Australian Government
Australian Radiation Protection and Nuclear Safety Agency

SAFETY GUIDE

Safe Transport of Radioactive Material (2008)

RADIATION PROTECTION SERIES No. 2.1

Radiation Protection Series

The ***Radiation Protection Series*** is published by the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) to promote practices which protect human health and the environment from the possible harmful effects of radiation. ARPANSA is assisted in this task by its Radiation Health and Safety Advisory Council, which reviews the publication program for the ***Series*** and endorses documents for publication, and by its Radiation Health Committee, which oversees the preparation of draft documents and recommends publication.

There are four categories of publication in the ***Series***:

Radiation Protection Standards set fundamental requirements for safety. They are regulatory in style and may be referenced by regulatory instruments in State, Territory or Commonwealth jurisdictions. They may contain key procedural requirements regarded as essential for best international practice in radiation protection, and fundamental quantitative requirements, such as exposure limits.

Codes of Practice are also regulatory in style and may be referenced by regulations or conditions of licence. They contain practice-specific requirements that must be satisfied to ensure an acceptable level of safety in dealings involving exposure to radiation. Requirements are expressed in 'must' statements.

Recommendations provide guidance on fundamental principles for radiation protection. They are written in an explanatory and non-regulatory style and describe the basic concepts and objectives of best international practice. Where there are related **Radiation Protection Standards** and **Codes of Practice,** they are based on the fundamental principles in the **Recommendations**.

Safety Guides provide practice-specific guidance on achieving the requirements set out in **Radiation Protection Standards** and **Codes of Practice**. They are non-regulatory in style, but may recommend good practices. Guidance is expressed in 'should' statements, indicating that the measures recommended, or equivalent alternatives, are normally necessary in order to comply with the requirements of the **Radiation Protection Standards** and **Codes of Practice**.

In many cases, for practical convenience, regulatory and guidance documents which are related to each other may be published together. A **Code of Practice** and a corresponding **Safety Guide** may be published within a single set of covers.

All publications in the *Radiation Protection Series* are informed by public comment during drafting, and Radiation Protection Standards and Codes of Practice, which may serve a regulatory function, are subject to a process of regulatory review. Further information on these consultation processes may be obtained by contacting ARPANSA.

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The mission of ARPANSA is to provide the scientific expertise and infrastructure necessary to support the objective of the ARPANS Act – to protect the health and safety of people, and to protect the environment, from the harmful effects of radiation.

Published by the Chief Executive Officer of ARPANSA in August 2008

This PDF incorporates corrections listed in the Errata issued 29 October 2008.

Foreword

The regulation of the transport of radioactive material throughout the world is based on requirements published by the International Atomic Energy Agency (IAEA). The recently published Australian *Code of Practice for the Safe Transport of Radioactive Material (2008)* (the Transport Code) adopts the IAEA's *Regulations for the Safe Transport of Radioactive Material* 2005 Edition (No. TS-R-1) and establishes requirements for the safe transport of radioactive material in Australia.

The Transport Code is a complex document designed to cover all transport of radioactive material ranging from bulk amounts of low activity material, small packages of medical isotopes, very high activity industrial sources through to spent reactor fuel. Many of the transports covered by the Transport Code are not performed in Australia and many companies only transport a limited range of material. As such, only certain sections of the Transport Code will apply.

This *Safety Guide* aims to assist transport users in interpreting the detailed provisions in, and to facilitate compliance with, the Transport Code for their given situation. It explains the requirements for the consignor, the carrier and the consignee for transports of radioactive material and provides examples of how to prepare a transport consignment for some common radioactive sources. It also outlines what the competent authority does and who a transport agent needs to contact when the material is being transported outside Australia.

The *Safety Guide* does not impose any new obligations on the user additional to what are in the Transport Code and in case of any conflict between the information in the *Safety Guide* and that contained in the Transport Code, the latter takes precedence.

A draft *Safety Guide* was released for a public comment period from 30 May 2008 to 30 June 2008. The working group reviewed the comments received, the Radiation Health Committee approved the final document at their meeting of 16-17 July 2008, and the Radiation Health and Safety Advisory Council at their meeting of 8 August 2008 advised the CEO to adopt the *Safety Guide*.

The *Safety Guide* will take its place in the Radiation Protection Series alongside the Transport Code as RPS No. 2.1. I expect that the Radiation Health Committee will review the *Safety Guide* in two years, and update it if necessary, so it supports the Transport Code in providing the highest standards of protection for the transport of radioactive material.

John Loy PSM
CEO of ARPANSA

27 August 2008

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Contents

Note: Terms that are described in the Glossary appear in **bold type** on their first occurrence in the text.

1. Introduction

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)* (the Transport Code[1]) in relation to the transport of **radioactive material** by:

- road;
- rail; or
- those waterways not covered by the Maritime legislation.

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
- meeting the requirements of the Transport Code.

Where there are discrepancies between the Transport Code and the information contained in this Safety Guide, the requirements in the Transport Code apply.

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.

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.

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.

[1] 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.

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.

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 the consignor in the transport documents. The consignor may be an individual, company, government or other organisation and may require an authorisation from the relevant regulatory authority of the Australian jurisdiction in which the transport originates.
- **the consignee (recipient)** – the addressee nominated in the documentation as the person or organisation or company responsible for the receipt of the consignment. The consignee may require an authorisation from the relevant regulatory authority of the Australian jurisdiction in which the transport terminates.
- **the carrier** – any organisation or individual or company transporting radioactive materials. The term includes both carriers for hire and carriers on own account. The carrier may require an authorisation from the relevant regulatory authority of each Australian jurisdiction through or into which the transport may take place.
- **the competent authority** – the regulatory authority that administers the various statutory regulations governing the transport of radioactive materials, and controls emergency action in the event of an incident. A complete list of Australian competent authorities is listed in Annex A.

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

2. Notes for Consignors

The consignor is responsible for ensuring that the consignment of radioactive materials is properly:

- packaged;
- labelled;
- certified; and
- documented,

to ensure safe carriage and prompt delivery. To achieve this, the consignor should make a careful study of the Transport Code and be familiar with:

- the relevant requirements of the Transport Code;
- the examples given on pages 5 to 11 of this Safety Guide; and
- all aspects of his or her area of operations relating to the consignment of radioactive materials.

Along with the goods, the consignor is required to supply information, sometimes known as a 'consignor's declaration' (see Figure 1), outlining details of the consignment, such as:

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

The consignor's declaration, which is often called the consignor's certificate, the shipper's certificate or even the dangerous goods certificate, also needs to contain a signed statement to certify that the consignment conforms to applicable regulations. Copies of the consignor's declaration for radioactive material are available for download from the ARPANSA web site at www.arpansa.gov.au. Figure 1 shows a typical consignor's declaration for radioactive materials to be transported by:

- road;
- rail; or
- those waterways not covered by the maritime legislation.

Further documentation will most likely be required for air or sea transport and the appropriate authorities should be consulted if a particular consignment will involve those modalities.

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

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 Refer overleaf	RADIONUCLIDE Name or symbol of principal radioactive content e.g. Iridium-192, Ir-192 or ^{192}Ir	FORM Physical state: gas, liquid, solid or special form	UNITED NATIONS NUMBER	SUBSIDIARY RISK (if applicable) Classes 1 to 8

NUMBER OF PACKAGES	ACTIVITY OF RADIONUCLIDE in Becquerel units (Bq). (Curie units (Ci) may be used)	HAZARD CATEGORY Delete category not applicable	TRANSPORT INDEX Definition: 100 times the maximum radiation dose in millisievert per hour (mSv/h) at 1 metre	PACKAGE CLASSIFICATION Delete classification not applicable	COMPETENT AUTHORITY CERTIFICATE NUMBER(S) required only for Type B containers
		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)

SEE REVERSE FOR INFORMATION FOR CARRIERS AND EMERGENCY PROCEDURES

Version Date: 1 January 2008

Figure 1 Sample of a consignor's or shipper's declaration

2.1 EXAMPLES OF SOME ACTIONS TAKEN TO PREPARE PARTICULAR MATERIALS FOR SHIPMENT

In order to prepare a **shipment**, the consignor first needs to define the radioactive material to be transported with reference to:

- the type of radioactive material (i.e. isotope or mixture of isotopes);
- the total activity of the consigned material;
- the chemical and physical form, for example:
  - solid, liquid, or gas; and
  - size, mass, encapsulation (special form), and
- determining $\mathbf{A_1}$ and $\mathbf{A_2}$ limits for the radionuclide (A_1 and A_2 are defined in para. 201 of the Transport Code and are used to determine package activity limits for special form and non-special form radioactive material respectively).

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

Using the above information, the consignor can refer to the appropriate Schedule included in this Safety Guide to assist in establishing the type of packaging and the documentation required. It is essential that every package carries the appropriate radiation level labels. The flowcharts included in Annex C are available to assist in determining the:

- package type; and
- labelling required for different packaging types.

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

Example 1

Consignment:

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

Action:

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

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

Step c Attach normal labelling from the shipping company plus a label on the depleted uranium shield indicating that it is radioactive. The package will also need to be marked with 'UN2909'.

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

The Director of Safeguards
Australian Safeguards and Non-Proliferation Office
Department of Foreign Affairs and Trade
Level 2
RG Casey Building
BARTON ACT 0221

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

Example 2

Consignment:

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

Action:

Step a

Radionuclide:	iodine-125
Total activity of consignment:	10 × 370 kBq = 3.7 MBq.
Chemical form:	solution (liquid).

Step b From Table 1 of the Transport Code relating to activity limits:

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

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

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

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

Step c Ensure that non-fixed external contamination does not exceed 4 Bq/cm^2. (Some carriers may require certified measurements.)

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

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

	Maximum radiation level at the surface of the package	
	≤5 μSv/h	>5 μSv/h but ≤10 mSv/h
Consignment Type	Excepted Package	Type A package (the package size cannot be less than 10 cm in any of its external measurements)
Applicable Schedule in this Safety Guide	Schedule 1	Schedule 9.
Absorbent Material	Because the package in this example contains radioactive liquid it will need to have either: • sufficient absorbent material to absorb twice the volume of the liquid contents; or • 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.	

Package Labelling	The packaging needs to be legibly and durably marked on the outside with:
	• an identification of the consignor, the consignee or both; and
	• the mark 'UN2910'.
	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.
		The packaging needs to be legibly and durably marked on the outside with:
		• an identification of the consignor, the consignee or both;
		• the marking 'TYPE A', if it conforms to the Type A package **design**;
		• the mark 'UN2915'; and
		• at least two completed:
		  • yellow II labels (if the maximum radiation level at any point on the package surface is >0.005 mSv/h but ≤0.5 mSv/h); or
		  • yellow III labels (if the maximum radiation level at any point on the package surface is >0.5 mSv/h but ≤10 mSv/h).

Transport Index (TI)	Not applicable	The maximum radiation level at 1 metre from any external surface of the package in mSv/h × 100 and rounded *up* to the first decimal place. A value of 0.05 or less may however be considered as zero.

	Maximum radiation level at the surface of the package	
	≤5 μSv/h	>5 μSv/h but ≤10 mSv/h
Transport Documents	The description 'UN2910'. A consignor's declaration is not required.	Relevant details of the consignment, information for carriers and a declaration that the consignment meets the requirements of the Transport Code[2]. 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 carrier should include instructions for storage and segregation, and the air waybill or consignment note.

Example 3

Consignment:

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

Action:

Step a Radionuclide: iodine-131

Total activity for consignment: 1.85 GBq (0.00185 TBq).

Physical/Chemical form: sodium iodide in solution.

Step b From Table 1 of the Transport Code relating to activity limits:

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

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

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

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

Step c Ensure that non-fixed external contamination does not exceed 4 Bq/cm^2. (Some carriers may require certified measurements.)

[2] See attached example at page 4.

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

- 5 μSv/h for a Category I-WHITE package;
- 500 μSv/h for a Category II-YELLOW package; or
- 2 mSv/h for a Category III-YELLOW package[3].

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

- sufficient absorbent material to absorb twice the volume of the liquid contents; or
- 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.

Step f *Labelling:* Check that the packaging:

- is legibly and durably marked on the outside with:
  - an identification of the consignor, the consignee or both;
  - the marking 'TYPE A', if it conforms to the Type A package design; and
  - the mark 'UN2915', and
- bears at least two completed Category I-WHITE, Category II-YELLOW or Category III-YELLOW labels, consistent with the external radiation levels measured in Step d. Category II-YELLOW or Category III-YELLOW labels will also need to include the TI.

