

# **SAFETY GUIDE**

## **Safe Transport of Radioactive Material 2008**

Radiation Protection Series No. 2.1

### **CONSULTATION DRAFT: 30 May 2008**

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All submissions will be held in a register of submissions, and unless marked confidential, may be made public.

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# 1. Introduction

1. This Safety Guide has been prepared to assist persons in meeting their responsibilities under the *Code of Practice for the Safe Transport of Radioactive Material (2008)*<sup>1</sup> (the Transport Code) in relation to the transport of radioactive material by road, rail, or inland waterway within Australia. The Safety Guide complements the Transport Code and although the Guide does not have any extra mandatory requirements, it provides advice and guidance on good radiation protection practice and on meeting the requirements of the Transport Code. Where there are any discrepancies between the Transport Code and the information contained in this Safety Guide, the requirements in the Transport Code apply.
2. The requirements for the safe transport of radioactive materials are included in the Transport Code published by ARPANSA in January 2008. The Transport Code directly adopts the International Atomic Energy Agency's (IAEA) *Regulations for the Safe Transport of Radioactive Material 2005 Edition* (No. TS-R-1), with the modification that the standards for radiation exposure limits are as set down in the ARPANSA Radiation Protection Series No. 1 *Recommendations for Limiting Exposure to Ionizing Radiation (1995)* and *National Standard for Limiting Occupational Exposure to Ionizing Radiation* (republished 2002). Reference to the Transport Code in this Safety Guide will be a direct reference to the 2005 IAEA Regulations (No. TS-R-1) unless an indication to the contrary is given.
3. The IAEA Regulations have been adopted and used by many countries throughout the world since their first publication in 1961. The IAEA has also published companion advisory documents for the IAEA Regulations and these are listed in paragraph 102 of the Transport Code. These documents contain supplementary information on the IAEA Regulations, and therefore the Transport Code.
4. As the IAEA Regulations are the internationally accepted requirements for the transport of radioactive material for all IAEA Member States, compliance with the Transport Code should ensure that any consignment of radioactive materials to destinations outside Australia will also meet the requirements for air and sea transport. The relevant air or sea transport authorities should be consulted where the consignment will involve those modalities.
5. For air or sea transport, evidence of a radiation protection program, including details of any relevant dangerous goods training incorporated in that program, will be required before a consignment can be moved.
6. The organisations or persons involved in a typical operation for the transport of radioactive materials are:
  - **the Consignor (shipper)** – anyone who presents a consignment of radioactive materials for transport, and who is named as consignor in the

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<sup>1</sup> Printed copies of the Transport Code, incorporating the IAEA Regulations, are available for sale directly from ARPANSA. Electronic versions of the Transport Code are available for free download (PDF format) from ARPANSA's website at [www.arpansa.gov.au](http://www.arpansa.gov.au).

42 transport documents. The consignor may be an individual, company,  
43 government or other organisation.

44 • **the Consignee (recipient)** – the addressee nominated in the documentation  
45 as the person or organisation or company responsible for the receipt of the  
46 consignment.

47 • **the Carrier** – any organisation or individual or company transporting  
48 radioactive materials. The term includes both carriers for hire and carriers on  
49 own account. The carrier may require an authorisation from the relevant  
50 regulatory authority of each Australian jurisdiction through or into which the  
51 transport may take place.

52 • **the Competent Authority** – the regulatory authority that administers the  
53 various statutory regulations governing the transport of radioactive materials,  
54 and controls emergency action in the event of an incident. A complete list of  
55 Australian Competent Authorities is listed in Annex A.

56 7. It is important that the Transport Code and the companion advisory material  
57 to the IAEA Regulations be read carefully to ensure optimum conditions for  
58 transporting radioactive material.

## 59 **2. Notes for Consignors (shipper or sender)**

60 8. The consignor is responsible for ensuring that the consignment (shipment)  
61 of radioactive materials is properly packaged, labelled, certified and  
62 documented to ensure safe carriage and prompt delivery. To achieve this,  
63 the consignor should make a careful study of the Transport Code and be  
64 thoroughly familiar with all aspects pertaining to his or her area of  
65 operations. In particular, the consignor should be familiar with the relevant  
66 requirements of the Transport Code and the examples given on pages 5 to 11  
67 of this Safety Guide.

68 9. Along with the goods, the consignor is required to supply information,  
69 sometimes known as a “Consignor’s Declaration” (see Figure 1), outlining  
70 details of the consignment, such as:

- 71 • the name(s) and activity of the radionuclides;
- 72 • the type of packaging;
- 73 • the hazard category of the package; and
- 74 • the transport index (TI). The TI is the maximum radiation level at 1 metre from  
75 any external surface of the package in mSv/h × 100 and rounded *up* to the first  
76 decimal place. A value of 0.05 or less may however be considered as zero. The  
77 TI is used to provide control over radiation exposure during transport.

78 The Consignor’s Declaration also needs to contain a signed statement to  
79 certify that the consignment conforms to applicable regulations. Copies of  
80 the Consigners Declaration for Radioactive Material are available for  
81 download from the ARPANSA web site at [www.arpansa.gov.au](http://www.arpansa.gov.au). Figure 1  
82 shows a typical Consignor’s Declaration for Radioactive Materials to be  
83 transported by road, rail or those inland waterways not covered by the  
84 Maritime legislation. It should be noted that further documentation will  
85 most likely be required for air or sea transport and the appropriate  
86 authorities should be consulted if a particular consignment will involve those  
87 modalities.

88 10. The level of potential hazard arising from the transport of radioactive  
89 material will vary with the radionuclide(s) and the physical form and  
90 quantity involved.

### 91 **Examples of some actions taken to prepare particular materials for** 92 **shipment**

93 11. In order to prepare a shipment, the consignor first needs to define the  
94 radioactive material to be transported with reference to:

- 95 (a) type of radioactive material (i.e. isotope or mixture of isotopes);
- 96 (b) total activity of the consigned material;
- 97 (c) chemical and physical form, e.g. solid, liquid, gas; size, mass,  
98 encapsulation (special form); and

**ROAD/RAIL/MARINE CONSIGNOR'S DECLARATION FOR DANGEROUS GOODS  
CLASS 7 RADIOACTIVE MATERIAL**

**TWO COMPLETED AND SIGNED COPIES OF THIS DECLARATION MUST BE PROVIDED TO THE CARRIER**

CONSIGNOR (SENDER'S NAME AND ADDRESS):	NAME OF TRANSPORTING COMPANY AND CONSIGNMENT No.
	CONSIGNOR'S REFERENCE No.
CONSIGNEE (RECEIVER'S NAME AND ADDRESS):	MARINE USE ONLY
	PORT OF LOADING .....
	DATE OF LOADING .....
	PORT OF DISCHARGE .....
	VESSEL .....
	CONTAINER No.....

**NATURE AND QUANTITY OF RADIOACTIVE MATERIAL**

See applicable Codes: International Atomic Energy Agency (IAEA) — Safety Requirements No. TS-R-1 (2005), Maritime Dangerous Goods Code (IMO) and Code of Practice for Safe Transport of Radioactive Material 2008 ("The Transport Code")

PROPER SHIPPING NAME <small>Refer overleaf</small>	RADIONUCLIDE <small>Name or symbol of principal radioactive content e.g. Iridium-192, Ir-192 or <sup>192</sup>Ir</small>	FORM <small>Physical state: gas, liquid, solid or special form</small>	UNITED NATIONS NUMBER	SUBSIDIARY RISK <small>(If applicable) Classes 1 to 8</small>

NUMBER OF PACKAGES	ACTIVITY OF RADIONUCLIDE <small>In Becquerel units (Bq). (Curie units (Ci) may be used)</small>	HAZARD CATEGORY <small>Delete category not applicable</small>	TRANSPORT INDEX <small>Definition: 100 times the maximum radiation dose in millisievert per hour (mSv/h) at 1 metre</small>	PACKAGE CLASSIFICATION <small>Delete classification not applicable</small>	COMPETENT AUTHORITY CERTIFICATE NUMBER(S) <small>required only for Type B containers</small>
		I White or II Yellow or III Yellow	For Yellow hazard categories only	Industrial I, II, III or Type A or Type B(U) or Type B(M)	

**"WARNING"**

FAILURE TO COMPLY IN ALL RESPECTS WITH THE APPLICABLE RADIOACTIVE MATERIALS  
TRANSPORT REGULATIONS MAY BE IN BREACH OF THE APPLICABLE LAW, SUBJECT TO LEGAL  
PENALTIES. THIS DECLARATION MUST NOT, IN ANY CIRCUMSTANCES, BE COMPLETED AND/OR  
SIGNED BY A CONSOLIDATOR, A FORWARDER OR CARGO AGENT.

I HEREBY DECLARE THAT THE CONTENTS OF THIS  
CONSIGNMENT ARE FULLY AND ACCURATELY DESCRIBED  
ABOVE BY THE PROPER SHIPPING NAME AND ARE CLASSIFIED,  
PACKED, MARKED AND LABELLED, AND ARE IN ALL RESPECTS  
IN PROPER CONDITION FOR TRANSPORT BY  
ROAD/RAIL/MARINE (check transport mode/s below) ACCORDING  
TO THE APPLICABLE INTERNATIONAL AND NATIONAL  
GOVERNMENTAL REGULATIONS.

ROAD     RAIL     MARINE

NAME OF SIGNATORY: (PLEASE PRINT)

\_\_\_\_\_

POSITION \_\_\_\_\_

SIGNATURE \_\_\_\_\_

(SEE ABOVE WARNING)

DATE \_\_\_\_\_

ADDITIONAL HANDLING INFORMATION (e.g. Ems Number, Schedule Number, Special arrangements, Exclusive use, other information)
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SEE REVERSE FOR INFORMATION FOR CARRIERS AND EMERGENCY PROCEDURES

Version Date: 1 January 2008

Figure 1 Sample of a Consignors or Shippers Declaration

100 (d) determining  $A_1$  and  $A_2$  limits for the radionuclide ( $A_1$  and  $A_2$  are  
101 defined in paras 401-406 of Section IV of the Transport Code).

102 12. It should be noted that in the case of uranium or thorium ores and  
103 concentrates there exists a inconsistency between the definitions provided in  
104 the IAEA Transport Regulations (and therefore the Transport Code) and  
105 those in the IAEA Basic Safety Standards. Annex B provides background  
106 information on interpretation on this inconsistency and should, as far as  
107 practicable, be followed for transport of uranium or thorium ores and  
108 concentrates in Australia.

109 13. Using the above information, the consignor can use the appropriate  
110 Schedule included in this Safety Guide to assist in establishing the type of  
111 packaging and the documentation required. It is essential that every  
112 package carries the appropriate radiation level labels. The flowcharts  
113 included in Annex C are also available to assist in determining the package  
114 type and the labelling required for different packaging types.

115 14. The following pages provide examples of the correct procedures required for  
116 some typical consignments.

#### 117 **Example 1**

#### 118 15. **Consignment:**

119 An empty isotope container weighing 25 kilograms, which has depleted  
120 uranium built into the packaging for shielding purposes, is to be returned to  
121 the overseas supplier.

#### 122 16. **Action:**

123 **Step a** An empty container would normally be covered by Schedule 4  
124 however, in this instance Schedule 3 is applicable because the  
125 container is fitted with a depleted uranium radiation shield, and  
126 depleted uranium is classified as a radioactive material. See  
127 Schedule 3 for procedures.

128 **Step b** Ensure that non-fixed external contamination is within applicable  
129 limits. (Some carriers may require certified measurements.)

130 **Step c** Attach normal labelling from the shipping company plus a label on  
131 the depleted uranium shield indicating that it is radioactive.

132 **Step d** Enter "UN2909" in the transport documentation. A Consignor's  
133 Declaration is not required. Depleted uranium is however, a  
134 "nuclear material" and its import or export requires the approval of  
135 the Australian Safeguards and Non-Proliferation Office.  
136 Application form ASO107 will be required for such an export and  
137 the application can be made to:

138 The Director of Safeguards  
 139 Australian Safeguards and Non-Proliferation Office  
 140 Department of Foreign Affairs and Trade  
 141 Level 2  
 142 RG Casey Building  
 143 **BARTON ACT 0221**

144 A description of the material, the name and address of the intended  
 145 recipient and the shipment details will need to be provided.

146 **Example 2**

147 17. **Consignment:**

148 Bulk pack of 10 in-vitro radioimmunoassay (RIA) kits each containing  
 149 370 kBq (10 µCi) iodine-125.

150 18. **Action:**

151 **Step a** Radionuclide: iodine-125

152 Total activity of consignment:  $10 \times 370 \text{ kBq} = 3.7 \text{ MBq}$ .

153 Chemical form: solution (liquid).

154 **Step b** From Table 1 of the Transport Code relating to Activity Limits:

155 Type A package activity limits (for iodine-125):

156  $A_1 = 20 \text{ TBq}, A_2 = 3 \text{ TBq}$ .

157 From Table 3 of the Transport Code “Activity Limits for Excepted  
 158 Packages”, the package limit for liquids is  $10^{-4} A_2$ .

159 The package limit for iodine-125 is therefore  
 160  $10^{-4} \times 3 \text{ TBq} = 300 \text{ MBq}$ . The activity to be transported is 3.7 MBq,  
 161 which is less than the excepted package limit for iodine-125.

162 **Step c** Ensure that non-fixed external contamination does not exceed  
 163 4 Bq/cm<sup>2</sup>. (Some carriers may require certified measurements.)

164 **Step d** Measure the radiation level at all surfaces of the package, including  
 165 the top and base.

166 **Step e** The following criteria apply, depending on the maximum radiation  
 167 level at the surface of the package:

<b>Maximum radiation level at the surface of the package</b>		
$\leq 5 \text{ } \mu\text{Sv/h}$		
$> 5 \text{ } \mu\text{Sv/h}$ but $\leq 10 \text{ mSv/h}$		
<b>Consignment Type</b>	Excepted Package	Type A package (the package size cannot be less than 10 cm in any of its external measurements)
<b>Applicable Schedule in this Safety Guide</b>	Schedule 1	Schedule 9.
<b>Absorbent Material</b>	Because the package in this example contains radioactive liquid it will need to have either: <ul style="list-style-type: none"> <li>• sufficient absorbent material to absorb twice the volume of the liquid</li> </ul>	

		<b>Maximum radiation level at the surface of the package</b>	
		$\leq 5 \mu\text{Sv/h}$	$> 5 \mu\text{Sv/h}$ but $\leq 10 \text{ mSv/h}$
	<p>contents; or</p> <ul style="list-style-type: none"> <li>a containment system comprising a primary inner and secondary outer containment components designed to ensure retention of the liquid contents, within the secondary outer containment components, even if the primary inner components leak.</li> </ul>		
<b>Package Labelling</b>	<p>The packaging needs to be legibly and durably marked on the outside with:</p> <ul style="list-style-type: none"> <li>an identification of the consignor, the consignee or both; and</li> <li>the mark “UN2910”.</li> </ul> <p>The marking “RADIOACTIVE” on an internal surface in such a manner that a warning of the presence of radioactive material is visible on opening the package.</p>	<p>The packaging needs to be legibly and durably marked on the outside with:</p> <ul style="list-style-type: none"> <li>an identification of the consignor, the consignee or both;</li> <li>the marking “TYPE A”, if it conforms to the Type A package design;</li> <li>the mark “UN2915”; and</li> <li>at least two completed: <ul style="list-style-type: none"> <li>yellow II labels (if the maximum radiation level at any point on the package surface is <math>&gt; 0.005 \text{ mSv/h}</math> but <math>\leq 0.5 \text{ mSv/h}</math>); or</li> <li>yellow III labels (if the maximum radiation level at any point on the package surface is <math>&gt; 0.5 \text{ mSv/h}</math> but <math>\leq 10 \text{ mSv/h}</math>).</li> </ul> </li> </ul>	
<b>Transport Index (TI)</b>	Not applicable		<p>The maximum radiation level at 1 metre from any external surface of the package in <math>\text{mSv/h} \times 100</math> and rounded <i>up</i> to the first decimal place. A value of 0.05 or less may however be considered as zero.</p>
<b>Transport Documents</b>	<p>The description “UN2910”.</p> <p>A Consignor’s Declaration is not required.</p>		<p>Relevant details of the consignment, information for carriers and a declaration that the consignment meets the requirements of the Transport Code<sup>2</sup>.</p> <p>It is common practice to produce at least two copies of the Consignor’s Declaration. One copy should be secured in a stout envelope to the outside of the package for reference by transport personnel and authorities during transit. The other should be handed to the carrier together with the order for transportation. Where more than one carrier is involved, it may be necessary for each such carrier to receive a copy of the Consignor’s Declaration. Information for the</p>

<sup>2</sup> See attached example at page 3.

		<b>Maximum radiation level at the surface of the package</b>	
		$\leq 5 \mu\text{Sv/h}$	$> 5 \mu\text{Sv/h}$ but $\leq 10 \text{ mSv/h}$
			carrier should include instructions for storage and segregation, and the Air Waybill or Consignment Note.

168 **Example 3**

169 19. **Consignment:**

170 1.85 GBq (50 mCi) of iodine-131 in solution.

171 20. **Action:**

172 **Step a** Radionuclide: iodine-131  
 173 Total activity for consignment: 1.85 GBq (0.00185 TBq).  
 174 Physical/Chemical form: sodium iodide in solution.

175 **Step b** From Table 1 of the Transport Code relating to Activity Limits:

176 Type A package activity limits (for iodine-131):

177  $A_1 = 3 \text{ TBq}, A_2 = 0.7 \text{ TBq}.$

178 From Table 3 of the Transport Code “Activity Limits for Excepted  
 179 Packages”, the package limit for liquids is  $10^{-4} A_2$ .

180 The package limit for iodine-131 is therefore  
 181  $10^{-4} \times 0.7 \text{ TBq} = 70 \text{ MBq}$ . The activity to be transported is  
 182 1.85 GBq, which is greater than the excepted package limit for  
 183 iodine-131, but is within the limitations for Type A packaging ( $A_2 =$   
 184  $0.7 \text{ TBq}$ ) therefore the requirements of Schedule 9 applies.

185 **Step c** Ensure that non-fixed external contamination does not exceed  
 186  $4 \text{ Bq/cm}^2$ . (Some carriers may require certified measurements.)

187 **Step d** Ensure that the maximum radiation level from any surface of the  
 188 package is no greater than:

- 189 •  $5 \mu\text{Sv/h}$  for a Category I-White package;
- 190 •  $500 \mu\text{Sv/h}$  for a Category II-Yellow package; or
- 191 •  $2 \text{ mSv/h}$  for a Category III-Yellow package<sup>3</sup>.

192 **Step e** *Containment of radioactive liquids:* Because the package in this  
 193 example contains radioactive liquid it will need to have either:

- 194 • sufficient absorbent material to absorb twice the volume of the  
 195 liquid contents; or
- 196 • a containment system comprising a primary inner and  
 197 secondary outer containment components designed to ensure  
 198 retention of the liquid contents, within the secondary outer  
 199 containment components, even if the primary inner  
 200 components leak.

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<sup>3</sup> The maximum radiation level from any surface of the package may be as high as 10 mSv/h but in such circumstances, the package will need to be transported under exclusive use.

- 201 **Step f** *Labelling:*  
202 Check that the packaging:  
203 • is legibly and durably marked on the outside with:  
204 – an identification of the consignor, the consignee or both;  
205 – the marking “TYPE A”, if it conforms to the Type A  
206 package design; and  
207 – the mark “UN2915”, and  
208 • bears at least two completed Category I-White, Category II-  
209 Yellow or Category III-Yellow labels, consistent with the  
210 external radiation levels measured in Step d. Category II-  
211 Yellow or Category III-Yellow labels will also need to include  
212 the TI.

213 **Step g** *Transport documents:*  
214 A Consignor’s Declaration<sup>4</sup> that contains relevant details of the  
215 consignment, information for carriers and a declaration that the  
216 consignment meets the requirements of the Transport Code is  
217 required.

218 It is common practice to produce at least two copies of the  
219 Consignor’s Declaration. One copy should be secured in a stout  
220 envelope to the outside of the package for reference by transport  
221 personnel and authorities during transit. The other should be  
222 handed to the carrier together with the order for transportation.  
223 Where more than one carrier is involved, it may be necessary for  
224 each such carrier to receive a copy of the Consignor’s Declaration.  
225 Information for the carrier should include instructions for storage  
226 and segregation, and the Air Waybill or Consignment Note.

227 **Step h** *Loading:*  
228 Check storage and segregation instructions. Check that the parcel  
229 is secured in the vehicle, and that the vehicle is correctly placarded  
230 (see item 6 of paragraph 59).

#### 231 **Example 4**

##### 232 **21. Consignment:**

233 An iridium-192 industrial radiography source with an activity of 2.96 TBq  
234 (80 curies).

##### 235 **22. Action:**

236 **Step a** Radionuclide: iridium-192

237 Total activity for consignment: 2.96 TBq

238 Physical form: “Special form” welded titanium capsule

239 Chemical form: metal

240 **Step b** From Table 1 of the Transport Code:

---

<sup>4</sup> See attached example at page 3.

