Transportation of Radioactive Materials
Through Canadian Ports

by

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1. Basis of the Regulations


1.2 The Atomic Energy Control Act, section 9(d) gives the Atomic Energy Control Board the power to make regulations regulating the transportation of radioactive materials.

1.3 The Atomic Energy Control Regulations, section 23, give the requirements for shipping radioactive prescribed substances which are as follows:

23. (1) No person shall ship any radioactive prescribed substances unless the shipment thereof complies with the requirements respecting packaging and labelling and any other requirements prescribed

(a) by any body having jurisdiction by statute over the proposed mode of transport; or
(b) by the Canadian Transport Commission, if no requirements have been prescribed by any body described in paragraph (a).

(2) Notwithstanding subsection (1), the Board may exempt any shipment of radioactive prescribed substances from the provisions of paragraph (1)(b) upon such conditions as the Board may specify.

1.4 The applicable regulations are given in Table 1.1 and are listed in detail in Appendix A.
### Table 1.1

**Regulatory Authorities and Applicable Regulations**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Regulatory Authority</th>
<th>Applicable Regulations</th>
</tr>
</thead>
</table>
| Rail   | Director of Operation  
Railway Transport Committee  
Canadian Transport Commission  | Regulations for the Transportation of Dangerous Commodities by Rail, 10th Amendment   |
| Road   | Acting Regulatory Authority  
Atomic Energy Control Board | As above                                                                             |
| Air    | Director, Aeronautical Licensing & Inspection Branch, Civil Aeronautics, Transport Canada  | International Air Transport Association. IATA Restricted Articles Regulations. 19th edition |
| Marine | Director  
Ship Safety Branch  
Canadian Coast Guard  
Transport Canada       | Intergovernmental Maritime Consultative Organization  
IMCO International Maritime Dangerous Goods (IMDG) Code |
2. Transportation by Sea

Transportation of dangerous goods by sea is controlled under the Dangerous Goods Shipping Regulations of the Canada Shipping Act. Section 7 of these regulations was amended in June 1973 (SOR/73-327 dated 14 June 1973), requiring that:

(1) Every ship carrying dangerous goods shall have a list or stowage plan that

(a) identifies each of the dangerous goods by class and technical name as set out in the International Maritime Dangerous Goods (IMDG) Code published by the Intergovernmental Maritime Consultative Organization (IMCO); and

(b) clearly describes or shows the location of the dangerous goods in the ship.

(c) Each ship carrying dangerous goods shall have a special list or manifest setting forth the dangerous goods on board and the location thereof. A detailed stowage plan which identifies by class and sets out the location of all dangerous goods on board may be used in place of such a special list or manifest. The total quantity of each dangerous substance should be shown in the list or manifest.

(2) The consignor of the dangerous goods shall

(a) prepare a certificate stating that the dangerous goods are packed, labelled and marked in accordance with the IMDG Code and that they are in proper condition for carriage by sea; and

(b) before the dangerous goods are loaded, deliver the certificate or document to the owner of the ship or his representative.

See Appendix B for a copy of the amendment to section 7.

A copy of the required certification is given as Appendix C.
3. Transportation of Radioactive Materials by Sea

The main requirements for the carriage of radioactive materials by sea are found in the 1974-75 Supplement to the IMDG Code as Amendment 10-74 to Class 7 Radioactive Substances, pages 202 to 264 which replace pages 7001 to 7064 of the previous edition. These regulations are based on the International Atomic Energy Agency (IAEA) Regulations for the Safe Transport of Radioactive Materials, 1973, Revised Edition. In order to fully understand the requirements for shipping radioactive materials it is necessary to have a copy of the IAEA Regulations as well as the supplement to the IMDG Code. Packaging and stowage provisions are summarized in the detailed schedules 1 to 12 of the IMDG Code 1974/1975 Supplement.

The following discussion is based on requirements of the IMDG Code as given in the 1974/1975 Supplement. Copies of p. 231 to 238 of the Supplement are attached as Appendix D. The page numbers given are those of the pages as amended.