Step g *Transport documents:* A consignor's declaration[4] that contains:

- relevant details of the consignment;
- information for carriers; and
- a declaration that the consignment meets the requirements of the Transport Code.

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 carrier should include instructions for storage and segregation, and the air waybill or consignment note.

[3] 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.

[4] See attached example at page 4.

Step h *Loading:* Check storage and segregation instructions. Check that the parcel is secured in the **vehicle**, and that the vehicle is correctly placarded.

Example 4

Consignment:

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

Action:

Step a

Radionuclide:	iridium-192
Total activity for consignment:	2.96 TBq
Physical form:	'Special form' welded titanium capsule
Chemical form:	metal

Step b From Table 1 of the Transport Code:

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

A_1 = 1 TBq, A_2 = 0.6 TBq.

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

Step c *Packaging.* Check that:

- the Type B(U) package approval certificate is current for the container and valid for the transport of 2.96 TBq of iridium-192;
- the 'special form' certificate is current and valid for the source capsule;
- where the package makes use of depleted uranium for shielding, a special export permit is required if the package is part of an export consignment (see Example 1);
- the non-fixed external contamination does not exceed 4 Bq/cm^2. (Some carriers may require certified measurements.);
- the external radiation level on any surface of the package does not exceed 2 mSv/h;
- the container for the source which forms a part of the package is sealed or locked;
- the appropriate UN number preceded by the letters 'UN' (in this example, UN2916) is legibly and durably marked on the outside of the packaging; and

- if the package weighs more than 50 kg, it is equipped with special handling facilities.

Step d *Labelling:* A Category III-YELLOW label is probably required (external dose rate >500 μSv/h), and the package and the container are to be durably marked:

TYPE B(U)
Weight ..... (if greater than 50 kg), package type approval certificate no. and serial no., etc.

Step d *Transport Documents:*

- a consignor's declaration[5] that contains:
  - relevant details of the consignment;
  - information for carriers; and
  - a declaration that the consignment meets the requirements of the Transport Code;
- the Type B(U) Package Approval Certificate;
- a **special form** source certificate;
- carrier's consignment note that describes the radionuclide and total activity;
- storage and packing instructions; and
- as the quantity is less than the lesser of 3000 × A1 TBq or 1000 TBq, no notification of the transport is required to be provided to competent authorities along the route *under the Transport Code*. Each competent authority along the route might however have separate requirements for notification; and

Step e *Despatch*. Check that:

- the consignment is secured within the vehicle; and
- the vehicle is correctly placarded (see Section 3).

Example 5

Consignment:

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

Action:

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

Step b The regulatory requirements for packaging LSA-I material allow for the consignment to be shipped in bulk or in most types of packaging. No testing procedures for packaging are prescribed, unless it is:

- in the form of a liquid or liquid slurry; and

[5] See attached example at page 4.

- it is not being transported under exclusive[6] use.

Steel drums with removable lids are often used, and it is common practice to limit the gross weight of each drum to 400 kg.

Step c As both road and sea transport modes are to be used, the shipment should satisfy the requirements of the:

- Transport Code; and
- International Maritime Dangerous Goods Code, including the Australian Supplement.

Although the requirements of both are very similar, it would be advisable to check for possible variations.

Step d The steel drums may be transported as a 'compact stack' or loaded into **freight container**s.

Step e *Labelling:* Each package will need to:

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

[6] 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.

3. Notes for Carriers

The Transport Code is designed to ensure that radiation exposures to any person involved in the transport of radioactive materials do not exceed those permitted for members of the public.

3.1 LABELLING

Except in the case of exempt or excepted materials, packages containing radioactive material are labelled according to the external radiation they emit. The consignor is responsible for attaching the appropriate label to the outside of each package showing the radiation level. Each category of label represents the potential hazard of the package as follows:

- a category I-WHITE label indicates that the radiation level at the surface of a package is very low (≤5 μSv/h);
- a category II-YELLOW label indicates a higher dose rate at the package surface (greater than 5 μSv/h but ≤500 μSv/h); and
- a category III-YELLOW (the highest radiation category) indicates that a significant level of radiation can be expected at the surface of the package (greater than 500 μSv/h and up to 2000 μSv/h (or 10 000 μSv/h if transported under **exclusive use**)) and in its near vicinity.

Each category II and III label will also include a number called the transport index (TI). The TI is:

- effectively one tenth of the maximum radiation level, in μSv/h, at 1 metre from any external surface of the package; and
- rounded up to the first decimal place (although a value of 0.05 or less is considered zero).

The TI is used to provide control over radiation exposure during transport.

Each package will also be clearly marked with the:

- name of the consignor, the consignee or both;
- proper shipping name; and
- appropriate UN number.

For excepted packages, the proper shipping name is not necessary.

3.2 HANDLING RULES

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

- contact time with the package should be kept short.
- a package of radioactive material should be handled without delay and kept moving.
- nobody should be permitted to stand around, sit near or sit on a package containing radioactive material.
- time-consuming tasks, such as paperwork, should not be carried out near a package.
- all persons should be kept as far away as practicable from packages containing radioactive material.
- packages should be stored well away from offices, rest rooms and occupied work areas.
- a vehicle transporting packages containing radioactive material needs to provide sufficient separation between the packages and any personnel to ensure that no person will receive a dose in excess of the radiation protection limits. Packages should not be placed on the passenger seat.
- each vehicle transporting category I, II or III packages or freight containers carrying packages other than excepted packages will need to bear placards that conform to the model given in Figure 2. Placards on trains are to be placed on two external lateral walls, on two lateral walls and the rear wall for road vehicles and on all four sides of a freight container.

Figure 2 Placard for vehicle or freight container

- the Transport Code also requires that category II or III packages are not carried in the passenger compartment of vehicles unless the compartment is specifically designed for that purpose.
- packages should be secured so that they will not move during transport — small, light packages can be stored in a basket while larger, heavy packages should be properly blocked and braced.
- groups of packages with transport indexes[7] that add up to more than 50 cannot be stored in the one location unless there is a separation of at least 6 metres between each such group.
- the Australian Dangerous Goods Code (ADG Code), as amended from time-to-time, requires that packages of radioactive materials (dangerous goods Class 7) be separated from other dangerous goods while being transported, or stored during transit, as follows:

[7] The transport index will be written on the YELLOW Category II or Category III label.

Dangerous Goods Classes Requiring Separation from Radioactive Materials During Transport		Minimum Separation Required[8] (metres)
Class 1	Explosives	24
Class 2.1	Flammable Gases	24
Class 3	Flammable Liquids	12
Class 4.1	Flammable Solids	12
Class 4.2	Spontaneously Combustible Substances	12
Class 4.3	Dangerous When Wet Substances	12
Class 5.1	Oxidising Agents	12
Class 5.2	Organic Peroxides	12
Class 8	Corrosive Substances	12

- the ADG Code also requires that radioactive materials (dangerous goods Class 7) are separated from rolling stock during transit as follows:

Rolling stock requiring Separation from Radioactive Materials During Transport	Minimum Separation Required[8] (metres)
Locomotive in power	24
Guard's brake van	24
Wagon loaded with logs, rails, beams, pipes etc. without bulkhead	24
Vehicle carrying passengers	24
Operating refrigerated container.	12

- the ADG Code allows packages of radioactive materials (dangerous goods Class 7) to be transported, or stored during transit, with the following classes of dangerous goods without restriction:

Dangerous Goods Classes PERMITTED to be Transported with Radioactive Materials (Dangerous Goods Class 7)	
Class 2.2	Non-flammable Non-toxic Gases
Class 2.3	Poisonous Gases
Class 6	Poisonous (Toxic) Substances
Class 9	Miscellaneous Dangerous Goods

3.3 EMERGENCY PROCEDURES

The procedures outlined in part 8 of this Safety Guide should be followed in the event of an incident involving:

[8] These distances are taken from the Sixth Edition of the ADG Code.

- a vehicle transporting radioactive material; or
- damage or suspected damage to the package itself.

3.4 TRANSPORT BY TAXI

In certain specific circumstances, radioactive material may be able to be transported by taxi. An example could be the carriage of an excepted package containing essential medical isotopes from one hospital to another. Such a transport could, however, require an authorisation from the relevant regulatory authority and it is essential that the appropriate requirements are checked before any such transport is carried out.

3.5 SECURITY OF RADIOACTIVE SOURCES

The Code of Practice for the Security of Radioactive Sources (the Security Code) will need to be consulted where a security enhanced source[9] is being transported. Depending on the nature and category of the source, the Security Code will require certain physical security measures to be implemented such as:

- the preparation of a Source Transport Security Plan; and
- a security background check for all persons who might be involved with transporting the source.

The Security Code should be consulted for further detailed information.

[9] A security enhanced source is defined in the Security Code as a radioactive source, or aggregation of radioactive sources, assigned the Category 1, 2 or 3 when using the methodology set out in Schedule B of that Code. It is important that these security categories are not confused with the radiation level category labelling on the packages. Generally, physical security measures apply to higher activity sources and the Security Code should be consulted for further details.

4. Notes For Consignees

On receipt of the package(s), the consignee should ensure that the consignment is:

- intact; and
- in agreement with the information entered in the documentation for the consignment.

In the event of damage to a package or any likelihood of loss of radioactive material during transportation which might pose a radiation hazard to people or the environment, the consignee should advise the competent authority immediately.

In the event of a lost consignment, the consignee should immediately inform the competent authority once the fact is ascertained.

5. Competent Authorities

The role of the competent authority is to:

- receive and assess applications for:
  - shipment approval;
  - special form approval;
  - package design approval; or
  - package validation approval;
- issue, where appropriate:
  - shipment approval certificates;
  - special form certificates;
  - package design approval certificates; and
  - validation of package design approval certificates from other countries;
- evaluate package designs and **special form radioactive materials**, and issue certificates of compliance;
- provide information to:
  - package designers;
  - consignors;
  - carriers; and
  - consignees, and
- receive notification of proposed shipments.

Competent authorities are also responsible for ensuring that adequate emergency plans exist.

5.1 COMPETENT AUTHORITIES IN AUSTRALIA

References in the Transport Code to dealings between competent authorities can be read as in relation to:

- a competent authority in Australia – the Commonwealth competent authority; and
- the foreign competent authority – that foreign competent authority.

The competent authority in Australia for the regulation of the safe transport of radioactive materials by:

- sea, either interstate or overseas, is the Australian Maritime Safety Authority (AMSA);
- air, is the Civil Aviation Safety Authority (CASA);
- land or water other than in (a) above is the designated competent authority in each State and the Northern Territory;

- a Commonwealth entity is ARPANSA; and
- land or water within a Commonwealth Territory is ARPANSA.

A list of competent authorities in Australia is given in Annex A.

5.2 SHIPMENT APPROVAL

Notice of an intended shipment, where required by the IAEA Regulations, is to be given to each competent authority through whose jurisdiction the shipment will pass. As an example, an intended radioactive material shipment from the Northern Territory to the United States, via Queensland, would involve notice of the shipment being given to the following competent authorities:

- Northern Territory's competent authority;
- Queensland's competent authority;
- AMSA or CASA (sea or air as appropriate); and
- in the United States – the U.S. Department of Transportation.

The competent authority listed in Annex A should be consulted for advice on matters relating to the transport of radioactive materials.

5.3 NOTIFICATION OF AN INCIDENT

Any incident that involves damage to a package containing radioactive material is to be reported as soon as practicable to the competent authority in whose jurisdiction the incident occurred. Relevant State or Territory emergency services should be contacted in accordance with the emergency response arrangements of the given jurisdiction. Chapter 8 of this Safety Guide covers emergency procedures.

6. Special Requirements for Various Modes of Transport

6.1 TRANSPORT BY SEA

The handling and carriage of radioactive materials in Australian ports for international and interstate transportation is regulated by the *Navigation (Cargo – Hazards Prevention) Regulations* and the *Navigation (Dangerous Goods) Regulations* 1979. These Regulations invoke the *International Maritime Dangerous Goods Code* (the IMDG Code), as amended from time to time, with the Australian Supplement. The provisions of the IAEA Regulations are incorporated in the IMDG Code.

For intrastate voyages of radioactive materials the regulations to be taken into consideration are the appropriate State/Territory legislation together with the Transport Code. The applicable competent authorities when undertaking such voyages are listed in Annex A of this Safety Guide.

