could be most effective and acceptable in the conditions under consideration. At the same time the following factors should be taken into account:

1. Expenditures on the use of the techniques.
2. Most efficient techniques for reducing the amount of wastes generated, reusing, collecting, separating, recycling and storing the wastes on board the ship.

3. Expediency, possibility and necessity of waste discharge into the sea or transfer to the shore reception facilities.

3.4. Documentation

The preparation of the report is the final stage of the analysis of waste generation sources, their quantity and composition assessment and the vessel's inspection. The report shall include the following data: type and amount of ship-generated wastes, sources of waste generation, review of the international and Russian rules of marine environment protection as applied to the Northern Sea Route.

The report shall contain the description of waste management techniques that are in use on the ship inspected as well as existing problems and shortcomings from the expert's point of view.

The example of the report format is given in Table 1 and Annex 1.

The Record Books (Oil, Sewage, Garbage) are official documents kept on the bridge of the ship and should be available for inspection by the competent authority of the Government while the ship is in port.

The Record Books should be retained on board for a period of two years after the last entry was made.

A copy of an entry in those Books certified by the Master, should be accessible as an official document in any judicial proceedings.

An entry is to be made in Record Books after:
- each discharge operation into the sea;
- each discharge to reception facilities;

Entries should include:
- date and time of start and stop of waste discharge, transfer or disposal;
- category and estimated quantity of waste treated, discharged or transferred;
- position (longitude, latitude) or name of a vessel which transfers its wastes or name of port or facility when discharged to reception facility ashore;
- signature of the person responsible for treatment or discharge or transfer operation.
- each page filled should be signed by the Master.

In addition to routine entries, an entry is to be made in the Record Books with regard to the extraordinary circumstances of unintentional discharge due to:
- the disposal of waste from the ship necessary for the purpose of securing the safety of the ship or saving life at sea;
- the escape of waste resulting from damage to the ship or its equipment.

When wastes are discharged to reception facilities ashore or transferred to another ship the Master should obtain a receipt signed by the operator of port reception facilities or by the Master of the ship receiving the waste. The receipts must be kept on board the ship with the relevant Record Books for two years.

Table 1

Report for Guide for Ship-generated Waste Management

Name of ship _____ Year of ship building _____
Number of berths for accommodating the crew _____ Distinctive number or letters _____
Type of ship _____

Type of waste	Quantity of waste generated per day (m^3 or t)	Handling techniques	Model, capacity of equipment, m^3/h	Conformity to MARPOL 73/78 and national requirements	Quantity of waste discharge		Conclusions and recommendations*
					into sea	to shore reception facilities	
Oils : – bilge waters – waste oils, including • fuel separated waste • lubricant separated waste • other waste oils a. b. c.							
Sewage: – drainage from toilets, urinals, WC scuppers – drainage from medical facilities – other a. b. c.							
Garbage: – plastics – domestic wastes – food wastes – oily rags – cargo-associated waste – other a. b. c.							

* May be done on separate pages. The conclusions of expert are annexed to the table.

3.5. Coordination of port and ship requirements

Good coordination of port and ship requirements would be important in avoiding undue delay and pollution of sea.

In order to plan waste disposal in ports, it is important that advance notification should be received as to which wastes a particular ship will want to discharge in the port. For a ship, the most important contact in a port is either the ship's agent or the port authorities. Either the ship's agent or the port authorities will have to make arrangements for the delivery of wastes.

When the ship contacts the agent or port authorities to make arrangements for arrival in port, this is an excellent time to draw attention to the disposal of wastes. As all ships generate oily wastes and garbage, it should become a standard procedure for the agent or port authorities to ask what the ships wish to discharge. If an agent does not make the right arrangements for a ship, this will have a negative impact on the disposal procedure (delays and possible high costs).

On the other hand, if prior notification is correctly carried out by the ship, the port should inform a certain period (e.g. within 24 hours after notification), in which the waste could be received. Port authorities should provide both ships and agents with sufficient information on the waste disposal procedures in a port.

If the port of call could not receive wastes the ship has to make arrangements for handling them on board, for example, to incinerate them.

4. Oily waste management strategy

4.1. General

Liquid and non-liquid wastes are produced on the ship mainly during operation of the ship's propulsion plant. Liquid wastes containing oil include:
- oil residues from purification of fuels and lubricating oils;
- fuel and oil leaks from detachable connections, sealing glands;
- wastes contaminated by oils and lubricants;
- oily bilge waters.

Non-liquid oily wastes include:
- oily rags;
- solid deposits from separators;
- sediments from settlers;
- solid oily deposits removed from machinery parts.