241 Type A package activity limits (for iridium-192):

242  $A_1 = 1 \text{ TBq}$ ,  $A_2 = 0.6 \text{ TBq}$ .

243 The activity of the source to be transported is greater than 1 TBq ( $A_1$   
244 limit for Type A package special form). A Type B(U) package is  
245 therefore required since there is no limit on the total activity per  
246 package except as prescribed in the package approval certificate.  
247 See Schedule 10 for procedures.

248 **Step c** *Packaging*. Check that:

- 249 (1) the Type B(U) Package Approval Certificate is current for the  
250 container and valid for the transport of 2.96 TBq of  
251 iridium-192;
- 252 (2) the “special form” certificate is current and valid for the  
253 source capsule;
- 254 (3) where the package makes use of depleted uranium for  
255 shielding, a special export permit is required if the package is  
256 part of an export consignment (see Example 1);
- 257 (4) the non-fixed external contamination does not exceed  
258  $4 \text{ Bq/cm}^2$ . (Some carriers may require certified  
259 measurements.);
- 260 (5) the external radiation level on any surface of the package  
261 does not exceed  $2 \text{ mSv/h}$ ;
- 262 (6) the container for the source which forms a part of the  
263 package is sealed or locked;
- 264 (7) the appropriate UN number preceded by the letters “UN” (in  
265 this example, UN2916) is legibly and durably marked on the  
266 outside of the packaging; and
- 267 (8) if the package weighs more than 50 kg, it is equipped with  
268 special handling facilities.

269 **Step d** *Labelling*:

270 A Category III-Yellow label is probably required (external dose rate  
271  $>500 \mu\text{Sv/h}$ ), and the package and the container are to be durably  
272 marked:

273 TYPE B(U)

274 Weight ..... (if greater than 50 kg), package type approval  
275 certificate no. and serial no., etc.

276 **Step d** *Transport Documents*:

- 277 (1) A Consignor’s Declaration<sup>5</sup> that contains relevant details  
278 of the consignment, information for carriers and a  
279 declaration that the consignment meets the  
280 requirements of the Transport Code is required;
- 281 (2) the Type B(U) Package Approval Certificate is required;
- 282 (3) a Special Form Source Certificate is required;

---

<sup>5</sup> See attached example at page 3.

- 283 (4) Carrier's Consignment Note should describe the  
284 radionuclide and total activity;  
285 (5) as the quantity is less than the lesser of  $3000 \times A_1$  TBq  
286 or 1000 TBq, no notification of the transport is required  
287 to be provided to Competent Authorities along the route  
288 *under the Transport Code*. Each Competent Authority  
289 along the route might however have separate  
290 requirements for notification; and  
291 (6) storage and packing instructions.
- 292 **Step e** *Despatch*. Check:  
293 (1) the consignment is secured within the vehicle; and  
294 (2) the vehicle is correctly placarded (see item 6 of  
295 paragraph 59).

## 296 **Example 5**

### 297 23. **Consignment:**

298 2000 kg yellowcake ( $U_3O_8$ ) to be transported by road and sea.

### 299 24. **Action:**

300 **Step a** Yellowcake is a chemical concentrate of uranium ore and it is defined  
301 by the Transport Code (para. 226(a)(i)) as being a low specific  
302 activity (LSA-I) material.

303 **Step b** The regulatory requirements for packaging LSA-I material allow for  
304 the consignment to be shipped in bulk or in most types of packaging.  
305 No testing procedures for packaging are prescribed, unless it is in the  
306 form of a liquid or liquid slurry *and* it is not being transported under  
307 exclusive use. Steel drums with a removable lid are often used, and  
308 it is common practice to limit the gross weight of each drum to  
309 400 kg.

310 **Step c** As both road and sea transport modes are to be used, the shipment  
311 should satisfy the requirements of the Transport Code and the  
312 International Maritime Dangerous Goods Code, including the  
313 Australian Supplement. Although the requirements of both are very  
314 similar, it would be advisable to check for possible variations.

315 **Step d** The steel drums may be transported as a "compact stack" or loaded  
316 into freight containers.

### 317 **Step e** *Labelling:*

318 Each package will need to:

- 319 • be marked with:
- 320 – the consignor or consignee's name or both;
  - 321 – UN2912 and the proper shipping name "RADIOACTIVE  
322 MATERIAL, LOW SPECIFIC ACTIVITY (LSA-1)"; and
  - 323 – the type of package e.g. IP-1 or IP-2 as appropriate.

324  
325  
326  
327

- have completed White or Yellow labels on opposite sides. For LSA-I material, the term “LSA-I” is all that is necessary in the “Contents” line of the Category label; the name of the radionuclide is not required.

### 328 **3. Notes for Carriers**

329 25. An objective of the Transport Code is to ensure that radiation exposures to  
330 persons involved in the transport of radioactive materials do not exceed  
331 those permitted for members of the public.

#### 332 **Labelling**

333 26. Except in the case of exempt or excepted materials, packages containing  
334 radioactive material are labelled according to the external radiation they  
335 emit. The consignor is responsible for attaching an appropriate label to the  
336 outside of each package indicating the correct radiation level.

337 27. A Category I-White label indicates that the radiation level at the surface of a  
338 package is very low ( $\leq 5 \mu\text{Sv/h}$ ). A Category II-Yellow label indicates a higher  
339 dose rate at the package surface (greater than  $5 \mu\text{Sv/h}$  but  $\leq 500 \mu\text{Sv/h}$ ), and  
340 a Category III-Yellow (the highest radiation category) indicates that a  
341 significant level of radiation can be expected at the surface of the package  
342 (greater than  $500 \mu\text{Sv/h}$  and up to  $2000 \mu\text{Sv/h}$  (or  $10\,000 \mu\text{Sv/h}$  if  
343 transported under exclusive use<sup>6</sup>)) and in its near vicinity.

344 28. Each Category II and III label will also include a number called the transport  
345 index (TI). The TI is the maximum radiation level at 1 metre from any  
346 external surface of the package in  $\text{mSv/h} \times 100$  and rounded up to the first  
347 decimal place although a value of 0.05 or less may be considered zero. The  
348 TI is used to provide control over radiation exposure during transport.

349 29. Each package will also be clearly marked with the name of the consignor or  
350 the consignee as well as the proper shipping name and appropriate UN  
351 number. For excepted packages however, the proper shipping name is not  
352 necessary.

#### 353 **Handling Rules**

354 30. Radioactive materials presented for transportation are packaged in  
355 accordance with the Transport Code which ensure that they are safe to  
356 handle under normal conditions. Nevertheless, to prevent unnecessary  
357 exposure to radiation there are certain basic rules that should be followed as  
358 the radiation exposure that a person receives depends on how long and how  
359 close that person stays near the packages containing radioactive materials.  
360 To minimise radiation exposures:

- 361 • Contact time with the package should be kept short.
- 362 • A package of radioactive material should be handled without delay and  
363 kept moving.
- 364 • Nobody should be permitted to stand around, sit near or sit on a package  
365 containing radioactive material.

---

<sup>6</sup> Exclusive use means the sole use of a conveyance or of a large freight container by a single consignor of which all initial, intermediate and final loading and unloading is carried out in accordance with the directions of the consignor or consignee.

- 366 • Time-consuming tasks, such as paperwork, should not be carried out  
367 near a package.
- 368 • All persons should be kept as far away as practicable from packages  
369 containing radioactive material.
- 370 • Packages should be stored well away from offices, rest rooms and  
371 occupied work areas.
- 372 • A vehicle packages containing radioactive material should allow enough  
373 separation between the packages and any personnel to ensure that no-  
374 one receives a dose in excess of the radiation protection limits. Packages  
375 should not be placed on the passenger seat.
- 376 • Each vehicle transporting Category II  
377 or Category III packages or freight  
378 container carrying packages other  
379 than excepted packages will need to  
380 bear placards that conform to the  
381 model given in Figure 2. Placards on  
382 trains are to be placed on two  
383 external lateral walls, on two lateral  
384 walls and the rear wall for road  
385 vehicles and on all four sides of a  
386 freight container.
- 387 • The Code also requires that Category  
388 II or III packages are not carried in  
389 the passenger compartment of  
390 vehicles unless the compartment is  
391 specifically designed for that  
392 purpose.
- 393 • Packages should be secured so that they will not move during transport  
394 – small, light packages can be stored in a basket while larger, heavy  
395 packages should be properly blocked and braced.
- 396 • Groups of packages with transport indexes that add up to more than 50<sup>7</sup>  
397 cannot be stored in the one location unless there is a separation of at  
398 least 6 metres between each such group.



Figure 2 Placard for vehicle or freight container

### 399 In Case of Incident<sup>8</sup>

- 400 31. If a radioactive material package has been damaged and it is suspected that  
401 the damage may allow leakage of radiation or spillage of radioactive  
402 material:
- 403 • The package should not be touched.
- 404 • All people should be kept away from the package.

<sup>7</sup> The transport index will be written on the Yellow Category II or Category III label.

<sup>8</sup> See Emergency Procedures in Chapter 8 for details.

- 405
- 406
- 407
- The supervisor or manager should be notified and provided with any information regarding any person who might have been contaminated – they will call for expert technical help if necessary.
- 408
- Any person who might have touched the damaged package needs to report to the supervisor or manager – they will arrange the necessary action.
- 409
- 410
- 411
- Any person who has touched the damaged package or objects near it needs to wash their hands thoroughly and advise the supervisor or manager of their possible contamination by radioactive material.
- 412
- 413
- 414
- Each person should be checked for possible contamination before they leave work.
- 415
- 416
- All vehicles involved in the incident should remain at the incident site until cleared by the police or other similar competent person (eg. fire brigade personnel, emergency response personnel, etc.)
- 417
- 418
- 419
- No-one should eat, drink, smoke or leave the site until checked for possible contamination.
- 420
- 421
- In the case of emergencies after hours, the police should be contacted. The Competent Authority should also be advised of details of the incident as soon as possible and any instructions subsequently issued by the Competent Authority should be followed.
- 422
- 423
- 424

425 **Transport by Taxi**

- 426 32. In certain specific circumstances, radioactive material may be able to be
- 427 transported by taxi. An example could be the carriage of an excepted
- 428 package or a Category I-White package containing essential medical isotopes
- 429 from one hospital to another. Such a transport could, however, require an
- 430 authorisation from the relevant regulatory authority and it is essential that
- 431 the appropriate requirements are checked before any such transport is
- 432 carried out.
- 433

434 **4. Notes For Consignees**

435 33. On receipt of the package(s), the consignee should ensure that the  
436 consignment is intact and in agreement with information entered into the  
437 documentation for the consignment.

438 34. In the event of damage to a package or any likelihood of loss of radioactive  
439 material during transportation which might pose a radiation hazard to  
440 people or the environment, the consignee should advise the Competent  
441 Authority immediately.

442 35. In the event of a lost consignment, the Competent Authority should be  
443 immediately informed once the fact is ascertained.  
444

## 445 **5. Competent Authorities**

- 446 36. The role of the Competent Authority is to:
- 447 (a) receive applications for shipment approval, special form approval,  
448 package design approval or package validation approval;
  - 449 (b) assess applications and issue shipment approval certificates, design  
450 approval certificates, special form certificates and validates design  
451 approval certificates from other countries
  - 452 (c) evaluate package designs and special form radioactive materials, and  
453 issue certificates of compliance;
  - 454 (d) provide information to package designers, consignors (shippers)  
455 carriers and consignees; and
  - 456 (e) receive notification of proposed shipments.
- 457 37. Competent Authorities are also responsible for ensuring that adequate  
458 emergency plans exist.

### 459 **Competent Authorities in Australia**

- 460 38. References in the Transport Code to dealings between Competent  
461 Authorities can be read as:
- 462 (a) in relation to a Competent Authority in Australia – the  
463 Commonwealth Competent Authority; and
  - 464 (b) in relation to the foreign Competent Authority – that foreign  
465 Competent Authority.
- 466 39. The Competent Authority in Australia for the regulation of the safe transport  
467 of radioactive materials by:
- 468 (a) sea, either interstate or overseas, is the Australian Maritime Safety  
469 Authority (AMSA);
  - 470 (b) air, is the Civil Aviation Safety Authority (CASA);
  - 471 (c) land or water other than in (a) above is the designated Competent  
472 Authority in each State and the Northern Territory; and
  - 473 (d) land or water within a Commonwealth Territory is the designated  
474 Commonwealth Competent Authority.
- 475 40. A list of Competent Authorities in Australia is given in Annex A.

### 476 **Shipment Approval**

- 477 41. Notice of an intended shipment, where required by the IAEA Regulations, is  
478 to be given to each Competent Authority through whose jurisdiction the  
479 shipment will pass. As an example, an intended radioactive material  
480 shipment from the Northern Territory to the United States, via Queensland,  
481 would involve notice of the shipment being given to the following Competent  
482 Authorities:

- 483 (a) Northern Territory's Competent Authority;  
484 (b) Queensland's Competent Authority;  
485 (c) AMSA or CASA (sea or air as appropriate); and  
486 (d) in the United States – the U.S. Department of Transportation.
- 487 42. For advice on matters relating to the transport of radioactive materials you  
488 should consult a Competent Authority listed in Annex A.

489 **Notification of an Incident**

- 490 43. Any incident that involves damage to a package containing radioactive  
491 material is to be reported as soon as practicable to the Competent Authority  
492 in whose jurisdiction the incident occurred. Relevant State or Territory  
493 emergency services should be contacted in accordance with the emergency  
494 response arrangements of the given jurisdiction. See Chapter 8 of the  
495 document emergency procedures.  
496

497 **6. Special Requirements for Various Modes of**  
498 **Transport**

499 **Transport by Sea**

500 44. The handling and carriage of radioactive materials in Australian ports for  
501 international and interstate transportation is regulated by the *Navigation*  
502 *(Cargo – Hazards Prevention) Regulations* and the *Navigation (Dangerous*  
503 *Goods) Regulations* 1979. These Regulations invoke the *International*  
504 *Maritime Dangerous Goods Code* (the IMDG Code) with the Australian  
505 Supplement. The provisions of the IAEA Regulations are incorporated in the  
506 IMDG Code.

507 45. For intrastate voyages of radioactive materials the regulations to be taken  
508 into consideration are the appropriate State/N.T. legislation together with  
509 the ARPANSA Transport Code. The applicable Competent Authorities when  
510 undertaking such voyages are listed in Annex A of this Safety Guide.

511  
512 The IMDG Code is available from:  
513 Hunter Publications,  
514 58A Gipps Street,  
515 **COLLINGWOOD VIC 3066**

516  
517 Radioactive substances (as they are termed in the IMDG Code) are dealt with  
518 under Class 7 and have been classified into 12 groups. Each group comprises  
519 a different type of consignment and has its own Schedule of Requirements  
520 for sea transport. The grouping is identical to that in the IAEA Regulations.

521 46. The documentation accompanying a consignment of radioactive material,  
522 other than an excepted package, presented for shipment will include a  
523 Consignor's Certificate (Shipper's Certificate). On this certificate the  
524 IAEA/IMDG Schedule number of the consignment is recorded and with this  
525 information reference may be made to the IMDG Code for all requirements.

526 47. The Competent Authority for international and interstate sea transportation  
527 of radioactive materials is AMSA. Addresses and telephone numbers for the  
528 purpose of notification, and for use in the event of any incident or  
529 emergency, are given in Chapter 8. Information on the carriage of  
530 radioactive materials and advice on the interpretation of Codes and  
531 Regulations is available at any Marine Survey Office of AMSA in the capital  
532 cities.

533 **Transport by Air**

534 48. The Australian requirements for the consigning and carriage of radioactive  
535 materials by air are specified in s.23 (Dangerous Goods) of the *Civil Aviation*  
536 *Act 1988* (CAA) and Part 92 (Consignment and carriage of dangerous goods  
537 by air) of the *Civil Aviation Safety Regulation 1998* (CASR).

538 49. Both s.23 of the CAA and Part 92 of the CASR specify the requirements for  
539 consignors (Shippers) and air carriers of dangerous goods (Operators).

- 540 50. s.23 of the CAA and Part 92 of the CASR mandate for the use of the ICAO  
541 *Technical Instructions For The Safe Transport Of Dangerous Goods By Air*  
542 effective at the time the goods are consigned for carriage by air for the  
543 technical requirements. The ICAO Technical Instructions are re-issued at 2  
544 yearly intervals. Part 92 of the CASR makes provision for the use of the  
545 current IATA Dangerous Goods Regulations as an equivalent to the ICAO  
546 Technical Instructions however, the ICAO Technical Instructions is the  
547 authoritative legal document.
- 548 51. If an item is listed in the ICAO Technical Instructions or IATA Dangerous  
549 Goods Regulations as FORBIDDEN for air transport then special permission  
550 for such transport is required. Initial inquiries should be made with CASA.  
551 See Annex A for contact details.
- 552 52. For practical purposes, the requirements of the ICAO Technical Instructions  
553 (and the IATA Dangerous Goods Regulations) reflect the requirements of the  
554 2005 IAEA Regulations for transportation of radioactive materials.
- 555 53. Consignors of radioactive material for transport by air should initially contact  
556 their airline to establish the relevant requirements. Two copies of a  
557 Dangerous Goods Transport Document form will need to be completed and  
558 presented with the goods when the consignment is lodged with the airline.  
559 The Dangerous Goods Transport Document requirements for air transport  
560 differs from the other modes. Attention to detail is essential if delays in  
561 transit or at destination airports are to be avoided.
- 562 54. There is also a mandatory training requirement in relation to consignors  
563 (shippers) of dangerous goods, including radioactive materials, by air. Details  
564 of the training requirements are available from the CASA web site at:  
565 [www.casa.gov.au](http://www.casa.gov.au).
- 566 55. The ICAO Technical Instructions for the Safe Transport of Dangerous Goods  
567 by Air, DOC9284, is available for purchase from:  
568 Attention: Document Sales Unit  
569 International Civil Aviation Organization  
570 999 University Street  
571 **MONTREAL QUEBEC CANADA H3C 5H7**  
572 Telephone: +1-514-954-8022
- 573 Or online at [www.icao.int](http://www.icao.int)
- 574 **NB:** The ICAO Technical Instructions also has a supplement covering  
575 transport of dangerous goods that are otherwise forbidden in air transport.  
576 The details in the supplement are not reproduced in the IATA Dangerous  
577 Goods Regulations.
- 578 56. The IATA Dangerous Goods Regulations are available for purchase from:  
579 Australian Federation of International Forwarders  
580 Telephone: +61-2-9314 3055
- 581 Or online at [www.afif.asn.au](http://www.afif.asn.au).

582 **Transport by Road and Rail**

583 57. Requirements for the transport of radioactive materials by road or rail are  
584 contained in the Code of Practice.

585 **58. Documentation Required:**

586 (1) Movement order or equivalent document such as waybill,  
587 consignment note, etc.

588 (2) Details of the consignment, including radionuclide, total activity and  
589 number of packages.

590 (3) Other than for an excepted package, a Consignor's Certificate  
591 (Shipper's Certificate):

592 A minimum of two copies is required. One for the carrier, and one,  
593 within a stout envelope, firmly fixed to the outside of the package for  
594 inspection in transit. Where more than one carrier is involved, it may  
595 be necessary for each such carrier to receive a copy of the Consignor's  
596 Certificate.

597 (4) Package certification as required.

598 (5) Special Form Certificate, if applicable, for sealed sources.

599 (6) Competent Authority Approval as required.

600 (7) Information for carriers:

601 (a) any supplementary operational requirements for loading,  
602 transport, storage (away from persons and films and for safe  
603 dissipation of heat), unloading and handling, or a statement  
604 that no supplementary operational requirements are necessary;  
605 and

606 (b) emergency arrangements specific to the package.

607 **59. Loading Procedures:**

608 (1) Restrictions on loading need to be observed in relation to separation  
609 from flammable and dangerous goods, foodstuffs, films, livestock and  
610 personnel.

611 (2) Any special conditions applying to an exclusive use shipment should  
612 be determined from the Transport Code.

613 **60. Trans-shipment and Storage of Load:**

614 (1) **Trans-shipment:** At the time of transfer of the load all  
615 documentation relating to the consignment should be handed to a  
616 person responsible for the next stage of the journey. All carriers  
617 should be aware of the limitations on mixed loading of vehicles, and  
618 limits on radiation levels – do not load packages with transport  
619 indexes that add up to more than 50 for any one load.

620 (2) **Storage:** Radioactive material should be stored in secure areas with  
621 restricted access and should not be stored with flammable or other  
622 dangerous material, foodstuffs, livestock, films, etc. Limits on total

623 radiation levels in storage will need to be observed – do not store  
624 packages with transport indexes that add up to more than 50 at any  
625 one location. Where a package gives off significant heat, the storage  
626 arrangements should provide for safe dissipation of the heat.