The IMDG Code is available from:

Hunter Publications,
58A Gipps Street,
COLLINGWOOD VIC 3066

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

The documentation accompanying a consignment of radioactive material, other than an excepted package, presented for shipment will include a consignor's declaration (shipper's certificate). On this certificate the IAEA/IMDG Schedule number of the consignment is recorded and with this information reference may be made to the IMDG Code for all requirements.

The competent authority for international and interstate sea transportation of radioactive materials is AMSA. Addresses and telephone numbers for the purpose of notification, and for use in the event of any incident or emergency, are given in Chapter 8. Information on the carriage of radioactive materials and advice on the interpretation of Codes and Regulations is available at any Marine Survey Office of AMSA in the capital cities.

6.2 TRANSPORT BY AIR

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

Both s.23 of the CAA and Part 92 of the CASR specify the requirements for:

- consignors (Shippers); and
- air carriers of dangerous goods (Operators).

Section 23 of the CAA and Part 92 of the CASR mandate the use of the ICAO *Technical Instructions For The Safe Transport Of Dangerous Goods By Air* effective at the time the goods are consigned for carriage by air for the technical requirements. The ICAO Technical Instructions are re-issued at 2 yearly intervals. Part 92 of the CASR makes provision for the use of the current IATA Dangerous Goods Regulations, as amended from time to time, as an equivalent to the ICAO Technical Instructions however, the ICAO Technical Instructions is the authoritative legal document.

The *ICAO Technical Instructions for the Safe Transport of Dangerous Goods by Air*, DOC9284, is available for purchase from:

Attention: Document Sales Unit
International Civil Aviation Organization
999 University Street
MONTREAL QUEBEC CANADA H3C 5H7
Telephone: +1-514-954-8022

or online at www.icao.int

and the IATA Dangerous Goods Regulations are available for purchase from:

Australian Federation of International Forwarders
Telephone: +61-2-9314 3055

or online at www.afif.asn.au.

The ICAO Technical Instructions and IATA Dangerous Goods Regulations list items that are 'forbidden' for air transport. A supplement in the ICAO Technical Instructions covers the air transport of dangerous goods and contains details about:

- forbidden items; and
- how to obtain special permission to transport dangerous goods.

The details in the supplement are not reproduced in the IATA Dangerous Goods Regulations. Initial inquires should be made with CASA. See Annex A for contact details.

For practical purposes, the requirements of the ICAO Technical Instructions (and the IATA Dangerous Goods Regulations) reflect the requirements of the 2005 IAEA Regulations for transportation of radioactive materials.

Consignors of radioactive material for transport by air should initially contact their airline to establish the relevant requirements. Two copies of a Dangerous Goods Transport Document form will need to be:

- completed; and
- presented with the goods when the consignment is lodged with the airline.

The Dangerous Goods Transport Document requirements for air transport differs from the other modes. Attention to detail is essential if delays in transit or at destination airports are to be avoided.

There is also a mandatory training requirement in relation to consignors (shippers) of dangerous goods, including radioactive materials, by air. Details of the training requirements are available from the CASA web site at: www.casa.gov.au.

6.3 TRANSPORT BY ROAD AND RAIL

Requirements for the transport of radioactive materials by road or rail are contained in the Transport Code.

The following documentation is required for transport by road or rail:

- a movement order or equivalent document such as a waybill, consignment note, etc.;
- details of the consignment, including the:
  - radionuclide;
  - total activity; and
  - number of packages;
- other than for an excepted package, a consignor's declaration. Generally, at least two copies are required; one for the carrier, and one, within a stout envelope, firmly fixed to the outside of the package for inspection in transit. Where more than one carrier is involved, it may be necessary for each carrier to receive a copy of the consignor's declaration;
- package certification, as required;
- special form certificate, if applicable, for sealed sources;
- competent authority approval, where required;
- information for carriers that includes:
  - any supplementary operational requirements for:
    - loading and unloading;
    - transport;
    - storage (for example, away from persons and undeveloped film or for the safe dissipation of heat); and
    - handling;

  - where applicable, a statement that no supplementary operational requirements are necessary; and
  - emergency arrangements specific to the package.

Restrictions on loading need to be observed in relation to separation from:

- flammable goods;
- other dangerous goods;
- foodstuffs;
- undeveloped film;
- livestock; and
- personnel.

Any special conditions applying to an exclusive use shipment should be determined from the Transport Code.

Trans-shipment of a load: During transfer of a radioactive consignment, all documents relating to the consignment should be handed to the person responsible for the next stage of the journey. Each carrier should be aware of the:

- limitations on mixed loading of vehicles; and
- limits on radiation levels – for example, packages with transport indexes that add up to more than 50 generally cannot be shipped in any one load[10].

Storage of a load: When radioactive material needs to be stored during shipment, the load should:

- be stored in a secure area with restricted access; and
- not be stored with:
  - flammable or other dangerous material;
  - foodstuffs;
  - livestock; or
  - undeveloped film.

Limits on the total radiation level during storage will need to be observed. For example, packages with transport indexes that add up to more than 50 generally cannot be stored in any one location[10].

Where a package gives off significant heat, the storage arrangements should provide for safe dissipation of the heat.

Consideration will also need to be given to the requirements of the Security Code (see section 3 of this Safety Guide for details).

[10] Some exceptions apply. See the Code for details.

Decontamination of packages and conveyances: The Transport Code requires that the non-fixed contamination on the external surfaces of any package or on the external and internal surfaces of any **overpack**, freight container, **tank**, **intermediate bulk container** or **conveyance** does not exceed:

- 4 Bq/cm^2 for beta, gamma and **low toxicity alpha emitters**; and
- 0.4 Bq/cm^2 for all other alpha emitters.

While the Transport Code defines 'package' and 'conveyance', there has, in the past, been some confusion as to what 'conveyance' actually covers. For road and rail transport, the definition of conveyance is *any vehicle*. Vehicle in this context is, however, only intended to include those vehicles used to transport radioactive material. It is not intended to include those vehicles owned by employees of the transporting company unless they are, in turn, actually used to transport radioactive material.

7. Check List For Consignors, Carriers and Consignees

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

7.1 WAYBILL OR CONSIGNMENT NOTE

Check:
- consignor's name and address present;
- consignee's name and address present;
- name and symbol of the radioactive material present;
- category of package(s) radiation level e.g. excepted, I-WHITE, II-YELLOW, III-YELLOW, etc.; and
- number of package(s) present.

7.2 PACKAGES

Check:
- correct number of packages present and are correct size and weight;
- packages in good condition and seals intact;
- all labels agree with consignor's declaration (shipper's certificate);
- information on:
  - transport index;
  - radioactive material;
  - activity given on the package label;
  - UN number;
  - proper packaging name;
  - consignor/consignee name and address; and
  - package weight,

  agrees with the consignor's declaration (shipper's certificate);
- a package containing liquid has a 'THIS SIDE UP' label; and
- the class of the package(s) marked e.g. Type A, B as appropriate.

7.3 CONSIGNOR'S DECLARATION

Check:
- contents are properly described by name and are properly packaged, marked and labelled in accordance with IAEA Regulations;
- it is in duplicate and in English;
- the name of the radioactive material is shown;

- chemical and physical forms are shown;
- total activity is shown;
- number of packages is shown;
- the transport index is shown – does this entail restrictions on loading?
- full name and address of consignor is shown;
- full name and address of consignee is shown;
- is the package Type A or Type B?
  - If Type B(U), that the certificate number is shown.
  - If Type B(U), that the certificate is present (if required);
- a copy of the special form material certificate is present;
- is a certificate for **fissile material** required? – if yes, check that it is present;
- does the shipment require a special export permit or other Government approval for transport? – if yes, check that this is present and' correct; and
- the transport certificate: is correctly signed by the consignor (shipper).

8. Emergency Procedures

Before carrying radioactive materials, everyone involved should be aware of the procedures to be followed in the event of an incident causing damage to a package containing the radioactive material. They should be familiar with the emergency plans appropriate to the risks associated with each shipment of radioactive materials. The appropriate competent authority should be consulted on particular requirements.

The carrier (or any other person involved with the transport) should be aware of the name and telephone number of each competent authority through whose jurisdiction the shipment will pass. The appropriate competent authority should be contacted as soon as practicable following an incident involving a radioactive consignment. Relevant State or Territory emergency services should be contacted in accordance with the emergency response arrangements of the given jurisdiction. If the incident occurs after hours, the local police should be contacted immediately.

8.1 In Case of Incident

If a radioactive material package has been damaged and it is suspected that the damage may allow radiation leakage or spillage of the radioactive material:

- the package should not be touched.
- all people should be kept away from the package.
- the supervisor, manager or other appropriate responsible person 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.
- any person who might have touched the damaged package needs to report to the supervisor, manager or other appropriate responsible person — they will arrange the necessary action.
- any person who has touched the damaged package, or objects near it, needs to:
  - wash their hands thoroughly; and
  - advise the supervisor, manager or other appropriate responsible person of their possible contamination by radioactive material.
- all vehicles involved in the incident should remain at the incident site until cleared by:
  - the police; or
  - other competent person (e.g. fire brigade personnel, emergency response personnel, etc.)

- no-one should:
  - eat;
  - drink;
  - smoke; or
  - leave the site,

  until checked for possible contamination.
- 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.
- a carrier or other person dealing with an incident where there has been significant damage to a package should, at least:
  - rescue injured persons and administer first aid (and advise ambulance and hospital personnel of the need for assistance and of possible radioactive contamination[11] – protective clothing may be needed for rescuers in some cases);
  - evacuate the area, staying upwind and at least 3 m from the package;
  - isolate the area by:
    - erecting barriers; or
    - otherwise preventing access by unauthorised persons;
  - as soon as possible, either:
    - call the police and have them advise the competent authority; or
    - advise the competent authority directly,

    giving details (from the consignor's declaration) of the radioactive material being transported;
  - follow any instructions subsequently issued by the police or the competent authority;
  - identify persons, vehicles and equipment that may have been:
    - contaminated; or
    - exposed to radiation[12],

    and ensure that they remain in the vicinity for examination;
  - ensure that any person who may be contaminated thoroughly wash themselves;

[11] Contamination arises from contact between clothing (or a part of the body) and a substance assumed to be the result of a spillage from a package.

[12] It should be noted that, depending on the nature of the radioactive material and the accident conditions, bystanders may have also become contaminated or exposed to radiation and need subsequent attention.

– place any clothing known or assumed to be contaminated in plastic bags for decontamination or safe disposal. Care should be taken to avoid contaminating oneself during this process;

– stand by until the arrival of an appropriate responsible person and provide that person with all the available information as to the type of radionuclide and the activity (e.g. caesium-137 – activity 7.4 GBq). All relevant transport documents should be made available to the appropriate responsible person; and

– inform the appropriate responsible person that, where applicable, some contamination of persons may have occurred.

In dealing with an incident where there has been significant damage to a package, no-one should attempt to:

- clean up any broken package(s) or materials;
- handle broken package(s) or materials in any way; or
- remove the spilt material, packaging or wrapping,

unless they have specific knowledge and training in how to do so safely.

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

The Schedules in this Safety Guide are provided as an aid to users of the Transport Code, but it is important to note that they do not contain any additional requirements. They are intended to:

- summarise the requirements in the Transport Code; and
- provide references to the relevant detailed provisions of the Transport Code to enable these to be consulted where necessary.

The use of the words 'must' and 'shall' is purely to reflect the requirements contained in the Transport Code.

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

TABLE 1 – Schedules in this Safety Guide

Schedule No.	Description of Material	UN Number
Common provisions for Schedules 1-4		
1	Limited quantities of radioactive material in excepted packages	**2910**
2	Instruments and articles in excepted packages	**2911**
3	Articles manufactured from natural uranium, depleted uranium or natural thorium as excepted packages	**2909**
4	Empty packagings as excepted packages	**2908**
Common provisions for Schedules 5-14		
5	**Low specific activity material** (LSA-I)	**2912 or 2978 (as applicable)**
6	Low specific activity material (LSA-II)	**2977, 2978, 3321 or 3324 (as applicable)**
7	Low specific activity material (LSA-III)	**2977, 2978, 3322 or 3325 (as applicable)**
8	**Surface contaminated objects** (SCO-I and SCO-II)	**2913 or 3326 (as applicable)**

Schedule No.	Description of Material	UN Number
9	Material in Type A packages	**2915, 2977, 2978, 3327, 3332 or 3333 (as applicable)**
10	Material in Type B(U) packages	**2916 or 3328 (as applicable)**
11	Material in Type B(M) packages	**2917 or 3329 (as applicable)**
12	Material in Type C packages	**3323 or 3330 (as applicable)**
13	Fissile material	**2977, 3324, 3325, 3326, 3327, 3328, 3329, 3330, 3331 or 3333 (as applicable)**
14	Material transported under **special arrangement**	**2919 or 3331 (as applicable)**
15	Summary of approval and prior notification requirements	–

Provisions that are common to most, but not necessarily all, of Schedules 1 to 4 are provided before those Schedules as 'Common Provisions for Schedules 1–4'.