4.2. Reduction of sources of ship oily wastes

The main sources of generating bilge waters are:
1. Water vapours condensation on inner surfaces of the ship's hull, snow and ice melting.
2. Water leaks from pipings and flange connections.
3. Hull leakages.
4. Water and steam leaks from boiler installations (pumps, evaporators, boilers).
5. Washings from the engine room.
6. Fuel and oil leaks from pipings.
7. Settled water from fuel and oil settling tanks.
8. Fuel and oil leaks from pump sealing glands.
9. Drainage from the cooling system, refrigerator evaporators, etc.
10. Fuel and oily mixtures generated in the course of washing the machinery parts.
11. Personnel's errors resulting in overflow of fuel oil tanks.

In the first turn it is necessary to consider the possibility of eliminating all kinds of leakages in pipings, connections, tanks, sealing glands in pumps, etc. In order to reduce or even eliminate such a source of oily waste generation as fuel oil overflow during bunkering or transfer of fuel inside the ship, it is recommended to include a special tank in the system of fuel overflow monitoring. In this case fuel can be returned to the fuel system without losses.

To reduce the amount of bilge waters requiring treatment, it is necessary to consider the possibility of using an oil-water surface separation detector while discharging settled water from a settling tank into bilge wells. The quality of purification of bilge waters from oil can be improved owing to including an intermediate settling tank in the fuel system and also owing to use of quickly decomposing detergents for washing the machinery parts, the requirements to such detergents being stated in the IMO recommendations [4].

4.3. Oily waste processing

4.3.1. Liquid oily waste processing

The following techniques of processing of liquid oily wastes can be used on board the ship: separation or filtration, homogenization and incineration.

All ships sailing over the Northern Sea Route are equipped with separation and oil-filtering equipment for treatment of oil-containing waters. The requirement of ensuring purification of water from oil to the content of 15 ppm applies to them. The equipment shall be provided with an alarm of exceeding the pre-set limit while a ship with the deadweight of more than 10,000 tons must have in addition a device for stopping water discharge in the case of exceeding 15 ppm (Annex 2). Oil separated from bilges is discharged into a sludge tank.

The fuel preparation system on some ships may have homogenizers which ensure obtaining a homogeneous mixture of fuel oil and liquid oily wastes, and sometimes of water, too, with the purpose of their burning in a diesel installation. The homogenizers shall ensure homogeneity of the mixture and its specific dispersive composition to prevent the fuel supply equipment from intensive wear and damage. The homogenized mixture can be also burnt in auxiliary boilers.

Most of sea-going transports sailing over the Northern Sea Route are equipped with incinerators [5] intended for destroying ship-generated garbage and oily wastes. Practically all oily wastes can be burnt in an incinerator. At the same time it is not recommended to incinerate waste lubricating oils when ship is going to call at the ports of Murmansk or Arkhangelsk because it is not economically advantageous and leads to environment pollution with metals contained in oils. In the above mentioned ports waste lubricating oils are received for regeneration and reuse. The main requirements to incinerators are stated in MEPC Resolution 71.(40) [5], while the operating instructions are provided by the manufacturers of incinerators.

While taking a decision on transfer of oily wastes to shore reception facilities in Arctic ports, it is necessary to check the possibility of their transfer by ship's pumps, the consistency of oily waters and in case of their high viscosity to provide for the possibility of heating the wastes up to the temperature at which they are so fluid that they can be transferred by ship's pumps.

4.3.2. Non-liquid oil waste treatment

Non-liquid oil waste is one of the types of garbage. The wastes are collected and stored separately from other type of garbage and incinerated or discharged to shore reception facilities.

4.4. Documentation

All the operations described in paragraphs 4.3 shall be entered into the Oil Record Book, part 1 and/or II, required by the International Convention MARPOL-73/78 [2].

5. Sewage management strategy

5.1. General

According to the definition of Regulation 1, Annex IV of MARPOL-73/78 (it has not yet come into force) sewage includes:

1. drainage and other wastes from any form of toilets, urinals and WC scuppers;
2. drainage from medical premises (dispensary, sick bay, etc.);
3. drainage from spaces containing live animals;
4. other waste waters when mixed with the drainages defined above.

The Russian national regulations do not require any measures on monitoring grey waste waters – drainage from showers, galleys, laundries, baths, washbasins, buffets if they are not mixed with the above mentioned drainage. They require compulsory treatment of sewage prior to its discharge into the sea (Annex 2).

5.2. Sewage generation source reduction

The amount of sewage generated on a ship depends on many factors, among them the number of the crewmembers, the type of the systems for collection and treatment of sewage.

The main cause of increased volume of sewage on board the ship is malfunction of shut-off equipment in flush cisterns in water closets. In this connection it is very important to execute constant monitoring of the condition of the shut-off equipment.