627 **61. Decontamination of packages and conveyances:**

628 (1) The Code requires that the non-fixed contamination on the external  
629 surfaces of any package or on the external and internal surfaces of any  
630 overpack, freight container, tank, intermediate bulk container or  
631 conveyance does not exceed:

632 (a) 4 Bq/cm<sup>2</sup> for beta, gamma and low toxicity alpha emitters; and

633 (b) 0.4 Bq/cm<sup>2</sup> for all other alpha emitters.

634 (2) The Code defines each of these items although there has, in the past,  
635 been some confusion as to what “conveyance” actually covers. For  
636 road and rail transport, the definition of conveyance is *any vehicle*.  
637 Vehicle in this context is, however, only intended to cover vehicles  
638 used to transport radioactive material and not those vehicles owned  
639 by employees of the transporting company unless those vehicles are,  
640 in turn, actually used to transport radioactive material.  
641

642 **7. Check List For Consignors, Carriers And**  
643 **Consignees**

644 62. The following check list is provided for consignors and carriers preparing or  
645 receiving radioactive materials for transport. It should also be used by the  
646 consignees, where appropriate, when receiving a shipment of radioactive  
647 materials. Tick off each item as checked.

648 63. **Waybill or Consignment Note:**

649 Check: (1) consignor's name and address present;  
650 (2) consignee's name and address present;  
651 (3) name and symbol of the radioactive material present;  
652 (4) category of package(s) radiation level e.g. excepted,  
653 I-White, II-Yellow, III-Yellow, etc.; and  
654 (5) number of package(s) present.

655 64. **Packages:**

656 Check: (1) correct number of packages present and are correct size  
657 and weight;  
658 (2) packages in good condition and seals intact;  
659 (3) labels agree with Consignor's Certificate (Shipper's  
660 Certificate);  
661 (4) information on transport index, radioactive material,  
662 and activity given on the package label agree with the  
663 Consignor's Certificate (Shipper's Certificate);  
664 (5) a package containing liquid should have "THIS SIDE  
665 UP" label; and  
666 (6) the class of the package(s) marked e.g. TYPE A, B as  
667 appropriate.

668 65. **Consignor's Certificate - (sometimes called Shipper's Certificate):**

669 Check: (1) contents are properly described by name and are  
670 properly packaged, marked and labelled in accordance  
671 with IAEA Regulations;  
672 (2) it is in duplicate and in English;  
673 (3) the name of the radioactive material is shown;  
674 (4) chemical and physical forms are shown;  
675 (5) total activity is shown;  
676 (6) number of packages is shown;  
677 (7) the transport index is shown – does this entail  
678 restrictions on loading?  
679 (8) full name and address of consignor is shown;  
680 (9) full name and address of consignee is shown;  
681 (10) is the package TYPE A or TYPE B?  
682 (a) If TYPE B(U), that the certificate number is shown.  
683 (b) If TYPE B(U), that the certificate is present (if  
684 required);  
685 (11) a copy of the special form material certificate is present;  
686 (12) is a certificate for fissile material required? – if yes, check  
687 that it is present;

688  
689  
690  
691  
692

- (13) does the shipment require a special export permit or other Government approval for transport? – if yes, check that this is present and' correct; and
- (14) the transport certificate: is correctly signed by the consignor (shipper).

693 **8. Emergency Procedures**

694 66. Before undertaking the carriage of radioactive materials, all persons involved  
695 should be aware of the procedures to be followed in the event of a transport  
696 incident causing damage to a package containing radioactive material. They  
697 should ensure that the emergency plans appropriate to the risks associated  
698 with each shipment of radioactive materials are available. The appropriate  
699 Competent Authority should be consulted on particular requirements.

700 67. The carrier (or persons involved) should be aware of the name and telephone  
701 number of each Competent Authority through whose jurisdiction the  
702 shipment will pass and, in the event of an incident involving the package(s),  
703 the appropriate Competent Authority should be contacted as soon as  
704 practicable. Relevant State or Territory emergency services should be  
705 contacted in accordance with the emergency response arrangements of the  
706 given jurisdiction. If the incident occurs after hours, the local police should  
707 be contacted immediately.

708 68. A carrier involved in an incident that results in significant damage to a  
709 package should carry out at least the following basic actions:

710 (a) rescue injured persons and administer first aid (and advise ambulance  
711 and hospital personnel of the need for assistance and of possible  
712 radioactive contamination – protective clothing may be needed for  
713 rescuers in some cases);

714 (b) do not, under any circumstances, attempt to clean up or in any way  
715 handle broken package(s) or materials or remove the spilt material,  
716 packaging or wrapping;

717 (c) evacuate the area (stay upwind and at least 3 m distant) and isolate  
718 the area by erecting barriers or otherwise preventing access by  
719 unauthorised persons;

720 (d) call the police and have them advise the Competent Authority, or  
721 advise the Competent Authority direct, as soon as possible giving  
722 details (from the Consignor's Certificate – sometimes called the  
723 Shipper's Certificate) of the radioactive material being transported  
724 and follow any instructions subsequently issued;

725 (e) identify persons, vehicles and equipment which may have been  
726 contaminated or exposed to radiation and ensure that they remain in  
727 the vicinity for examination;

728 (f) stand by until the arrival of a responsible officer and provide him with  
729 all the available information as to the type of radionuclide and the  
730 activity (e.g. caesium-137 – activity 7.4 GBq). All relevant transport  
731 documents should be made available to the responsible officer; and

732 (g) ensure that persons suspected of being contaminated thoroughly wash  
733 their bodies, and inform a responsible officer that some  
734 contamination of persons may have occurred. Contamination arises  
735 from contact between clothing (or a part of the body) and a substance  
736 assumed to be the result of a spillage from a package. Place clothing

737  
738

known or assumed to be contaminated in plastic bags for decontamination or safe disposal.

739 **9. Schedules summarising the requirements for**  
740 **particular kinds of material and packages**

741 69. The Schedules in this Safety Guide are provided as an aid to users of the  
742 Transport Code, but it is important to note that they do not contain any  
743 additional requirements. They are intended to summarise the requirements  
744 in the Transport Code and also provide references to the relevant detailed  
745 provisions of the Transport Code to enable these to be consulted where  
746 necessary. The use of the words “must” and “shall” is purely to reflect the  
747 requirements contained in the Transport Code.

748 70. Consignments have been grouped into 15 Schedules (see Table 1 below,  
749 which also includes UN Numbers for each packaging type), each of which  
750 sets out particular requirements for packaging and documentation according  
751 to the amount of activity to be transported. The Schedules are included in  
752 this Safety Guide.

**TABLE 1 – Schedules in this Safety Guide**

<b>Schedule No.</b>	<b>Description of Material</b>	<b>UN Number</b>
Common provisions for Schedules 1-4		
<b>1</b>	Limited quantities of radioactive material in excepted packages	<b>2910</b>
<b>2</b>	Instruments and articles in excepted packages	<b>2911</b>
<b>3</b>	Articles manufactured from natural uranium, depleted uranium or natural thorium as excepted packages	<b>2909</b>
<b>4</b>	Empty packagings as excepted packages	<b>2908</b>
Common provisions for Schedules 5-14		
<b>5</b>	Low Specific Activity material (LSA-I)	<b>2912 or 2978 (as applicable)</b>
<b>6</b>	Low Specific Activity material (LSA-II)	<b>2977, 2978, 3321 or 3324 (as applicable)</b>
<b>7</b>	Low Specific Activity material (LSA-III)	<b>2977, 2978, 3322 or 3325 (as applicable)</b>
<b>8</b>	Surface Contaminated Objects (SCO-I and SCO-II)	<b>2913 or 3326 (as applicable)</b>
<b>9</b>	Material in Type A packages	<b>2915, 2977, 2978, 3327, 3332 or 3333 (as applicable)</b>
<b>10</b>	Material in Type B(U) packages	<b>2916 or 3328 (as applicable)</b>
<b>11</b>	Material in Type B(M) packages	<b>2917 or 3329 (as applicable)</b>
<b>12</b>	Material in Type C packages	<b>3323 or 3330 (as applicable)</b>
<b>13</b>	Fissile material	<b>2977, 3324, 3325, 3326, 3327, 3328, 3329, 3330, 3331 or 3333 (as applicable)</b>
<b>14</b>	Material transported under special arrangement	<b>2919 or 3331 (as applicable)</b>
<b>15</b>	Summary of Approval and Prior Notification Requirements	–

- 753 71. Provisions that are common to most, but not necessarily all, of Schedules 1  
754 to 4 are provided before those Schedules as “Common Provisions for  
755 Schedules 1–4”.
- 756 72. Similarly, provisions that are common to most, but not necessarily all, of  
757 Schedules 5 to 14 are provided before those Schedules as “Common  
758 Provisions for Schedules 5–14”.
- 759 73. Each Schedule contains further information than that covered in the  
760 “Common Provisions” as applicable to each transport type.
- 761 74. If there are any discrepancies between the Transport Code and the  
762 information contained in this Safety Guide, including the Schedules, the  
763 requirements in the Transport Code apply.

## 764 **Common Provisions For Schedules 1–4**

### 765 **1. Materials**

766 Competent Authority approval will be required for the calculation of radionuclide values that  
767 are not listed in Table 1 of the Transport Code. Alternately, the radionuclide values in Table  
768 2 of the Transport Code may be used without obtaining Competent Authority approval.

769 The contents of uranium hexafluoride in an excepted package is restricted to less than 0.1 kg.

### 770 **2. Packaging/Package**

771 Although excepted packages do not require Competent Authority approval, the consignor  
772 will need to be prepared to demonstrate the compliance of the package design with all the  
773 applicable requirements to the relevant Competent Authority.

### 774 **3. Maximum Radiation Levels**

775 5 µSv/h at the surface of a package.

### 776 **4. Contamination**

777 Non-fixed contamination on the external surfaces of excepted packages and on the internal  
778 and external surfaces of overpacks, freight containers, tanks, intermediate bulk containers  
779 and conveyances need to be kept as low as practicable and not exceed the following limits:

780 (a) beta, gamma and low toxicity alpha emitters: 4 Bq/cm<sup>2</sup>; and

781 (b) all other alpha emitters: 0.4 Bq/cm<sup>2</sup>.

### 782 **5. Decontamination**

783 A conveyance and equipment used regularly for the transport of radioactive material needs  
784 to be periodically checked to determine the level of contamination (paragraph 509 of the  
785 Code). The frequency of such checks will be related to the likelihood of contamination and  
786 the extent to which radioactive material is transported.

787 Conveyances, equipment or parts thereof that have become contaminated above the limits  
788 outlined in 4 above, or which show a surface radiation level in excess of 5 µSv/h in the course  
789 of transport of the specified type of radioactive material consignment, will need to be  
790 decontaminated as soon as possible, and in any case before reuse:

- 791 • to levels not exceeding those specified above; and
- 792 • so that the resulting surface radiation level after decontamination does not exceed  
793 5 µSv/h.

794 Tanks and intermediate bulk containers used for the transport of radioactive material must  
795 not be used for storage or transport of other goods, unless decontaminated below one tenth  
796 of the levels specified above.

### 797 **6. Loading and Segregation**

798 There are no specific provisions. If however, permitted dangerous goods that are not  
799 radioactive are also on board (mixed load), segregation rules may apply.

### 800 **7. Labelling and Marking**

801 Packages containing materials having additional dangerous properties will need to be  
802 labelled as required by the Australian Dangerous Goods Code.

803 Packages with a gross mass exceeding 50 kg will need to be legibly and durably marked on  
804 the outside of the packaging with their permissible gross mass.

805 **8. Placarding**

806 None required for radioactive nature of contents. Placards may be required for other  
807 dangerous properties of contents.

808 **9. Transport documents**

809 See appropriate Schedule.

810 **10. Mixed Contents and Carriage**

811 No specific provisions.

812 **11. Other provisions**

813 Other dangerous properties of contents and transport with other dangerous goods — clause  
814 2.3 and para 507.

815 General provisions for radiation protection — see paras 301–303.

816 Incident provisions — see paras 304 and 305.

817 Quality assurance — see para. 306.

818 Compliance assurance — see para. 307 and 308.

819 Damaged or leaking packages — see para. 511.

820 Customs — see para. 582.

821 Undeliverable packages — see para. 583.

822 Shipment of radioactive material by post is not permitted under Australian Postal  
823 requirements.

824 **Schedule 1. Limited Quantities of Radioactive Material in**  
 825 **Excepted Packages**

<b>UN Number</b>
2910

826 Limited quantities of radioactive material, in forms other than manufactured instruments  
 827 and articles, which represent a very limited radiological risk may be transported in excepted  
 828 packages. In addition to the requirements specified in the Common Provisions, the  
 829 following criteria apply:

830 **1. Materials**

831 **Non-fissile radioactive material:** the amounts cannot exceed the appropriate limits in  
 832 Column 2 specified in Table S1.1 below.

833 **Fissile material:**

- 834 • the amounts cannot exceed the appropriate limits specified in Table S1.1 below; and
- 835 • additionally, satisfying with regard to amounts, form and packaging the requirements  
 836 of the Transport Code allowing them to be regulated as fissile-excepted packages.

**Table S1.1. Activity Limits in Terms of  $A_1$  and  $A_2$  Values for Excepted Packages  
 Containing Radioactive Material<sup>a,b</sup>**

Physical state of contents	Package limits
Solids	
special form	$10^{-3} A_1$
other forms	$10^{-3} A_2$
Liquids	$10^{-4} A_2$
Gases	
Tritium	$2 \times 10^{-2} A_2$
special form	$10^{-3} A_1$
other forms	$10^{-3} A_2$

837 <sup>a</sup> For specific values of  $A_1$  and  $A_2$  see Tables 1 and 2 of the Transport Code.

838 <sup>b</sup> For mixtures of radionuclides the methods for defining  $A_1$  and  $A_2$  are provided in paras 404–406.

839 **2. Packaging/Package**

840 Paras 515 and 620 of the Transport Code apply.

841 **3. Labelling and Marking**

842 Packages will need to bear the marking “RADIOACTIVE” on an internal surface in such a  
 843 manner that a warning of the presence of radioactive material is visible on opening the  
 844 package.

845 All packages shall be legibly and durably marked on the outside of the packaging with an  
 846 identification of either the consignor or consignee and bear the mark “UN 2910”.

847 **4. Transport Documents**

848 Packages shall be described in the transport documents as “UN 2910”.

849 **5. Storage, Dispatch and Carriage**

850 There are no specific provisions.

851 **Schedule 2. Instruments or Articles in Excepted Packages**

<b>UN Number</b>
2911

852

853 Specified quantities of radioactive material, that are enclosed in or form a component of an  
 854 instrument or other manufactured article, and which represent a very limited radiological  
 855 risk, may be transported in excepted packages. In addition to the requirements specified in  
 856 the Common Provisions, the following criteria apply:

857 **1. Materials**

858 Instruments and manufactured articles such as clocks, electronic tubes or apparatus having  
 859 as a component part radioactive material in amounts not exceeding the appropriate limits.

860 The radiation level at 10 cm from the external surface of any unpackaged instrument or  
 861 article cannot exceed 0.1 mSv/h.

862 Instruments and manufactured articles containing fissile material in amounts not exceeding  
 863 the appropriate limits specified in Table S2.1 below and, in addition, satisfying with regard to  
 864 amounts, form and packaging the requirements of the Transport Code allowing them to be  
 865 regulated as fissile-excepted packages.

**Table S2.1. Activity Limits in Terms of A<sub>1</sub> and A<sub>2</sub> Values for Excepted Packages Containing Instruments or Articles<sub>a,b</sub>**

Physical state of contents	Item limits	Package limits
Solids		
special form	$10^{-2} A_1$	$A_1$
other forms	$10^{-2} A_2$	$A_2$
Liquids	$10^{-3} A_2$	$10^{-1} A_2$
Gases		
Tritium	$2 \times 10^{-2} A_2$	$2 \times 10^{-1} A_2$
special form	$10^{-3} A_1$	$10^{-2} A_1$
other forms	$10^{-3} A_2$	$10^{-2} A_2$

866 <sup>a</sup> For specific values of A<sub>1</sub> and A<sub>2</sub> see Tables 1 and 2 of the Transport Code.

867 <sup>b</sup> For mixtures of radionuclides the methods for defining A<sub>1</sub> and A<sub>2</sub> are provided in paras 404–406 of the  
 868 Transport Code.

869

870 **2. Packaging/Package**

871 Paras 515 and 620 of the Transport Code apply.

872 **3. Labelling and Marking**

873 Instruments and articles — each instrument or article (except radioluminescent time pieces)  
 874 shall bear the marking “Radioactive”.

875 All packages must be legibly and durably marked on the outside of the packaging with:

- 876 • an identification of either the consignor or consignee; and
- 877 • the mark “UN 2911”.

878 **4. Transport Documents**

879 Packages will be described in the transport documents as “UN 2911”.

880 **5. Mixed Contents, Loading and Segregation Storage, and Dispatch, and**  
881 **Carriage**

882 There are no specific provisions.

883 **Schedule 3. Articles Manufactured from Natural Uranium,**  
884 **Depleted Uranium or Natural Thorium as**  
885 **Excepted Packages**

<b>UN Number</b>
2909

886  
887 Articles manufactured of natural uranium, depleted uranium or natural thorium, which  
888 represent a very limited radiological risk, may be transported in or as excepted packages. In  
889 addition to the requirements specified in the Common Provisions, the following criteria  
890 apply:

891 **1. Materials**

892 Manufactured articles in which the sole radioactive material is natural uranium or depleted  
893 uranium or natural thorium. Such articles may be unused, empty packagings intended for  
894 the transport of radioactive material.

895 **2. Packaging/Package**

896 The package shall meet the requirements specified in paras 515 and 620.

897 Transport of unpackaged articles manufactured of natural uranium, depleted uranium or  
898 natural thorium is allowed if the article itself qualifies as an excepted package and the outer  
899 surface of the uranium or thorium is enclosed in an inactive sheath made of metal or some  
900 other substantial material.

901 **3. Labelling and Marking**

902 All packages shall be legibly and durably marked on the outside of the packaging with an  
903 identification of either the consignor or consignee. Packages shall bear the mark “UN 2909”.

904 **4. Transport Documents**

905 Packages shall be described in the transport documents as “UN 2909”.

906 **5. Mixed Contents, Loading and Segregation, Storage and Dispatch, and**  
907 **Carriage**

908 There are no specific provisions.

909 **Schedule 4. Empty Packagings as Excepted Packages**

<b>UN Number</b>
2908

910  
911 Empty packagings which have contained radioactive material and which represent a very  
912 limited radiological risk may be transported as excepted packages. In addition to the  
913 requirements specified in the Common Provisions, the following criteria apply:

914 **1. Materials**

915 Empty packagings which have previously contained radioactive material.

916 The internal non-fixed contamination levels shall not exceed one hundred times the  
917 contamination levels specified in the Common Provisions.

918 **2. Packaging/Package**

919 The package must meet the requirements specified in paras 515 and 620.

920 The packaging must be in a well maintained condition and securely closed.

921 If the empty packaging includes any uranium or thorium in its structure, the outer surface of  
922 the uranium or thorium must be covered with an inactive sheath made of metal or some  
923 other substantial material.

924 **3. Decontamination**

925 In addition, an empty tank or intermediate bulk container which has been used for the  
926 transport of radioactive material may be transported as an excepted package but shall not be  
927 used for the storage or transport of other goods unless decontaminated below one tenth of  
928 the levels specified in the Common Provisions.

929 **4. Labelling and Marking**

930 For all packages, any labels which related to the previously contained radioactive contents  
931 shall be removed or covered.

932 All packages shall be legibly and durably marked on the outside of the packaging with an  
933 identification of either the consignor or consignee. Packages shall bear the mark "UN 2908".

934 **5. Transport Documents**

935 Packages shall be described in the transport documents as "UN 2908".

936 **6. Mixed Contents, Loading and Segregation, Storage and Dispatch, and**  
937 **Carriage**

938 There are no specific provisions.

## 939 **Common Provisions For Schedules 5–14**

### 940 **1. Materials**

941 Competent Authority approval shall be required for the calculation of radionuclide values  
942 that are not listed in Table 1 of the Transport Code. Alternately, the radionuclide values in  
943 Table 2 of the Transport Code may be used without obtaining Competent Authority approval.

### 944 **2. Packaging/Package**

945 The smallest overall external dimension of the package shall not be less than 10 cm.

946 The transitional arrangements for package designs that did not require approval of design by  
947 the Competent Authority and which meet the requirements of the 1985 or 1985 (As Amended  
948 1990) Editions of the IAEA Regulations<sup>9</sup> are detailed in para. 815.

949 The transitional arrangements for packagings manufactured to a package design approved  
950 by the Competent Authority under the provisions of the 1973 or 1973 (As Amended) Editions  
951 of the IAEA Regulations<sup>10</sup> are detailed in para. 816.