Similarly, provisions that are common to most, but not necessarily all, of Schedules 5 to 14 are provided before those Schedules as 'Common Provisions for Schedules 5–14'.

Each Schedule contains further information than that covered in the 'Common Provisions' as applicable to each transport type.

If there are any discrepancies between the Transport Code and the information contained in this Safety Guide, including the Schedules, the requirements in the Transport Code apply.

9.1 COMMON PROVISIONS FOR SCHEDULES 1–4

1. Materials

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

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

2. Packaging/Package

Although excepted packages do not require competent authority approval, the consignor will need to be prepared to demonstrate the compliance of the package design with all the applicable requirements to the relevant competent authority.

3. Maximum Radiation Levels

5 μSv/h at the surface of a package.

4. Contamination

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

- beta, gamma and low toxicity alpha emitters: 4 Bq/cm^2; and
- all other alpha emitters: 0.4 Bq/cm^2.

5. Decontamination

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

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

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

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

6. Loading and Segregation

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

7. Labelling and Marking

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

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

8. Placarding

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

9. Transport documents

See appropriate Schedule.

10. Mixed Contents and Carriage

No specific provisions.

11. Other provisions

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

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

Incident provisions — see paras 304 and 305.

Quality assurance — see para. 306.

Compliance assurance — see para. 307 and 308.

Damaged or leaking packages — see para. 511.

Customs — see para. 582.

Undeliverable packages — see para. 583.

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

Schedule 1. Limited Quantities of Radioactive Material in Excepted Packages

UN Number
2910

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

1. Materials

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

Fissile material:

- the amounts cannot exceed the appropriate limits specified in Table S1.1 below; and
- additionally, satisfying with regard to amounts, form and packaging the requirements 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[a,b]

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	2×10^{-2} A_2
	special form	10^{-3} A_1
	other forms	10^{-3} A_2

a For specific values of A_1 and A_2 see Tables 1 and 2 of the Transport Code.
b For mixtures of radionuclides the methods for defining A_1 and A_2 are provided in paras 404-406.

2. Packaging/Package

Paras 515 and 620 of the Transport Code apply.

3. Labelling and Marking

Packages will need to bear 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.

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

4. Transport Documents

Packages shall be described in the transport documents as 'UN 2910'.

5. Storage, Dispatch and Carriage

There are no specific provisions.

Schedule 2. Instruments or Articles in Excepted Packages

UN Number
2911

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

1. Materials

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

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

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

Table S2.1. Activity Limits in Terms of A_1 and A_2 Values for Excepted Packages Containing Instruments or Articles[a,b]

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	2×10^{-2} A_2	2×10^{-1} A_2
	special form	10^{-3} A_1	10^{-2} A_1
	other forms	10^{-3} A_2	10^{-2} A_2

a For specific values of A1 and A2 see Tables 1 and 2 of the Transport Code.
b For mixtures of radionuclides the methods for defining A1 and A2 are provided in paras 404–406 of the Transport Code.

2. Packaging/Package

Paras 515 and 620 of the Transport Code apply.

3. Labelling and Marking

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

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

- an identification of either the consignor or consignee; and
- the mark 'UN 2911'.

4. Transport Documents

Packages will be described in the transport documents as 'UN 2911'.

5. Mixed Contents, Loading and Segregation Storage, and Dispatch, and Carriage

There are no specific provisions.

Schedule 3. Articles Manufactured from Natural Uranium, Depleted Uranium or Natural Thorium as Excepted Packages

UN Number
2909

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

1. Materials

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

2. Packaging/Package

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

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

3. Labelling and Marking

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

4. Transport Documents

Packages shall be described in the transport documents as 'UN 2909'.

5. Mixed Contents, Loading and Segregation, Storage and Dispatch, and Carriage

There are no specific provisions.

Schedule 4. Empty Packagings as Excepted Packages

UN Number
2908

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

1. Materials

Empty packagings which have previously contained radioactive material.

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

2. Packaging/Package

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

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

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

3. Decontamination

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

4. Labelling and Marking

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

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

5. Transport Documents

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

6. Mixed Contents, Loading and Segregation, Storage and Dispatch, and Carriage

There are no specific provisions.

9.2 COMMON PROVISIONS FOR SCHEDULES 5–14

1. Materials

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

2. Packaging/Package

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

The transitional arrangements for package designs that did not require approval of design by the competent authority and which meet the requirements of the 1985 or 1985 (As Amended 1990) Editions of the IAEA Regulations[13] are detailed in para. 815.

The transitional arrangements for packagings manufactured to a package design approved by the competent authority under the provisions of the 1973 or 1973 (As Amended) Editions of the IAEA Regulations[14] are detailed in para. 816.

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

3. Maximum Radiation Levels

Radiation level limits for packages or overpacks are:

(i) 0.1 mSv/h at 1 m from the external surfaces of the package or overpack, except when transported under exclusive use, and

(ii) 2 mSv/h on any external surface of the package or overpack, except when transported under exclusive use by rail or by road, or under exclusive use and special arrangement by **vessel** or by air, and

(iii) 10 mSv/h on any external surface of a package transported under exclusive use.

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

(i) the vehicle is equipped with an enclosure which prevents unauthorised access during transport;

[13] These IAEA Regulations were incorporated into the *Code of Practice for the Safe Transport of Radioactive Substances 1990*.

[14] These IAEA Regulations were incorporated into the *Code of Practice for the Safe Transport of Radioactive Substances 1982*.

(ii) the package or overpack is secured to retain its position within the enclosure during routine transport; and

(iii) there are no loading or unloading operations between the beginning and end of the shipment.

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

Radiation levels for road or rail vehicles under exclusive use shall not exceed 0.1 mSv/h at any point 2 m from the vertical planes represented by the outer lateral surfaces of the vehicle, or, if the load is transported in an open vehicle, at any point 2 m from the vertical planes projected from the outer edges of the vehicle.

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

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

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

4. Contamination

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

- for beta, gamma and low toxicity alpha emitters: 4 Bq/cm^2;
- for all other alpha emitters: 0.4 Bq/cm^2.

5. Decontamination

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

Conveyances, equipment or parts thereof which have, in the course of transport of radioactive material, become contaminated above the limits

specified in Common Provision 4, or which show a radiation level in excess of 5 μSv/h at the surface, shall be decontaminated as soon as possible by a qualified person and shall not be reused unless the non-fixed contamination does not exceed the limits specified in Common Provision 4. In addition, the radiation level resulting from the fixed contamination on surfaces after decontamination shall be less than 5 μSv/h.

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

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

6. Mixed Contents

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

7. Loading and Segregation

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

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

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

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

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

8. Labelling and Marking

Packages:

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

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

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

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

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

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

Freight containers and overpacks:

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

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

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

9. Placarding

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

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

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

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

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

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

10. Transport Documents

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

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

11. Storage and Dispatch

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

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

12. Carriage

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

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

For transport by air:

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

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

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

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

(i) A radiation protection program for the shipment shall be approved by the competent authority of the flag state of the vessel and, when requested, by the competent authority at each port of call;

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

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

Transport by post is not permitted.

13. Other Provisions

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

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

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

Quality assurance — see para. 306.

Compliance assurance — see para. 307.

Damaged or leaking packages — see paras 510 and 511.

Determination of transport index — see paras 526 and 527.

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

Customs — see para. 582.

Undeliverable packages — see para. 583.

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

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

UN Number
2912, 2978 as applicable

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

1. Materials

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

(i) uranium and thorium ores and concentrates of such ores, and other ores containing naturally occurring radionuclides which are intended to be processed for the use of these radionuclides;

(ii) solid unirradiated natural uranium or depleted uranium or natural thorium or their solid or liquid compounds or mixtures;

(iii) radioactive material for which the A_2 value is unlimited, excluding fissile material in quantities not excepted under para. 672; or

(iv) other radioactive material in which the activity is distributed throughout and the estimated average specific activity does not exceed 30 times the values for activity concentration specified in paras 401–406, excluding fissile material in quantities not excepted under para. 672.

2. Packaging/Package

LSA-I material may be transported unpackaged if:

(i) all material other than ores containing only naturally occurring radionuclides are transported in such a manner that under routine conditions of transport there will be no escape of the radioactive contents from the conveyance nor will there be any loss of shielding, and

(ii) it is transported in a conveyance under exclusive use.

Packaged LSA-I material may be transported if:

(i) the package meets the design requirements for a Type IP-1 (para. 621) or Type IP-2 (para. 622) as appropriate for the physical form of the LSA-I. LSA-I shall be packaged in Type IP-1 packages, except that liquid LSA-I, not transported under exclusive use, shall be packaged in Type IP-2 packages; or

(ii) the packaging meets one of the alternative requirements for tanks, freight containers or intermediate bulk containers to be qualified as Type IP-2 as given in paras 624–628; and

(iii) in the case of uranium hexafluoride, the design satisfies the requirements of paras 629–632.

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

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

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

3. Maximum Radiation Levels

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

4. Mixed Contents

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

5. Loading and Segregation

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

6. Labelling and Marking

Packages:

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

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

If, however, the packages contain uranium hexafluoride, the packages contains uranium hexafluoride, the package shall bear the mark 'UN 2978' and the proper shipping name 'RADIOACTIVE MATERIAL, URANIUM HEXAFLUORIDE'.

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

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

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

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

Freight containers and overpacks:

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

7. Placarding

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

8. Storage, Dispatch and Carriage

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

There is no limit on the total transport index.

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

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

UN Number
2977, 2978, 3321, 3324 as applicable

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

1. Materials

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

(i) water with tritium concentration up to 0.8 TBq/L;

(ii) solids and gases with activity distributed throughout of not more than 10^{-4} A_2/g; or

(iii) liquids with activity distributed throughout of not more than 10^{-5} A_2/g.

2. Packaging/Package

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

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

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

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

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

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

(i) type IP-2 and Type IP-3 package designs approved to contain fissile material shall satisfy the transitional arrangements of section 2 of the Common Provisions on page 40 as appropriate.

(ii) other Type IP-2 and Type IP-3 package designs, which previously did not require competent authority approval, shall satisfy the relevant transitional arrangements of section 2 of the Common Provisions on page 40.

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

3. Maximum Radiation Levels

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

4. Mixed Contents

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

5. Loading and Segregation

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

6. Labelling and Marking

Packages:

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

(ii) Packages shall bear the mark:

- 'UN 3321' and the proper shipping name 'RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II)', if either non-fissile or fissile-excepted material; or
- 'UN 3324' and the proper shipping name 'RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), FISSILE' for fissile material.

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

- 'UN 2978' and the proper shipping name 'RADIOACTIVE MATERIAL, URANIUM HEXAFLUORIDE' for uranium hexafluoride that is non-fissile or fissile-excepted material; or
- 'UN 2977' and the proper shipping name 'RADIOACTIVE MATERIAL, URANIUM HEXAFLUORIDE, FISSILE' for uranium hexafluoride that is fissile material.

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

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

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

Freight containers and overpacks:

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

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

7. Placarding

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

8. Carriage

Transport of unpackaged LSA-II is not permitted.

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

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

UN Number
2977, 2978, 3322, 3325 as applicable

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

1. Materials

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

(i) the radioactive material is distributed throughout a solid or collection of solid objects, or is essentially uniformly distributed in a solid compact binding agent (e.g. concrete, bitumen, ceramic);

(ii) the radioactive material is relatively insoluble, or is intrinsically contained in a relatively insoluble matrix; and

(iii) the estimated average specific activity does not exceed 2×10^{-3} A_2/g.

2. Packaging/Package

LSA-III shall be transported in packagings.

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

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

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

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

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

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

(i) Type IP-2 and Type IP-3 package designs approved to contain fissile material shall satisfy the transitional arrangements of section 2 of the Common Provisions on page 40 as appropriate.