5.3. Sewage processing

According to the requirements stated in the environment protection regulations all sea-going transport ships are equipped with sewage treatment plants whose operation is allowed even in the port waters. Besides, a ship may have plants for comminuting and disinfecting sewage, prior to its discharge into the sea. As a rule, they are used on board ships which operate sewage treatment plants whose work is based on physicochemical and not biochemical methods of sewage processing. As a result of operation of such plants sludge is generated whose discharge overboard is prohibited, and the sludge can be either burnt in incinerators or discharged into shore reception facilities. The conditions for discharge of sewage overboard are stated in Annex 2.

5.4. Documentation

All operations on collection, accumulation, treatment and discharge of sewage shall be recorded in the Sewage Record Book, required on board a ship by the Russian environment protection regulations [6].

6. Garbage management strategy

6.1. General

According to MARPOL-73/78 "garbage" means all solid wastes generated on board a ship in the course of its normal operation except solid remains of cargoes, and also packings contaminated with cargo carried. Garbage can be conditionally subdivided into a few categories:

- domestic solid waste;
- maintenance waste;
- cargo-associated waste;
- special waste.

Domestic solid waste is garbage from living quarters (paper products, rags, metal and plastic cans, bottles, batteries, etc.), from galleys and messrooms (food waste), and also packing materials contaminated by such waste (wrapping paper, plastics, rags). During maintenance of a ship the following kinds of garbage are generated: soot, sludge from fuel and lubricating oil separators, waste lubricating oil from main and auxiliary machinery, paint removed from walls during their repair, incinerator ash, deck sweepings, rags, including oiled ones, wiping materials, remains of packings for expendables and spare parts.

Packing remains, dunnage, pallets, trays, various kinds of plastics, paper products, cardboard, metal belong to cargo-associated waste. Garbage from medical spaces (dressing, remains of medicine packing, etc.), remains of cargo, spoiled cargo, wiping material contaminated with cargo belong to special waste that requires special measures on its processing, storage and utilization.

The amount and composition of domestic and maintenance garbage generated on board a ship during a voyage depend on many factors, the main ones being the type of the ship, the number of the crew, length of the voyage, the type of processing equipment on board, the number and type of containers for storing garbage. The inspection of ships engaged on voyages along the Northern Sea Route shows that the ships generate approximately 2 kg of food waste and 1.5 kg of domestic waste per person per day, and about 10 kg of maintenance waste (from the engine room and deck) per day. [7]

The amount of garbage generated during carriage of cargo depends, in the first turn, on the type of a ship and cargo carried by it. The smallest amount of garbage is generated on container ships, while the largest amount is generated on timber carriers and general cargo ships.

Approximately it can be accepted that general cargo ships generate on the average 1 ton of cargo-associated solid waste per 100 tons of cargo, container ships – 1 ton per 25,000 tons of cargo, dry bulk cargo ships – 1 to 20 tons per 10,000 tons of cargo. [7]

It should be also noted that according to the Russian sanitary regulations [3] food and medical wastes require special measures of control. For example, it is prohibited to remove them from the port area without preliminary disinfection if they come from ships engaged in international trade and making voyages to the ports of other countries.

6.2 Garbage generation source reduction

All ship operators should minimize taking potential garbage aboard as well as on-board waste generation.

Domestic wastes may be minimized through proper provisioning practices. Ship operators and governments should encourage ships' suppliers and provisioners to consider their products in terms of the garbage they generate. Options available to decrease the amount of domestic waste generated aboard ship include the following:

- Bulk packaging of consumable items may result in less waste being created. However, factors such as inadequate shelf-life once a container is open must be considered to avoid increasing wastes.
- Reusable packaging and containers can decrease the amount of garbage being generated. Use of disposable cups, utensils, dishes, towels and rags and other convenience items should be limited and replaced by washable items when possible.
- Where practical options exist, supplies packaged in or made of materials other than disposable plastic should be selected to replenish ship supplies unless a reusable plastic alternative is available.

Operational waste generation is specific to individual ship activities and cargoes. It is recommended that manufacturers, shippers, ship operators and governments consider the garbage associated with various categories of cargoes and take action as needed to minimize their generation. Suggested actions are listed below:

- consider replacing disposable plastic sheeting used for cargo protection with permanent, reusable covering material;
- consider stowage systems and methods that reuse coverings, dunnage, shoring, lining and packing materials;
- dunnage, lining and packaging materials generated in port during cargo discharge should preferably be disposed of to the port reception facilities and not retained on board for discharge at sea.

Governments are encouraged to undertake research and technology development to minimize potential garbage and its impacts on the marine environment. Suggested areas for such study are listed below:

- development of recycling technology and systems for synthetic materials returned to shore as garbage;
- development of technology for degradable synthetic materials to replace current plastic products as appropriate. In this connection, governments should also study the impacts on the environment of the products of degradation of such new materials.