952 The transitional arrangements for packagings manufactured to a package design approved  
953 by the Competent Authority under the provisions of the 1985 or 1985 (As Amended 1990)  
954 Editions of the IAEA Regulations are detailed in para. 817.

### 955 **3. Maximum Radiation Levels**

956 Radiation level limits for packages or overpacks are:

- 957 (i) 0.1 mSv/h at 1 m from the external surfaces of the package or overpack,  
958 except when transported under exclusive use, and
- 959 (ii) 2 mSv/h on any external surface of the package or overpack, except when  
960 transported under exclusive use by rail or by road, or under exclusive use and  
961 special arrangement by vessel or by air, and
- 962 (iii) 10 mSv/h on any external surface of a package transported under exclusive  
963 use.

964 The radiation levels at any point on the external surface of packages or overpacks  
965 transported under exclusive use by rail or road may only exceed 2 mSv/h provided that:

- 966 (i) The vehicle is equipped with an enclosure which prevents unauthorised access  
967 during transport;
- 968 (ii) The package or overpack is secured to retain its position within the enclosure  
969 during routine transport; and
- 970 (iii) There are no loading or unloading operations between the beginning and end  
971 of the shipment.

972 Surface radiation levels for road or rail vehicles under exclusive use, at any point on the  
973 outer surfaces of the vehicle, including the upper and lower surfaces, or, in the case of an  
974 open vehicle, at any point on the vertical planes projected from the outer edges of the  
975 vehicle, on the upper surface of the load, and on the lower external surface of the vehicle  
976 shall not exceed 2 mSv/h.

977 Radiation levels for road or rail vehicles under exclusive use shall not exceed 0.1 mSv/h at  
978 any point 2 m from the vertical planes represented by the outer lateral surfaces of the

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<sup>9</sup> These IAEA Regulations were incorporated into the *Code of Practice for the Safe Transport of Radioactive Substances 1990*.

<sup>10</sup> These IAEA Regulations were incorporated into the *Code of Practice for the Safe Transport of Radioactive Substances 1982*.

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979 vehicle, or, if the load is transported in an open vehicle, at any point 2 m from the vertical  
980 planes projected from the outer edges of the vehicle.

981 Packages or overpacks that have a surface radiation level greater than 2 mSv/h, unless they  
982 are being carried in or on a vehicle under exclusive use in accordance with footnote (a) of  
983 Table 9 of the Transport Code, shall not be transported by vessel except under special  
984 arrangement.

985 Loading of freight containers and the accumulation of packages, overpacks and freight  
986 containers aboard a single conveyance shall be such that the radiation level under routine  
987 conditions of transport shall not exceed 2 mSv/h at any point on, and 0.1 mSv/h at 2 m from,  
988 the external surface of the conveyance.

989 Packages or overpacks having a surface radiation level greater than 2 mSv/h shall not be  
990 transported by air except by special arrangement.

#### 991 **4. Contamination**

992 Non-fixed contamination on external surfaces of packages, and on the internal and external  
993 surfaces of overpacks, freight containers, tanks, intermediate bulk containers and  
994 conveyances, shall be kept as low as practicable and shall not exceed the following limits:

995 (a) For beta, gamma and low toxicity alpha emitters: 4 Bq/cm<sup>2</sup>;

996 (b) For all other alpha emitters: 0.4 Bq/cm<sup>2</sup>.

#### 997 **5. Decontamination**

998 A conveyance and equipment used regularly for the transport of radioactive material shall be  
999 periodically checked to determine the level of contamination. The frequency of such checks  
1000 shall be related to the likelihood of contamination and the extent to which radioactive  
1001 material is transported.

1002 Conveyances, equipment or parts thereof which have, in the course of transport of  
1003 radioactive material, become contaminated above the limits specified in Common Provision  
1004 4, or which show a radiation level in excess of 5 µSv/h at the surface, shall be  
1005 decontaminated as soon as possible by a qualified person and shall not be reused unless the  
1006 non-fixed contamination does not exceed the limits specified in Common Provision 4. In  
1007 addition, the radiation level resulting from the fixed contamination on surfaces after  
1008 decontamination shall be less than 5 µSv/h.

1009 An overpack, freight container, tank, intermediate bulk container or conveyance dedicated to  
1010 the transport of radioactive material or surface contaminated objects under exclusive use  
1011 may be excepted from the requirements specified in Common Provisions 4 and 5 solely with  
1012 regard to its internal surfaces and only for as long as it remains under that specific exclusive  
1013 use.

1014 Tanks and intermediate bulk containers used for the transport of radioactive material shall  
1015 not be used for storage or transport of other goods, unless decontaminated below one tenth  
1016 of the levels specified in Common Provision 4.

#### 1017 **6. Mixed Contents**

1018 A package shall not contain any other items except such articles and documents as are  
1019 necessary for the use of the radioactive material. The transport of such articles and  
1020 documents in a package with other items may be permitted provided that there is no  
1021 interaction between them and the packaging or its radioactive contents that would reduce  
1022 the safety of the package.

#### 1023 **7. Loading and Segregation**

1024 Except under the condition of exclusive use, loading of freight containers and the  
1025 accumulation of packages, overpacks and freight containers aboard a single conveyance shall  
1026 be so limited that the total sum of the transport indexes aboard the conveyance does not  
1027 exceed the values shown in Table 9 of the Transport Code.

1028 Where a consignment is transported under exclusive use, there shall be no limit on the sum  
1029 of the transport indexes aboard a single conveyance.

1030 Loading of freight containers and the accumulation of packages, overpacks and freight  
1031 containers aboard a single conveyance shall be such that the radiation level under routine  
1032 conditions of transport shall not exceed 2 mSv/h at any point on, and 0.1 mSv/h at 2 m from,  
1033 the external surface of the conveyance.

1034 Consignments shall be segregated from other dangerous goods during transport in  
1035 compliance with the relevant transport regulations. If the consignment is transported under  
1036 exclusive use the carriage of other goods is permitted provided the arrangements are  
1037 controlled only by the consignor and it is not prohibited by other regulations.

1038 Radioactive material shall be segregated from undeveloped photographic film so that the  
1039 radiation exposure of film due to the transport of radioactive material is limited to 0.1 mSv  
1040 per consignment of such film.

## 1041 **8. Labelling and Marking**

### 1042 *Packages:*

1043 (i) For all packages, any labels which do not relate to the radioactive contents shall be  
1044 removed or covered.

1045 (ii) Each package shall be legibly and durably marked on the outside of the packaging  
1046 with an identification of either the consignor or consignee, or both.

1047 (iii) Each label shall be marked with the maximum activity of the radioactive contents  
1048 during transport.

1049 (iv) Each YELLOW label shall be marked with the transport index of that package.

1050 (v) Packages with a gross mass exceeding 50 kg shall be durably and legibly marked  
1051 with their permissible gross mass on the outside of the packaging.

1052 (vi) Packages containing materials having additional dangerous properties (e.g.  
1053 uranium hexafluoride) shall also be labelled as required by the relevant transport  
1054 regulations.

### 1055 *Freight containers and overpacks:*

1056 (i) Except for mixed loads, each label shall be marked with the maximum activity of  
1057 the radioactive contents of the freight container or overpack during transport,  
1058 totalled for the entire contents. For mixed loads such entries may read "See  
1059 Transport Documents".

1060 (ii) Each YELLOW label shall be marked with the transport index (TI) for that loaded  
1061 freight container or overpack.

1062 (iii) Freight containers and overpacks containing materials having additional  
1063 dangerous properties (e.g. uranium hexafluoride) shall also be labelled as required  
1064 by the relevant transport regulations.

## 1065 **9. Placarding**

1066 Large freight containers and tanks shall bear four placards. The placards shall be affixed in a  
1067 vertical orientation to the two external side walls and the two external end walls of a freight  
1068 container or tank.

1069 As an alternative to the use of placards on large freight containers and tanks, enlarged labels  
1070 are permitted.

1071 Placards shall be affixed in a vertical orientation to the two external lateral walls of a rail  
1072 vehicle.

1073 Placards shall be affixed in a vertical orientation to the two external lateral walls and the  
1074 external rear wall of a road vehicle.

1075 Placards may be required for other dangerous properties of the contents.

1076 Any placards which do not relate to the radioactive contents shall be removed.

## 1077 **10. Transport Documents**

1078 For a summary of the approval and notification requirements, see Schedule 15.

1079 The transport documents shall include the relevant particulars of the consignment, paras  
1080 550–554, and information for carriers, paras 556 and 557.

## 1081 **11. Storage and Dispatch**

1082 Segregation during storage in transit is required from other dangerous goods, and from  
1083 persons and undeveloped photographic films and plates.

1084 Provided that its average surface heat flux does not exceed 15 W/m<sup>2</sup> and that the  
1085 immediately surrounding cargo is not in sacks or bags, a package or overpack may be stored  
1086 among packaged general cargo without any special stowage provisions except as may be  
1087 specifically required by the Competent Authority in an applicable approval certificate.

## 1088 **12. Carriage**

1089 Category II-YELLOW or III-YELLOW packages or overpacks shall not be carried in  
1090 compartments occupied by passengers, except those exclusively reserved for couriers  
1091 specially authorised to accompany such packages or overpacks.

1092 Any package or overpack having a transport index greater than 10 shall be transported only  
1093 under exclusive use.

1094 *For transport by air:*

1095 (i) Vented Type B(M) packages, packages which require external cooling by an  
1096 ancillary cooling system, packages subject to operational controls during  
1097 transport and packages containing liquid pyrophoric materials are prohibited.

1098 (ii) Type B(M) packages and consignments under exclusive use are prohibited on  
1099 passenger aircraft.

1100 *For transport by road*, no persons other than the driver and assistants shall be permitted in  
1101 vehicles carrying packages, overpacks or freight containers bearing category II-YELLOW or  
1102 III-YELLOW labels.

1103 Transport of consignments by special use vessel, dedicated to the purpose of carrying  
1104 radioactive material, may be excepted from the requirements specified in para. 567 provided  
1105 that:

1106 (i) A radiation protection programme for the shipment shall be approved by the  
1107 Competent Authority of the flag state of the vessel and, when requested, by  
1108 the Competent Authority at each port of call;

1109 (ii) Stowage arrangements shall be predetermined for the whole voyage including  
1110 any consignments to be loaded at ports of call en route; and

1111 (iii) The loading, carriage and the unloading of the consignments shall be  
1112 supervised by persons qualified in the transport of radioactive material.

1113 Transport by post is not permitted.

1114 **13. Other Provisions**

1115 Other dangerous properties of contents and transport with other dangerous goods — see  
1116 paras 109 and 507.

1117 General provisions for radiation protection — see paras 301–303, 308, 311 and 563.

1118 Incident provisions — see paras 304, 305 and 556(c).

1119 Quality assurance — see para. 306.

1120 Compliance assurance — see para. 307.

1121 Damaged or leaking packages — see paras 510 and 511.

1122 Determination of transport index — see paras 526 and 527.

1123 Determination of criticality safety index — see paras 528 and 529 (if applicable).

1124 Customs — see para. 582.

1125 Undeliverable packages — see para. 583.

1126 Shipment of radioactive material by post is not permitted under Australian Postal  
1127 requirements.

1128

1129 **Schedule 5. Low Specific Activity Material (LSA-I)**

<b>UN Number</b>
2912, 2978 as applicable

1130

1131 LSA-I is the first of three groups of radioactive material which, by its nature, has a limited  
1132 specific activity or for which limits of estimated average specific activity apply. Fissile  
1133 material may only be present in quantities excepted under para. 672.

1134 **1. Materials**

1135 LSA-I – Radioactive material meeting one of the following requirements:

- 1136 (i) Uranium and thorium ores and concentrates of such ores, and other ores  
1137 containing naturally occurring radionuclides which are intended to be processed  
1138 for the use of these radionuclides;
- 1139 (ii) Solid unirradiated natural uranium or depleted uranium or natural thorium or  
1140 their solid or liquid compounds or mixtures;
- 1141 (iii) Radioactive material for which the  $A_2$  value is unlimited, excluding fissile  
1142 material in quantities not excepted under para. 672; or
- 1143 (iv) Other radioactive material in which the activity is distributed throughout and the  
1144 estimated average specific activity does not exceed 30 times the values for  
1145 activity concentration specified in paras 401–406, excluding fissile material in  
1146 quantities not excepted under para. 672.

1147 **2. Packaging/Package**

1148 LSA-I material may be transported unpackaged if:

- 1149 (i) all material other than ores containing only naturally occurring radionuclides are  
1150 transported in such a manner that under routine conditions of transport there  
1151 will be no escape of the radioactive contents from the conveyance nor will there  
1152 be any loss of shielding, and
- 1153 (ii) it is transported in a conveyance under exclusive use.

1154 Packaged LSA-I material may be transported if:

- 1155 (i) the package meets the design requirements for a Type IP-1 (para. 621) or Type  
1156 IP-2 (para. 622) as appropriate for the physical form of the LSA-I. LSA-I shall be  
1157 packaged in Type IP-1 packages, except that liquid LSA-I, not transported under  
1158 exclusive use, shall be packaged in Type IP-2 packages; or
- 1159 (ii) the packaging meets one of the alternative requirements for tanks, freight  
1160 containers or intermediate bulk containers to be qualified as Type IP-2 as given  
1161 in paras 624–628; and
- 1162 (iii) in the case of uranium hexafluoride, the design satisfies the requirements of  
1163 paras 629–632.

1164 Except for packages containing 0.1 kg or more of uranium hexafluoride, package design  
1165 approval is not required. However, the consignor shall be prepared to demonstrate the  
1166 compliance of the package design with all the applicable requirements to the relevant  
1167 Competent Authority.

1168 Competent Authority approval of design is required for packages designed to contain 0.1 kg  
1169 or more of uranium hexafluoride according to paras 802 and 805.

1170 Packages designed according to the 1985 or 1985 (As Amended 1990) Editions of these  
1171 Regulations may be used provided they satisfy the transitional arrangements of Common  
1172 Provision 2.

### 1173 **3. Maximum Radiation Levels**

1174 The quantity of LSA-I in a single package shall be so restricted that the external radiation  
1175 level at 3 m from the unshielded material does not exceed 10 mSv/h.

### 1176 **4. Mixed Contents**

1177 The requirement in Common Provision 6 does not preclude the transport of LSA-I with other  
1178 items.

### 1179 **5. Loading and Segregation**

1180 For consignments of LSA-I material there is no limit on the sum of the transport indexes.

### 1181 **6. Labelling and Marking**

#### 1182 *Packages*

1183 (i) Completed WHITE or YELLOW labels with the radioactive contents described on  
1184 the label as “LSA-I”, shall be affixed externally to two opposite sides of the  
1185 package or overpack, or to all four sides of freight containers and tanks when  
1186 being used as packages.

1187 (ii) Packages shall bear the mark “UN 2912”, and the proper shipping name  
1188 “RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-I)”.

1189 If, however, the packages contain uranium hexafluoride, the packages contains  
1190 uranium hexafluoride, the package shall bear the mark “UN 2978” and the  
1191 proper shipping name “RADIOACTIVE MATERIAL, URANIUM  
1192 HEXAFLUORIDE”.

1193 (iii) Each package that conforms to a Type IP-1 or a Type IP-2 shall be marked with  
1194 “Type IP-1” or “Type IP-2”, as appropriate.

1195 (iv) Each package that conforms to a Type IP-2 shall be marked with the  
1196 international vehicle registration code of the country of origin of design and the  
1197 name of the manufacturers, or other identification of the packaging specified by  
1198 the Competent Authority.

1199 (v) Packages designed to contain more than 0.1 kg of uranium hexafluoride, and  
1200 approved to para. 805, shall be legibly and durably marked on the outside of the  
1201 packaging with both the identification mark allocated to the design by the  
1202 Competent Authority and a serial number to uniquely identify each packaging  
1203 which conforms to that design.

1204 (vi) Where LSA-I is contained in receptacles or wrapping materials and is  
1205 transported under exclusive use, the outer surface of these receptacles or  
1206 wrapping materials may bear the marking “RADIOACTIVE LSA-I”.

#### 1207 *Freight containers and overpacks:*

1208 Completed WHITE or YELLOW labels with the radioactive contents described  
1209 with the name of the radionuclide, or for mixtures the names of the most  
1210 restrictive radionuclides, followed by “LSA-I”, shall be affixed externally to all four  
1211 sides of freight containers, or to two opposite sides of overpacks.

### 1212 **7. Placarding**

1213 For unpackaged LSA-I in a freight container or tank, or where an exclusive use consignment  
1214 in a freight container is packaged LSA-I and no other UN Number commodities are present  
1215 in the freight container, the UN Number “2912” shall be displayed on all four sides of the  
1216 freight container or tank, either in the lower half of the placards, preceded by the letters  
1217 “UN”, or on the specially designed UN Number placards shown in the Transport Code.

1218 **8. Storage, Dispatch and Carriage**

1219 Transport of unpackaged LSA-I is only permitted under exclusive use.

1220 There is no limit on the total transport index.

1221 There is no limit on the total activity in a single conveyance.

1222 **Schedule 6. Low Specific Activity Material (LSA-II)**

UN Number
2977, 2978, 3321, 3324 as applicable

1223

1224 LSA-II is the second of three groups of radioactive material which, by its nature, has a  
1225 limited specific activity or for which limits of estimated average specific activity apply. If  
1226 fissile material is present, other than fissile material meeting one of the provisions of para.  
1227 672, the requirements of Schedule 13 shall be met in addition to the requirements  
1228 summarised in this Schedule.

1229 **1. Materials**

1230 LSA-II — Radioactive material meeting one of the following requirements:

- 1231 (i) Water with tritium concentration up to 0.8 TBq/L;
- 1232 (ii) Solids and gases with activity distributed throughout of not more than  $10^{-4}$  A<sub>2</sub>/g;  
1233 or
- 1234 (iii) Liquids with activity distributed throughout of not more than  $10^{-5}$  A<sub>2</sub>/g.

1235 **2. Packaging/Package**

1236 LSA-II must be transported in packagings that meets the design requirements for Type IP-2  
1237 or Type IP-3, as appropriate for the physical form of the LSA-II. LSA-II shall be packaged in  
1238 Type IP-2 packages, except that liquid and gaseous LSA-II, not transported under exclusive  
1239 use, shall be packaged in Type IP-3 packages.

1240 Alternate requirements for tanks, freight containers or intermediate bulk containers to be  
1241 qualified as Type IP-2 or Type IP-3 are given in paras 624–628.

1242 Uranium hexafluoride may be transported as LSA-II provided the package design satisfies  
1243 the requirements of paras 629–632.

1244 Except for packages containing 0.1 kg or more of uranium hexafluoride, or containing fissile  
1245 material in quantities not excepted under para. 672, package design approval is not required.  
1246 However, the consignor needs to be prepared to demonstrate the compliance of the package  
1247 design with all applicable requirements to the relevant Competent Authority.

1248 Competent Authority approval of design is required for packages designed to contain more  
1249 than 0.1 kg of uranium hexafluoride or fissile material in quantities not excepted under para.  
1250 672.

1251 Transitional arrangements for Type IP-2 and Type IP-3 packages designed to a previous  
1252 edition of the Transport Code:

- 1253 (i) Type IP-2 and Type IP-3 package designs approved to contain fissile material  
1254 shall satisfy the transitional arrangements of section 2 of the Common Provisions  
1255 on page 36 as appropriate.
- 1256 (ii) Other Type IP-2 and Type IP-3 package designs, which previously did not require  
1257 Competent Authority approval, shall satisfy the relevant transitional  
1258 arrangements of section 2 of the Common Provisions on page 36.

1259 For quantities exceeding 3000 A<sub>2</sub> and carried by air, the packaging shall meet the  
1260 requirements for a Type C package.

1261 **3. Maximum Radiation Levels**

1262 The quantity of LSA-II in a single package must be restricted so that the external radiation  
1263 level at 3 m from the unshielded material does not exceed 10 mSv/h.

#### 1264 **4. Mixed Contents**

1265 The requirements in section 6 of the Common Provisions do not preclude the transport of  
1266 LSA-II with other items.

#### 1267 **5. Loading and Segregation**

1268 The total activity in a single hold or compartment of an inland water craft, or in another  
1269 conveyance, for carriage of LSA-II shall not exceed the limits shown in Table 5 of the  
1270 Transport Code.

#### 1271 **6. Labelling and Marking**

##### 1272 *Packages*

1273 (i) Completed WHITE or YELLOW labels with the radioactive contents described on  
1274 the label “LSA-II” shall be affixed externally to two opposite sides of the package  
1275 or overpack, or to all four sides of freight containers and tanks when being used  
1276 as packages.