(ii) Other Type IP-2 and Type IP-3 package designs, which previously did not require competent authority approval, shall satisfy the appropriate transitional arrangements of section 2 of the Common Provision.

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

3. Maximum Radiation Levels

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

4. Mixed Contents

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

5. Loading and Segregation

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

6. Labelling and Marking

Packages:

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

(ii) Packages shall bear the mark:

- 'UN 3322' and the proper shipping name 'RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-III)' if either non-fissile or fissile-excepted material; or
- 'UN 3325' and the proper shipping name 'RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-III), FISSILE' for fissile material.

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

- 'UN 2978' and the proper shipping name 'RADIOACTIVE MATERIAL, URANIUM HEXAFLUORIDE' for non-fissile or fissile-excepted uranium hexafluoride; or

- 'UN 2977' and the proper shipping name 'RADIOACTIVE MATERIAL, URANIUM HEXAFLUORIDE, FISSILE' for uranium hexafluoride that is fissile material.

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

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

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

Freight containers and overpacks:

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

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

7. Placarding

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

8. Carriage

Transport of unpackaged LSA-III is not permitted.

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

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

UN Numbers
2913, 3326 as applicable

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

1. Materials

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

2. Packaging/Package

SCO-I may be transported unpackaged if:

(i) it is transported in such a manner that, in routine transport, there will be no escape of radioactive contents from the conveyance and no loss of shielding; and

(ii) for SCO-I, where it is suspected that non-fixed contamination exists on inaccessible surfaces in excess of 4 Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters, or 0.4 Bq/cm^2 for all other alpha emitters, measures are taken to ensure that the radioactive material is not released into the conveyance and it is transported under exclusive use.

Packaged SCO may be transported if:

(i) the package meets the design requirements for Type IP-1 for SCO-I, or Type IP-2 for SCO-II; or

(ii) the packaging meets one of the alternative requirements for intermediate bulk containers or freight containers to be qualified as Type IP-2 as given in paras 627–628.

Generally, approval of the design by the competent authority of industrial packages is not required, although the consignor shall be prepared to demonstrate the compliance of the package design to the appropriate competent authority.

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

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

(i) Package designs approved to contain fissile SCO material shall satisfy the transition arrangements of section 2 of the Common Provisions on page 40 as appropriate.

(ii) Other package designs which previously did not require competent authority approval shall satisfy the appropriate transitional arrangements of the Common Provisions on page 40.

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

3. Maximum Radiation Levels

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

4. Mixed Contents

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

5. Loading and Segregation

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

6. Labelling and Marking

Packages:

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

(ii) Packages shall bear the mark:

- 'UN 2913' and the proper shipping name 'RADIOACTIVE MATERIAL, SURFACE CONTAMINATED OBJECTS (SCO-I or SCO-II)' for either non-fissile or fissile-excepted material; or
- 'UN 3326' and the proper shipping name 'RADIOACTIVE MATERIAL, SURFACE CONTAMINATED OBJECTS (SCO-I or SCO-II), FISSILE' for fissile material.

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

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

Freight containers and overpacks:

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

7. Placarding

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

8. Carriage

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

- 4 Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters; or
- 0.4 Bq/cm^2 for all other alpha emitters

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

Transport of unpackaged SCO-II is not permitted.

The total activity in a single conveyance shall not exceed 100 A_2 if the conveyance is other than an inland waterway craft, and 10 A_2 if the consignment of SCO is transported in the hold or compartment of an inland waterway craft.

Schedule 9. Material in Type A Packages

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

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

1. Materials

Radioactive material:

(i) With an activity not exceeding A_1 if as special form radioactive material; or

(ii) With an activity not exceeding A_2 if as other than special form radioactive material; or

(iii) For mixtures of radionuclides whose identities and respective activities are known, the condition given in para. 414 shall apply to the radioactive contents of a Type A package.

2. Packaging/Package

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

(i) Type A package designs approved to contain fissile material shall satisfy the transitional arrangements of section 2 of the Common Provisions on page 40 as appropriate.

(ii) Other Type A package designs, which previously did not require competent authority approval, shall satisfy the appropriate transitional arrangements in the Common Provisions on page 40.

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

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

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

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

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

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

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

3. Labelling and Marking

Packages:

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

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

- 'UN 3332' and the proper shipping name 'RADIOACTIVE MATERIAL, TYPE A PACKAGE, SPECIAL FORM' for either non-fissile or fissile-excepted material; or
- 'UN 3333' and the proper shipping name 'RADIOACTIVE MATERIAL, TYPE A PACKAGE, SPECIAL FORM, FISSILE' for fissile material.

Packages containing other radioactive material shall bear the mark:

- 'UN 2915' and the proper shipping name 'RADIOACTIVE MATERIAL, TYPE A PACKAGE' for either non-fissile or fissile-excepted material; or
- 'UN 3327' and the proper shipping name 'RADIOACTIVE MATERIAL, TYPE A PACKAGE, FISSILE' for fissile material.

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

- 'UN 2978' and the proper shipping name 'RADIOACTIVE MATERIAL, URANIUM HEXAFLUORIDE' for non-fissile or fissile-excepted uranium hexafluoride; or
- 'UN 2977' and the proper shipping name 'RADIOACTIVE MATERIAL, URANIUM HEXAFLUORIDE, FISSILE' for uranium hexafluoride that is fissile material.

(iii) Each package which conforms to a Type A package design shall be marked with 'Type A'.

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

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

Freight containers and overpacks:

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

4. Placarding

Where an exclusive use consignment in a freight container is non-fissile or fissile-excepted special form radioactive material in Type A packages and no other UN number commodities are present in the freight container, '3332' shall be displayed on all four sides of the freight container, either in the lower half of the placards, preceded by the letters 'UN', or on the specially designed UN number placards shown in the Transport Code In the case of fissile material transported as special form radioactive material in Type A packages, '3333' shall be displayed on the placards.

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

Schedule 10. Material in Type B(U) Packages

UN Numbers
2916, 3328 as applicable

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

1. Materials

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

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

(i) for **low dispersible radioactive material** — as authorised for the package design as specified in the certificate of approval;

(ii) for special form radioactive material — 3000 A_1 or 100 000 A_2, whichever is lower; or

(iii) for all other radioactive material — 3000 A_2.

2. Packaging/Package

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

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

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

If the radioactive contents are special form radioactive material and the activity exceeds the A_2 activity limit and credit is taken for the special form nature of the radioactive contents in the design, competent authority approval of the design for the special form radioactive material is required.

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

If the radioactive contents are low dispersible radioactive material and credit is taken for the low dispersible nature of the radioactive contents in the design, multilateral competent authority approval of the design for the low dispersible radioactive material is required.

3. Labelling and Marking

Packages:

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

(ii) Packages shall bear the mark:

- 'UN 2916' and the proper shipping name 'RADIOACTIVE MATERIAL, TYPE B(U) PACKAGE' for either non-fissile or fissile-excepted material; or
- 'UN 3328' and the proper shipping name 'RADIOACTIVE MATERIAL, TYPE B(U) PACKAGE, FISSILE' for fissile material.

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

(iv) Each package which conforms to a Type B(U) package design shall be marked with the identification mark allocated to that design by the competent authority and a serial number to uniquely identify each packaging which conforms to that design.

Freight containers and overpacks:

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

4. Placarding

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

5. Transport Documents

The competent authority approval certificate for the package design is required.

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

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

6. Storage and Dispatch

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

Any provisions in the competent authority approval certificates shall be observed.

7. Carriage

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

Schedule 11. Material in Type B(M) Packages

UN Numbers
2917, 3329 as applicable

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

1. Materials

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

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

(i) for low dispersible radioactive material — as authorised for the package design as specified in the certificate of approval;

(ii) for special form radioactive material — 3000 A_1 or 100 000 A_2, whichever is the lower; or

(iii) for all other radioactive material — 3000 A_2.

2. Packaging/Package

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

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

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

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

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

Approval of the design of Type B(M) packages is required both by the competent authority of the country of origin of the design and of each country through or into which the packages are transported (multilateral approval).

If the radioactive contents are special form radioactive material, and the activity exceeds the A_2 activity limit, and credit is taken for the special form nature of the radioactive contents in the design, competent authority approval of the design for the special form radioactive material is required.

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

If the radioactive contents are low dispersible radioactive material, and the activity exceeds the 3000 A_2 activity limit, and credit is taken for the low dispersible nature of the radioactive contents in the design, competent authority approval of the design for the low dispersible radioactive material is required.

3. Labelling and Marking

Packages:

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

(ii) Packages shall bear the mark:

- 'UN 2917' and the proper shipping name 'RADIOACTIVE MATERIAL, TYPE B(M) PACKAGE' for either non-fissile or fissile excepted material; or
- 'UN 3329' and the proper shipping name 'RADIOACTIVE MATERIAL, TYPE B(M) PACKAGE, FISSILE' for fissile material.

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

(iv) Each package which conforms to a Type B(M) package design shall be marked with the identification mark allocated to that design by the competent authority and a serial number to uniquely identify each packaging which conforms to that design.

Freight containers and overpacks:

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

4. Placarding

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

5. Transport Documents

The multilateral approval certificate for the package design is required.

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

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

6. Storage and Dispatch

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

Any provisions in the competent authority approval certificates shall be observed.

7. Carriage

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

Schedule 12. Material in Type C Packages

UN Numbers
3323, 3330 as applicable

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

1. Materials

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

2. Packaging/Package

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

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

If the radioactive contents are special form radioactive material and the activity exceeds the A_2 activity limit and credit is taken for the special form nature of the radioactive contents in the design, competent authority approval of the design for the special form radioactive material is required.

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

3. Labelling and Marking

Packages:

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

(ii) Packages shall bear the mark:

- 'UN 3323' and the proper shipping name 'RADIOACTIVE MATERIAL, TYPE C PACKAGE' for either non-fissile or fissile-excepted material;
- 'UN 3330' and the proper shipping name 'RADIOACTIVE MATERIAL, TYPE C PACKAGE, FISSILE' for fissile material.

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

(iv) Each package which conforms to a Type C package design shall be marked with the identification mark allocated to that design by the competent authority and a serial number to uniquely identify each packaging which conforms to that design.

Freight containers and overpacks:

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

4. Placarding

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

5. Transport Documents

The unilateral approval certificate for the package design is required.

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

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

6. Storage and Dispatch

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

Any provisions in the competent authority approval certificates shall be observed.

7. Carriage

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

Schedule 13. Fissile Material

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

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

1. Materials

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

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

2. Packaging/Package

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

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

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

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

3. Labelling and Marking

Packages:

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

(ii) Completed criticality safety index labels, with the criticality safety index as stated in the certificate of approval for package design or the certificate of approval for special arrangement, shall be affixed externally to two opposite sides of the package, or to all four sides of freight containers and tanks when being used as packages.

Freight containers and overpacks:

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

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

4. Transport Documents

The multilateral approval certificate for the fissile material package design is required from the competent authority of each country through or into which the package is to be transported.

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

For additional documentation requirements, see appropriate Schedule.

5. Storage and Dispatch

See the 'Loading and Segregation' provisions of this Schedule.

6. Carriage

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

See the 'Loading and Segregation' provisions of this Schedule.

Schedule 14. Material Transported Under Special Arrangement

UN Numbers
2919, 3331 as applicable

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

1. Materials

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

2. Packaging/Package

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

For domestic shipments, approval of provisions by the competent authority is required.

For international shipments, multilateral approval is required.

3. Maximum Radiation Levels

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

4. Contamination

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

5. Decontamination

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

6. Mixed Contents

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

7. Loading and Segregation

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

8. Labelling and Marking

Packages:

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

(ii) Packages shall bear the mark:

- 'UN 2919' and the proper shipping name 'RADIOACTIVE MATERIAL, TRANSPORTED UNDER SPECIAL ARRANGEMENT' for either non-fissile or fissile-excepted material; or
- 'UN 3331' and the proper shipping name 'RADIOACTIVE MATERIAL, TRANSPORTED UNDER SPECIAL ARRANGEMENT, FISSILE' for fissile material.

(iii) Other labelling and marking requirements approved by the Competent Authorities shall be fulfilled.

Freight containers and overpacks:

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

(ii) Other labelling and marking requirements approved by the Competent Authorities shall be fulfilled.

9. Placarding

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

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

10. Transport Documents

Each consignment shipped under special arrangement require multilateral approval.