6.3. Garbage management technology

6.3.1. Garbage collection

According to the requirements of MARPOL-73/78 garbage is categorized into 6 types which are advisable to collect in specially marked containers. However, due to the lack of sufficient space on board a ship for their placing, impossibility to process different categories of garbage at shore reception facilities in Arctic ports the ships engaged on Arctic voyages can be recommended to collect garbage by the following groups:

1. Garbage that can be burnt in an incinerator.
2. Non-combustible garbage liable to disposal to port reception facilities.
3. Foods and sanitary-dangerous kinds of garbage.

6.3.2. Garbage processing

As it has been mentioned above most of sea-going transports sailing over the Northern Sea Route carry on board incinerators in which all combustible components of garbage, a part of food waste and oily waste can be burnt. Operation of the equipment has to be performed in compliance with the operating instructions of the manufacturing factory. Food waste which is allowed to discharge under certain conditions overboard in Arctic seas is subject to preliminary treatment, i.e. comminuting. To reduce the volume of garbage stored on board which cannot be discharged overboard or incinerated, it is advisable to compact it with the help of special equipment.

6.3.3. Garbage storage

With regard for the length of Arctic voyages, impossibility of disposal of garbage in certain ports the problem of garbage storage may become very serious. It is necessary to solve the following problems:

- to determine an approximate volume and weight of garbage to be stored (Annex 1);
- to determine places of collecting and storing garbage prior to its processing on board a ship;
- to ensure separation and storage of non-combustible components of garbage;
- to determine places of storage of food and sanitary-dangerous wastes;
- to assess the route over which garbage is delivered to the place of recycling.

For temporary collection of garbage in the places of its generation in the living quarters, engine room, galley, messroom, etc. it is necessary to provide for small size containers. The recommended capacities of such containers are: 15 l for living quarters, 60 l for operational area. For permanent storage of garbage HELCOM (Helsinki Commission) and "Guidelines for control pollution from ships" [7] recommend containers of the following capacities (Table 2).

Table 2

Recommended capacities of containers

	Registered tonnage					
	over 400 t		400 t- -1,600 t	1,600 t- - 4,000 t	4,000 t- - 10,000 t	over 10,000t
	over 10 persons	over 50 persons				
Minimum total capacity of garbage storage containers, (cu m)	0.1	0.5	0.4	1.2	2.5	5.0

Places for garbage storage are marked in the Garbage management plan [6] and shall be located in well-ventilated spaces. It is not recommended to store garbage in plastic and paper bags as they can be easily damaged or destroyed. Containers for storing garbage shall be made of material which is easy to clean, they shall be marked appropriately and all crew members must know their location.

In connection with the fact that in Arctic ports it is practically impossible to recycle garbage and to reuse its components (paper, plastic, metal, glass, etc.) ships have to collect and store them together, except the ships which are able to separate and retain garbage for disposal at end of voyage and intend to call at ports Arkhangelsk, Murmansk and Nachodka.

6.3.4. Transfer to shore reception facilities and discharge into the sea

Taking into account the fact that discharge of garbage in the Arctic is prohibited and Arctic ports along the Northern Sea Route mainly dispose of garbage by sending it for burial at dumps, it is necessary to take all possible measures for its processing with the help of shipboard equipment. To ensure reception of garbage by ports it is necessary to notify them in advance about the amount of garbage to be disposed of and about its type.

All operations carried out with garbage on board a ship shall be registered in the shipboard Garbage Record Book required in compliance with Annex V of MARPOL-73/78 and by the Russian regulations of marine environment protection from pollution.

6.3.5.Reuse

One of the methods of reducing the amount of garbage is refusal from using disposable articles: dishes, cutlery, packings. It is advisable to use cardboard boxes as packings for expendables, and also cases-containers made of high-strength polyethylene or wood which can be returned to the supplier while receiving a new lot of goods. Reduction of the amount of cargo-associated garbage is possible owing to reuse of separation materials in cargo holds.

6.4. Documentation

In accordance with the requirements of Annex V of MARPOL-73/78 after July 1, 1998 all ships of 400 tons deadweight and above, and after July 1, 1997 ships coming into operation shall have on board the Garbage Management Plan, the Garbage Record Book and posters informing about the rules of garbage handling, the same documents being also required by the Russian regulations of marine environment protection from pollution [6].

The garbage management plan shall include the following sections:
- description of the procedures used for collecting, processing, storing and disposal of garbage to shore reception facilities or overboard;
- nominating persons responsible for the above mentioned procedures.

All operations on collection, storage, processing and discharge of garbage shall be recorded in the Garbage Record Book.

Annex 1

Characteristics of the ship's environment protection practices.