1277 (ii) Packages shall bear the mark:

1278 • “UN 3321” and the proper shipping name “RADIOACTIVE MATERIAL, LOW  
1279 SPECIFIC ACTIVITY (LSA-II)”, if either non-fissile or fissile-excepted  
1280 material; or

1281 • “UN 3324” and the proper shipping name “RADIOACTIVE MATERIAL, LOW  
1282 SPECIFIC ACTIVITY (LSA-II), FISSILE” for fissile material.

1283 If, however, the packages contain uranium hexafluoride, the packages shall bear  
1284 the mark:

1285 • “UN 2978” and the proper shipping name “RADIOACTIVE MATERIAL,  
1286 URANIUM HEXAFLUORIDE” for uranium hexafluoride that is non-fissile or  
1287 fissile-excepted material; or

1288 • “UN 2977” and the proper shipping name “RADIOACTIVE MATERIAL,  
1289 URANIUM HEXAFLUORIDE, FISSILE” for uranium hexafluoride that is  
1290 fissile material.

1291 (iii) Each package which conforms to a Type IP-2 or Type IP-3 shall be marked with  
1292 “Type IP-2” or “Type IP-3”, as appropriate.

1293 (iv) Each package which conforms to a Type IP-2 or Type IP-3 shall be marked with  
1294 the international vehicle registration code of the country of origin of design and  
1295 the name of the manufacturers, or other identification of the packaging specified  
1296 by the Competent Authority.

1297 (v) Packages designed to contain more than 0.1 kg of uranium hexafluoride shall be  
1298 legibly and durably marked on the outside of the packaging with both the  
1299 identification mark allocated to the design by the Competent Authority and a  
1300 serial number to uniquely identify each packaging which conforms to that design.

##### 1301 *Freight containers and overpacks:*

1302 (i) Completed WHITE or YELLOW labels with the radioactive contents described  
1303 with the name of the radionuclide, or for mixtures the names of the most  
1304 restrictive radionuclides, followed by “LSA-II”, shall be affixed externally to all  
1305 four sides of freight containers, or to two opposite sides of overpacks.

1306 (ii) Freight containers and overpacks carrying mixed loads are referred to Schedule  
1307 13 in the case where they contain packages which themselves contain fissile  
1308 material.

1309 **7. Placarding**

1310 Where an exclusive use consignment in a freight container is non-fissile or fissile-excepted  
1311 LSA-II and no other UN Number commodities are present in the freight container, “3321”  
1312 shall be displayed on all four sides of the freight container, either in the lower half of the  
1313 placards, preceded by the letters “UN”, or on the specially designed UN Number placards  
1314 shown in the Transport Code. In the case of fissile material transported as LSA-II, “3324”  
1315 shall be displayed on the placards.

1316 **8. Carriage**

1317 Transport of unpackaged LSA-II is not permitted.

1318 Total activity in a single conveyance shall not exceed the values specified in Table 5 of the  
1319 Transport Code.

1320 **Schedule 7. Low Specific Activity Material (LSA-III)**

UN Number
2977, 2978, 3322, 3325 as applicable

1321

1322 LSA-III is the third of three groups of radioactive material which, by its nature, has a limited  
1323 specific activity or for which limits of estimated average specific activity apply. If fissile  
1324 material is present, other than fissile material meeting one of the provisions of para. 672, the  
1325 requirements of Schedule 13 shall be met in addition to the requirements summarised in this  
1326 Schedule.

1327 **1. Materials**

1328 LSA-III — Solid radioactive material, excluding powders, meeting one of the following  
1329 requirements:

- 1330 (i) the radioactive material is distributed throughout a solid or collection of solid  
1331 objects, or is essentially uniformly distributed in a solid compact binding agent  
1332 (e.g. concrete, bitumen, ceramic);
- 1333 (ii) the radioactive material is relatively insoluble, or is intrinsically contained in a  
1334 relatively insoluble matrix; and
- 1335 (iii) the estimated average specific activity does not exceed  $2 \times 10^{-3} A_2/g$ .

1336 **2. Packaging/Package**

1337 LSA-III shall be transported in packagings.

1338 The packaging shall meet the design requirements for Type IP-2 if transported under  
1339 exclusive use, or Type IP-3 Table 4 of the Transport Code if not transported under exclusive  
1340 use.

1341 Alternative requirements for freight containers and intermediate bulk containers to be  
1342 qualified as Type IP-2 or Type IP-3 are given in paras 627–628.

1343 Uranium hexafluoride may be transported as LSA-III provided the design satisfies the  
1344 requirements of paras 629–632.

1345 Except for packages containing 0.1 kg or more of uranium hexafluoride, or containing fissile  
1346 material in quantities not excepted under para. 672, package design approval is not required.  
1347 However, the consignor shall be prepared to demonstrate the compliance of the package  
1348 design with all applicable requirements to the relevant Competent Authority.

1349 Competent Authority approval of design is required for packages designed to contain more  
1350 than 0.1 kg of uranium hexafluoride or fissile material in quantities not excepted under para.  
1351 672.

1352 Transitional arrangements for Type IP-2 and Type IP-3 packages designed to a previous  
1353 edition of these Regulations:

- 1354 (i) Type IP-2 and Type IP-3 package designs approved to contain fissile material  
1355 shall satisfy the transitional arrangements of section 2 of the Common Provisions  
1356 on page 36 as appropriate.
- 1357 (ii) Other Type IP-2 and Type IP-3 package designs, which previously did not require  
1358 Competent Authority approval, shall satisfy the appropriate transitional  
1359 arrangements of section 2 of the Common Provision.

1360 For quantities exceeding 3000  $A_2$  and carried by air, the packaging shall meet the  
1361 requirements for a Type C package.

1362 **3. Maximum Radiation Levels**

1363 The quantity of LSA-III in a single package shall be so restricted that the external radiation  
1364 level at 3 m from the unshielded material does not exceed 10 mSv/h.

1365 **4. Mixed Contents**

1366 The requirements in Common Provision 6 do not preclude the transport of LSA-III with  
1367 other items.

1368 **5. Loading and Segregation**

1369 The total activity in a single hold or compartment of an inland water craft, or in another  
1370 conveyance, for carriage of LSA-III shall not exceed the limits shown in Table 5 of the  
1371 Transport Code.

1372 **6. Labelling and Marking**

1373 *Packages*

1374 (i) Completed WHITE or YELLOW labels with the radioactive contents described on  
1375 the label with the name of the radionuclide, or for mixtures the names of the  
1376 most restrictive radionuclides, followed by "LSA-III", shall be affixed externally  
1377 to two opposite sides of the package, or to all four sides of freight containers  
1378 when being used as packages.

1379 (ii) Packages shall bear the mark:

- 1380 • "UN 3322" and the proper shipping name "RADIOACTIVE MATERIAL, LOW  
1381 SPECIFIC ACTIVITY (LSA-III)" if either non-fissile or fissile-excepted  
1382 material; or
- 1383 • "UN 3325" and the proper shipping name "RADIOACTIVE MATERIAL, LOW  
1384 SPECIFIC ACTIVITY (LSA-III), FISSILE" for fissile material.

1385 If, however, the packages contain uranium hexafluoride, the packages shall bear  
1386 the mark:

- 1387 • "UN 2978" and the proper shipping name "RADIOACTIVE MATERIAL,  
1388 URANIUM HEXAFLUORIDE" for non-fissile or fissile-excepted uranium  
1389 hexafluoride; or
- 1390 • "UN 2977" and the proper shipping name "RADIOACTIVE MATERIAL,  
1391 URANIUM HEXAFLUORIDE, FISSILE" for uranium hexafluoride that is  
1392 fissile material.

1393 (iii) Each package which conforms to a Type IP-2 or Type IP-3 shall be marked with  
1394 "Type IP-2" or "Type IP-3", as appropriate.

1395 (iv) Each package which conforms to a Type IP-2 or Type IP-3 shall be marked with  
1396 the international vehicle registration code of the country of origin of design and  
1397 the name of the manufacturers, or other identification of the packaging specified  
1398 by the Competent Authority.

1399 (v) Packages designed to contain more than 0.1 kg of uranium hexafluoride shall be  
1400 legibly and durably marked on the outside of the packaging with both the  
1401 identification mark allocated to the design by the Competent Authority and a  
1402 serial number to uniquely identify each packaging which conforms to that design.

1403 *Freight containers and overpacks:*

1404 (i) Completed WHITE or YELLOW labels with the radioactive contents described  
1405 with the name of the radionuclide, or for mixtures the names of the most

1406 restrictive radionuclides, followed by “LSA-III”, shall be affixed externally to all  
1407 four sides of freight containers, or to two opposite sides of overpacks.

1408 (ii) Freight containers and overpacks carrying mixed loads are referred to Schedule  
1409 13 in the case where they contain packages which themselves contain fissile  
1410 material.

1411 **7. Placarding**

1412 Where an exclusive use consignment in a freight container is non-fissile or fissile-excepted  
1413 LSA-III and no other UN Number commodities are present in the freight container, “3322”  
1414 shall be displayed on all four sides of the freight container, either in the lower half of the  
1415 placards, preceded by the letters “UN”, or on the specially designed UN Number placards  
1416 shown in the Transport Code. In the case of fissile material transported as LSA-III, “3325”  
1417 shall be displayed on the placards.

1418 **8. Carriage**

1419 Transport of unpackaged LSA-III is not permitted.

1420 Total activity in a single conveyance shall not exceed the values specified in Table 5 of the  
1421 Transport Code.

1422 **Schedule 8. Surface Contaminated Objects (SCO-I and**  
1423 **SCO-II)**

<b>UN Numbers</b>
2913, 3326 as applicable

1424  
1425 A surface contaminated object (SCO) is a solid object which is not itself radioactive but  
1426 which has radioactive material distributed on its surfaces. There are two groups, SCO-I and  
1427 SCO-II, which differ in the maximum level of contamination permitted. If fissile material is  
1428 present, other than fissile material meeting one of the provisions of para. 672, the  
1429 requirements of Schedule 13 shall be met in addition to the requirements summarised in this  
1430 Schedule.

1431 **1. Materials**

1432 A solid, non-radioactive object, which has radioactive material distributed on its surfaces,  
1433 may be classified as SCO-I or SCO-II when the fixed and non-fixed surface contamination  
1434 levels, averaged over 300 cm<sup>2</sup> (or the area of the surface if less than 300 cm<sup>2</sup>), do not exceed  
1435 the limits specified in Table 8 of the Transport Code.

1436 **2. Packaging/Package**

1437 SCO-I may be transported unpackaged if:

- 1438 (i) it is transported in such a manner that, in routine transport, there will be no  
1439 escape of radioactive contents from the conveyance and no loss of shielding; and  
1440 (ii) for SCO-I, where it is suspected that non-fixed contamination exists on  
1441 inaccessible surfaces in excess of 4 Bq/cm<sup>2</sup> for beta and gamma emitters and low  
1442 toxicity alpha emitters, or 0.4 Bq/cm<sup>2</sup> for all other alpha emitters, measures are  
1443 taken to ensure that the radioactive material is not released into the conveyance  
1444 and it is transported under exclusive use.

1445 Packaged SCO may be transported if:

- 1446 (i) the package meets the design requirements for Type IP-1 for SCO-I, or Type IP-2  
1447 for SCO-II; or  
1448 (ii) the packaging meets one of the alternative requirements for intermediate bulk  
1449 containers or freight containers to be qualified as Type IP-2 as given in paras  
1450 627–628.

1451 Generally, approval of the design by the Competent Authority of industrial packages is not  
1452 required, although the consignor shall be prepared to demonstrate the compliance of the  
1453 package design to the appropriate Competent Authority.

1454 Competent Authority approval of design is required for packages designed to contain SCO  
1455 contaminated with fissile material in quantities not excepted under para. 672.

1456 Transitional arrangements for packages designed to a previous edition of these Regulations:

- 1457 (i) Package designs approved to contain fissile SCO material shall satisfy the  
1458 transition arrangements of section 2 of the Common Provisions on page 36 as  
1459 appropriate.  
1460 (ii) Other package designs which previously did not require Competent Authority  
1461 approval shall satisfy the appropriate transitional arrangements of the Common  
1462 Provisions on page 36.

1463 For quantities exceeding 3000 A<sub>2</sub> and carried by air, the packaging shall meet the  
1464 requirements for a Type C package.

1465 **3. Maximum Radiation Levels**

1466 The quantity of SCO in a single package or object or collection of objects shall be so restricted  
1467 that the external radiation level at 3 m from the unshielded material does not exceed  
1468 10 mSv/h.

1469 **4. Mixed Contents**

1470 The requirements specified in Common Provision 6 do not preclude the transport of SCO  
1471 with other items.

1472 **5. Loading and Segregation**

1473 The total activity in a single hold or compartment of an inland water craft, or in another  
1474 conveyance, for carriage of SCO shall not exceed the limits shown in Table 5 of the Transport  
1475 Code.

1476 **6. Labelling and Marking**

1477 *Packages*

1478 (i) Completed WHITE or YELLOW labels with the radioactive contents described on  
1479 the label with the name of the radionuclide, or for mixtures the names of the  
1480 most restrictive radionuclides, followed by “SCO-I” or “SCO-II”, as appropriate,  
1481 shall be affixed externally to two opposite sides of the package, or to all four sides  
1482 of freight containers when being used as packages.

1483 (ii) Packages shall bear the mark:

1484 • “UN 2913” and the proper shipping name “RADIOACTIVE MATERIAL,  
1485 SURFACE CONTAMINATED OBJECTS (SCO-I or SCO-II)” for either non-  
1486 fissile or fissile-excepted material; or

1487 • “UN 3326” and the proper shipping name “RADIOACTIVE MATERIAL,  
1488 SURFACE CONTAMINATED OBJECTS (SCO-I or SCO-II), FISSILE” for  
1489 fissile material.

1490 (iii) Each package which conforms to a Type IP-1 or Type IP-2 shall be marked with  
1491 “Type IP-1” or “Type IP-2”, as appropriate.

1492 (iv) Each package which conforms to a Type IP-2 shall be marked with the  
1493 international vehicle registration code of the country of origin of design and the  
1494 name of the manufacturers, or other identification of the packaging specified by  
1495 the Competent Authority.

1496 *Freight containers and overpacks:*

1497 (i) Completed WHITE or YELLOW labels with the radioactive contents described  
1498 with the name of the radionuclide, or for mixtures the names of the most  
1499 restrictive radionuclides, followed by “SCO-I” or “SCO-II”, as appropriate, shall  
1500 be affixed externally to all four sides of freight containers, or to two opposite  
1501 sides of overpacks.

1502 **7. Placarding**

1503 For unpackaged SCO-I in a freight container, or where an exclusive use consignment in a  
1504 freight container is packaged non-fissile or fissile-excepted SCO and no other UN Number  
1505 commodities are present in the freight container, the UN Number “2913” shall be displayed  
1506 on all four sides of the freight container, either in the lower half of the placards, preceded by  
1507 the letters “UN”, or on the specially designed UN Number placards shown in the Transport  
1508 Code. In the case of fissile SCO, the UN Number “3326” shall be displayed on the placards.

1509 **8. Carriage**

1510 SCO-I on which the contamination on the accessible and inaccessible surfaces is not greater  
1511 than:

- 1512 • 4 Bq/cm<sup>2</sup> for beta and gamma emitters and low toxicity alpha emitters; or
- 1513 • 0.4 Bq/cm<sup>2</sup> for all other alpha emitters

1514 may be transported unpackaged. SCO-I on which the contamination exceeds these values  
1515 may only be transported unpackaged under exclusive use.

1516 Transport of unpackaged SCO-II is not permitted.

1517 The total activity in a single conveyance shall not exceed 100 A<sub>2</sub> if the conveyance is other  
1518 than an inland waterway craft, and 10 A<sub>2</sub> if the consignment of SCO is transported in the  
1519 hold or compartment of an inland waterway craft.

1520 **9. Placarding**

1521 For unpackaged SCO-I in a freight container, or where an exclusive use consignment in a  
1522 freight container is packaged non-fissile or fissile-excepted SCO and no other UN Number  
1523 commodities are present in the freight container, the UN Number “2913” shall be displayed  
1524 on all four sides of the freight container, either in the lower half of the placards shown in Fig.  
1525 6 or on the placards shown in Fig. 7. In the case of fissile SCO, the UN Number “3326” shall  
1526 be displayed on the placards. For the placards shown in Fig. 6, the numbers shall be  
1527 preceded by the letters “UN”.

1528 **10. Carriage**

1529 SCO-I on which the contamination on the accessible and inaccessible surfaces is not greater  
1530 than 4 Bq/cm<sup>2</sup> for beta and gamma emitters and low toxicity alpha emitters or 0.4 Bq/cm<sup>2</sup>  
1531 for all other alpha emitters may be transported unpackaged.

1532 SCO-I on which the contamination exceeds the values specified above may be transported  
1533 unpackaged only under exclusive use.

1534 Transport of unpackaged SCO-II is not permitted.

1535 The total activity in a single conveyance shall not exceed 100 A<sub>2</sub> if the conveyance is other  
1536 than an inland waterway craft, and 10 A<sub>2</sub> if the consignment of SCO is transported in the  
1537 hold or compartment of an inland waterway craft.

1538 **Schedule 9. Material in Type A Packages**

UN Numbers
2915, 2977, 2978, 3327, 3332, 3333 as applicable

1539

1540 Radioactive material in quantities representing a limited radiation risk may be carried in a  
1541 Type A package which shall be designed to withstand normal conditions of transport. If  
1542 fissile material is present, other than fissile material meeting one of the provisions of para.  
1543 672, the requirements of Schedule 13 shall be met in addition to the requirements  
1544 summarised in this Schedule.

1545 **1. Materials**

1546 *Radioactive material:*

- 1547 (i) With an activity not exceeding  $A_1$  if as special form radioactive material; or  
1548 (ii) With an activity not exceeding  $A_2$  if as other than special form radioactive  
1549 material; or  
1550 (iii) For mixtures of radionuclides whose identities and respective activities are  
1551 known, the condition given in para. 414 shall apply to the radioactive contents of  
1552 a Type A package.

1553 **2. Packaging/Package**

1554 Transitional arrangements for Type A packages designed to a previous edition of the  
1555 Transport Code:

- 1556 (i) Type A package designs approved to contain fissile material shall satisfy the  
1557 transitional arrangements of section 2 of the Common Provisions on page 36 as  
1558 appropriate.  
1559 (ii) Other Type A package designs, which previously did not require Competent  
1560 Authority approval, shall satisfy the appropriate transitional arrangements in the  
1561 Common Provisions on page 36.

1562 Type A packages shall meet the requirements specified in para. 633.

1563 Type A packages designed to transport 0.1 kg or more of uranium hexafluoride shall, in  
1564 addition, satisfy the requirements specified in paras 629–632.

1565 Except for packages containing 0.1 kg or more of uranium hexafluoride, or containing fissile  
1566 material in quantities not excepted under para. 672, package design approval is not required.  
1567 However, the consignor shall be prepared to demonstrate the compliance of the package  
1568 design with all applicable requirements to the relevant Competent Authority.

1569 Competent Authority approval of design is required for packages designed to contain more  
1570 than 0.1 kg of uranium hexafluoride or fissile material in quantities not excepted under para.  
1571 672.

1572 If the radioactive contents are special form radioactive material, unilateral approval of the  
1573 design for the special form radioactive material is required.

1574 Special form radioactive material manufactured to a design which had received unilateral  
1575 approval by the Competent Authority under the 1973, 1973 (As Amended), 1985 or 1985 (As  
1576 Amended 1990) Editions of the IAEA Regulations may continue to be used when in  
1577 compliance with the mandatory programme of quality assurance in accordance with the  
1578 applicable requirements of para. 306.

1579 All special form radioactive material manufactured after 31 December 2003 shall meet the  
1580 requirements of the 2008 Edition of the Transport Code, in full.

1581 **3. Labelling and Marking**

1582 *Packages*

1583 (i) Completed WHITE or YELLOW labels with the radioactive contents described on  
1584 the label with the name of the radionuclide, or for mixtures the names of the  
1585 most restrictive radionuclides shall be affixed externally to two opposite sides of  
1586 the package, or to all four sides of freight containers and tanks when being used  
1587 as Type A packages.

1588 (ii) Packages containing special form radioactive material shall bear the mark:

1589 • “UN 3332” and the proper shipping name “RADIOACTIVE MATERIAL, TYPE  
1590 A PACKAGE, SPECIAL FORM” for either non-fissile or fissile-excepted  
1591 material; or

1592 • “UN 3333” and the proper shipping name “RADIOACTIVE MATERIAL, TYPE  
1593 A PACKAGE, SPECIAL FORM, FISSILE” for fissile material.

1594 Packages containing other radioactive material shall bear the mark:

1595 • “UN 2915” and the proper shipping name “RADIOACTIVE MATERIAL, TYPE  
1596 A PACKAGE” for either non-fissile or fissile-excepted material; or

1597 • “UN 3327” and the proper shipping name “RADIOACTIVE MATERIAL, TYPE  
1598 A PACKAGE, FISSILE” for fissile material.

