TRANSPORTATION OF RADIOACTIVE MATERIALS THROUGH CANADIAN PORTS

by

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Atomic Energy Control Board
Ottawa, Canada

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Transportation of Radioactive Materials Through Canadian Ports

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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>
<tbody>
<tr>
<td>Rail</td>
<td>Director of Operation, Railway Transport Committee, Canadian Transport Commission</td>
<td>Regulations for the Transportation of Dangerous Commodities by Rail, 10th Amendment</td>
</tr>
<tr>
<td>Road</td>
<td>Acting Regulatory Authority, Atomic Energy Control Board</td>
<td>As above</td>
</tr>
<tr>
<td>Air</td>
<td>Director, Aeronautical Licensing &amp; Inspection Branch, Civil Aeronautics, Transport Canada</td>
<td>International Air Transport Association, IATA Restricted Articles Regulations, 21st edition</td>
</tr>
<tr>
<td>Post</td>
<td>Post Master General, Canada Post Office</td>
<td>Post Office Regulations Section 23, Prohibited Mail Regulations</td>
</tr>
</tbody>
</table>
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 in a readily accessible place on board 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.

(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 Substances by Sea

The main requirements for the carriage of radioactive substances by sea are found in the latest edition of the IMDG Code, Class 7 Radioactive Substances pages 7001 to 7062. These regulations are based on the latest edition of the International Atomic Energy (IAEA) Regulations for the Safe Transport of Radioactive Materials. In order to fully understand the requirements for shipping radioactive substances it is necessary to use a copy of the IAEA Regulations as well as the IMDG Code. Packaging and stowage provisions are summarized in detailed schedules 1 to 12 of the IMDG Code (ip. 7038 to 7049).

The following discussion is based on requirements of the IMDG Code. The page numbers given are those appearing in the 1977 edition of the Code. See Appendix D.

3.1 Segregation from Other Dangerous Goods (p. 7027)

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 "separate from" refer to v. I of the IMDG Code.

The segregation requirements for roll-on/roll-off ships is dealt with in v. I s. 17 p. 0114 of the code. Because of the structural difference of such ships from conventional ships, i.e. the "garage" like space in each deck, section 17 contains special or additional provisions and recommendations.
3.1.1 Segregation of Freight Containers (p. 0032)

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. 0032 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. The number of packages containing radioactive materials permitted is limited by transport indices. See section 3.1.3. See section 12.3.7, p. 0034 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, packages containing cobalt-60 or 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 M Ci 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 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 substances with insulating materials 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 substances must be separated from people, film and other groups of radioactive substances. This separation is governed by the transport index which is defined under Class 7 section 2.3 p. 7007.
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. 7016.

3.2 Transport Documents (p. 7028)

3.2.1 Particulars of Consignment

All radioactive substances 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. 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 Shippers 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. 7029)

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 certain Type B(M) packages, Fissile Class III packages and packages shipped under Special Arrangements. Design and shipment approvals are combined in a single certificate for Canadian shipments. Canadian competent authority certificates issued by the AECB are forwarded to the appropriate modal authorities in Canada.

An application is required for a permit to move dangerous goods through ports and harbours under the jurisdiction of the National Harbours Board and through those operating under the Canadian Marine Transport Administration. When approved, a permit is issued by the harbour master or other responsible authority for loading, unloading or handling the dangerous goods. For radioactive material, detailed information similar to that given in s. 9.1 of the IMDG Code p. 7028 is required. This information is to be provided by the consignor for export shipments and by the owner of the vessel in the case of import shipments or shipments in transit.

Export and import permits are also required by the exporter or importer for all shipments of radioactive substances.

General requirements for approval of design and shipment are given in section 32 on p. 7033 and 7034 of the IMDG Code. The Canadian Atomic Energy Control Board must approve all shipments of fissile materials for both, export and import.

### 3.2.4 Information for Carriers (p. 7029)

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.

The applicable competent authority certificate need not necessarily accompany the consignment to which they relate. The consignor shall, however, be prepared to provide it to the carrier before loading, unloading and any trans-shipment.

A good practice is to provide two copies of the certificate to the original carrier. The second copy should accompany the shipment to its destination and can be utilized by each carrier handling the goods.