1. Ship's name and registry/official number.

2. Maximum crew size.

3. Designated person(s) in charge of:
   - .1 Ship's Waste Management Strategy,
   - .2 Engine Department,
   - .3 Deck Department,
   - .4 Galley,
   - .5 Other.

4. Specific or estimated ship-generated waste generated per day (m^3 or t).

   4.1 Oils
   - .1 bilge waters (Appendix 1) —
   - .2 waste oils, including —
     - fuel separated waste —
     - lubricant separated waste —
     - other waste oils —

   4.2 Sewage, (m^3)
   - .1 Drainage from toilets, urinals, WC scuppers —
   - .2 Drainage from medical facilities —
   - .3 Other (specify) —

   4.3 Garbage, (m^3 or t).
   - .1 Plastics —
   - .2 Domestic wastes —
   - .3 Food wastes —
   - .4 Oily rags —
   - .5 Cargo-associated waste —
   - .6 Other (specify) —

5. Processing equipment on board
   - .1 Oil filtering equipment
     (number, model, capacity, location)
   - .2 Homogenizers
     (model, capacity)
   - .3 Incinerators
     (number, model, capacity, location)
   - .4 Sewage treatment plant
     (number, model, type of treatment, capacity, location)
   - .5 Comminuters
     (number, model, capacity, location)

6. Waste storage capacities

6.1 Oil

1. Storage for Waste Oils
   (type, capacity, location).
2. Storage for bilge waters
   (capacity, location)
3. Other storage
   (capacity, specification, location)

6.2 Sewage water

1. Storage for sewage
   (specification, capacity, location, type)

6.3 Garbage

1. Receptacles
   (specification, capacity, location, type)

Appendix 1

Recommendation for determination of quantity of bilge waters

Proceeding from the inspections of the ship and the analysis of the data obtained, one may say approximately that the intensity of accumulation of oily bilge waters depends on the displacement of the ship (the power of the propulsion plant) and the time that has passed since the last repair.

Fig. 1 shows the graph relationship between the amount of oily bilge waters and the ship's deadweight [7].

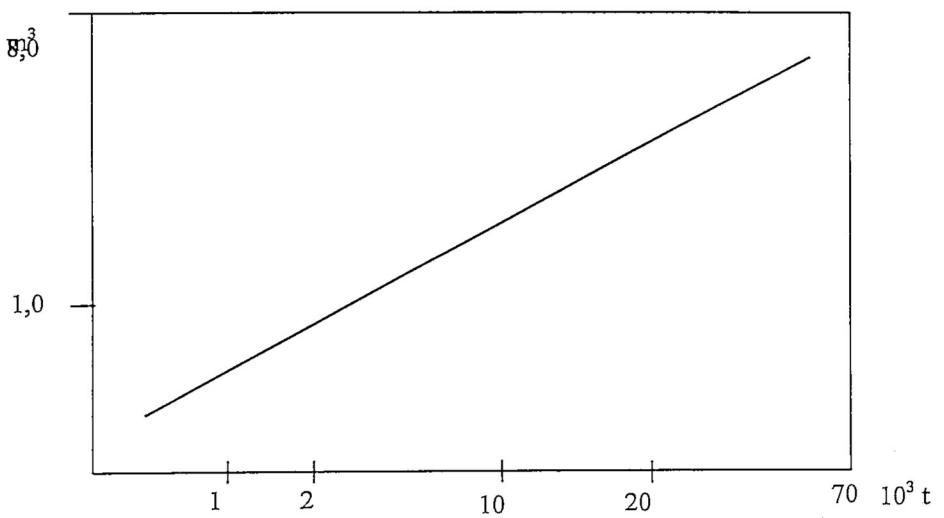

Fig. 1. Dependence of the amount of generated oily bilge waters on the deadweight of the ship with a diesel engine.

Annex 2

Conditions of discharge of the ship generated wastes along NSR

1. CONDITIONS OF DISCHARGE OF OILY WATERS ALONG THE NSR

Area of the sea	Discharge from machinery rooms bilges		Discharge of ballast from oil tanker
	Ship type and dimensions	Discharge criteria	Discharge criteria
The NSR	Any ship other than oil tanker of up to 400 tons gross tonnage	Undiluted effluent containing not more than I5 ppm of oil	Discharge is prohibited with the exception of clean or segregated ballast
	Any oil tanker and any ship of 400 tons gross tonnage and above	Discharge is prohibited with the exception, when: 1) bilge water is not mixed with bilge water of cargo pump room or cargo residues; 2) the ship is "en route"; 3) oil content in the effluent is I5 ppm; 4) equipment in correspondence with Regulation I6(5) of the Annex I MARPOL 73/78 is available	

