

INDUSTRIAL PACKAGE REQUIREMENTS FOR LSA MATERIAL AND SCO

(Please refer AERB/NRF-TS/SC-1 (Rev.1) Safe Transport of Radioactive Material 2016, for the respective clauses)

About LSA material and SCO

1) Low Specific Activity Material

Classification of LSA Material

LSA material shall be further classified as LSA-I or LSA-II or LSA-III:

1) LSA-I:

Uranium and thorium ores and concentrates of such ores, and other ores containing naturally occurring radionuclides.

Natural uranium, depleted uranium, natural thorium or their compounds or mixtures, that are un-irradiated and in solid or liquid form.

Radioactive material for which the A2 value is unlimited. Fissile material may be included only if excepted as specified in this section in clause 4.6.1.1.

Other radioactive material in which the activity is distributed throughout and the estimated average specific activity does not exceed 30 times the values for the activity concentration specified in Section 3. Fissile material may be included only if excepted under clause 4.6.1.1

2) LSA-II:

Water with a tritium concentration of up to 0.8 TBq.L⁻¹

Other material in which the activity is distributed throughout and the estimated average specific activity does not exceed 10⁻⁴ A2.g⁻¹ for solids and gases, and 10⁻⁵ A2.g⁻¹ for liquids.

3) LSA-III: Solids (e.g. consolidated wastes, activated materials), excluding powders, that meet the requirements of clause 4.2.3.1, 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 and ceramic).

The radioactive material is relatively insoluble, or 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 7 days would not exceed 0.1A2.

The estimated average specific activity of the solid, excluding any shielding material, does not exceed 2×10^{-3} A2.g⁻¹.

4) Requirement for LSA-III Material

4) LSA-III material shall be a solid of such a nature that if the entire contents of a package were subjected to the leaching Test for LSA-III Material specified in clause 4.2.3.2, the activity in the water would not exceed 0.1A2.

5) A solid material sample representing the entire contents of the package shall be immersed for 7 days in water at ambient temperature. The volume of water to be used in the test shall be sufficient to ensure that at the end of the 7 day test period, the free volume of the unabsorbed and unreacted water remaining shall be at least 10% of the volume of the solid test sample itself. The water shall have an initial pH of 6–8 and a maximum conductivity of 1 mS.m⁻¹ at 20°C. The total activity of the free volume of water shall be measured following the 7 day immersion of the test sample.

6) Surface Contaminated Object

Radioactive material may be classified as SCO if the conditions in clauses 4.3.2, 6.8.1 to 6.8.7 are met.

SCO shall be a solid object classified as either SCO-I or SCO-II specified below:

TABLE-IV
CLASSIFICATION OF SURFACE CONTAMINATED OBJECTS

SCO Group	Contamination Level Bq.cm ⁻² Averaged over 300 cm ² or (the area of the surface if less than 300 cm ²)					
	The Non-fixed Contamination on the Accessible Surface		The Fixed Contamination on the Accessible Surface		The Non-fixed Contamination plus the Fixed Contamination on the Inaccessible Surface	
	for Beta and Gamma Emitters and Low Toxicity Alpha Emitters	for all other Alpha Emitters	for Beta and Gamma Emitters and Low Toxicity Alpha Emitters	for all other Alpha Emitters	for Beta and Gamma Emitters and Low Toxicity Alpha Emitters	for all other Alpha Emitters
SCO-I	4	0.4	4 x 10 ⁴	4 x 10 ³	4 x 10 ⁴	4 x 10 ³
SCO-II	400	40	8 x 10 ⁵	8 x 10 ⁴	8 x 10 ⁵	8 x 10 ⁴

Requirements for Packaging

Requirements for Type IP-1

A Type IP-1 package shall be designed to meet the above-specified [general requirements](#) for all packages in addition to the requirement that the smallest overall external dimension of the package shall not be less than 10 cm and the additional requirements for packages transported by air (clause 5.4), if carried by air.

7) Requirements for Type IP-2

A package to be qualified as Type IP-2 shall be designed to meet the requirements for Type IP-1 and, in addition, if it were subjected to the free drop test (clause 5.8.4.3) and the stacking test (clause 5.8.4.4), it would prevent:

- a) Loss or dispersal of the radioactive contents
- b) More than a 20% increase in the maximum radiation level at any external surface of the package.

