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
DOT definition of Radioactive Material:

- Any material having a specific activity greater than 70 Bq/gram (0.002 $\mu$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 $^3$H concentration of $\leq 0.8 \text{ TBq/liter (20.0 Ci/liter)}$
  - material in which radioactive material is distributed throughout & the average specific activity is:
    - $\leq 10^{-4} \text{A}_2/\text{gram for solids}$
    - $\leq 10^{-5} \text{A}_2/\text{gram for liquids}$
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 (e.g. 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 $\leq 2 \times 10^{-3} A_2/\text{g}$
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

<table>
<thead>
<tr>
<th></th>
<th>All average over 300 cm²</th>
<th>SCO-I</th>
<th>SCO-II</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fixed on accessible surface</strong></td>
<td></td>
<td><strong>α</strong></td>
<td>0.1 μCi/cm²</td>
</tr>
<tr>
<td></td>
<td>β / γ / l.t. α</td>
<td>1.0 μCi/cm²</td>
<td>20 μCi/cm²</td>
</tr>
<tr>
<td><strong>Non-fixed on accessible surface</strong></td>
<td></td>
<td><strong>α</strong></td>
<td>10⁻⁵ μCi/cm²</td>
</tr>
<tr>
<td></td>
<td>β / γ / l.t. α</td>
<td>10⁻⁴ μCi/cm²</td>
<td>0.01 μCi/cm²</td>
</tr>
<tr>
<td><strong>Total on inaccessible surfaces</strong></td>
<td></td>
<td><strong>α</strong></td>
<td>0.1 μCi/cm²</td>
</tr>
<tr>
<td></td>
<td>β / γ / l.t. α</td>
<td>1.0 μCi/cm²</td>
<td>20 μCi/cm²</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Contents</th>
<th>Exclusive Use shipment</th>
<th>Non-exclusive use shipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSA-I solid</td>
<td>IP-I</td>
<td>IP-I</td>
</tr>
<tr>
<td>LSA-I liquid</td>
<td>IP-I</td>
<td>IP-I</td>
</tr>
<tr>
<td>LSA-II solid</td>
<td>IP-2</td>
<td>IP-2</td>
</tr>
<tr>
<td>LSA-II liquid/gas</td>
<td>IP-2</td>
<td>IP-3</td>
</tr>
<tr>
<td>LSA-III</td>
<td>IP-2</td>
<td>IP-3</td>
</tr>
<tr>
<td>SCO-I</td>
<td>IP-1</td>
<td>IP-1</td>
</tr>
<tr>
<td>SCO-II</td>
<td>IP-2</td>
<td>IP-2</td>
</tr>
</tbody>
</table>
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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