



*New Regulations for
Transporting Radioactive
Material*

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Reason for Changing Regulations

- *Conform to 1985 IAEA Safety Series #6: Safe Transport of Radioactive Material*
- *Regulations now conform to international shipping regulations*

Major Changes

- *Use of SI units*
- *New definition for Low Specific Activity (LSA)*
- *Addition of Surface Contaminated Objects (SCO)*
- *Packaging requirements for LSA/SCO*

Major Changes cont.

- *New A_1 & A_2 values for some radioisotopes*
- *New method of calculation for A_1 & A_2 values*
- *Additions to shipping papers*
- *Fissile material requirements*

Definitions (§173.403)

■ *DOT definition of Radioactive Material:*

- *Any material having a specific activity greater than 70 Bq/gram (0.002 $\mu\text{Ci/g}$).*

Definitions cont.

■ A_1

- *maximum activity of special form radioactive material permitted in a Type A package*

Definitions cont.

■ A_2

- *maximum activity of radioactive material, other than special form, LSA, or SCO, permitted in a Type A package.*



Definitions cont.

■ Exclusive Use

- *sole use by a single consignor of a conveyance for which all loading & unloading are done in accordance with the direction of the consignor or consignee.*

International Units (SI)

- *Activity on shipping papers & labels must be expressed in Becquerels.*
- *Radiation levels must be expressed in Sieverts.*
- *Customary units may be put in parentheses following SI Units.*

Low Specific Activity (§173.403)

■ *LSA-I*

- *naturally occurring ores*
- *solid unirradiated natural or depleted uranium or thorium*
- *solid or liquid compounds or mixtures of natural or depleted uranium or thorium*

Low Specific Activity cont.

- *LSA-I con.*
 - *radioactive material, other than fissile material, with an unlimited A_2*
 - *Mill tailings, concrete, rubble, contaminated earth, other debris, & activated material with an average specific activity $\leq 10^6 A_2/g$*

Low Specific Activity cont.

■ *LSA-II*

- *water with ^3H concentration of ≤ 0.8 TBq/liter (20.0 Ci/liter)*
- *material in which radioactive material is distributed throughout & the average specific activity is:*
 - $\leq 10^4 A_2/\text{gram}$ for solids
 - $\leq 10^5 A_2/\text{gram}$ for liquids

Low Specific Activity cont.

- *LSA-II con.*
 - *Intended to include normal laboratory contaminated debris*
- *Some LSA-II activity limits:*
 - *^{32}P solids : 0.811 mCi/g*
 - *^{32}P liquids : 0.0811 mCi/g*
 - *^{14}C solids : 5.41 mCi/g*
 - *^{14}C liquids : 0.541 mCi/g*

Low Specific Activity cont.

■ *LSA-III*

- *solids meeting §173.468 (leaching tests for LSA-III material)*
- *material is distributed throughout a solid, collection of solid objects, or solid compact binding agent (et. al. concrete)*

Low Specific Activity cont.

- *LSA-III con.*

- *material is relatively insoluble or intrinsically contained in a relatively insoluble material so leaching in water will not exceed $0.1 A_2$ after 7 days*
- *average specific activity $\leq 2 \times 10^{-3} A_2/g$*

Surface Contaminated Objects (§173.403)

- *objects which themselves are not radioactive but have radioactive contamination on their surfaces*
- *contamination limits must not exceed limits set forth in §173.403*



Surface Cont. Objects cont.

- *2 groups: SCO-I & SCO-II*
- *SCO material is not intended to include contaminated laboratory debris or activated material*

SCO Contamination Limits

All average over 300 cm ²		SCO-I	SCO-II
Fixed on accessible surface	α	0.1 $\mu\text{Ci}/\text{cm}^2$	2 $\mu\text{Ci}/\text{cm}^2$
	$\beta / \gamma / \text{l.t. } \alpha$	1.0 $\mu\text{Ci}/\text{cm}^2$	20 $\mu\text{Ci}/\text{cm}^2$
Non-fixed on accessible surface	α	$10^{-5} \mu\text{Ci}/\text{cm}^2$	$10^{-3} \mu\text{Ci}/\text{cm}^2$
	$\beta / \gamma / \text{l.t. } \alpha$	$10^{-4} \mu\text{Ci}/\text{cm}^2$	0.01 $\mu\text{Ci}/\text{cm}^2$
Total on inaccessible surfaces	α	0.1 $\mu\text{Ci}/\text{cm}^2$	2 $\mu\text{Ci}/\text{cm}^2$
	$\beta / \gamma / \text{l.t. } \alpha$	1.0 $\mu\text{Ci}/\text{cm}^2$	20 $\mu\text{Ci}/\text{cm}^2$

l.t. = low toxicity

Packaging Changes

- *General Design Requirements, which must be met by all radioactive material packages (§173.410):*
 - *easily handled*
 - *lifting attachments must have minimum security factor of 3 against yielding & failure will not impair ability of package to meet other requirements*
 - *easily decontaminated*



General design requirements cont.

- *outer layer must avoid water collection*
- *added features will not reduce safety*
- *capable of withstanding vibration*
- *chemically & physically compatible with contents*
- *valves must be protected against unauthorized openings*



Industrial Packages

(§173.411)

■ Industrial Package Type 1

- must meet general design requirements*
- is essentially a strong, tight container*
- documentation of testing not required*

Industrial Packages cont.

- *Industrial Package Type 2*
 - *meet IP-1 requirements*
 - *Type A free drop test & stacking test*
 - *prevent loss or dispersal of contents*
 - *no significant increases in radiation levels*
 - *test documentation required*

Industrial Packages cont.

- *Industrial Package Type 3*
 - *meet IP-1 & IP-2 requirements*
 - *meet §173.412 (a-j)*
 - *Type A water spray, drop, stacking, & penetration tests in §173.465*
 - *documentation required*

Packaging LSA/SCO

(§173.427)

- *LSA/SCO material may be packaged 3 ways:*
 - *appropriate Industrial Package (see table 8 in §173.427)*
 - *DOT 7A Type A for domestic transportation only*
 - *strong, tight container for domestic transportation only provided certain conditions are met*

Strong, Tight Containers

- *essentially an IP-1*
- *can use for LSA/SCO if:*
 - *shipment is exclusive use*
 - *domestic transportation only*
 - *activity $\leq A_2$*
 - *radiation levels at 3 meters from unshielded material is $< 1 \text{ rem/h}$ (0.01 Sv/h)*

Industrial Package Integrity Requirements for LSA/SCO

<i>Contents</i>	<i>Industrial Package Type</i>	
	<i>Exclusive Use shipment</i>	<i>Non-exclusive use shipment</i>
<i>LSA-I solid</i>	<i>IP-1</i>	<i>IP-1</i>
<i>LSA-I liquid</i>	<i>IP-1</i>	<i>IP-1</i>
<i>LSA-II solid</i>	<i>IP-2</i>	<i>IP-2</i>
<i>LSA-II liquid/gas</i>	<i>IP-2</i>	<i>IP-3</i>
<i>LSA-III</i>	<i>IP-2</i>	<i>IP-3</i>
<i>SCO-I</i>	<i>IP-1</i>	<i>IP-1</i>
<i>SCO-II</i>	<i>IP-2</i>	<i>IP-2</i>

Additions to Shipping Papers

- *Shipping paper must have a clearly visible statement indicating if the shipment is exclusive use.*
- *Appropriate group notations for LSA/SCO must be indicated.*

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