

Process for Classifying Radioactive Material as LSA Material and SCO Based on the Transport Regulations

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Introduction

The transport regulations take into account the inherent properties of low specific activity (LSA) material and surface contaminated objects (SCOs), and allow for less-strict package requirements as compared to other radioactive materials, while retaining comparable levels of safety at lower costs. The primary purpose of this paper is to assist the consignors in preparing LSA material and SCOs for transport in compliance with the international and domestic regulations[1][2][3]. Process for classifying radioactive material as LSA material and SCOs is provided in question and answer format on the classification and various aspects of transporting LSA material and SCOs. However, use of this process is not mandatory. Methods other than those described herein may also be found to be acceptable based on reasoned argument, or other adequate justification.

LSA Material and SCOs

LSA material means radioactive material with limited specific activity which satisfies the descriptions and limits set forth in the regulations. Specific activity limits for the LSA material are specified for three groups; LSA-I, LSA-II and LSA-III, which are explicitly related to the A_2 value of the radioactive material involved. LSA materials distinguish between two types of distribution of activity in the material; essentially uniformly distributed and distributed throughout. Shielding materials surrounding the LSA material may not be considered in determining the estimated average specific activity of the package contents.

SCO is a solid object which is not itself classed as radioactive, but which has radioactive material distributed on any of its surfaces. SCOs are divided into two groups; SCO-I and SCO-II. Objects that are themselves radioactive (e.g., activated objects) and that are contaminated cannot generally be classified as SCO, but may be classified as LSA material.

LSA material and SCOs are the only radioactive material for which a dose rate limit is specified for the package contents, in addition to the package and vehicle limits. The regulatory requirements specifies that the dose rate should not exceed an external radiation level of 10mSv/h at 3m from the unshielded material or object in a packaging.

Package Requirements

Changes to the package for LSA material and SCOs were implemented by the 2001 domestic regulatory revisions. Industrial packages(IPs) were introduced into the regulation and an upper limit was placed on the amount of activity in LSA material and SCOs which could be transported in a non-accident resistant package. Type IP-1, IP-2 and IP-3 packages are required to protect and contain contents during normal conditions but not required to survive accident conditions. If the requirements for the unshielded dose rate limit for LSA material and SCOs is not satisfied, accident-resistant, i.e., Type B packages must be used. Table 1 presents the minimum regulatory package requirements for all radioactive materials.

Table 1. Package requirements

Radioactive material	Package type	
	$< A_2$	$\geq 10\text{mSv/h}$ at 3m
Non-LSA and non-SCO	Type A	Type B
LSA-I and SCO-I (E) LSA-I solid (NE)	IP-1	Type B
LSA-II, LSA-III and SCO-II (E) LSA-I liquid, LSA-II solid, SCO-II (N-E)	IP-2	
LSA-II liquid and gas, LSA III (N-E)	IP-3	

Note : E is exclusive use and N-E is non-exclusive use.

Conclusion

Table 2 provides a more detailed description of package requirements for the various forms of LSA material and SCOs. Once the appropriate classification of the radioactive material is reached using the process according to the steps of Table 2, that is, the radioactive material is successfully classified as LSA-I, LSA-II, LSA-III, SCO-I or SCO-II, then Table 1 may be used to identify package options for the corresponding radioactive material.

Reference

- [1] IAEA, Regulation for the Safe Transport of Radioactive Material, Safety Standard Series No.TS-R-1(2005 Ed)
- [2] U.S CFR, Packaging and Transportation of Radioactive Material, Part 71, Title 10, Energy
- [3] Korea MOST, Regulation for the Transport and Packaging of Radioactive Material, Notice No. 2001-23