3.1 Segregation from Other Dangerous Goods (p. 7028)

With the exception of items of Class 6, Poisons and Infectious Substances, radioactive material packages, other than exempt packages, must be stowed "away from" non-inflammable gases and oxidizing materials or "separated from" all other classes of dangerous goods. For the meaning of "away from" and "separated from" refer to v. I of the IMDG Code.

3.1.1 Segregation of Freight Containers (p. 0026)

Radioactive materials are often packaged for sea shipment in open or closed freight containers. Requirements for freight container traffic are given in section 12 p. 0026 (as amended) of the IMDG Code.

Those responsible for the packaging of the dangerous goods into a container should provide a "Container Packing Certificate" certifying that this has been properly carried out and embodying the following provisions:

The container was clean, dry and apparently fit to receive goods.
No incompatible substances have been packed in the container.

All packages have been inspected for damage, and only sound packages packed.

All packages have been packed in the container and secured.

The container and packages are properly marked and labelled.

The Dangerous Goods Declaration required in subsection 9.3 of the IMDG Code has been received for each dangerous goods consignment packed in the container.

See section 12.3.7, p. 0027-1 of the IMDG Code.

3.1.2 Segregation for Heat Dissipation

It must be recognized that heat is produced by the radioactive decay of all radionuclides. While this is not a problem in the shipment of small quantities or with Low Specific Activity or Low Level Solid materials, shipments of cobalt-60 and irradiated nuclear fuel produce considerable heat. For example, a shipment of 200 kCi of cobalt-60 generates approximately 3 kW of heat. In one specific package, the surface heat flux can be as great as 630 W/m². A shipment of nuclear fuel containing 2.25 MCi of mixed fission products could generate 10.5 kW of heat. For heat loads of this magnitude it is necessary to issue special instructions to ensure that ample space and ventilation is provided to dissipate the heat produced. Packages with a heat output of 15 W/m² can be packaged with general cargo, but some clearance (10 mm) should be allowed for heat dissipation. Do not overstow packages containing radioactive materials with bags of mail or bags which prevent heat escape. If the heat produced by the radioactive material is not dissipated, the heat buildup could be sufficient to char or ignite surrounding cargo.

3.1.3 Segregation of Radioactive Materials by Transport Indices (p. 7017)

In addition to the requirement for separation from other dangerous goods, radioactive materials must be separated from people, film and other groups of
radioactive materials. This separation is governed by the transport index which is defined under Class 7 section 2.3 p. 7008.

The total sum of transport indices in each group of packages or freight containers shall not exceed 50. Each group must be segregated from any other group of packages or freight containers containing Category II or III - Yellow labelled packages by a distance of not less than 6 m. For freight containers this requires a separation of at least one freight container (6.1 m) fore and aft and a separation of 3 freight containers (7.2 m) athwartship. The space may be filled with neutral containers.

For packages not in freight containers, the total sum of the transport indices shall not exceed 50 in any hold, compartment or defined deck area. For freight containers the total sum of transport indices shall not exceed 200 in any hold, compartment or defined deck area.

For shipments of LSA or LLS Radioactive Materials the above requirements do not apply provided the packages are maintained in a compact stack and carriage is not as Fissile Class II or Class III. Certain relaxation of the requirements for stowage is also made under full load conditions. See section 5, p. 7017.

3.2 Transport Documents (p. 7029)

3.2.1 Particulars of Consignment

All radioactive material shipped by sea must be declared as such in the transport documents. Each shipment must be identified as "Radioactive Substance, Class 7, Schedule No. ___ and packaged, marked labelled and shipped in accordance with Schedules 1 to 12 which give the detailed requirements for shipment. See p. 7038 to 7049 as given in the 1974/1975 Supplement. Exempt items must be declared. Other information required in particulars of consignment is similar to that required for road and rail shipments.