### 3.2.5 Notification to Competent Authorities (p. 7030)

Under the conditions given in the IMDG Code Class 7 s. 9.5, the consignor (shipper) of designated types and quantities of radioactive materials is required to notify the competent authorities of the countries into which or through which the shipment is made. The information to be provided is required from both Canadian and foreign shippers. The consignor (shipper) is responsible for ensuring that competent authority certificates and other required information is provided to the Transport Section, Atomic Energy Control Board, P. O. Box 1046, Ottawa, Canada, K1P 5S9 or to the competent authorities of the countries involved in the movement at least 15 days in advance of the shipping date.
4. **Shipments and Incidents**

4.1 **Shipments**

An estimated 500,000 packages containing radioactive material were transported in Canada in 1977. Table 4.1 gives the distribution of these shipments by use or type of material and by the major transport mode. In nearly all cases, transport by road is necessary in the first and last stages of transport. Table 4.1 is further subdivided into (a) radionuclides other than those in the nuclear fuel cycle and (b) materials in the nuclear fuel cycle.

Packages in the first category (a) usually carry small (exempt) and Type A quantities of radioactive materials, or instruments containing individual radionuclides. These are normally shipped by road or air. In the industrial category quantities may exceed Type A limits and therefore must be shipped in packaging certified by the AECB as Type B. The most significant radionuclide carried by sea is cobalt-60. This radionuclide may be transported by sea in Type B packages of several megagrams (Mg) mass in activities up to 200 kCi.

Of the nuclear fuel cycle packages (b), low specific activity materials shipped in large quantities (volume) are uranium chemical precipitates, uranium hexafluoride, thorium nitrate and tritiated heavy water. Packages containing irradiated nuclear fuel, representing shipments of high activity, are encountered as shipments in transit through Canadian ports. Fissile substances such as uranium hexafluoride and uranium dioxide containing uranium enriched in uranium-235 are also encountered as in-transit shipments.

4.2 **Incidents**

Over a period of 21 years (1957-1977) 114 transport incidents have been reported to the AECB. The distribution of these incidents by mode and location is given in table 4.2.

<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>48</td>
<td>17</td>
<td>65</td>
</tr>
<tr>
<td>Air</td>
<td>19</td>
<td>13</td>
<td>32</td>
</tr>
<tr>
<td>Sea</td>
<td>3</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Rail</td>
<td>5</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Post</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>78</td>
<td>36</td>
<td>114</td>
</tr>
</tbody>
</table>

One road accident involving a head-on collision resulted in the death of the driver and his assistant as a result of the impact, but the radionuclide in the instrument carried was not released, although the electronic components were seriously damaged. A few of the other incidents reported resulted in significant increase in radiation levels, but there were no known serious radiation injuries to any individuals.
Table 4.1 Shipments of Radionuclides in Canada 1977

(a) Radionuclides other than those in Nuclear Fuel Cycle.

<table>
<thead>
<tr>
<th>Description</th>
<th>Total</th>
<th>Road</th>
<th>Rail</th>
<th>Sea</th>
<th>Air</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical Instruments &amp; Devices</td>
<td>84,800</td>
<td>26,300</td>
<td>3,400</td>
<td>-</td>
<td>55,100</td>
</tr>
<tr>
<td>Industrial</td>
<td>351,900</td>
<td>249,800</td>
<td>35,200</td>
<td>-</td>
<td>66,900</td>
</tr>
<tr>
<td></td>
<td>3,040</td>
<td>900</td>
<td>850</td>
<td>100</td>
<td>1,190</td>
</tr>
<tr>
<td>Sub-total</td>
<td>439,740</td>
<td>277,000</td>
<td>39,450</td>
<td>100</td>
<td>123,190</td>
</tr>
<tr>
<td>%</td>
<td>100.0</td>
<td>63.0</td>
<td>9.0</td>
<td>0.02</td>
<td>28.0</td>
</tr>
</tbody>
</table>

(b) Nuclear Fuel Cycle.

<table>
<thead>
<tr>
<th>Description</th>
<th>Total</th>
<th>Road</th>
<th>Rail</th>
<th>Sea</th>
<th>Air</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uranium (nat. &amp; depl.)</td>
<td>49,340</td>
<td>45,303</td>
<td>2,174</td>
<td>1,848</td>
<td>15</td>
</tr>
<tr>
<td>Thorium (nat.)</td>
<td>697</td>
<td>5</td>
<td>-</td>
<td>692</td>
<td>-</td>
</tr>
<tr>
<td>Irradiated and fissile</td>
<td>756</td>
<td>689</td>
<td>64</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>Sub-total</td>
<td>50,793</td>
<td>45,997</td>
<td>2,238</td>
<td>2,540</td>
<td>18</td>
</tr>
<tr>
<td>%</td>
<td>100.0</td>
<td>90.6</td>
<td>4.4</td>
<td>5.0</td>
<td>0.04</td>
</tr>
<tr>
<td>Total</td>
<td>490,533</td>
<td>322,997</td>
<td>41,688</td>
<td>2,640</td>
<td>123,208</td>
</tr>
<tr>
<td>%</td>
<td>100.0</td>
<td>65.9</td>
<td>8.5</td>
<td>0.5</td>
<td>25.1</td>
</tr>
</tbody>
</table>
The incidents involving sea transport are listed in table 4.3.