2. CONDITIONS OF SEWAGE WATER DISCHARGE ALONG THE NSR

Sewage type	Area of water consum-ption	Area of fish consum-ption	Sanitary protection zone	Within 4 miles from land*	Between 4 and I2 miles from land	More than I2 miles from land
Non-processed sewage water*	Discharge is prohibited					Carried out when the ship is moving at not less than 4 knots
Processed sewage water (black water)	Discharge is prohibited		Discharge is prohibited except for discharge after processing in approved installations in accor-dance with the conditions of Regulation 3 (I)(a)(i) and Regulation 8 (I)(b) of the Annex IV MAR-POL 73/78**		Discharge is prohibited except the discharge after processing: 1. in approved installations in accordance with conditions of Regulation 3 (I)(a)(i) and Regulation 8 (I)(b) of the Annex IV MARPOL 73/78. 2. in approved systems for communication and desinfection of sewage water, in accordance with the conditions of Regulation 3 (I)(a)(ii) and Regulation 8 (I)(a) of the Annex IV MAR-POL 73/78	Not restricted
Domestic waste water (grey water)	Not restricted					

Note:

* - It is permitted to discharge non-processed sewage water in territorial waters from the ships, when the number of crew, special personnel and passengers does not exceed 10 persons.

** - In the water areas and roads of the ports of the Arctic and Dalnevostochny basins the discharge from ships of the processed and disinfected sewage, provided the following conditions are satisfied:

– an arrangement for processing and disinfection of sewage is in operation on board the ship, and the degree of its purification provides for its consequent disinfection up to the value of I000 per liter by e-coli count; if disinfection is effected by means of chlorine the discharge of chlorine concentration up to I6 mg/l is allowed; the discharge does not result in the appearance of visible floating particles and change in the color of the surrounding water.

3. CONDITIONS OF GARBAGE DISCHARGE ALONG THE NSR

Garbage type	Area of water consumption	All other areas of NSR
Non-processed garbage of all kinds	Discharge prohibited	Discharge prohibited. To be transferred to reception facilities
Comminuted and pressed plastic sheets, syn-thetic ropes, nets and products of plastic or their ashes	Discharge prohibited	Discharge prohibited. To be transferred to reception facilities
Garbage which is prohibited to be comminuted and pressed: fiberboard, cardboard, receptacles for liquid and bulk substances, thick-walled metallic items and hermetically sealed receptacles.	Discharge prohibited	Discharge prohibited. To be transferred to reception facilities or incinerated (if they burn up)*
Comminuted and pressed floating separating material, fixing and packing materials	Discharge prohibited	Discharge in deep waters (not less than 50 m) not less than 25 miles from land or incinerated (if they burn up)*
Comminuted and pressed paper, rags, glass, metal, bottles, containers, and other wastes	Discharge prohibited	Discharge in deep waters (not less than 50 m) not less than 12 miles from land or incinerated (if they burn up)*
Food wastes non-comminuted	Discharge prohibited	Discharge at 12 miles from land or above
Food wastes comminuted	Recommended to be collected in slop tanks.	Discharge at 12 miles from land or above

Note:
*
- The use of the incinerator in ports should be restricted as this may result in pollution of the atmosphere. In some ports the permission of port authorities for the use of an incinerator may be necessary.

Annex 3

References

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2. International Convention for Prevention of Pollution from Ships, 1973, as Modified by the Protocol of 1978 Relating Thereto MARPOL 73/78, IMO-520E and 640E, London, 1991 and 1996 edition.
3. Regulations for protection against pollution of sea coastal waters, approved by the Ministry of Water Industry of the USSR, Ministry of Fishery of the USSR and Ministry of Public Health of the USSR, No. 2641-82, Moscow, I984, 48 p.p.
4. IMO: "MEPC/Circ. 235" Guidelines for Systems for Handling Oily Wastes in Machinery Spaces of Ships"; London 1990.
5. IMO: MEPC Res. 70.(40); Standard Specification for Shipboard Incinerators; London, 1997.
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7. G. Semanov, J. Kirsh, V. Karev, N. Sisemov and O. Zhuravlev. Control of Pollution from Ships on the Northern Sea Route. - INSROP: Working paper No. 63-1996, II.6.1.
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17. Control of ships and discharges, IMO-601E, London, 1986 edition.
18. Provisions concerning the reporting of incidents involving harmful substances under MARPOL 73/78, IMO-516E, London.
19. IMDG code supplement, IMO-210E, London.
20. Pollution prevention equipment required under MARPOL 73/78 (1996 edition) IMO – 646E.