3.2.2 Shipper's Certificate

The following certificate signed by the consignor and dated must accompany the shipment.
"This is to certify that the above-named articles are properly classified, described, packaged, marked and labelled, and are in proper condition for transportation according to the applicable regulations of the Canadian Transport Commission and the Ministry of Transport." This certificate may be printed on the consignment document or it may be a separate certificate such as that shown in Appendix C.

It is unlawful for the consignor to present dangerous goods to a carrier for shipment and unlawful for the carrier to transport these goods unless he has been given the properly signed and dated certificate.

3.2.3 Competent Authority Certificates (p. 7030)

Competent authority certificates issued by the Atomic Energy Control Board are not required for exempt packages, LSA or LLS packages, nor for Type A packages designed for non-fissile materials, but are required for special form design if the amount exceeds the exempt quantity, fissile package design, Type B(U) and Type B(M) package design. Shipment certificates are required for Fissile Class III shipments and shipments made under Special Arrangements. Design and shipment approvals are combined in a single certificate for Canadian shipments.

Competent authority certificates for all Type B shipments together with pertinent shipping information must be forwarded to the National Harbours Board before shipment. These certificates must be provided to carriers before loading, unloading or any trans-shipment. The normal practice is to provide two copies of the certificate to the original carrier, one copy of which accompanies the shipment to its destination and may be utilized by each carrier handling the goods.

Export permits are also required by the shipper for customs use. Import certificates are required for incoming shipments.

General requirements for approval of design and shipment are given in section 12 on p. 7034 and 7035 of the IMDG Code. However, the Canadian Atomic Energy Control Board must approve all shipments of fissile materials for both export and import.
3.2.4 Information for Carriers

The consignor must provide the carrier with
(a) supplementary operational requirements for loading, carriage, unloading, handling and stowage for safe dissipation of heat;
(b) emergency arrangements specific to the approval design.

3.2.5 Notification of Competent Authorities (p. 7031)

The consignor is required to notify the competent authorities of the countries into which or through which the shipment is made under conditions laid down in the IMDG Code Class 7 sec. 9.5.

4. Shipment and Accidents

4.1 Shipments

At the present time (1976) approximately 60,000 shipments per year of radioactive materials, other than uranium and thorium ores and concentrates are made in Canada. Using an estimate made in the USA in 1974, we arrive at the distribution given in Table 4.1.

<table>
<thead>
<tr>
<th>Type of Shipment</th>
<th>Number Shipped</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiopharmaceuticals</td>
<td>50,000</td>
<td>83</td>
</tr>
<tr>
<td>Medical Research</td>
<td>7,000</td>
<td>12</td>
</tr>
<tr>
<td>Other Research</td>
<td>2,400</td>
<td>4</td>
</tr>
<tr>
<td>Industrial</td>
<td>600</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>60,000</td>
<td>100</td>
</tr>
</tbody>
</table>

Most of these shipments in Canada are made by passenger aircraft and road vehicle transport. A relatively small number, possibly 200 shipments per year are shipped by rail and sea. These later shipments are largely of the industrial type. Major shipments consist of the following:

- Cobalt - 60
- Irradiated nuclear fuels
- Tritiated heavy water
- Uranium chemical precipitates
- Uranium hexafluoride
4.2 Accidents

Over a period of 18 years (1957-1975) 62 transport incidents in a total of 402,000 shipments have been reported, a frequency of one incident per 6,500 shipments. The distribution of these incidents by mode and location is given in table 4.3.

Table 4.3

<table>
<thead>
<tr>
<th>Mode</th>
<th>In Transit</th>
<th>At Terminal</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road</td>
<td>31</td>
<td>5</td>
<td>36</td>
</tr>
<tr>
<td>Air</td>
<td>10</td>
<td>8</td>
<td>18</td>
</tr>
<tr>
<td>Sea</td>
<td>3</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Rail</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td>17</td>
<td>62</td>
</tr>
</tbody>
</table>

One of the road accidents reported resulted in the death of the driver and his companion as a result of the impact, but the radionuclide was not released from the container. None of the other incidents reported resulted in serious radiation injuries to any individuals.