1599 If, however, the packages contain uranium hexafluoride, the packages shall bear  
1600 the mark:

1601 • “UN 2978” and the proper shipping name “RADIOACTIVE MATERIAL,  
1602 URANIUM HEXAFLUORIDE” for non-fissile or fissile-excepted uranium  
1603 hexafluoride; or

1604 • “UN 2977” and the proper shipping name “RADIOACTIVE MATERIAL,  
1605 URANIUM HEXAFLUORIDE, FISSILE” for uranium hexafluoride that is  
1606 fissile material.

1607 (iii) Each package which conforms to a Type A package design shall be marked with  
1608 “Type A”.

1609 (iv) Each package which conforms to a Type A package design shall be marked with  
1610 the international vehicle registration code of the country of origin of design and  
1611 the name of the manufacturers, or other identification of the packaging specified  
1612 by the Competent Authority.

1613 (v) Packages designed to contain more than 0.1 kg of uranium hexafluoride shall be  
1614 legibly and durably marked on the outside of the packaging with both the  
1615 identification mark allocated to the design by the Competent Authority and a  
1616 serial number to uniquely identify each packaging which conforms to that design.

1617 *Freight containers and overpacks:*

1618 (i) Completed WHITE or YELLOW labels with the radioactive contents described  
1619 with the name of the radionuclide, or for mixtures the names of the most  
1620 restrictive radionuclides, shall be affixed externally to all four sides of freight  
1621 containers, or to two opposite sides of overpacks.

1622 **4. Placarding**

1623 Where an exclusive use consignment in a freight container is non-fissile or fissile-excepted  
1624 special form radioactive material in Type A packages and no other UN Number commodities  
1625 are present in the freight container, “3332” shall be displayed on all four sides of the freight  
1626 container, either in the lower half of the placards, preceded by the letters “UN”, or on the

1627 specially designed UN Number placards shown in the Transport Code In the case of fissile  
1628 material transported as special form radioactive material in Type A packages, “3333” shall be  
1629 displayed on the placards.

1630 Where an exclusive use consignment in a freight container is non-fissile or fissile-excepted  
1631 radioactive material in Type A packages and no other UN Number commodities are present  
1632 in the freight container, “2915” shall be displayed on all four sides of the freight container,  
1633 either in the lower half of the placards, preceded by the letters “UN”, or on the specially  
1634 designed UN Number placards shown in the Transport Code In the case of fissile material  
1635 transported in Type A packages, “3327” shall be displayed on the placards.

1636 **Schedule 10. Material in Type B(U) Packages**

<b>UN Numbers</b>
2916, 3328 as applicable

1637

1638 Radioactive material with an activity not exceeding any limit specified in the appropriate  
1639 Competent Authority certificate of unilateral approval of Type B(U) package design may be  
1640 carried in a Type B(U) package, which shall be so designed that it is unlikely to release its  
1641 radioactive contents or lose its shielding integrity in incident conditions of transport. If  
1642 fissile material is present, other than fissile material meeting one of the provisions of para.  
1643 672, the requirements of Schedule 13 shall be met in addition to the requirements  
1644 summarised in this Schedule.

1645 **1. Materials**

1646 The limit on the total activity in a Type B(U) package is as prescribed in the design approval  
1647 certificate for that package.

1648 Type B(U) packages, if transported by air, shall not contain activities greater than the  
1649 following:

- 1650 (i) For low dispersible radioactive material — as authorised for the package design  
1651 as specified in the certificate of approval;
- 1652 (ii) For special form radioactive material — 3000 A<sub>1</sub> or 100 000 A<sub>2</sub>, whichever is  
1653 lower; or
- 1654 (iii) For all other radioactive material — 3000 A<sub>2</sub>.

1655 **2. Packaging/Package**

1656 Transitional arrangements for package designs approved to previous editions of the  
1657 Regulations shall satisfy the transitional arrangements of Common Provisions 2(c) and 2(d).

1658 The Type B(U) package shall meet the requirements specified in para. 650.

1659 In addition, a Type B(U) package designed to contain uranium hexafluoride shall satisfy the  
1660 requirements specified in paras 629–632.

1661 If the radioactive contents are special form radioactive material and the activity exceeds the  
1662 A<sub>2</sub> activity limit and credit is taken for the special form nature of the radioactive contents in  
1663 the design, Competent Authority approval of the design for the special form radioactive  
1664 material is required.

1665 Special form radioactive material manufactured to a design which had received unilateral  
1666 approval by the Competent Authority under the 1973, 1973 (As Amended), 1985 or 1985 (As  
1667 Amended 1990) Editions of the IAEA Transport Regulations may continue to be used when  
1668 in compliance with the mandatory programme of quality assurance in accordance with the  
1669 applicable requirements of para. 310. All special form radioactive material manufactured  
1670 after 31 December 2003 shall meet this Edition of the Transport Code in full.

1671 If the radioactive contents are low dispersible radioactive material and credit is taken for the  
1672 low dispersible nature of the radioactive contents in the design, multilateral Competent  
1673 Authority approval of the design for the low dispersible radioactive material is required.

1674 **3. Labelling and Marking**

1675 *Packages*

- 1676 (i) Completed WHITE or YELLOW labels with the radioactive contents described on  
1677 the label with the name of the radionuclide, or for mixtures the names of the  
1678 most restrictive radionuclides shall be affixed externally to two opposite sides of

1679 the package, or to all four sides of freight containers and tanks when being used  
1680 as Type B(U) packages.

1681 (ii) Packages shall bear the mark:

1682 • “UN 2916” and the proper shipping name “RADIOACTIVE MATERIAL, TYPE  
1683 B(U) PACKAGE” for either non-fissile or fissile-excepted material; or

1684 • “UN 3328” and the proper shipping name “RADIOACTIVE MATERIAL, TYPE  
1685 B(U) PACKAGE, FISSILE” for fissile material.

1686 (iii) Each package which conforms to a Type B(U) package design shall be marked  
1687 with “Type B(U)” and the trefoil symbol embossed or stamped on the outermost  
1688 fire- and water-resistant receptacle.

1689 (iv) Each package which conforms to a Type B(U) package design shall be marked  
1690 with the identification mark allocated to that design by the Competent Authority  
1691 and a serial number to uniquely identify each packaging which conforms to that  
1692 design.

1693 *Freight containers and overpacks:*

1694 (i) Completed WHITE or YELLOW labels with the radioactive contents described  
1695 with the name of the radionuclide, or for mixtures the names of the most  
1696 restrictive radionuclides, shall be affixed externally to all four sides of freight  
1697 containers, or to two opposite sides of overpacks.

#### 1698 **4. Placarding**

1699 Where an exclusive use consignment in a freight container is non-fissile or fissile-excepted  
1700 radioactive material in Type B(U) packages and no other UN Number commodities are  
1701 present in the freight container, “2916” shall be displayed on all four sides of the freight  
1702 container, either in the lower half of the placards, preceded by the letters “UN”, or on the  
1703 specially designed UN Number placards shown in the Transport Code. In the case of fissile  
1704 material transported in Type B(U) packages, “3328” shall be displayed on the placards.

#### 1705 **5. Transport Documents**

1706 The Competent Authority approval certificate for the package design is required.

1707 Before the first shipment of any Type B(U) package, the consignor shall be in possession of  
1708 all relevant approval certificates and shall ensure that copies of each applicable Competent  
1709 Authority approval certificate have been submitted to the Competent Authority of each  
1710 country through or into which the package is to be transported.

1711 Before each shipment where the activity is greater than  $3 \times 10^3 A_1$  or  $3 \times 10^3 A_2$ , as  
1712 appropriate, or 1000 TBq, whichever is the lower, the consignor shall notify the Competent  
1713 Authorities of all countries through or into which the consignment is to be transported  
1714 preferably at least seven days in advance.

#### 1715 **6. Storage and Dispatch**

1716 The consignor shall have complied with the relevant pre-use and pre-shipment requirements  
1717 of the Regulations.

1718 Any provisions in the Competent Authority approval certificates shall be observed.

#### 1719 **7. Carriage**

1720 If the temperature of the accessible surface of the package could exceed 50°C in the shade,  
1721 carriage by air is prohibited and carriage by other modes is permitted only under exclusive  
1722 use, for which the surface temperature is limited to 85°C.

1723 **Schedule 11. Material in Type B(M) Packages**

<b>UN Numbers</b>
2917, 3329 as applicable

1724

1725 Radioactive material with an activity not exceeding any limit specified in the appropriate  
1726 Competent Authority certificate of multilateral approval of Type B(M) package design may  
1727 be carried in a Type B(M) package, which shall be so designed that it is unlikely to release its  
1728 radioactive contents or lose its shielding integrity in incident conditions of transport. If  
1729 fissile material is present, other than fissile material meeting one of the provisions of para.  
1730 672, the requirements of Schedule 13 shall be met in addition to the requirements  
1731 summarised in this Schedule.

1732 **1. Materials**

1733 The limit on the total activity in a Type B(M) package is as prescribed in the design approval  
1734 certificate for that package.

1735 Type B(M) packages, if transported by air, shall not contain activities greater than the  
1736 following:

- 1737 (i) For low dispersible radioactive material – as authorised for the package design  
1738 as specified in the certificate of approval;
- 1739 (ii) For special form radioactive material – 3000 A<sub>1</sub> or 100 000 A<sub>2</sub>, whichever is the  
1740 lower; or
- 1741 (iii) For all other radioactive material – 3000 A<sub>2</sub>.

1742 **2. Packaging/Package**

1743 Transitional arrangements for package designs approved to previous editions of the  
1744 Regulations shall satisfy the transitional arrangements of Common Provisions 2(b) and 2(c).

1745 The Type B(M) package shall meet the requirements specified in para. 665.

1746 In addition, a Type B(M) package designed to contain uranium hexafluoride shall satisfy the  
1747 requirements specified in paras 629–632.

1748 Intermittent venting during transport may be permitted provided that the operational  
1749 controls for venting are acceptable to the relevant Competent Authorities.

1750 Supplementary operational controls necessary to ensure the safety of the Type B(M) package  
1751 during transport or to compensate for the deficiencies from the Type B(U) requirements and  
1752 any restrictions on mode or conditions of transport shall be approved by the Competent  
1753 Authorities involved (multilateral approval).

1754 Approval of the design of Type B(M) packages is required both by the Competent Authority  
1755 of the country of origin of the design and of each country through or into which the packages  
1756 are transported (multilateral approval).

1757 If the radioactive contents are special form radioactive material, and the activity exceeds the  
1758 A<sub>2</sub> activity limit, and credit is taken for the special form nature of the radioactive contents in  
1759 the design, Competent Authority approval of the design for the special form radioactive  
1760 material is required.

1761 Special form radioactive material manufactured to a design which had received unilateral  
1762 approval by the Competent Authority under the 1973, 1973 (As Amended), 1985 or 1985 (As  
1763 Amended 1990) Editions of these Regulations may continue to be used when in compliance  
1764 with the mandatory programme of quality assurance in accordance with the applicable  
1765 requirements of para. 310. All special form radioactive material manufactured after 31  
1766 December 2003 shall meet this Edition of the Regulations in full.

1767 If the radioactive contents are low dispersible radioactive material, and the activity exceeds  
1768 the 3000 A<sub>2</sub> activity limit, and credit is taken for the low dispersible nature of the radioactive  
1769 contents in the design, Competent Authority approval of the design for the low dispersible  
1770 radioactive material is required.

### 1771 **3. Labelling and Marking**

#### 1772 *Packages*

1773 (i) Completed WHITE or YELLOW labels with the radioactive contents described on  
1774 the label with the name of the radionuclide, or for mixtures the names of the  
1775 most restrictive radionuclides, shall be affixed externally to two opposite sides of  
1776 the package, or to all four sides of freight containers and tanks when being used  
1777 as Type B(M) packages.

1778 (ii) Packages shall bear the mark:

1779 • “UN 2917” and the proper shipping name “RADIOACTIVE MATERIAL, TYPE  
1780 B(M) PACKAGE” for either non-fissile or fissile excepted material; or

1781 • “UN 3329” and the proper shipping name “RADIOACTIVE MATERIAL, TYPE  
1782 B(M) PACKAGE, FISSILE” for fissile material.

1783 (iii) Each package which conforms to a Type B(M) package design shall be marked  
1784 with “Type B(M)” and the trefoil symbol embossed or stamped on the outermost  
1785 fire- and water-resistant receptacle.

1786 (iv) Each package which conforms to a Type B(M) package design shall be marked  
1787 with the identification mark allocated to that design by the Competent Authority  
1788 and a serial number to uniquely identify each packaging which conforms to that  
1789 design.

#### 1790 *Freight containers and overpacks:*

1791 (i) Completed WHITE or YELLOW labels with the radioactive contents described  
1792 with the name of the radionuclide, or for mixtures the names of the most  
1793 restrictive nuclides, shall be affixed externally to all four sides of freight  
1794 containers, or to two opposite sides of overpacks.

### 1795 **4. Placarding**

1796 Where an exclusive use consignment in a freight container or tank is non-fissile or fissile-  
1797 excepted radioactive material in Type B(M) packages and no other UN Number commodities  
1798 are present in the freight container or tank, the UN Number “2917” shall be displayed on all  
1799 four sides of the freight container or tank, either in the lower half of the placards, preceded  
1800 by the letters “UN”, or on the specially designed UN Number placards shown in the  
1801 Transport Code. In the case of fissile material transported in Type B(M) packages, the UN  
1802 Number “3329” shall be displayed on the placards.

### 1803 **5. Transport Documents**

1804 The multilateral approval certificate for the package design is required.

1805 Before the first shipment of any Type B(M) package, the consignor shall be in possession of  
1806 all relevant approval certificates and shall ensure that copies of each applicable Competent  
1807 Authority approval certificate have been submitted to the Competent Authority of each  
1808 country through or into which the package is to be transported.

1809 Before each shipment, the consignor shall notify the Competent Authorities of all countries  
1810 through or into which the consignment is to be transported preferably at least seven days in  
1811 advance.

1812 **6. Storage and Dispatch**

1813 The consignor shall have complied with the relevant pre-use and pre-shipment requirements  
1814 of the Regulations.

1815 Any provisions in the Competent Authority approval certificates shall be observed.

1816 **7. Carriage**

1817 If the temperature of the accessible surface of the package could exceed 50°C in the shade,  
1818 carriage by air is prohibited and carriage by other modes is permitted only under exclusive  
1819 use, for which the surface temperature is limited to 85°C.

1820 **Schedule 12. Material in Type C Packages**

UN Numbers
3323, 3330 as applicable

1821

1822 Radioactive material with an activity not exceeding any limit specified in the appropriate  
1823 Competent Authority certificate of unilateral approval of Type C package design may be  
1824 carried in a Type C package, which shall be so designed that it is unlikely to release its  
1825 radioactive contents or lose its shielding integrity in incident conditions of transport,  
1826 including those associated with the air mode. If fissile material is present, other than fissile  
1827 material meeting one of the provisions of para. 672, the requirements of Schedule 13 shall be  
1828 met in addition to the requirements summarised in this Schedule.

1829 **1. Materials**

1830 The limit on the total activity in a Type C package is as prescribed in the design approval  
1831 certificate for that package.

1832 **2. Packaging/Package**

1833 The packaging shall meet the requirements specified in para. 667.

1834 In addition, a Type C package designed to contain uranium hexafluoride shall satisfy the  
1835 requirements specified in paras 629–632.

1836 If the radioactive contents are special form radioactive material and the activity exceeds the  
1837  $A_2$  activity limit and credit is taken for the special form nature of the radioactive contents in  
1838 the design, Competent Authority approval of the design for the special form radioactive  
1839 material is required.

1840 Special form radioactive material manufactured to a design which had received unilateral  
1841 approval by the Competent Authority under the 1973, 1973 (As Amended), 1985 or 1985 (As  
1842 Amended 1990) Editions of these Regulations may continue to be used when in compliance  
1843 with the mandatory programme of quality assurance in accordance with the applicable  
1844 requirements of para. 310. All special form radioactive material manufactured after  
1845 31 December 2003 shall meet this Edition of the Regulations in full.

1846 **3. Labelling and Marking**

1847 *Packages*

1848 (i) Completed WHITE or YELLOW labels with the radioactive contents described on  
1849 the label with the name of the radionuclide, or for mixtures the names of the  
1850 most restrictive radionuclides shall be affixed externally to two opposite sides of  
1851 the package, or to all four sides of freight containers and tanks when being used  
1852 as Type C packages.

1853 (ii) Packages shall bear the mark:

- 1854 • “UN 3323” and the proper shipping name “RADIOACTIVE MATERIAL, TYPE  
1855 C PACKAGE” for either non-fissile or fissile-excepted material;
- 1856 • “UN 3330” and the proper shipping name “RADIOACTIVE MATERIAL, TYPE  
1857 C PACKAGE, FISSILE” for fissile material.

1858 (iii) Each package which conforms to a Type C package design shall be marked with  
1859 “Type C” and the trefoil symbol embossed or stamped on the outermost fire- and  
1860 water-resistant receptacle.

1861 (iv) Each package which conforms to a Type C package design shall be marked with  
1862 the identification mark allocated to that design by the Competent Authority and

1863 a serial number to uniquely identify each packaging which conforms to that  
1864 design.

1865 *Freight containers and overpacks:*

1866 (i) Completed WHITE or YELLOW labels, with the radioactive contents described  
1867 with the name of the radionuclide, or for mixtures the names of the most  
1868 restrictive radionuclides shall be affixed externally to all four sides of freight  
1869 containers, or to two opposite sides of overpacks.

#### 1870 **4. Placarding**

1871 Where an exclusive use consignment in a freight container is nonfissile or fissile-excepted  
1872 radioactive material in Type C packages and no other UN Number commodities are present  
1873 in the freight container, the UN Number “3323” shall be displayed on all four sides of the  
1874 freight container, either in the lower half of the placards, preceded by the letters “UN”, or on  
1875 the specially designed UN Number placards shown in the Transport Code. In the case of  
1876 fissile material transported in Type C packages, the UN Number “3330” shall be displayed on  
1877 the placards.

#### 1878 **5. Transport Documents**

1879 The unilateral approval certificate for the package design is required.

1880 Before the first shipment of any Type C package, the consignor shall be in possession of all  
1881 relevant approval certificates and shall ensure that copies of each applicable Competent  
1882 Authority approval certificate have been submitted to the Competent Authority of each  
1883 country through or into which the package is to be transported.

1884 Before each shipment where the activity is greater than  $3 \times 10^3 A_1$  or  $3 \times 10^3 A_2$ , as  
1885 appropriate, or 1000 TBq, whichever is the lower, the consignor shall notify the Competent  
1886 Authorities of all countries through or into which the consignment is to be transported  
1887 preferably at least seven days in advance.

#### 1888 **6. Storage and Dispatch**

1889 The consignor shall have complied with the relevant pre-use and pre-shipment requirements  
1890 of the Regulations.

1891 Any provisions in the Competent Authority approval certificates shall be observed.

#### 1892 **7. Carriage**

1893 If the temperature of the accessible surface of the package could exceed 50°C in the shade,  
1894 carriage by air is prohibited and carriage by other modes is permitted only under exclusive  
1895 use, for which the surface temperature is limited to 85°C.

1896 **Schedule 13. Fissile Material**

UN Numbers
2977, 3324, 3325, 3326, 3327, 3328, 3329, 3330, 3331, 3333 as applicable

1897

1898 Radioactive material which is also fissile material (except those fissile materials which are  
1899 fissile-excepted by satisfying one of the requirements of para. 672 of the Regulations) shall  
1900 be packaged, transported and stored so as to meet the requirements specified in the  
1901 Regulations for nuclear criticality safety (as summarised in this Schedule) and the  
1902 requirements appropriate to its radioactivity (as summarised in Schedules 6–12 and 14, as  
1903 appropriate).

1904 **1. Materials**

1905 Fissile material is uranium-233, uranium-235, plutonium-239, plutonium-241, or any  
1906 combination of these radionuclides, except for unirradiated natural uranium and depleted  
1907 uranium, and natural uranium or depleted uranium which has been irradiated in thermal  
1908 reactors only.

1909 Consignments of fissile material shall also be in full compliance with the requirements of the  
1910 Regulations summarised in one of the other Schedules, as appropriate to the radioactivity of  
1911 the consignment.

1912 **2. Packaging/Package**

1913 Fissile material meeting one of the provisions (a)–(d) of para. 672 is excepted from the  
1914 requirement to be transported in packages that comply with para. 671 as well as the other  
1915 requirements of these Regulations that apply to fissile material. Only one type of exception  
1916 is allowed per consignment.

1917 Otherwise, packages containing fissile material shall meet the design requirements for the  
1918 type of package necessary for the criticality safety indexes in a freight container and aboard a  
1919 single conveyance shall not exceed the values shown in Table 10 of the Transport Code.