Transport Canada - AMNS
Prairie & Northern Region - Marine
330 Sparks Street,
Ottawa, Ontario
K1A 0N5

Transports Canada - AMNS
Région des Prairies et du Nord - Marine
330, rue Sparks
Ottawa, Ontario
K1A 0N5

Our file Notre référence
AMNS 8103-70-6

November 30, 1998

Mr. Claes Lykke Ragner
Deputy Head, INSROP Secretariat
P.O. Box 326
Fridtjof, Nansens vei 17
Lysaker, Norway
N-1324

Re: MANUAL OF SHIPBOARD WASTE MANAGEMENT
Report Review

The report proposes to establish the basis for the (Northern Sea Route) Manual of Shipboard Waste Management. The authors are to be commended for the practical approach and informative style. As the framework for the manual is further developed the following comments are offered for consideration.

1. The report might be more appropriately titled and useful as the "Guide for Shipboard (or Ship-generated) Waste Management in the Northern Sea Route."
2. Use consistent (preferably IMO) nomenclature throughout: Shipboard or Ship-generated, Oily Waste or Oil-containing Waste, etc.
3. The Summary as presented reads better as the Preamble or Introduction. If a Summary is retained, it should refer more specifically to the contents of the report as a precis.
4. Items 2, 3 and 4 could be subdivided (Contents) under consistent subheadings - General, Handling, Source Reduction, Documentation, etc., - for ease of reference.
5. Item 1.1. Residues and Residues of Chemical Cargoes are listed without further mention. One sentence might deal with it by indicating that there are no special measures for Arctic operations.
6. Item 1.1. The Ship-generated Waste Situation Report seems to be the same description as for the Manual in Item 1.2.6. Substitute IMO Polar Code for "Code of Arctic Navigation"

November 30, 1998

7. Item 1.2. The last sentence lists three (suggest four) approaches but Reuse and Recycling does not have a follow-up heading. The fourth approach would be Transfer to Shore Reception Facilities.

8. Item 1.2.1. Add new heading Reuse and Recycle as item 1.2.2 ahead of Reuse of products... and renumber 1.2.2 and 1.2.3 as 1.2.2.1 and 1.2.2.2 respectively, and 1.2.5 as 1.2.3

9. Item 1.2.6 to be renumbered 1.3. The list of information items for the Manual needs to be expanded to include description of waste management technologies and existing problems and shortcoming as suggested under Item 1.1, Situation Report. As well, Company Policy, Training and Contacts Ashore would be subjects worth mentioning. It is assumed that this list is what would be developed into tables, regulation and rule references. etc., as an easy guide for operators to follow.

10. Item 2.1. Non-liquid oil-containing waste is to be dealt with in the chapter on Garbage but no reference is found there, where for example, mention could be made not to store oil soaked rags with the garbage.

11. Item 2.1. Is there a reference document to be listed for Figure 1 ? and make reference to IMO/ Oil Record Book under new heading of Documentation.

12. Item 2.2. Suggest rewording as follows: "Taking into account the Northern Sea Route lack of shore reception facilities[3], and ...

13. Item 2.2.1. Substitute reference [4] for [5].

14. Item 2.2.2. Substitute reference [5] for [4[and reference [5] for [6].

15. Item 3.1. Add the title of Source Reduction to the last paragraph as Item 3.3.

16. Item 3.2. Substitute Annex 2 for Annex 1. Add title to penultimate paragraph at Item 3.5, Transfer to Shore Facilities and Discharge at Sea. Add title to last paragraph as Item 3.4, Documentation; and move (Annex 3) after Sewage Record Book and add a reference [ ] number after (Russian) environment protection legislation (regulations).

17. Item 4.1 and 4.2. Add reference [ ] numbers after the Sanitary Regulations and the Protection from Pollution Regulations.

November 30, 1998

18. Item 4.3.2. Substitute disposal for burial. The last sentence should not be so emphatic about single storage as many new ships are able to separate and retain garbage for disposal at end of voyage.

19. Item 4.3.3. As a guide, not all ships are equipped with incinerators.

20. Item 4.3.4. Describe HELCOM and provide reference [ ] number for the Guidelines which does not appear to be [4] as stated.

21. Item 4.3.5. Delete the last sentence as it repeats information under 4.2.

22. All references should have their full title.

23. Substitute Annex 1 for Appendix 1

24. Either add the Oil Record Book as an Annex for completeness or preferably remove Annexes 3 and 4 , and add them all as reference [ ] numbers only.

This report provides a solid basis for the development of a guide on waste management for Northern Sea Route traffic. There is practical advice and many operational tips in dealing with waste matter under Arctic conditions. Any other specific additions for cold weather conditions will be beneficial.

Thank you for the opportunity to review this report.