The incidents involving sea transport are listed in table 4.4.

Table 4.4

Radiation Incidents Involving Sea Transport

<table>
<thead>
<tr>
<th>Identification</th>
<th>Date</th>
<th>Package Type</th>
<th>Radioisotope</th>
<th>Quantity</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-14 Road-Sea</td>
<td>27 Mar 62</td>
<td>B (LRS)</td>
<td>$^{60}$Co</td>
<td>625</td>
<td>Handling</td>
</tr>
<tr>
<td>I-19 Road-Sea</td>
<td>17 Oct 73</td>
<td>B</td>
<td>$^{226}$Ra+Be</td>
<td>0.6</td>
<td>Handling</td>
</tr>
<tr>
<td>1974-3 Sea</td>
<td>1 Jul 73</td>
<td>B (LRS)</td>
<td>$^{60}$Co</td>
<td>24,653</td>
<td>Container knocked off ship by crane</td>
</tr>
</tbody>
</table>

Sea Transit

<table>
<thead>
<tr>
<th></th>
<th>Date</th>
<th>Package Type</th>
<th>Radioisotope</th>
<th>Quantity</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>III - 1</td>
<td>29 Oct 58</td>
<td>B</td>
<td>$^{226}$Ra</td>
<td>0.5</td>
<td>Leakage of radon</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Improper procedure.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Heat source loaded in insulated</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>container</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Packaging smashed in storm.</td>
</tr>
</tbody>
</table>

1975 - 3  | 30 Dec 75  | B (LRS)      | $^{60}$Co    | 9,600    | *Note: LRS - Large Radioactive Source |

*Note: LRS - Large Radioactive Source
Radioactive material in the form of radon gas was released from the package of radium-226 in the incident which occurred in 1958, but this did not result in injury to people. In all other cases connected with sea transport there was no release of radioactive material and radiation levels did not increase beyond acceptable levels.

4.3 Emergency Response (p. 7032)

The procedure for dealing with incidents involving radioactive materials at sea and in port are dealt with in section 10, p. 7032 of the code. Attached as Appendix E is a Telephone List of individuals capable of responding to accidents involving transportation of radioactive material. It is planned to incorporate this list in the National Environmental Emergency Location System (NEELS) which is currently designed for response to oil spills.

5. Comment

This paper has been presented to introduce you to the requirements of the transportation of radioactive material by sea. It is necessary for all shippers, forwarders and carriers to have a copy of the IMDG code in order to comply with requirements. For radioactive material shipments the 1974/1975 Supplement must be used to ensure that shipments are made in accordance with the regulations.
APPENDIX A

ATOMIC ENERGY CONTROL BOARD

TRANSPORTATION OF RADIOACTIVE MATERIALS

TRANSPORT REQUIREMENTS

Transport of radioactive materials within Canada must meet the requirements of certain international and Canadian regulations. These regulations, currently based on 1967 IAEA Regulations are being revised using as a basis the following publication.

BASIS FOR FUTURE REGULATIONS

(1) IAEA Regulations for the Safe Transport of Radioactive materials. Safety Series No. 6 1973 Revised Edition. STI/PUB/323. Obtainable from:

Publishing Centre
Supply & Services Canada
270 Albert Street
Ottawa, Ontario K1A 0S9

Price $6.00 - See also Advisory Material (STI/PUB/324)

APPLICABLE INTERNATIONAL REGULATIONS


IMCO Secretariat
Publications Section
101 - 104 Piccadilly
London W1V 0AE

Price $35.00 for 3 volumes
$ 3.50 for Supplement 1974/75


International Air Transport Association
26 chemin de Joinville
P. O. Box 160
1216 Cointrin/Geneva
Switzerland

Price $10.00 U.S.
APPLICABLE CANADIAN REGULATIONS

(4) Regulations for the Transportation of Dangerous Commodities by Rail, issued by Canadian Transport Commission, 10th Amendment effective 30 August 1974. Obtainable from:

Publishing Centre
Supply & Services Canada
270 Albert Street
Ottawa, Ontario K1A 0S9

Price $15.00
Service and amendments $4.00 per year

(5) The CTC Regulations are also applicable to the transport of radioactive materials by road under section 23 of the Atomic Energy Control Regulations SOR/74-334 dated 4 June 1974.