8) Requirements for Type IP-3

A package to be qualified as Type IP-3 shall be designed to meet the requirements for Type IP-1 and, in addition, the requirements for [Type A packages](#) except those for containing liquid and gaseous radioactive material

9) Alternative Requirements for Type IP-2 and Type IP-3

- 1) Packages may be used as Type IP-2, provided that:
 - a) They satisfy the requirements for Type IP-1
 - b) They are designed to satisfy the requirements prescribed for UN Packing Group I or II in Chapter 6.1 of the United Nations Recommendations on the Transport of Dangerous Goods, Model Regulations [2].
 - c) When subjected to the tests required for UN Packing Group I or II, they would prevent.
 - i. Loss or dispersal of the radioactive contents.
 - ii. More than a 20% increase in the maximum radiation level at any external surface of the package.

- 2) Portable Tanks may also be used as Type IP-2 or Type IP-3, provided that:
 - a) They satisfy the requirements for Type IP-1
 - b) They are designed to satisfy the requirements prescribed in Chapter 6.7 of the United Nations Recommendations on the Transport of Dangerous Goods, Model Regulations [2], or other requirements, at least equivalent, and are capable of withstanding a test pressure of 265 kPa.
 - c) They are designed so that any additional shielding that is provided shall be capable of withstanding the static and dynamic stresses resulting from handling and routine conditions of transport and of preventing more than a 20% increase in the maximum radiation level at any external surface of the portable tanks.

- 3) Tanks, other than portable tanks, may also be used as Type IP-2 or Type IP-3 for transporting LSA-I and LSA-II liquids and gases as prescribed in Table VI, provided that:
 - a) They satisfy the requirements for Type IP-1
 - b) They are designed to satisfy the requirements prescribed in regional or national regulations for the transport of dangerous goods and are capable of withstanding a test pressure of 265 kPa.
 - c) They are designed so that any additional shielding that is provided shall be capable of withstanding the static and dynamic stresses resulting from handling and routine conditions of transport and of preventing more than a 20% increase in the maximum radiation level at any external surface of the tanks.

TABLE-VI

INDUSTRIAL PACKAGE REQUIREMENTS FOR LSA MATERIAL AND SCO

Radioactive Contents	Industrial Package Type	
	Exclusive Use	Not Under Exclusive Use
LSA-I		
Solid ^a	Type IP-1	Type IP-1
Liquid	Type IP-1	Type IP-2
LSA-II		
Solid	Type IP-2	Type IP-2
Liquid and gas	Type IP-2	Type IP-3
LSA-III	Type IP-2	Type IP-3
SCO-I ^a	Type IP-1	Type IP-1
SCO-II	Type IP-2	Type IP-2

¹⁰⁾ Under the conditions specified in clauses 6.7.5 and 6.8.5 of [AERB Safety Code](#) LSA-I material and SCO-I may be transported unpackaged.

- a. Freight Containers with the characteristics of a permanent enclosure may also be used as Type IP-2 or Type IP-3, provided that:
 - a) The radioactive contents are restricted to solid materials.
 - b) They satisfy the requirements for Type IP-1 (clause 5.6.1).
 - c) They are designed to conform to the International Organization for Standardization document ISO 1496/1: Series 1 Freight Containers: Specifications and Testing — Part 1: General Cargo Containers for General Purposes [11] excluding dimensions and ratings. They shall be designed such that if subjected to the tests prescribed in that document and to the accelerations occurring during routine conditions of transport they would prevent:
 - i) loss or dispersal of the radioactive contents; and
 - ii) more than a 20% increase in the maximum radiation level at any external surface of the freight containers.

- b. Metal IBCs may also be used as Type IP-2 or Type IP-3, provided that:
 - a) They satisfy the requirements for Type IP-1
 - b) They are designed to satisfy the requirements prescribed for UN Packing Group I or II in Chapter 6.5 of the United Nations Recommendations on the Transport of Dangerous Goods, Model Regulations [2], and if they were subjected to the tests prescribed in that document, but with the drop test conducted in the most damaging orientation, they would prevent:
 - i. loss or dispersal of the radioactive contents; and
 - ii. more than a 20% increase in the maximum radiation level at any external surface of the IBC.