1920 Except under the condition of exclusive use the consignment shall be so handled and stowed  
1921 that the total sum of CSI's in any group does not exceed 50, and that each group is handled  
1922 and stowed so that the groups are separated from each other by at least 6 m.

1923 Where a consignment is transported under exclusive use the consignment shall be so  
1924 handled and stowed that the total sum of CSI's in any group does not exceed 100, and that  
1925 each group is handled and stowed so that the groups are separated from each other by at  
1926 least 6 m. The intervening space between groups may be occupied by other cargo in  
1927 accordance with para. 505.

1928 **3. Labelling and Marking**

1929 *Packages*

- 1930 (i) See Common Provision 8 and appropriate Schedule; and
- 1931 (ii) Completed criticality safety index labels, with the criticality safety index as stated  
1932 in the certificate of approval for package design or the certificate of approval for  
1933 special arrangement, shall be affixed externally to two opposite sides of the  
1934 package, or to all four sides of freight containers and tanks when being used as  
1935 packages.

1936 *Freight containers and overpacks:*

- 1937 (i) See Common Provision 8 and appropriate Schedule; and

1938 (ii) The criticality safety index entered on the labels of the overpack or freight  
1939 container shall be the total for the entire fissile contents of the overpack or  
1940 freight container. The labels shall be affixed externally to all four sides of freight  
1941 containers, or two opposite sides of overpacks.

1942 **4. Transport Documents**

1943 The multilateral approval certificate for the fissile material package design is required from  
1944 the Competent Authority of each country through or into which the package is to be  
1945 transported.

1946 Certificates of multilateral approval of shipment are required for packages containing fissile  
1947 material if the sum of the criticality safety indexes of the packages in the consignment  
1948 exceeds 50.

1949 For additional documentation requirements, see appropriate Schedule.

1950 **5. Storage and Dispatch**

1951 See the “Loading and Segregation” provisions of this Schedule.

1952 **6. Carriage**

1953 Any package, overpack or consignment having a criticality safety index greater than 50 shall  
1954 be transported only under the condition of exclusive use.

1955 See the “Loading and Segregation” provisions of this Schedule.

1956 **Schedule 14. Material Transported Under Special**  
1957 **Arrangement**

<b>UN Numbers</b>
2919, 3331 as applicable

1958  
1959 Radioactive material as specified in the appropriate certificate of multilateral approval of  
1960 shipment under special arrangement may be transported under special arrangement, subject  
1961 to the implementation of special provisions approved by the Competent Authority (or  
1962 Competent Authorities for international shipments). These provisions will be established to  
1963 ensure that the overall level of safety in transport and during storage in transit shall be at  
1964 least equivalent to that which would be provided if all the applicable requirements of  
1965 Schedules 1-13, as appropriate, had been satisfied.

1966 **1. Materials**

1967 Radioactive material which may be shipped under special arrangement includes any of the  
1968 materials covered by Schedules 5-12, and, in addition, Schedule 13 if applicable.

1969 **2. Packaging/Package**

1970 Provisions shall be adequate to ensure that the overall level of safety in transport and during  
1971 storage in transit is at least equivalent to that which would be provided if all applicable  
1972 requirements had been satisfied.

1973 For domestic shipments, approval of provisions by the Competent Authority is required.

1974 For international shipments, multilateral approval is required.

1975 **3. Maximum Radiation Levels**

1976 The maximum radiation levels for packages transported under special arrangement shall be  
1977 approved by the Competent Authorities.

1978 **4. Contamination**

1979 The limits allowed by the Competent Authorities approval certificates for special  
1980 arrangement shall be complied with.

1981 **5. Decontamination**

1982 The limits allowed by the Competent Authorities approval certificates for special  
1983 arrangement shall be complied with.

1984 **6. Mixed Contents**

1985 As allowed by the Competent Authorities approval certificates for special arrangement.

1986 **7. Loading and Segregation**

1987 Specific loading and segregation requirements approved by the Competent Authorities shall  
1988 be fulfilled.

1989 **8. Labelling and Marking**

1990 *Packages*

1991 (i) Completed III-YELLOW labels, with the radioactive contents described on the  
1992 label with the name of the radionuclide, or for mixtures the names of the most  
1993 restrictive radionuclides, shall be affixed externally to two opposite sides of the

- 1994 package, or to all four sides of freight containers and tanks when being used as  
1995 packages.
- 1996 (ii) Packages shall bear the mark:
- 1997 • “UN 2919” and the proper shipping name “RADIOACTIVE MATERIAL,  
1998 TRANSPORTED UNDER SPECIAL ARRANGEMENT” for either non-fissile  
1999 or fissile-excepted material; or
- 2000 • “UN 3331” and the proper shipping name “RADIOACTIVE MATERIAL,  
2001 TRANSPORTED UNDER SPECIAL ARRANGEMENT, FISSILE” for fissile  
2002 material.
- 2003 (iii) Other labelling and marking requirements approved by the Competent  
2004 Authorities shall be fulfilled.
- 2005 *Freight containers and overpacks:*
- 2006 (i) Completed III-YELLOW labels, with the radioactive contents described with the  
2007 name of the radionuclide, or for mixtures the names of the most restrictive  
2008 nuclides, shall be affixed externally to all four sides of freight containers, or to  
2009 two opposite sides of overpacks.
- 2010 (ii) Other labelling and marking requirements approved by the Competent  
2011 Authorities shall be fulfilled.

## 2012 **9. Placarding**

2013 Where an exclusive use consignment in a freight container or tank is non-fissile or fissile-  
2014 excepted radioactive material being transported under special arrangement and no other UN  
2015 Number commodities are present in the freight container or tank, the UN Number “2919”  
2016 shall be displayed on all four sides of the freight container or tank, either in the lower half of  
2017 the placards, preceded by the letters “UN”, or on the specially designed UN Number placards  
2018 shown in the Transport Code. In the case of fissile material being transported under special  
2019 arrangement, the UN Number “3331” shall be displayed on the placards.

2020 Other placarding requirements approved by the Competent Authorities shall be fulfilled.

## 2021 **10. Transport Documents**

2022 Each consignment shipped under special arrangement require multilateral approval.

2023 Before each shipment performed under special arrangement, the consignor shall be in  
2024 possession of all relevant approval certificates.

2025 Before each shipment the consignor shall notify the Competent Authorities of all countries  
2026 through or into which the consignment is to be transported preferably at least seven days in  
2027 advance.

## 2028 **11. Storage and Dispatch, Carriage and Other Provisions**

2029 Specific storage, dispatch, carriage and other requirements approved by the Competent  
2030 Authorities will need to be fulfilled.

2031 **Schedule 15. Summary of Approval and Prior Notification**  
 2032 **Requirements**

2033  
 2034 This summary reflects the contents of the Code of Practice for the Safe Transport of  
 2035 Radioactive Material (2008). The user's attention is called to the fact that there may be  
 2036 deviations (exceptions, additions, etc.) relative to:

- 2037 (a) national regulations relating to safety  
 2038 (b) carrier restrictions; and  
 2039 (c) national regulations relating to security, physical protection, liability,  
 2040 insurance, pre-notification and/or routing, and import/export/transit  
 2041 licensing.  
 2042

Class of package or material	Competent Authority approval required		Consignor required to notify country of origin and countries en route <sup>a</sup> of each shipment
	Country of origin	Countries en route <sup>a</sup>	
Excepted package <sup>b</sup> other than by post	No	No	No
LSA material <sup>b,c</sup> and SCO <sup>c</sup> — Industrial package Types 1, 2 or 3.	No	No	No
Type A <sup>b,c</sup>	No	No	No
Type B(U) <sup>b,c</sup> — Package design — Shipment	Yes No	No <sup>d</sup> No	(See Notes 1 + 2)
Type B(M) <sup>b,c</sup> — Package design — Shipment	Yes (See Note 3)	Yes (See Note 3)	Yes (See Note 1)
Type C <sup>b,c</sup> — Package design — Shipment	Yes No	No No	(See Notes 1 + 2)
Packages for fissile material — Package design — Shipment	Yes <sup>e</sup>	Yes <sup>e</sup>	
Σ CSI ≤ 50	No <sup>f</sup>	No <sup>f</sup>	(See Notes 2 + 4)
Σ CSI >50	Yes	Yes	(See Notes 2 + 4)
Packages containing 0.1 kg or more of uranium hexafluoride — Package design — Shipment	No <sup>g</sup> No <sup>f</sup>	No <sup>g</sup> No <sup>f</sup>	(See Note 2)
Special form radioactive material — Design — Shipment	Yes (See Note 5)	No (See Note 5)	No (See Note 5)
Low dispersible radioactive material — Design — Shipment	Yes (See Note 5)	Yes (See Note 5)	No (See Note 5)
Special arrangement — Shipment	Yes	Yes	Yes
Type B(U) packages for which design approved under: 1973 Regulations 1985 Regulations	Yes Yes	Yes Yes (since 31 December 2003)	(See Note 1) (See Note 1)

- 2043 <sup>a</sup> Countries through or into which (but not over which) the consignment is transported.  
 2044 <sup>b</sup> If the radioactive contents are UF<sub>6</sub> in quantities of 0.1 kg or more, the approval requirements  
 2045 for packages containing uranium hexafluoride shall additionally apply.  
 2046 <sup>c</sup> If the radioactive contents are fissile material which is not excepted from the requirements for  
 2047 packages containing fissile material, then the approval requirements in paras 812 and 820 of  
 2048 the Transport Code shall additionally apply.

- 2049 d If the radioactive contents are low dispersible radioactive material, and the package is to be  
2050 shipped by air, multilateral approval of the package design is required.
- 2051 e Designs of packages containing fissile material may also require approval in respect of one of  
2052 the other items in this Schedule.
- 2053 f Shipments may, however, require approval in respect of one of the other items in this  
2054 Schedule.
- 2055 g Except that after 31 December 2000, designs that only meet the requirement of para. 632  
2056 require multilateral approval, and after 31 December 2003, designs that meet the  
2057 requirements of paras 629–631 require unilateral approval.  
2058
- 2059 Note 1 — Before the first shipment of any package requiring Competent Authority approval of the  
2060 design, the consignor must ensure that a copy of the approval certificate for that design has  
2061 been submitted to the Competent Authority of each country.
- 2062 Note 2 — Notification required if contents exceed  $3 \times 10^3 A_1$ , or  $3 \times 10^3 A_2$ , or 1000 TBq, whichever is  
2063 the lower.
- 2064 Note 3 — Multilateral approval of shipment required if contents exceed  $3 \times 10^3 A_1$ , or  $3 \times 10^3 A_2$ , or  
2065 1000 TBq, whichever is the lower; or if controlled intermittent venting is allowed.
- 2066 Note 4 — The multilateral approval requirement for fissile packages and some uranium hexafluoride  
2067 packages automatically satisfies the requirement of para. 558 of the Regulations.
- 2068 Note 5 — See approval and prior notification requirements for applicable package.

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**Annex A**

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**Competent Authorities for transport by road or rail**

COMMONWEALTH STATE / TERRITORY	CONTACT	COMPETENT AUTHORITY
Commonwealth	Chief Executive Officer ARPANSA PO Box 655 Miranda NSW 1490 Tel: (02) 9541 8333 Fax: (02) 9541 8314 Email: <a href="mailto:info@arpansa.gov.au">info@arpansa.gov.au</a>	Australian Radiation Protection and Nuclear Safety Agency (ARPANSA)
Australian Capital Territory	Manager Radiation Safety ACT Health Locked Bag 5 Weston Creek ACT 2611 Tel: (02) 6207 6946 Fax: (02) 6207 6966 Email: <a href="mailto:radiation.safety@act.gov.au">radiation.safety@act.gov.au</a>	Australian Capital Territory Radiation Council
New South Wales	Manager Hazardous Material and Radiation PO Box A290 Sydney South NSW 1232 Tel: (02) 9995 5000 Fax: (02) 9995 6603 Email: <a href="mailto:radiation@environment.nsw.gov.au">radiation@environment.nsw.gov.au</a>	Department of Environment and Climate Change
Northern Territory (i) for radioactive ores and concentrates	Chief Inspector – Radioactive Ores and Concentrates (Packaging and Transport) NT WorkSafe Department of Education, Employment & Training GPO Box 4821 Darwin NT 0801 Tel: (08) 8999 5010 Fax: (08) 8999 5141 Email: <a href="mailto:neil.watson@nt.gov.au">neil.watson@nt.gov.au</a>	Work Health Authority
(ii) for all other radioactive substances	Manager – Radiation Health Radiation Health Section Department of Health & Community Services GPO Box 40596 Casuarina NT 0811 Tel: (08) 8999 2983 Fax: (08) 8999 2700 Email: <a href="mailto:envirohealth@nt.gov.au">envirohealth@nt.gov.au</a>	Department of Health & Community Services
Queensland	Director, Radiation Health Unit Department of Health 450 Gregory Terrace Fortitude Valley QLD 4006 Tel: (07) 3406 8000 Fax: (07) 3406 8030 Email: <a href="mailto:radiation_health@health.qld.gov.au">radiation_health@health.qld.gov.au</a>	Queensland Department of Health
South Australia	Director, Radiation Protection Division Environment Protection Authority PO Box 721 Kent Town SA 5071 Tel: (08) 8130 0700 Fax: (08) 8130 0777 Email: <a href="mailto:radiationprotection@epa.sa.gov.au">radiationprotection@epa.sa.gov.au</a>	Minister for Environment & Conservation
Tasmania	Senior Health Physicist, Health Physics Branch Department of Health & Human Services GPO Box 125 Hobart TAS 7001 Tel: (03) 6222 7256 Fax: (03) 6222 7257 Email: <a href="mailto:health.physics@dhhs.tas.gov.au">health.physics@dhhs.tas.gov.au</a>	Director of Public Health
Victoria	Manager, Radiation Safety Section Department of Human Services GPO Box 4057 Melbourne VIC 3001 Tel: 1300 767 469 Fax: 1300 769 274 Email: <a href="mailto:radiation.safety@dhs.vic.gov.au">radiation.safety@dhs.vic.gov.au</a>	Secretary, Department of Human Services
Western Australia	Secretary Radiological Council Locked Bag 2006 Nedlands WA 6009 Tel: (08) 9346 2260 Fax: (08) 9381 1423 Email: <a href="mailto:radiation.health@health.wa.gov.au">radiation.health@health.wa.gov.au</a>	Radiological Council

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## Competent Authorities for the transport by Sea or Air

MODE OF TRANSPORT	CONTACT	COMPETENT AUTHORITY
Air Transport	Director, Aviation Safety Civil Aviation Safety Authority GPO Box 2005 Canberra ACT 2601 Email: <a href="mailto:dg@casa.gov.au">dg@casa.gov.au</a>	Civil Aviation Safety Authority Tel: +61 131 757 Fax: (02) 6217 1500
Sea (international and interstate)	Manager, Ship Inspections Maritime Operations Australian Maritime Safety Authority GPO Box 2181 Canberra ACT 2601 Email: <a href="mailto:MOCBRSHIPMAN@amsa.gov.au">MOCBRSHIPMAN@amsa.gov.au</a>	Australian Maritime Safety Authority Tel: (02) 6279 5048 Fax: (02) 6279 5058

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Tables 1 and 2 above were correct at the time of printing but are subject to change from time to time. For the most up-to-date list, the reader is advised to consult the ARPANSA web site.

2079 **Annex B**

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2081 **Exemption Levels for Transport of Ores and**  
2082 **Concentrates Containing Uranium or Thorium**

2083 **Introduction**

2084 Before 1996, the exemption concentration for transport of radioactive material was simple:  
2085 70 Bq/g for all radionuclides, or mixtures of radionuclides. It was clear however that this  
2086 limit had little if any radiological justification. The development of the 1996 IAEA Basic  
2087 Safety Standards (BSS 115)<sup>[1]</sup>, which gave “exemption levels” for most radionuclides,  
2088 prompted a change to make the exemption levels for transport more closely related to  
2089 radiological risks. While leading to a more rational basis for exemption, this change has  
2090 added some elements of confusion into the situation for uranium or thorium ores and  
2091 concentrates.

2092 **“Natural Uranium” (and Thorium)**

2093 When dealing with uranium and thorium there is always the question of what radionuclides  
2094 in the decay series are present. Ores containing uranium will have the uranium isotopes  
2095 (<sup>234</sup>U, <sup>235</sup>U and <sup>238</sup>U), and all their decay products present (with half lives ranging from  
2096 240 000 years to fractions of a second), usually in secular equilibrium. Uranium can be  
2097 chemically separated from the ore, and either enriched or depleted in <sup>235</sup>U (and consequently  
2098 <sup>234</sup>U). The term “natural uranium” usually refers to uranium in its natural isotopic  
2099 abundance. Similar considerations apply to thorium.

2100 The derivation of the BSS exemption levels was originally based on an EU report “Radiation  
2101 Protection 65” (RP 65)<sup>[2]</sup>. In RP 65 calculations for uranium were made for two situations:

- 2102       • U-238+       <sup>238</sup>U in equilibrium with <sup>234</sup>Th and <sup>234m</sup>Pa
- 2103       • U-238N       <sup>238</sup>U in equilibrium with all its progeny down to <sup>210</sup>Po

2104 This gave activity concentration exemption limits of 4.76 Bq/g for U-238+ and 1.83 Bq/g for  
2105 U-238N. These numbers were then rounded to 10 Bq/g for U238+ and 1 Bq/g for U-238N.

2106 In the description of the methodology for calculation of the exemption limits the following  
2107 was stated:

2108       “Some of the radionuclides considered have decay products (daughters) which are  
2109 themselves radioactive and need to be taken into account when assessing exposure.  
2110 Table 2 shows a list of all the decay sequences considered in the calculations. The  
2111 daughters considered have half-lives sufficiently short, relative to their parent that  
2112 secular equilibrium would be likely to be established within the timescales considered  
2113 in the exposure scenarios.

2114       Two special decay sequences have also been included consisting of <sup>238</sup>U and <sup>232</sup>Th  
2115 each in secular equilibrium with all their decay produces (these sequences appear in  
2116 nature). These are referred in this report as <sup>238</sup>U<sub>N</sub> and <sup>232</sup>Th<sub>N</sub>.”

2117 Note that <sup>238</sup>U<sub>N</sub> and <sup>232</sup>Th<sub>N</sub> are listed in the tables as U-238N and Th-232N respectively.

2118 In the BSS, this terminology was translated into “U-nat” and “Th-nat”. The transport  
2119 regulations, however, define “natural uranium” as:

2120 “uranium (which may be chemically separated) containing the naturally occurring  
2121 distribution of uranium isotopes (approximately 99.28% uranium-238 and 0.72%  
2122 uranium-235 by mass)”.

2123 The usage of “U-nat” in the BSS is thus inconsistent with the definition of “natural uranium”  
2124 in the Transport Regulations.

2125 Further confusion arises in Table 1 of the IAEA Transport Regulations where “U-nat” is used  
2126 in two quite different ways. In columns 2 and 3 of the table (the  $A_1$  and  $A_2$  values used to  
2127 derive Type A Package limits), “U (nat)” is used to denote “natural uranium”, but in columns  
2128 4 and 5 (the exemption limits) it means “ $^{238}\text{U}_N$ ” – that is uranium-238 with its decay  
2129 products as listed in footnote “b” to the table. Its use in this way for the exemption limits is  
2130 again inconsistent with the definition of “natural uranium” in the definitions.

2131 The definition in the Transport Regulations<sup>[3]</sup> has compounded this problem with its  
2132 definition. The use of the word “may” suggests that it is possible that it might not be  
2133 chemically separated, that is it might still contain its decay products –  $\text{U}238\text{N}$ . This surely is  
2134 not what is meant, and so adds additional confusion.

### 2135 **Exemption Concentrations**

2136 Despite the confusions outlined above, it is the clear intention that the exemption  
2137 concentration for U-nat in Table 1 of the IAEA Transport Regulations should be applied to  
2138 uranium ores and concentrates. This value is 1 Bq/g, which corresponds to a uranium grade  
2139 of approximately 77 ppm. However, as paragraph 107 states that

2140 “The Regulations do not apply to natural material and ores containing naturally  
2141 occurring radionuclides that are either in their natural state, or have been processed  
2142 only for purposes other than for the extraction of the radionuclides, and that are not  
2143 intended to be processed for use of these radionuclides, provided that the activity  
2144 concentration of the material does not exceed 10 times the values specified in para.  
2145 401(b), or calculated in accordance with paras 402–406” (that is, table 1).

2146 Ores and concentrates containing uranium are therefore exempt from the transport  
2147 requirements if the uranium content is less than 770 ppm, provided that processing intended  
2148 to remove radionuclides has not, and will not be undertaken.

2149 Similar considerations lead to an exemption level of 2500 ppm for ores or concentrates  
2150 containing thorium ( $^{232}\text{Th}$ ). This is quite a significant concentration and would lead to  
2151 gamma dose rates that would normally require management. Where both uranium and  
2152 thorium are present, the exemption limit will be between the uranium and thorium values,  
2153 and should be established using the usual “method of mixtures” (para 404).