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

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

11. Storage and Dispatch, Carriage and Other Provisions

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

Schedule 15. Summary of Approval and Prior Notification Requirements

This summary reflects the contents of the Transport Code. The user's attention is called to the fact that there may be deviations (exceptions, additions, etc.) relative to:

(a) national regulations relating to safety;

(b) carrier restrictions; and

(c) national regulations relating to security, physical protection, liability, insurance, pre-notification and/or routing, and import/export/transit licensing.

	Competent authority approval required		
Class of package or material	**Country of origin**	**Countries en route[a]**	**Consignor required to notify country of origin and countries en route[a] of each shipment**
Excepted package[b] other than by post	No	No	No
LSA material[b,c] and SCO[c] — Industrial package Types 1, 2 or 3	No	No	No
Type A[b,c]	No	No	No
Type B(U) [b,c] — Package design — Shipment	Yes No	No[d] No	(See Notes 1 + 2)
Type B(M) [b,c] — Package design — Shipment	Yes (See Note 3)	Yes (See Note 3)	Yes (See Note 1)
Type C [b,c] — Package design — Shipment	Yes No	No No	(See Notes 1 + 2)
Packages for fissile material — Package design — Shipment Σ CSI ≤ 50 Σ CSI >50	Yes[e] No[f] Yes	Yes[e] No[f] Yes	 (See Notes 2 + 4) (See Notes 2 + 4)
Packages containing 0.1 kg or more of uranium hexafluoride — Package design — Shipment	No[g] No[f]	No[g] No[f]	(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 Dec 03)	(See Note 1) (See Note 1)

[a] Countries through or into which (but not over which) the consignment is transported.

[b] If the radioactive contents are UF_6 in quantities of 0.1 kg or more, the approval requirements for packages containing uranium hexafluoride shall additionally apply.

[c] If the radioactive contents are fissile material which is not excepted from the requirements for packages containing fissile material, then the approval requirements in paras 812 and 820 of the Transport Code shall additionally apply.

[d] If the radioactive contents are low dispersible radioactive material, and the package is to be shipped by air, multilateral approval of the package design is required.

[e] Designs of packages containing fissile material may also require approval in respect of one of the other items in this Schedule.

[f] Shipments may, however, require approval in respect of one of the other items in this Schedule.

[g] Except that after 31 December 2000, designs that only meet the requirement of para. 632 require multilateral approval, and after 31 December 2003, designs that meet the requirements of paras 629–631 require unilateral approval.

Note 1 — Before the first shipment of any package requiring competent authority approval of the design, the consignor must ensure that a copy of the approval certificate for that design has been submitted to the competent authority of each country.

Note 2 — Notification required if contents exceed 3×10^3 A_1, or 3×10^3 A_2, or 1000 TBq, whichever is the lower.

Note 3 — Multilateral approval of shipment required if contents exceed 3×10^3 A_1, or 3×10^3 A_2, or 1000 TBq, whichever is the lower; or if controlled intermittent venting is allowed.

Note 4 — The multilateral approval requirement for fissile packages and some uranium hexafluoride packages automatically satisfies the requirement of para. 558 of the Regulations.

Note 5 — See approval and prior notification requirements for applicable package.

Annex A

Competent Authorities for Transport by Road, Rail or Those Waterways Not Covered by the Maritime Legislation

COMMONWEALTH STATE/TERRITORY	CONTACT	COMPETENT AUTHORITY
Commonwealth	Chief Executive Officer ARPANSA PO Box 655 Tel: (02) 9541 8333 Miranda NSW 1490 Fax: (02) 9541 8314 Email: info@arpansa.gov.au	Australian Radiation Protection and Nuclear Safety Agency (ARPANSA)
Australian Capital Territory	Manager Radiation Safety ACT Health Locked Bag 5 Tel: (02) 6207 6946 Weston Creek ACT 2611 Fax: (02) 6207 6966 Email: radiation.safety@act.gov.au	Australian Capital Territory Radiation Council
New South Wales	Manager Hazardous Materials and Radiation PO Box A290 Tel: (02) 9995 5000 Sydney South NSW 1232 Fax: (02) 9995 6603 Email: radiation@environment.nsw.gov.au	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 Dept of Education, Employment & Training GPO Box 4821 Tel: (08) 8999 5010 Darwin NT 0801 Fax: (08) 8999 5141 Email: neil.watson@nt.gov.au	Work Health Authority
(ii) for all other radioactive substances	Manager Radiation Protection Radiation Health Section Department of Health & Families GPO Box 40596 Tel: (08) 8922 7152 Casuarina NT 0811 Fax: (08) 8922 7334 Email: envirohealth@nt.gov.au	Department of Health & Community Services
Queensland	Director, Radiation Health Unit Department of Health 450 Gregory Terrace Tel: (07) 3406 8000 Fortitude Valley QLD 4006 Fax:(07) 3406 8030 Email: radiation_health@health.qld.gov.au	Queensland Department of Health
South Australia	Director, Radiation Protection Division Environment Protection Authority PO Box 721 Tel: (08) 8130 0700 Kent Town SA 5071 Fax: (08) 8130 0777 Email: radiationprotection@epa.sa.gov.au	Minister for Environment & Conservation
Tasmania	Senior Health Physicist, Health Physics Branch Department of Health & Human Services GPO Box 125 Tel: (03) 6222 7256 Hobart TAS 7001 Fax: (03) 6222 7257 Email: health.physics@dhhs.tas.gov.au	Director of Public Health
Victoria	Team Leader, Radiation Safety Department of Human Services GPO Box 4057 Tel: 1300 767 469 Melbourne VIC 3001 Fax: 1300 769 274 Email: radiation.safety@dhs.vic.gov.au	Secretary, Department of Human Services
Western Australia	Secretary Radiological Council Locked Bag 2006 PO Tel: (08) 9346 2260 Nedlands WA 6009 Fax: (08) 9381 1423 Email: radiation.health@health.wa.gov.au	Radiological Council

Competent Authorities for the Transport by Sea or Air

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

The tables 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 (www.arpansa.gov.au).

Annex B

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

Introduction

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

'Natural Uranium' (and Thorium)

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

The derivation of the BSS exemption levels was originally based on an EU report 'Radiation Protection 65' (RP 65). In RP 65 calculations for uranium were made for two situations:

- U-238+ ^{238}U in equilibrium with ^{234}Th and ^{234m}Pa
- U-238N ^{238}U in equilibrium with all its progeny down to ^{210}Po

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

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

> 'Some of the radionuclides considered have decay products (daughters) which are themselves radioactive and need to be taken into account when assessing exposure. Table 2 shows a list of all the decay sequences considered in the calculations. The daughters considered have half-lives sufficiently short, relative to their parent that secular equilibrium would be likely to be established within the timescales considered in the exposure scenarios.
>
> Two special decay sequences have also been included consisting of ^{238}U and ^{232}Th each in secular equilibrium with all their decay products (these sequences appear in nature). These are referred in this report as $^{238}U_N$ and $^{232}Th_N$.'

Note that $^{238}U_N$ and $^{232}Th_N$ are listed in the tables as U-238N and Th-232N respectively.

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

> 'uranium (which may be chemically separated) containing the naturally occurring distribution of uranium isotopes (approximately 99.28% uranium-238 and 0.72% uranium-235 by mass)'.

The usage of 'U-nat' in the BSS is thus inconsistent with the definition of 'natural uranium' in the Transport Regulations.

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

The definition in the Transport Regulations has compounded this problem with its definition. The use of the word 'may' suggests that it is possible that it might not be chemically separated, that is it might still contain its decay products – U238N. This surely is not what is meant, and so adds additional confusion.

Exemption Concentrations

Despite the confusions outlined above, it is the clear intention that the exemption concentration for U-nat in Table 1 of the IAEA Transport Regulations should be applied to uranium ores and concentrates. This value is 1 Bq/g, which corresponds to a uranium grade of approximately 80 ppm. However, as paragraph 107 states that

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

Ores and concentrates containing uranium are therefore exempt from the transport requirements if the uranium content is less than 800 ppm, provided that processing intended to remove radionuclides has not, and will not be undertaken.

Similar considerations lead to an exemption level of 2400 ppm for ores or concentrates containing thorium (^{232}Th). This is quite a significant concentration and would lead to gamma dose rates that would normally require management. Where both uranium and thorium are present, the exemption limit will be between the uranium and thorium values, and should be established using the usual 'method of mixtures' (para 404).

Conclusions

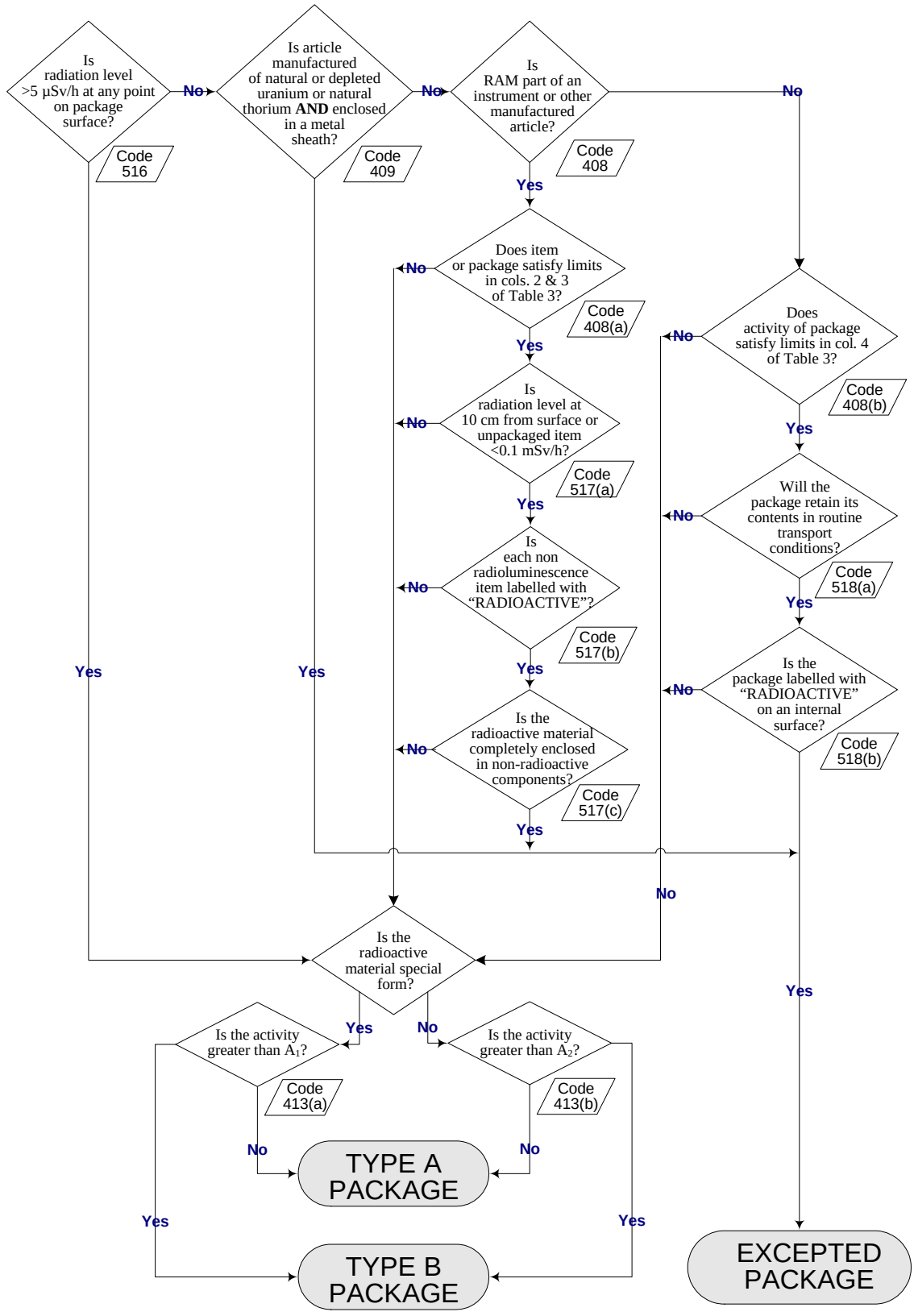
Exemption concentrations for transport of ores and concentrates containing uranium or thorium can be derived using the values for 'U (nat)' and 'Th (nat)' in the IAEA Transport Regulations. An additional allowance of a factor of ten applies when processing to extract radionuclides has not and will not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

- For uranium ores and concentrates: 800 ppm
- For thorium ores and concentrates: 2400 ppm.