**Table 4.3**

<table>
<thead>
<tr>
<th>Date</th>
<th>Radionuclide</th>
<th>Activity $37 \times 10^9$ s$^{-1}$</th>
<th>Package Type</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>At Terminal</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>62 Mar 27</td>
<td>$^{60}$Co</td>
<td>6 2 5</td>
<td>B(LRS)*</td>
<td>Handling.</td>
</tr>
<tr>
<td>66 Jun 22</td>
<td>$^{232}$Th</td>
<td>1.0</td>
<td>LSA</td>
<td>Packaging failure - Leakage caused by corrosion</td>
</tr>
<tr>
<td>67 Aug 22</td>
<td>$^{232}$Th</td>
<td>1.0</td>
<td>LSA</td>
<td>Same as above.</td>
</tr>
<tr>
<td>73 Jul 1</td>
<td>$^{60}$Co</td>
<td>24,600</td>
<td>B(LRS)</td>
<td>Container knocked off ship by crane.</td>
</tr>
<tr>
<td>73 Oct 17</td>
<td>$^{226}$Ra:Be</td>
<td>0.6</td>
<td>B</td>
<td>Handling.</td>
</tr>
<tr>
<td><strong>At Sea</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>58 Oct 29</td>
<td>$^{226}$Ra</td>
<td>0.5</td>
<td>B</td>
<td>Packaging failure - Leakage of radon-222 gas.</td>
</tr>
<tr>
<td>74 Jul 1</td>
<td>$^{60}$Co</td>
<td>193,000</td>
<td>B(U)</td>
<td>Improper procedure - Heat source loaded in insulated container.</td>
</tr>
<tr>
<td>75 Dec 30</td>
<td>$^{60}$Co</td>
<td>9,600</td>
<td>B(U)</td>
<td>Packaging smashed in storm.</td>
</tr>
</tbody>
</table>

Notes:

1. *LRS Large radioactive source.
2. The curie (Ci) is a unit of activity. A quantity of radioactive substance has an activity of 1 Ci if the number of disintegrations of atoms per second is $37 \times 10^9$.
3. The becquerel (Bq) is the basic unit and is equal to one disintegration per second. This unit will probably replace the curie (Ci).

In the sea transport incident with radium-226 which occurred in 1958, a small quantity of radon gas escaped from the container, but this did not result in injury to any person. Leakage from a number of drums of acidic thorium sulphate sludge, classified as low specific activity material, as a result of corrosion of the drums by sulphuric acid occurred on several shipments, but the situation was corrected by the shipper. Leaking drums were rejected at the port if found leaking. In the other incidents with radium-226 and cobalt shipments of high activity material, there was no release of radioactive material and the radiation levels did not increase beyond acceptable levels.
4.3 Emergency Response (p. 7032)

The procedures for dealing with incidents involving radioactive materials at sea and in port are given in section 10, p. 7032 of the Code. Appendix E shows the steps that should be taken if an emergency should occur involving radioactive materials for transport by land.

5. Summary

This paper has been presented as an introduction to the requirements for transportation of radioactive materials by sea. It is necessary for all shippers, forwarding agents and carriers to have a copy of the IMDG code in order to comply with the regulatory requirements. Volume 4 Class 7 Radioactive Substances contains the requirements for shipment of radioactive substances by sea.
APPENDIX A

REGULATIONS CONCERNING THE TRANSPORTATION OF RADIOACTIVE MATERIALS

INTERNATIONAL REGULATIONS

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

Publishing Section
International Atomic Energy Agency
Kärntner Ring 11, P. O. Box 590
A-1011 Vienna, Austria

See also Advisory Material (STI/PUB/324).