### 2154 **Conclusions**

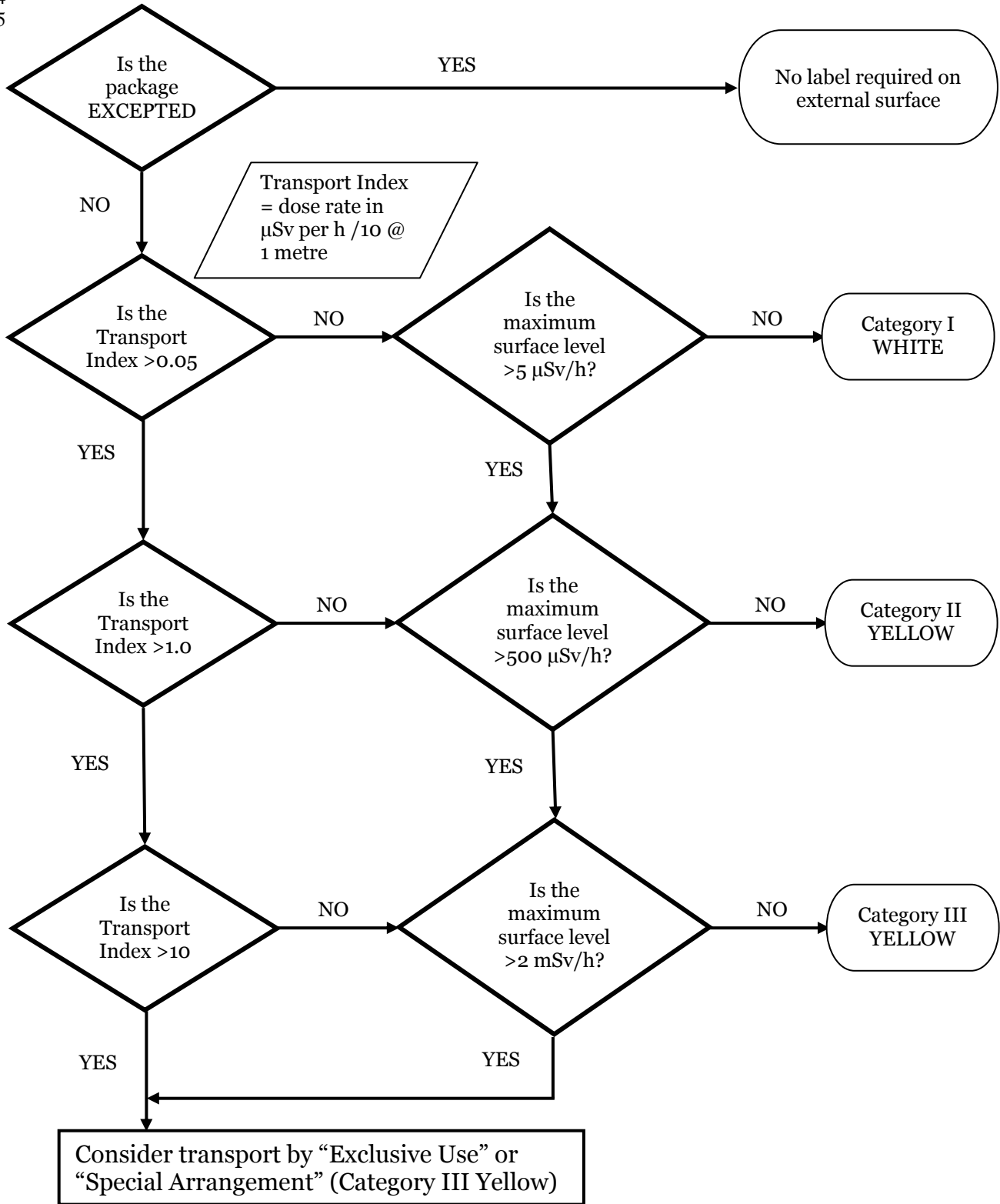
2155 Exemption concentrations for transport of ores and concentrates containing uranium or  
2156 thorium can be derived using the values for “U (nat)” and “Th (nat)” in the IAEA Transport  
2157 Regulations. An additional allowance of a factor of ten applies when processing to extract  
2158 radionuclides has not and will not be undertaken. The resulting concentrations are

- 2159 • For uranium ores and concentrates: 770 ppm
- 2160 • For thorium ores and concentrates: 2500 ppm.

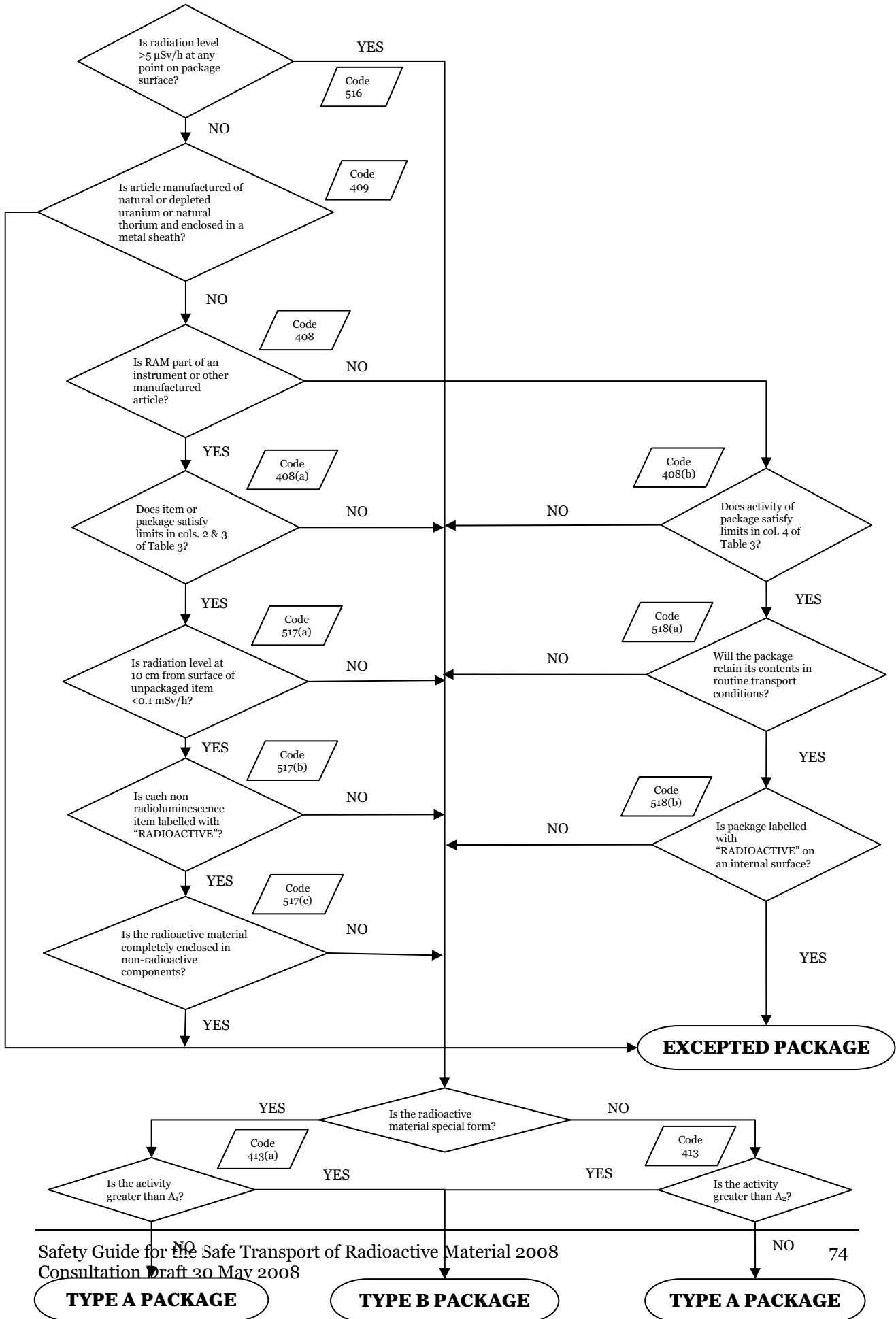
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# Annex C

## 1. Label Category Test Flow Chart



## 2. Test for Package Type



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## **Annex D**

### **Health Effects of Ionizing Radiation and Standards for Control of Exposure**

2172 It is well known that high doses of ionizing radiation can cause harm, but there is continuing  
2173 scientific uncertainty about effects at low doses. At levels of dose routinely encountered by  
2174 members of the public and occupationally exposed persons, there is little or no  
2175 epidemiological evidence of health effects. Radiation protection standards recognise that it  
2176 is not possible to eliminate all radiation exposure, but they do provide for a system of control  
2177 to avoid unnecessary exposure and to keep doses in the low dose range.

2178 Extreme doses of radiation to the whole body (around 10 sievert<sup>11</sup> and above), received in a  
2179 short period, cause so much damage to internal organs and tissues of the body that vital  
2180 systems cease to function and death may result within days or weeks. Very high doses  
2181 (between about 1 sievert and 10 sievert), received in a short period, kill large numbers of  
2182 cells, which can impair the function of vital organs and systems. Acute health effects, such as  
2183 nausea, vomiting, skin and deep tissue burns, and impairment of the body's ability to fight  
2184 infection may result within hours, days or weeks. The extent of the damage increases with  
2185 dose. However, 'deterministic' effects such as these are not observed at doses below certain  
2186 thresholds. By limiting doses to levels below the thresholds, deterministic effects can be  
2187 prevented entirely.

2188 Doses below the thresholds for deterministic effects may cause cellular damage, but this does  
2189 not necessarily lead to harm to the individual: the effects are probabilistic or 'stochastic' in  
2190 nature. It is known that doses above about 100 millisievert, received in a short period, lead  
2191 to an increased risk of developing cancer later in life. There is good epidemiological evidence  
2192 – especially from studies of the survivors of the atomic bombings – that, for several types of  
2193 cancer, the risk increases roughly linearly with dose, and that the risk factor averaged over  
2194 all ages and cancer types is about 1 in 100 for every 100 millisievert of dose (i.e. 1 in 10 000  
2195 per millisievert).

2196 At doses below about 100 millisievert, the evidence of harm is not clear-cut. While some  
2197 studies indicate evidence of radiation-induced effects, epidemiological research has been  
2198 unable to establish unequivocally that there are effects of statistical significance at doses  
2199 below a few tens of millisieverts. Nevertheless, given that no threshold for stochastic effects  
2200 has been demonstrated, and in order to be cautious in establishing health standards, the  
2201 proportionality between risk and dose observed at higher doses is presumed to continue  
2202 through all lower levels of dose to zero. This is called the linear, no-threshold (LNT)  
2203 hypothesis and it is made for radiation protection purposes only.

2204 There is evidence that a dose accumulated over a long period carries less risk than the same  
2205 dose received over a short period. Except for accidents and medical exposures, doses are not  
2206 normally received over short periods, so that it is appropriate in determining standards for  
2207 the control of exposure to use a risk factor that takes this into account. While not well  
2208 quantified, a reduction of the high-dose risk factor by a factor of two has been adopted  
2209 internationally, so that for radiation protection purposes the risk of radiation-induced fatal  
2210 cancer (the risk factor) is taken to be about 1 in 20 000 per millisievert of dose for the  
2211 population as a whole.

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<sup>11</sup> The sievert (Sv) is a unit of measurement of radiation dose (see ARPANSA's *Recommendations for limiting exposure to ionizing radiation (2002)*).

2212 If the LNT hypothesis is correct, any dose carries some risk. Therefore, measures for control  
 2213 of exposure for stochastic effects seek to avoid all reasonably avoidable risk. This is called  
 2214 optimising protection. However, risk in this sense may often be assessed in terms of risk to a  
 2215 population, and may not ensure sufficient protection of the individual. Consequently, the  
 2216 optimisation approach is underpinned by applying dose limits that restrict the risk to  
 2217 individuals to an acceptable level. The fundamental regulatory philosophy is expressed in  
 2218 three principles, based on the recommendations of the International Commission on  
 2219 Radiological Protection (ICRP) (ICRP), which may be summarised as follows:

2220 *Justification:* human activities that cause exposure to radiation may be permitted  
 2221 only if they do more good than harm;

2222 *Optimisation of protection:* exposure to radiation from justified activities should be  
 2223 kept as low as reasonably achievable, social and economic factors being taken into  
 2224 account; and

2225 *Limitation of individual dose:* doses must not exceed the prescribed dose limits.

2226 Determining what is an acceptable risk for regulatory purposes is a complex value  
 2227 judgement. The ICRP (ICRP) reviewed a number of factors in developing its  
 2228 recommendations, which have in general been internationally endorsed, including by the  
 2229 World Health Organization, the International Labour Organisation and the International  
 2230 Atomic Energy Agency. Australia's Radiation Health Committee, now established under the  
 2231 ARPANS Act<sup>12</sup>, has recommended that the international standards be adopted in Australia.  
 2232 The recommended dose limits are summarised as follows:

2233 **Limit on effective dose\***

	For occupational exposure	For members of the public
To limit individual risk	20 mSv per year, averaged over 5 years*	1 mSv in a year*

2238 \*for details, see *ARPANSA's Recommendations for limiting exposure to ionizing radiation (2002)*

2239 In most situations, the requirements for limiting individual risk ensure that doses are below  
 2240 deterministic thresholds, but for cases where this does not apply, the recommended limits  
 2241 are as follows:

2242 **Annual limit on equivalent dose\***

	For occupational exposure	For members of the public
To prevent deterministic effects		
in the lens of the eye	150 mSv	15 mSv
in the skin	500 mSv	50 mSv
in the hands and feet	500 mSv	–

2249 \*for details, see *ARPANSA's Recommendations for limiting exposure to ionizing radiation (2002)*

2250 In the case of occupational exposure during pregnancy, the general principle is that the  
 2251 embryo or fetus should be afforded the same level of protection as is required for a member  
 2252 of the public. For medical workers, the ICRP(ICRP) recommends that there should be a

<sup>12</sup> The *Australian Radiation Protection and Nuclear Safety Act (1998)*

2253 reasonable assurance that fetal dose can be kept below 1 mGy<sup>13</sup> during the course of the  
2254 pregnancy. This guidance may be generalised to cover all occupationally exposed pregnant  
2255 workers by keeping the fetal dose below 1 mSv. A full explanation of radiation protection  
2256 principles and of the recommended standards for Australia is given in ARPANSA/NOHSC  
2257 Radiation Protection Series No. 1: *Recommendations for limiting exposure to ionizing*  
2258 *radiation (1995)* and *National standard for limiting occupational exposure to ionizing*  
2259 *radiation (both republished 2002)*.

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<sup>13</sup> The gray (Gy) is a unit of radiation dose. For X-rays and gamma radiation, it is essentially equivalent to the sievert.

2261 **Annex E**

2262

2263 **ARPANSA Radiation Protection Series Publications**

2264 ARPANSA has taken over responsibility for the administration of the former NHMRC  
2265 Radiation Health Series of publications and for the codes developed under the *Environment*  
2266 *Protection (Nuclear Codes) Act 1978*. The publications are being progressively reviewed and  
2267 republished as part of the *Radiation Protection Series*. All of the Nuclear Codes have now  
2268 been republished in the Radiation Protection Series.

2269 All publications listed below are available in electronic format, and can be downloaded free  
2270 of charge by visiting ARPANSA's website at **[www.arpansa.gov.au/codes.htm](http://www.arpansa.gov.au/codes.htm)**.

2271 Radiation Protection Series publications are available for purchase directly from ARPANSA.  
2272 Further information can be obtained by telephoning ARPANSA on 1800 022 333 (freecall  
2273 within Australia) or (03) 9433 2211.

2274 **RADIATION PROTECTION SERIES**

2275 RPS 1. Recommendations for Limiting Exposure to Ionizing Radiation (1995) and  
2276 National Standard for Limiting Occupational Exposure to Ionizing Radiation  
2277 (republished 2002)

2278 RPS 2. Code of Practice for the Safe Transport of Radioactive Material (2001)

2279 RPS 3. Radiation Protection Standard for Maximum Exposure Levels to Radiofrequency  
2280 Fields – 3 kHz to 300 GHz (2002)

2281 RPS 4. Recommendations on the Discharge of Patients undergoing Treatment with  
2282 Radioactive Substances (2002)

2283 RPS 5. Code of Practice and Safety Guide for Portable Density/Moisture Gauges  
2284 Containing Radioactive Sources (2004)

2285 RPS 6. National Directory for Radiation Protection, Edition 1.0 (2004)

2286 RPS 7. Recommendations for Intervention in Emergency situations Involving Radiation  
2287 Exposure (2004)

2288 RPS 8. Code of Practice for the Exposure of Humans to Ionizing Radiation for Medical  
2289 Research Purposes (2005)

2290 RPS 9. Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste  
2291 Management in Mining and Mineral Processing (2005)

2292 RPS 10. Code of Practice and Safety Guide for Radiation Protection in Dentistry (2005)

2293 RPS 11. Code of Practice for the Security of Radioactive Sources (2007)

2294 RPS 12. Radiation Protection Standard for Occupational Exposure to Ultraviolet Radiation  
2295 (2006)

2296 RPS 13. Code of Practice and Safety Guide for Safe Use of Fixed Radiation Gauges (2007)

2297 Those publications from the NHMRC Radiation Health Series that are still current are:

2298 **RADIATION HEALTH SERIES**

- 2299 RHS 3. Code of practice for the safe use of ionizing radiation in veterinary radiology: Parts  
2300 1 and 2 (1982)
- 2301 RHS 8. Code of nursing practice for staff exposed to ionizing radiation (1984)
- 2302 RHS 9. Code of practice for protection against ionizing radiation emitted from X-ray  
2303 analysis equipment (1984)
- 2304 RHS 10. Code of practice for safe use of ionizing radiation in veterinary radiology: part  
2305 3-radiotherapy (1984)
- 2306 RHS 13. Code of practice for the disposal of radioactive wastes by the user (1985)
- 2307 RHS 14. Recommendations for minimising radiological hazards to patients (1985)
- 2308 RHS 15. Code of practice for the safe use of microwave diathermy units (1985)
- 2309 RHS 16. Code of practice for the safe use of short wave (radiofrequency) diathermy units  
2310 (1985)
- 2311 RHS 18. Code of practice for the safe handling of corpses containing radioactive materials  
2312 (1986)
- 2313 RHS 19. Code of practice for the safe use of ionizing radiation in secondary schools (1986)
- 2314 RHS 21. Revised statement on cabinet X-ray equipment for examination of letters,  
2315 packages, baggage, freight and other articles for security, quality control and other  
2316 purposes (1987)
- 2317 RHS 22. Statement on enclosed X-ray equipment for special applications (1987)
- 2318 RHS 23. Code of practice for the control and safe handling of radioactive sources used for  
2319 therapeutic purposes (1988)
- 2320 RHS 24. Code of practice for the design and safe operation of non-medical irradiation  
2321 facilities (1988)
- 2322 RHS 25. Recommendations for ionization chamber smoke detectors for commercial and  
2323 industrial fire protection systems (1988)
- 2324 RHS 28. Code of practice for the safe use of sealed radioactive sources in borehole logging  
2325 (1989)
- 2326 RHS 30. Interim guidelines on limits of exposure to 50/60Hz electric and magnetic fields  
2327 (1989)
- 2328 RHS 31. Code of practice for the safe use of industrial radiography equipment (1989)
- 2329 RHS 34. Safety guidelines for magnetic resonance diagnostic facilities (1991)
- 2330 RHS 35. Code of practice for the near-surface disposal of radioactive waste in Australia  
2331 (1992)
- 2332 RHS 36. Code of practice for the safe use of lasers in schools (1995)

- 2333 RHS 37. Code of practice for the safe use of lasers in the entertainment industry (1995)
- 2334 RHS 38. Recommended limits on radioactive contamination on surfaces in laboratories  
2335 (1995)

2336 **References**

- 2337 1. Australian Radiation Protection and Nuclear Safety Agency, Code of Practice for the Safe  
2338 Transport of Radioactive Material 2008, Radiation Protection Series 2.
- 2339 2. International Atomic Energy Agency Basic Safety Standards BSS 115 'International Basic  
2340 Safety Standards for Protection against Ionizing Radiation and for the Safety of  
2341 Radiation Sources', 1996.
- 2342 3. The Commission of European Communities report Radiation Protection 65 'Principles  
2343 and Methods for Establishing Concentrations and Quantities (Exemption Values) below  
2344 which Reporting is not Required in the European Directive' by M Harvey, S Mobbs, J  
2345 Cooper, A M Sugier, T Schneider, J Lochard and A Janssens, 1993.
- 2346 4. International Atomic Energy Agency Basic Safety Standards Series, 'Regulations for the  
2347 Safe Transport of Radioactive Material 2005 Edition' Regulations TS-R-1, 2005.  
2348