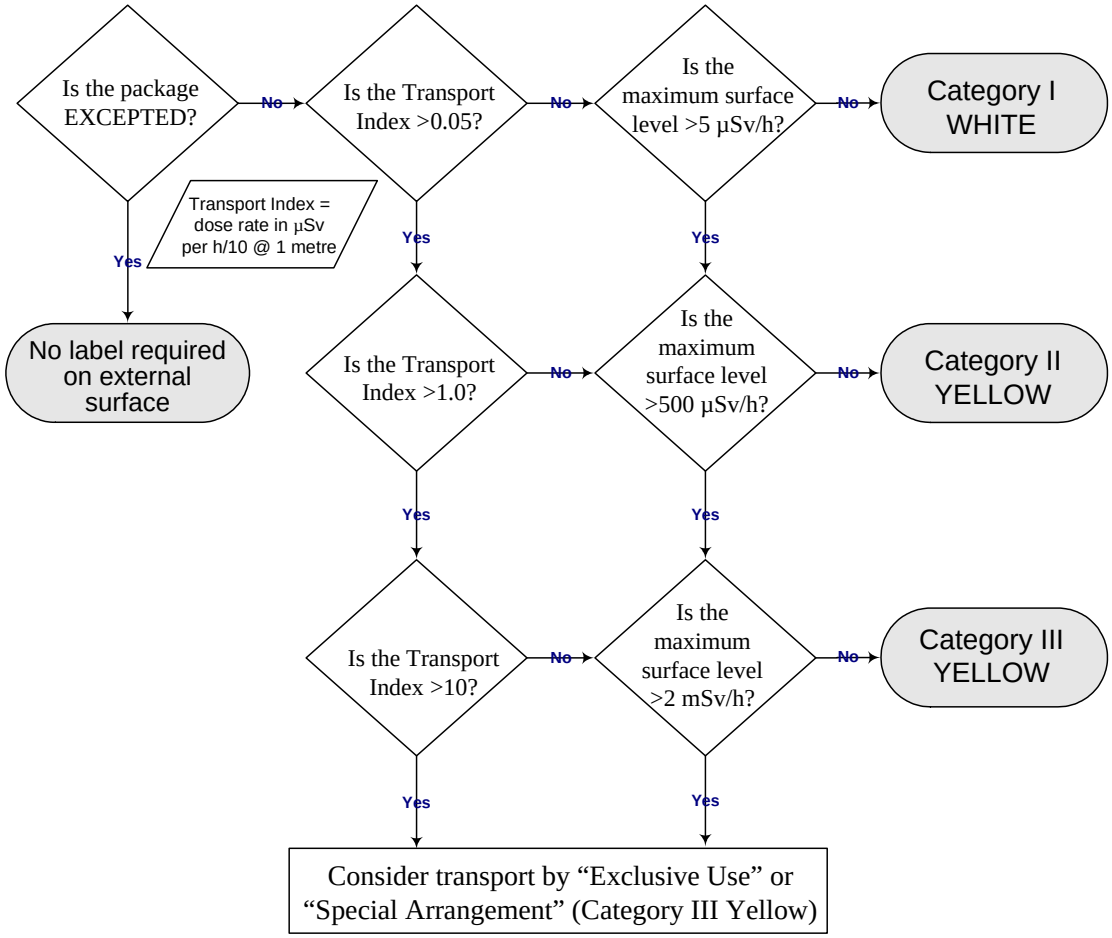
Adapted from *Exemption levels for transport of ores and concentrates containing uranium or thorium*, PA Burns and PC Crouch, Radiation Protection in Australasia **23(1)**, 12-14, (2006).

Annex C

1. Test for Package Type



2. Label Category Test Flow Chart



Exclusive use means that a single consignor has the sole use of a:

- conveyance; or
- large freight container,

and all initial, intermediate and final loading and unloading is carried out in accordance with the directions of the consignor or consignee.

A **special arrangement** incorporates the provisions under which a consignment that does not satisfy all applicable requirements of the Transport Code may be transported. A special arrangement consignment can only be transported with the specific approval of the competent authority of:

- the jurisdiction of the origin of the shipment; and
- each jurisdiction through or into, but not over, which the shipment will take place.

Annex D

Health Effects of Ionizing Radiation and Standards for Control of Exposure

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

Extreme doses of radiation to the whole body (around 10 sievert[15] and above), received in a short period, cause so much damage to internal organs and tissues of the body that vital systems cease to function and death may result within days or weeks. Very high doses (between about 1 sievert and 10 sievert), received in a short period, kill large numbers of cells, which can impair the function of vital organs and systems. Acute health effects, such as nausea, vomiting, skin and deep tissue burns, and impairment of the body's ability to fight infection may result within hours, days or weeks. The extent of the damage increases with dose. However, 'deterministic' effects such as these are not observed at doses below certain thresholds. By limiting doses to levels below the thresholds, deterministic effects can be prevented entirely.

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

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

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

[15] The sievert (Sv) is a unit of measurement of radiation dose (see ARPANSA's *Recommendations for limiting exposure to ionizing radiation (2002)*).

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

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

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

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

Determining what is an acceptable risk for regulatory purposes is a complex value judgement. The ICRP reviewed a number of factors in developing its recommendations, which have in general been internationally endorsed, including by the World Health Organization, the International Labour Organisation and the International Atomic Energy Agency. Australia's Radiation Health Committee, now established under the ARPANS Act[16], has recommended that the international standards be adopted in Australia. The recommended dose limits are summarised as follows:

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*

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

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

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	–

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

[16] The *Australian Radiation Protection and Nuclear Safety Act (1998)*

In the case of occupational exposure during pregnancy, the general principle is that the embryo or fetus should be afforded the same level of protection as is required for a member of the public. For medical workers, the ICRP recommends that there should be a reasonable assurance that fetal dose can be kept below 1 mGy[17] during the course of the pregnancy. This guidance may be generalised to cover all occupationally exposed pregnant workers by keeping the fetal dose below 1 mSv. A full explanation of radiation protection principles and of the recommended standards for Australia is given in ARPANSA/NOHSC Radiation Protection Series No. 1: *Recommendations for limiting exposure to ionizing radiation (1995)* and *National standard for limiting occupational exposure to ionizing radiation (both republished 2002).*

[17] The gray (Gy) is a unit of radiation dose. For X-rays and gamma radiation, it is essentially equivalent to the sievert.

Annex E

ARPANSA Radiation Protection Series Publications

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

All publications listed below are available in electronic format, and can be downloaded free of charge by visiting ARPANSA's website at www.arpansa.gov.au/Publications/codes/index.cfm.

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

RPS 1	Recommendations for Limiting Exposure to Ionizing Radiation (1995) and National Standard for Limiting Occupational Exposure to Ionizing Radiation (republished 2002)
RPS 2	Code of Practice for the Safe Transport of Radioactive Material (2008)
RPS 2.1	Safety Guide for the Safe Transport of Radioactive Material (2008)
RPS 3	Radiation Protection Standard for Maximum Exposure Levels to Radiofrequency Fields – 3 kHz to 300 GHz (2002)
RPS 4	Recommendations for the Discharge of Patients Undergoing Treatment with Radioactive Substances (2002)
RPS 5	Code of Practice and Safety Guide for Portable Density/Moisture Gauges Containing Radioactive Sources (2004)
RPS 6	National Directory for Radiation Protection – Edition 1.0 (2004)
RPS 7	Recommendations for Intervention in Emergency Situations Involving Radiation Exposure (2004)
RPS 8	Code of Practice for the Exposure of Humans to Ionizing Radiation for Medical Research Purposes (2005)
RPS 9	Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing (2005)
RPS 10	Code of Practice and Safety Guide for Radiation Protection in Dentistry (2005)
RPS 11	Code of Practice for the Security of Radioactive Sources (2007)
RPS 12	Radiation Protection Standard for Occupational Exposure to Ultraviolet Radiation (2006)
RPS 13	Code of Practice and Safety Guide for Safe Use of Fixed Radiation Gauges (2007)
RPS 14	Code of Practice for Radiation Protection in the Medical Applications of Ionizing Radiation (2008)
RPS 14.1	Safety Guide for Radiation Protection in Diagnostic and Interventional Radiology (2008)

RPS 14.2 Safety Guide for Radiation Protection in Nuclear Medicine (2008)

RPS 15 Safety Guide for Management of Naturally Occurring Radioactive Material (NORM) (2008)

RPS 16 Safety Guide for the Predisposal Management of Radioactive Waste (2008)

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

RHS 3 Code of practice for the safe use of ionizing radiation in veterinary radiology: Parts 1 and 2 (1982)

RHS 8 Code of nursing practice for staff exposed to ionizing radiation (1984)

RHS 9 Code of practice for protection against ionizing radiation emitted from X-ray analysis equipment (1984)

RHS 10 Code of practice for safe use of ionizing radiation in veterinary radiology: part 3-radiotherapy (1984)

RHS 13 Code of practice for the disposal of radioactive wastes by the user (1985)

RHS 14 Recommendations for minimising radiological hazards to patients (1985)

RHS 15 Code of practice for the safe use of microwave diathermy units (1985)

RHS 16 Code of practice for the safe use of short wave (radiofrequency) diathermy units (1985)

RHS 18 Code of practice for the safe handling of corpses containing radioactive materials (1986)

RHS 19 Code of practice for the safe use of ionizing radiation in secondary schools (1986)

RHS 21 Revised statement on cabinet X-ray equipment for examination of letters, packages, baggage, freight and other articles for security, quality control and other purposes (1987)

RHS 22 Statement on enclosed X-ray equipment for special applications (1987)

RHS 23 Code of practice for the control and safe handling of radioactive sources used for therapeutic purposes (1988)

RHS 24 Code of practice for the design and safe operation of non-medical irradiation facilities (1988)

RHS 25 Recommendations for ionization chamber smoke detectors for commercial and industrial fire protection systems (1988)

RHS 28 Code of practice for the safe use of sealed radioactive sources in bore-hole logging (1989)

RHS 30 Interim guidelines on limits of exposure to 50/60Hz electric and magnetic fields (1989)

RHS 31 Code of practice for the safe use of industrial radiography equipment (1989)

RHS 34 Safety guidelines for magnetic resonance diagnostic facilities (1991)

RHS 35 Code of practice for the near-surface disposal of radioactive waste in Australia (1992)

RHS 36 Code of practice for the safe use of lasers in schools (1995)

RHS 38 Recommended limits on radioactive contamination on surfaces in laboratories (1995)

References and Bibliography

Australian Radiation Protection and Nuclear Safety Agency 2002, *Recommendations for Limiting Exposure to Ionizing Radiation (1995), and National Occupational Health and Safety Commission National Standard for Limiting Occupational Exposure to Ionizing Radiation*, Radiation Protection Series No. 1, republished 2002, ARPANSA, Yallambie.

Australian Radiation Protection and Nuclear Safety Agency 2008, *Code of Practice for the Safe Transport of Radioactive Material 2008*, Radiation Protection Series 2, published 2008, ARPANSA, Yallambie.

Australian Radiation Protection and Nuclear Safety Agency 2007, *Code of Practice for the Security of Radioactive Sources 2007*, Radiation Protection Series 11, published 2007, ARPANSA, Yallambie.

Commission of European Communities Report Radiation Protection 65 *Principles and Methods for Establishing Concentrations and Quantities (Exemption Values) below which Reporting is not Required in the European Directive* by M Harvey, S Mobbs, J Cooper, A M Sugier, T Schneider, J Lochard and A Janssens, 1993.

Federal Office of Road Safety 1998, *The Australian Code for the Transport of Dangerous Goods by Road and Rail Sixth Edition* and *The Rail (Dangerous Goods) Rules*, Commonwealth of Australia 1998.

International Atomic Energy Agency Basic Safety Standards BSS 115 *International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources*, Vienna, 1996.

International Atomic Energy Agency, Safety Standards Series, *Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material*, Safety Guide No. TS-G-1.1 (ST-2), Vienna, 2002.

International Atomic Energy Agency, Safety Standards Series, *Planning and Preparing for Emergency Response to Transport Accidents Involving Radioactive Material*, Safety Guide No. TS-G-1.2 (ST-3), Vienna, 2002.

International Atomic Energy Agency, Safety Standards Series, *Radiation Protection Programmes for the Transport of Radioactive Material*, Safety Guide No. TS-G-1.3, Vienna, 2007.