V.M. Santos-Pedro
Regional Director, Marine
Prairie & Northern Region
Transport Cnada

Annex 5

Authors' Answers

10 January, 1999

To: V.M. Santos-Pedro Regional Director,
Marine Prairie & Northern Region Transport Canada

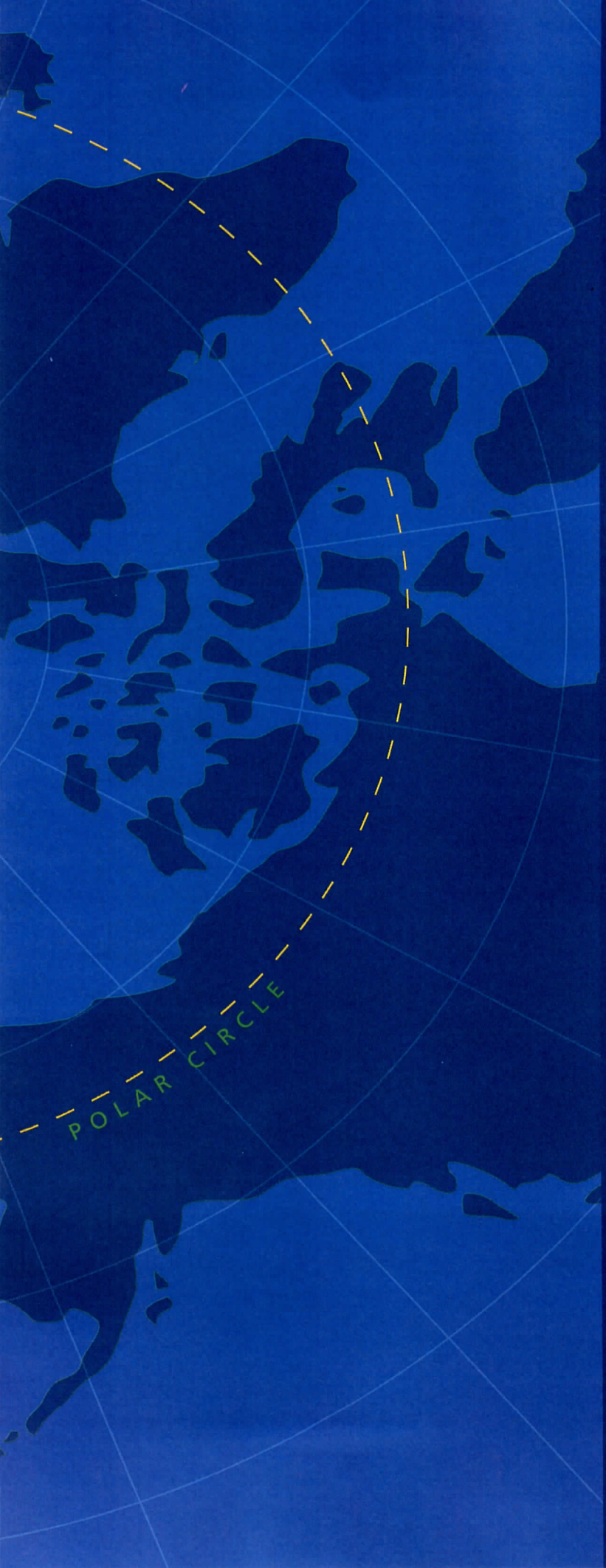
Dear Mr. Santos-Pedro,

We are extremely grateful for your thorough and detailed comments. We have improved and updated the paper according to your proposals:

- changed the title of the paper;
- taken into consideration all the remarks;
- deleted Annexes 3 and 4 and added them all as reference numbers only;
- added new information about recycling and reusing of wastes;
- made a number of corrections in responses to your recommendations

Sincerely yours

Authors



The three main cooperating institutions of INSROP

Ship & Ocean Foundation (SOF), Tokyo, Japan.
SOF was established in 1975 as a non-profit organization to advance modernization and rationalization of Japan's shipbuilding and related industries, and to give assistance to non-profit organizations associated with these industries. SOF is provided with operation funds by the Nippon Foundation, the world's largest foundation operated with revenue from motorboat racing. An integral part of SOF, the Tsukuba Institute, carries out experimental research into ocean environment protection and ocean development.

Central Marine Research & Design Institute (CNIIMF), St. Petersburg, Russia.
CNIIMF was founded in 1929. The institute's research focus is applied and technological with four main goals: the improvment of merchant fleet efficiency; shipping safety; technical development of the merchant fleet; and design support for future fleet development. CNIIMF was a Russian state institution up to 1993, when it was converted into a stock-holding company.

The Fridtjof Nansen Institute (FNI), Lysaker, Norway.
FNI was founded in 1958 and is based at Polhøgda, the home of Fridtjof Nansen, famous Norwegian polar explorer, scientist, humanist and statesman. The institute spesializes in applied social science research, with special focus on international resource and environmental management. In addition to INSROP, the research is organized in six integrated programmes. Typical of FNI research is a multi-disciplinary approach, entailing extensive cooperation with other research institutions both at home and abroad. The INSROP Secretariat is located at FNI.