(6) Seaway Handbook, issued by the St. Lawrence Seaway Development Corporation. Cat. No. T52-165. Obtainable from:

Information Officer
St. Lawrence Seaway Authority
330 Sparks Street, Place de Ville
Ottawa, Ontario K1R 7R9

Price $10.00 per copy


Publishing Centre
Supply & Services Canada


Publishing Centre
Supply & Services Canada

(9) Canada Post Office. Prohibited Mail Regulations, SOR/72/481 dated 21 November 1972. Obtainable from:

Publishing Centre
Supply & Services Canada
CANADA SHIPPING ACT

Dangerous Goods Shipping Regulations, amendment

P.C. 1973-1529 12 June, 1973

His Excellency the Governor General in Council, on the recommendation of the Minister of Transport, pursuant to section 379 and subsection 450(1) of the Canada Shipping Act, is pleased hereby to amend the Dangerous Goods Shipping Regulations made by Order in Council P.C. 1954-1811 of 23rd November, 1954, as amended, in accordance with the schedule hereto.

SCHEDULE

1. The Dangerous Goods Shipping Regulations are amended by adding thereto, immediately after section 7 thereof, the following heading and sections:

"Shipping Documents"

7.1 Every ship carrying dangerous goods shall have in a readily accessible place on board a list or stowage plan that identifies each of the dangerous goods by its class and technical name, as set out in the International Maritime Dangerous Goods Code published by the Intergovernmental Maritime Consultative Organization; and
(b) clearly describes or shows the location of the dangerous goods in the ship.

7.2 The consignor of dangerous goods that are to be loaded onto a ship for carriage shall
(a) prepare and sign a certificate or other similar document stating that the dangerous goods are packed, labelled and marked in accordance with these Regulations and that they are in proper condition for carriage by sea; and
(b) before the dangerous goods are loaded onto the ship, deliver the certificate or document to the owner of the ship or his representative."

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2 SOR/68-219, Canada Gazette Part II, Vol. 102, No. 11, June 12, 1968
FORM OF APPLICATION AND CERTIFICATE FOR FORWARDING/SHIPMENT OF DANGEROUS OR HAZARDOUS CARGO

TO: Carrier "X"

Please confirm acceptance of the following goods for forwarding/shipment per
for which the following information is certified to be correct.

<table>
<thead>
<tr>
<th>Shipping/Forwarding</th>
<th>Package Nos.</th>
<th>Description of packages etc.</th>
<th>Substance Name (flashpoint if any)</th>
<th>Container Net</th>
<th>Package Gross</th>
<th>Class number or label facsimile</th>
<th>Supplementary Information</th>
</tr>
</thead>
</table>

It is certified that the goods are packed in a manner adequate to withstand the ordinary risks of handling and transport by sea having regard to the nature of the goods, and the package or packages labelled or stencilled on the outside to indicate the identity of the goods and the nature of the danger; the foregoing in accordance with the requirements of the International Convention for the Safety of Life at Sea, 1960.

Signature ............ on behalf of ............

........................
........................
........................

(name & address of consignor)

Date ............... 19....
APPENDIX D

Radioactive Substances CLASS 7

8. SEGREGATION FROM OTHER DANGEROUS GOODS

8.1 As other dangerous goods may under accident conditions affect the integrity of a package containing radioactive substances segregation from such goods is necessary. The requirements stated below are not intended, however, to apply to exempted substances as specified in section 3.