IMCO Secretariat
Publications Section
101 - 104 Piccadilly
London W1V OAE

(3) IATA Restricted Articles Regulations. 20th Edition 1977. Refer to Part 2 Radioactive Materials. Obtainable from:

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

or

Labelmaster
6001 N. Clark Street
Chicago, Illinois 60660

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
Place du Portage, Phase III
11 Laurier Street
Hull, Quebec
K1A0S5
(5) The CTC Regulations are also applicable to the transport of radioactive materials by road under section 23 of the Atomic Energy Regulations SOR/74-334 dated 4 June 1974. An excerpt giving regulations for "radioactive materials" may be obtained from:

Atomic Energy Control Board
P. O. Box 1046
Ottawa, Ontario
K1P 5S9

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

Information Officer
St. Lawrence Seaway Authority
320 Queen Street
Place de Ville, Tower A
Ottawa, Ontario
K1A 5A3

(7) Marine Services, Ports and Harbours, Public Harbour Regulations, date 15 August 1971, reissued 1 November 1974. Obtainable from:

Publishing Centre
Supply & Services Canada

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

Publishing Centre
Supply & Services Canada
Registration
SOR/73-327, 14 June, 1973

CANADA SHIPPING ACT

Dangerous Goods Shipping Regulations, amendment

P.C. 1973-4529 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 (a) 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."

ẬPPENDIX B

27/6/73  Canada Gazette Part II, Vol. 107, No. 12

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ATHERS  PRINTER FOR CANADA, OTTAWA, 1973

1456
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 Mark and Destination or address</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 . . .
CLASS 7  -  Radioactive substances

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 (2.2)
- Oxidizing substances

Separated from:
- Explosives
- Inflammable gases (2.1)
- Inflammable liquids
- Inflammable solids
- Spontaneously combustible substances
- Substances which are dangerous when wet
- Organic peroxides
- Corrosives

Class 2
Class 5.1
Class 1, Divisions 1.1, 1.2, 1.3, 1.4 and 1.5
Class 2
Class 3 (3.1, 3.2 and 3.3)
Class 4.1
Class 4.2
Class 4.3
Class 5.2
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”.

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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, labeled 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 \(3 \times 10^3 A_1\) or \(3 \times 10^3 A_2\) as appropriate, or \(3 \times 10^6 C\) 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 trans-shipment.

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:
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 $3 \times 10^3 A_1$ or $3 \times 10^3 A_2$, as appropriate, or $3 \times 10^4 C_i$, 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 $3 \times 10^3 A_1$ or $3 \times 10^3 A_2$, as appropriate, or $3 \times 10^4 C_i$, 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 7019 or 7020. If, however, there are national regulations as to segregation, these may be used in their place.
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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>I</td>
<td>Special Form Substance</td>
</tr>
<tr>
<td>2</td>
<td>Type A, commercial type and strong industrial type</td>
</tr>
<tr>
<td>3</td>
<td>Type B(U)</td>
</tr>
<tr>
<td>4</td>
<td>Type B(M)</td>
</tr>
<tr>
<td>5</td>
<td>Fissile packages*</td>
</tr>
<tr>
<td></td>
<td>Package designs complying with IAEA paragraphs 620, 623 and 624</td>
</tr>
<tr>
<td></td>
<td>Package designs complying with IAEA paragraphs 612 to 614 and 622</td>
</tr>
<tr>
<td></td>
<td>All other package designs</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.
### 12.2 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 $3 \times 10^4 C_i$, whichever is the lesser.</td>
</tr>
<tr>
<td>3. Type B(M)</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) Non 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 $3 \times 10^4 C_i$, 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 unless specified in the competent authority shipment approval</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>Country of origin and all countries en route</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 $3 \times 10^4 C_i$, 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 PROCEDURES FOR
RADIOACTIVE MATERIALS INCIDENTS

Step 1. From shipping papers or Hazard Information Emergency Response Form ascertain type of radioactive material and package. If unable to locate, determine type of label or placard on vehicle, freight container or shipment. Determine extent of damage or injury and, if possible, consignor and consignee.

Step 2. Immediately relate information from Step 1 to nearest police detachment: RCMP, OPP, QPP or local police who will contact nearest source of expert assistance.

Step 3. Call shipper.

Step 4. Call one of the National Report Centres.

Step 5. The telephone numbers of the National Report Centres are:

For Radioactive Materials Emergencies
Call Atomic Energy Control Board – 613-995-0479.

For Environmental Emergencies
Call Environmental Emergency Centre – 819-997-3742.

Contacts with Provincial Health or Labour authorities will be made through the police.