Table 2. Classification process of LSA material or SCOs

No.	Classification method	YES	NO
1	Is it limited quantity of radioactive material?	Type L package	To 2
2	Is non-fissile or fissile excepted ?	To 3	Not classified as LSA or SCO
3	Is the external dose rate at 3m from the unshielded material or object $\leq 10\text{mSv/h}$?	To 4	Not classified as LSA or SCO
4	Is the content liquid or gas?	To 5	To 10
5	Liquid compound or mixture composed of irradiated natural Uranium, depleted Uranium or natural Thorium?	LSA-I	To 6
6	Liquid or gas, other than fissile material, with unlimited A_2 value?	LSA-I	To 7
7	Water with tritium $\leq 0.8\text{TBq/li}$?	To 9	To 8
8	Activity $\leq 10^{-5}A_2/\text{g}$ for liquid, or $\leq 10^{-4}A_2/\text{g}$ for gas?	To 9	Not classified as LSA or SCO
9	Quantity $\leq 100A_2$ or can be divided so quantity per conveyance $\leq 100A_2$?	LSA-II	Not classified as LSA or SCO
10	Is the solid or an object or a collection of objects?	To 11	To 12
11	Is solid activated or otherwise radioactive?	To 25	To 12
12	Ore containing natural Uranium, depleted Uranium or natural Thorium?	LSA-I	To 13
13	Unirradiated natural Uranium, depleted Uranium or natural Thorium, or compound or mixture there of?	LSA-I	To 14
14	A_2 unlimited, non fissile?	LSA-I	To 15
15	Mill, debris etc. activity essentially uniformly distributed $\leq 10^{-4}A_2/\text{g}$?	LSA-I	To 16
16	Activity distributed throughout, $> 10^{-6}A_2/\text{g}$ but $\leq 10^{-4}A_2/\text{g}$?	To 17	To 19
17	Noncombustible?	LSA-II	To 18
18	Quantity $\leq 100A_2$ or can be divided so quantity per conveyance $\leq 100A_2$?	LSA-II	To 19
19	Activity distributed throughout?	To 21	To 20
20	Activity essentially uniformly distributed in solid compact binding agent?	To 21	Not classified as LSA or SCO
21	Relatively insoluble when placed in water for 7 days?	To 22	Not classified as LSA or SCO
22	Is specific activity $> 10^{-4}A_2/\text{g}$ but $2 \times 10^{-3}A_2/\text{g}$?	To 23	Not classified as LSA or SCO
23	Noncombustible?	LSA-III	To 24
24	Quantity $\leq 100A_2$ or can be divided so quantity per conveyance $\leq 100A_2$?	LSA-III	Not classified as LSA or SCO
25	Is the solid contaminated anywhere on its surface at level $> 0.4\text{Bq/cm}^2$ for β , γ and low toxicity α emitter and $> 0.04\text{Bq/cm}^2$ for all other α emitters?	To 26	Not classified as radioactive material
26	Quantity of total activity ($100A_2$ or can be divided so quantity per conveyance ($100A_2$?	To 27	Not classified as LSA or SCO
27	Non-fixed contamination on accessible surface (4Bq/cm^2 for (, (and low toxicity (emitter and (0.4Bq/cm^2 for all other (emitters?	To 28	To 30
28	Fixed contamination on accessible surface $\leq 4 \times 10^4\text{Bq/cm}^2$ for β , γ and low toxicity α emitter and $\leq 4 \times 10^3\text{Bq/cm}^2$ for all other α emitters?	To 29	To 30
29	Non-fixed plus fixed contamination on inaccessible surface $\leq 4 \times 10^4\text{Bq/cm}^2$ for β , γ and low toxicity α emitter and $\leq 4 \times 10^3\text{Bq/cm}^2$ for all other α emitters?	SCO-I	To 30
30	Non-fixed contamination on accessible surface $\leq 400\text{Bq/cm}^2$ for β , γ and low toxicity α emitter and $\leq 40\text{Bq/cm}^2$ for all other α emitters?	To 31	Not classified as SCO
31	Fixed contamination on accessible surface $\leq 8 \times 10^5\text{Bq/cm}^2$ for β , γ and low toxicity α emitter and $\leq 8 \times 10^4\text{Bq/cm}^2$ for all other α emitters?	To 32	Not classified as SCO
32	Non-fixed plus fixed contamination on inaccessible surface $\leq 8 \times 10^5\text{Bq/cm}^2$ for β , γ and low toxicity α emitter and $\leq 8 \times 10^4\text{Bq/cm}^2$ for all other α emitters?	SCO-II	Not classified as SCO