8.1.1 In general, radioactive substances should be stowed:

Away from*:
- Non-inflammable gases Class 2
- Oxidizing substances Class 5.1

Separated from*:
- Explosives Class 1
- Inflammable gases Class 2
- Inflammable liquids Class 3
- Inflammable solids Class 4.1
- Spontaneously combustible substances Class 4.2
- Substances emitting inflammable gases when wet Class 4.3
- Organic peroxides Class 5.2
- Corrosives Class 8

* Definitions of terms used:

Away from: effectively segregated so that incompatible substances cannot interact dangerously in the event of accident, but may be carried in the same hold or compartment or on deck provided a minimum horizontal separation of 3 metres (10 feet) projected vertically, is provided.

Separated from: in different holds when stowed under deck. Provided an intervening deck is resistant to fire and liquid, a vertical separation, i.e. in different compartments, may be accepted as equivalent to this segregation. For "on deck" stowage this segregation means "away from".
9. TRANSPORT DOCUMENTS

9.1 Particulars of Consignment

9.1.1 All radioactive substances must be declared as such in the transport documents. For all consignments other than those exempted the following information shall be given:

(a) the words "RADIOACTIVE SUBSTANCE — CLASS 7 — SCHEDULE No. . . . ."
   (i) for a consignment of Low Specific Activity Substances, the words "LOW SPECIFIC ACTIVITY";
   (ii) for a consignment of Low Level Solid Radioactive Substances, the words "LOW LEVEL SOLID";
   (iii) for Type A Packages the words "TYPE A";

(b) the identification mark of each competent authority certificate (Special Form, package design and shipment) applicable to the consignment;

(c) the name of the radioactive substance or nuclide;

(d) a description of the physical and chemical form of the substance, or whether it is Special Form;

(e) the activity of the radioactive substance in appropriate curie units;

(f) the Category of the package (i.e. "Category I — WHITE", "Category II — YELLOW", "Category III — YELLOW");

(g) the transport index (Category II and Category III — YELLOW only);

(h) for a consignment of Fissile Substances:
   (i) if exempted under the provisions of IAEA paragraph 601 the words "FISSILE EXEMPT";
   (ii) if not so exempted, the Fissile Class of the package(s).

9.1.2 Exempt items must be declared as specified on the appropriate Schedule (see Schedules 1 to 4).

* Schedule No. to be inserted.
9.2 Shipper’s Certificate

On the same document containing the particulars of consignment as set out in paragraph 9.1.1 above, shall be the shipper’s certificate from the consignor or his agent certifying that the contents of the consignment are properly described by name, that the goods are properly marked, labelled and packaged in accordance with the relevant provisions of this Class and are in a proper condition for carriage. The certificate shall be signed and dated by the consignor.

9.3 Competent Authority Certificates

9.3.1 Competent authority approval certificates are required in the following cases:

(a) Special Form Design when activity exceeds those given for Special Form in the table at sub-section 3.1;

(b) Fissile Package design;

(c) Type B(U) or Type B(M) Package design;

(d) shipment certificates in respect of:

   (i) Type B(M) Packages specially designed to allow continuous venting;

   (ii) Type B(M) Packages with activity contents greater than $3 \times 10^3 \text{A}_1$ or $3 \times 10^3 \text{A}_2$ as appropriate, or $3 \times 10^4 \text{Ci}$ whichever is the lesser;

   (iii) Fissile Class III packages;

   (iv) Special Arrangements, including explosive radioactive substances.

9.3.2 Approval certificates are not required for exempt packages, nor for LSA and LLS packages, nor for Type A Packages designed for non-fissile substances.

9.3.3 Each certificate issued by a competent authority shall be identified by an identification mark (see IAEA paragraphs 822 and 823).

9.3.4 The package and shipment certificates may be combined into a single certificate.

9.3.5 The applicable competent authority certificates need not necessarily accompany the consignment, but they must be provided to carriers before loading, unloading or any transshipment.

9.4 Information for Carriers

The consignor shall provide in the transport documents a statement regarding actions, if any, that must be taken by the carrier. The statement shall be in the languages deemed necessary by the carrier or the competent authorities concerned, and shall include at least the following information:

IMCO CODE PAGE 7030
Amtd. 10-74
CLASS 7 Radioactive Substances

(a) supplementary operational requirements for loading, carriage, unloading, handling and stowage for safe dissipation of heat, or a statement that no supplementary operational requirements are necessary;

(b) emergency arrangements specific to the approval design.