International Atomic Energy Agency Basic Safety Standards Series, *Regulations for the Safe Transport of Radioactive Material 2005 Edition* Regulations TS-R-1, Vienna, 2005.

International Atomic Energy Agency, Training Course Series, *Safe Transport of Radioactive Material*, Fourth Edition, Vienna, 2006.

Radiation Protection in Australasia, Vol 23, Pt 1, pp12-14, *Exemption levels for transport of ores and concentrates containing uranium or thorium*, Burns PA and Crouch PC, 2006.

Glossary

The terms included in this glossary are essentially the same as those used in the IAEA *Regulations for the Safe Transport of Radioactive Material 2005 Edition (TS-R-1)*, as incorporated in the Transport Code.

A_1 and A_2

A_1 means the activity value of special form radioactive material which is listed in Table 1 of the Transport Code or derived in Section IV of the Transport Code and is used to determine the activity limits for the requirements of these Regulations.

A_2 means the activity value of radioactive material, other than special form radioactive material, which is listed in Table 1 of the Transport Code or derived in Section IV of the Transport Code and is used to determine the activity limits for the requirements of the Transport Code.

Aircraft

Cargo aircraft means any aircraft, other than a passenger aircraft, which is carrying goods or property.

Passenger aircraft means an aircraft that carries any person other than a crew member, a carrier's employee in an official capacity, an authorised representative of an appropriate national authority, or a person accompanying a consignment.

Approval

Multilateral approval means approval by the:

- relevant competent authority of the country of origin of the design or shipment, as applicable; and
- competent authority of any other country that the consignment is to be transported through or into.

The term 'through or into' specifically excludes 'over', i.e. the approval and notification requirements do not apply to a country over which radioactive material is carried in an aircraft, provided that there is no scheduled stop in that country.

Unilateral approval means an approval of a design that is required to be given by the competent authority of the country of origin of the design only.

Carrier

Carrier means any person, organisation or government undertaking the carriage of radioactive material by any means of transport. The term includes both carriers for hire or reward (known as common or contract carriers in some countries) and carriers on own account (known as private carriers in some countries).

Competent authority

Competent authority means any national or international regulatory body or authority designated or otherwise recognised as such for any purpose in connection with the Transport Code.

Compliance assurance

Compliance assurance means a systematic program of measures applied by a competent authority which is aimed at ensuring that the provisions of the Transport Code are met in practice.

Consignee

The consignee is any person, organisation or government which receives a consignment.

Consignment

The consignment is any package or packages, or load of radioactive material, presented by a consignor for transport.

Consignor

The consignor is any person, organisation or government that prepares a consignment for transport.

Containment system

Containment system means the assembly of components of the packaging specified by the designer as intended to retain the radioactive material during transport.

Contamination

Contamination means the presence of a radioactive substance on a surface in quantities in excess of:

- 0.4 Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters; or
- 0.04 Bq/cm^2 for all other alpha emitters.

Non-fixed contamination means contamination that can be removed from a surface during routine conditions of transport.

Fixed contamination means contamination other than non-fixed contamination.

Conveyance

Conveyance means any:

- vehicle for transport by road or rail;
- vessel, or any hold, compartment, or **defined deck area** of a vessel for transport by water; and
- aircraft for transport by air.

Criticality safety index

The criticality safety index (CSI) assigned to a package, overpack or freight container containing fissile material is a number used to provide control over the accumulation of packages, overpacks or freight containers containing fissile material.

Defined deck area

Defined deck area means the area of:

- the weather deck of a vessel; or
- a vehicle deck of a roll-on/roll-off ship or a ferry,

which is allocated for the stowage of radioactive material.

Design

Design means the description of special form radioactive material, low dispersible radioactive material, package or packaging that enables such an item to be fully identified. The description may include specifications, engineering drawings, reports demonstrating compliance with regulatory requirements, and other relevant documentation.

Exclusive use

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

Fissile material

Fissile material means uranium-233, uranium-235, plutonium-239, plutonium-241, or any combination of these radionuclides. Excepted from this definition is:

- natural uranium or depleted uranium which is unirradiated, and
- natural uranium or depleted uranium which has been irradiated in thermal reactors only.

Freight container

A freight container is an article of transport equipment designed to facilitate the transport of goods, either packaged or unpackaged, by one or more modes of transport without intermediate reloading. A freight container:

- is of a permanent enclosed character;
- is rigid and strong enough for repeated use; and
- needs to be be fitted with devices facilitating its handling, particularly in transfer between conveyances and from one mode of transport to another.

A *small freight container* has either:

- any overall outer dimension less than 1.5 m; or
- an internal volume of not more than 3 m^3.

Any other freight container is considered to be a large freight container.

Intermediate bulk container

An intermediate bulk container (IBC) is a portable packaging that:

- has a capacity of not more than 3 m^3;

- is designed for mechanical handling;
- is resistant to the stresses produced in handling and transport, as determined by performance tests; and
- is designed to conform to the standards in the chapter on Recommendations on Intermediate Bulk Containers (IBCs) of the United Nations Recommendations on the Transport of Dangerous Goods.

Low dispersible radioactive material

Low dispersible radioactive material is either:

- a solid radioactive material; or
- a solid radioactive material in a sealed capsule, that has limited dispersibility and is not in powder form.

Low specific activity material

Low specific activity (LSA) material is radioactive material that by its nature has a limited specific activity, or radioactive material for which limits of estimated average specific activity apply. External shielding materials surrounding the LSA material are not considered in determining the estimated average specific activity.

LSA material is in one of three groups:

- LSA-I
  - uranium and thorium ores and concentrates of such ores, and other ores containing naturally occurring radionuclides which are intended to be processed for the use of these radionuclides;
  - natural uranium, depleted uranium, natural thorium or their compounds or mixtures, providing they are unirradiated and in solid or liquid form;
  - radioactive material for which the A_2 value is unlimited, excluding fissile material in quantities not excepted under para. 672 of the Transport Code; or
  - other radioactive material in which the activity is distributed throughout and the estimated average specific activity does not exceed 30 times the values for activity concentration specified in paras 401–406 of the Transport Code, excluding fissile material in quantities not excepted under para. 672 of the Transport Code.
- LSA-II
  - water with tritium concentration up to 0.8 TBq/L; or
  - other material in which the activity is distributed throughout and the estimated average specific activity does not exceed 10^{-4} A_2/g for solids and gases, and 10^{-5} A_2/g for liquids.
- LSA-III

  Solids (e.g. consolidated wastes, activated materials), excluding powders, in which:
  - the radioactive material is distributed throughout a solid or a collection of solid objects, or is essentially uniformly distributed in a solid compact binding agent (such as concrete, bitumen, ceramic, etc.);

– the radioactive material is relatively insoluble, or it is intrinsically contained in a relatively insoluble matrix, so that, even under loss of packaging, the loss of radioactive material per package by leaching when placed in water for seven days would not exceed 0.1 A_2; and

– the estimated average specific activity of the solid, excluding any shielding material, does not exceed 2×10^{-3} A_2/g.

Low toxicity alpha emitters

Low toxicity alpha emitters are:

- natural uranium;
- depleted uranium;
- natural thorium;
- uranium-235 or uranium-238;
- thorium-232;
- thorium-228 and thorium-230 when contained in ores or physical and chemical concentrates; or
- alpha emitters with a half-life of less than 10 days.

Overpack

An overpack is an enclosure such as a box or bag that is used by a single consignor to facilitate as a handling unit a consignment of one or more packages for convenience of handling, stowage and carriage.

Package

Package means the packaging with its radioactive contents as presented for transport. The types of packages covered by the Transport Code, which are subject to the activity limits and material restrictions of Section IV of the Transport Code and meet the corresponding requirements, are:

- excepted package;
- industrial package Type 1 (Type IP-1);
- industrial package Type 2 (Type IP-2);
- industrial package Type 3 (Type IP-3);
- Type A package;
- Type B(U) package;
- Type B(M) package; and
- Type C package.

Packages containing fissile material or uranium hexafluoride are subject to additional requirements.

Packaging

Packaging means the assembly of components necessary to enclose the radioactive contents completely. It may, in particular, consist of:

- one or more receptacles, absorbent materials, spacing structures, radiation shielding and service equipment for filling, emptying, venting and pressure relief;
- devices for cooling, absorbing mechanical shocks, handling and tie-down, and thermal;
- insulation; and
- service devices integral to the package.

The packaging may be a box, drum or similar receptacle, or may also be a freight container, tank or intermediate bulk container.

Quality assurance

Quality assurance is a systematic program of controls and inspections applied by any organisation or body involved in the transport of radioactive material which is aimed at providing adequate confidence that the standard of safety prescribed in the Transport Code is achieved in practice.

Radiation level

Radiation level means the corresponding dose rate expressed in millisieverts per hour.

Radiation Protection Program

Radiation Protection Program means systematic arrangements aimed at providing adequate consideration of radiation protection measures.

Radioactive contents

Radioactive contents are the radioactive material together with any contaminated or activated solids, liquids and gases within the packaging.

Radioactive material

For the purpose of the Transport Code, radioactive material is any material containing radionuclides where both the activity concentration and the total activity in the consignment exceed the values specified in paras 401–406 of the Transport Code.

Shipment

Shipment means the specific movement of a consignment from origin to destination.

Special arrangement

Special arrangement means those provisions, approved by the competent authority, under which consignments which do not satisfy all the applicable requirements of the Transport Code may be transported.

Special form radioactive material

Special form radioactive material is either an indispersible solid radioactive material or a sealed capsule containing radioactive material.

Specific activity

Specific activity of a radionuclide is the activity per unit mass of that nuclide. The specific activity of a material shall mean the activity per unit mass of the material in which the radionuclides are essentially uniformly distributed.

Surface contaminated object

A surface contaminated object (SCO) is a solid object which is not itself radioactive but which has radioactive material distributed on its surfaces.

SCO shall be in one of two groups:

- SCO-I: A solid object on which:
  - the non-fixed contamination on the accessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm2) does not exceed:
    - 4 Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters; or
    - 0.4 Bq/cm2 for all other alpha emitters; and
  - the fixed contamination on the accessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed:
    - 4×10^4 Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters; or
    - 4×10^3 Bq/cm^2 for all other alpha emitters; and
  - the non-fixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed 4×10^4 Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters, or 4×10^3 Bq/cm2 for all other alpha emitters.
- SCO-II: A solid object on which either the fixed or non-fixed contamination on the surface exceeds the applicable limits specified for SCO-I in (a) above and on which:
  - the non-fixed contamination on the accessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm2) does not exceed:
    - 400 Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters; or
    - 40 Bq/cm^2 for all other alpha emitters; and
  - the fixed contamination on the accessible surface, averaged over 300 cm^2 (or the area of the surface if less than 300 cm2) does not exceed:
    - 8×10^5 Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters; or
    - 8×10^4 Bq/cm^2 for all other alpha emitters; and

– the non-fixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm2) does not exceed:
  - 8×10^5 Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters; or
  - 8×10^4 Bq/cm^2 for all other alpha emitters.

Tank

A tank is a:

- tank container;
- portable tank;
- road tank vehicle;
- rail tank wagon; or
- receptacle with a capacity of not less than 450 litres to contain liquids, powders, granules, slurries or solids which are loaded as gas or liquid and subsequently solidified, and of not less than 1000 litres to contain gases.

A tank container needs to possess stabilising members and tie-down attachments external to the shell and be capable of being:

- carried on land or on sea;
- loaded and discharged without the need of removal of its structural equipment; and
- lifted when full.

Transport index

The transport index (TI) assigned to a package, overpack or freight container, or to unpackaged LSA-I or SCO-I, is a number used to provide control over radiation exposure.

Uranium — natural, depleted, enriched

Natural uranium means uranium (which may be chemically separated) containing the naturally occurring distribution of uranium isotopes (approximately 99.28% uranium-238 and 0.72% uranium-235 by mass).

Depleted uranium means uranium containing a lesser mass percentage of uranium-235 than natural uranium.

Enriched uranium means uranium containing a greater mass percentage of uranium-235 than 0.72%.

In all cases, a very small mass percentage of uranium-234 is present.

Vehicle

A vehicle is a road vehicle (including an articulated vehicle, i.e. a tractor and semi-trailer combination) or railroad car or railway wagon. Each trailer shall be considered as a separate vehicle.

Vessel

A vessel is any seagoing vessel or inland waterway craft used for carrying cargo.

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