9.5 Notification to Competent Authorities

9.5.1 Before the first shipment of a Type B(U) Package containing radioactive substances with an activity greater than $3 \times 10^3A_1$ or $3 \times 10^3A_2$, as appropriate, or $3 \times 10^4$Ci, whichever is the lesser the consignor shall ensure that copies of each applicable competent authority certificate applying to that package design have been submitted to the competent authority of each country through or into which the consignment is to be carried.

9.5.2 For each shipment listed in sub-paragraphs (a) to (d) below inclusive, the consignor shall notify the competent authorities of each country through or into which the consignment is to be carried. This notification shall be in the hands of each competent authority prior to the commencement of the shipment, and preferably at least 15 days in advance:

(a) Type B(U) Packages containing radioactive substances with an activity greater than $3 \times 10^3A_1$ or $3 \times 10^3A_2$, as appropriate, or $3 \times 10^4$Ci, whichever is the lesser;

(b) Type B(M) Packages;

(c) Fissile Class III packages;

(d) Transport by Special Arrangement.

9.5.3 The consignment notification shall include:

(a) sufficient information to enable the identification of the package, including all applicable certificate numbers and identification marks; and

(b) information on the date of shipment, the expected date of arrival and proposed routing.
10. ACCIDENTS

10.1 General

10.1.1 Type A Packages as well as industrial packages (see sub-sections 4.2 and 4.3) are designed to withstand the normal conditions of carriage, including minor mishaps, without loss of the contents or reduction in radiation shielding efficiency. The radioactive contents of these packages are so restricted that, in the event of an accident and damage to the packaging, there is a high probability that any substance released, or shielding efficiency lost, would not give rise to such hazard as to interfere with normal fire-fighting or rescue operations.

10.1.2 Type B Packages are designed to be strong enough to withstand severe accidents without significant loss of contents or dangerous loss of radiation shielding efficiency.

10.2 Accident Procedures

10.2.1 At Sea

10.2.1.1 In the event of a package containing radioactive substances becoming involved in a fire, normal fire-fighting procedures may be followed. For instance, the fire should be fought from upwind (windward) to the degree possible; the use of water sprays onto the packages will assist in preventing the melting of radiation shielding material such as lead.

10.2.1.2 The use of fire-fighting clothing, and particularly respiratory protection, where exposure to smoke and fumes is possible, will assist in preventing or reducing contamination. On completion of fire-fighting the personnel must remove clothing and equipment. Clothing must be isolated, after which personnel should have a good shower bath. Any clothing thought to be contaminated should be submitted to the competent authorities on arrival at port.

10.2.1.3 In the event of a package containing radioactive substances suffering from breakage or leakage, indiscriminate access or movement in its vicinity should be avoided until radiological advice, either at the first port of call or through the competent national authority, can be obtained.

10.2.1.4 Foodstuffs and drinking water which may have been contaminated as a result of accidents should not be consumed until they have either been examined by qualified persons or appropriate advice has been obtained.

10.2.2 In Port

In the event of an accident involving damage to radioactive packages while a ship is in port, the port authorities should be informed. Procedures have been drawn up in many countries for summoning radiological assistance in any such emergency.
11. EXPOSURE OF CREW

11.1 The present low frequency of carriage of radioactive substances by sea does not justify members of the crew wearing film badges, nor need the ship carry any special instruments for measuring radiation. Segregation distances from living accommodation are set out in Table I or II on IMCO Code Pages 7020 or 7021. If, however, there are national regulations as to segregation, these may be used in their place.
12. **APPROVAL**

12.1 Approval of Special Form Substances, Packaging and Package Designs

Provisions are summarized in the table hereunder:

<table>
<thead>
<tr>
<th>Subject of Approval</th>
<th>Competent Authority whose Approval is required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Special Form Substance</td>
<td>Country of origin</td>
</tr>
<tr>
<td>2 Type A, commercial type and strong industrial type</td>
<td>None unless contents are fissile and not exempted from the fissile requirements under IAEA paragraph 601 in which case country of origin.</td>
</tr>
<tr>
<td>3 Type B(U)</td>
<td>Country of origin</td>
</tr>
<tr>
<td>4 Type B(M)</td>
<td>Country of origin and all countries en route</td>
</tr>
<tr>
<td>5 Fissile packages*</td>
<td>Country of origin and all countries en route</td>
</tr>
</tbody>
</table>

* Fissile packages will also come under one of the types of package in 2, 3 or 4 above and the relevant information therein will also apply.

**NOTE:** "Country of origin" refers to the country where the design originated.
### Approval of Shipments and prior Notification

Provisions are summarized in the table hereunder:

<table>
<thead>
<tr>
<th>Package</th>
<th>Competent Authority whose Approval is required for each Shipment</th>
<th>Prior Notification of each Shipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Type A</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>2. Type B(U)</td>
<td>None</td>
<td>Country of origin and all countries en route when contents exceed $3 \times 10^3 A_1$ or $3 \times 10^3 A_2$, as appropriate or $3 \times 10^4 Ci$ whichever is the lesser</td>
</tr>
<tr>
<td>3. Type B(M) Continuously venting</td>
<td>Country of origin and all countries en route</td>
<td>Country of origin and all countries en route</td>
</tr>
<tr>
<td>4. Type B(M) Not continuously venting</td>
<td>Country of origin and all countries en route when contents exceed $3 \times 10^3 A_1$ or $3 \times 10^3 A_2$, as appropriate or $3 \times 10^4 Ci$ whichever is the lesser</td>
<td>Country of origin and all countries en route</td>
</tr>
<tr>
<td>5. Fissile Packages*</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Fissile Class I</td>
<td>Packages complying with IAEA paragraph 620 only: Country of origin and all countries en route</td>
<td>None unless specified in the competent authority shipment approval</td>
</tr>
<tr>
<td>Fissile Class II</td>
<td>Country of origin and all countries en route</td>
<td>Country of origin and all countries en route</td>
</tr>
<tr>
<td>Fissile Class III</td>
<td>Country of origin and all countries en route</td>
<td>Country of origin and all countries en route</td>
</tr>
<tr>
<td>6. Packages subject to carriage under Special Arrangements</td>
<td>Country of origin and all countries en route</td>
<td>Country of origin and all countries en route</td>
</tr>
</tbody>
</table>

* Fissile packages will also come under one of the other entries in this table and the relevant information therein will also apply.

**NOTE:** Before shipping a Type B(U) Package the contents of which exceed $3 \times 10^3 A_1$ or $3 \times 10^3 A_2$, as appropriate, or $3 \times 10^4 Ci$ whichever is the lesser for the first time, the consignor must ensure that copies of each applicable competent authority certificate applying to the design have been submitted to the competent authority of those countries through or into which it is to be carried. Country of origin refers to the country where the shipment originated.
### EMERGENCY ACTION

Step 1. Identify (a) Placard (b) Label on package.
Step 2. Call nearest police detachment, RCMP, OPP, QPP, or local police who will contact nearest source of expert assistance, notify shipper and one of the National report centres.
Step 3. Identify location, package, consignor or consignee, extent of injury or damage. State telephone number.
Step 4. Have a person stand by telephone for reply.

<table>
<thead>
<tr>
<th>AREA</th>
<th>NAME</th>
<th>REPRESENTING</th>
<th>TELEPHONE</th>
<th>LOCATION</th>
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<td>PLACE</td>
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</tr>
<tr>
<td>NATIONAL</td>
<td>Environmental Emergency Centre</td>
<td>Hull</td>
<td>819</td>
<td>997-3742</td>
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<td>Radiation Protection Bureau</td>
<td>Ottawa</td>
<td>613</td>
<td>998-4614</td>
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