

# Safe transport of radioactive material: Revised international regulations

*A technical overview of the latest main revisions to the IAEA's advisory Regulations for the Safe Transport of Radioactive Material*

by Richard R.  
Rawl

Since 1961 the IAEA at the request of the United Nations Economic and Social Council has issued advisory *Regulations for the Safe Transport of Radioactive Material*, published as IAEA Safety Series No. 6. These regulations have come to be recognized throughout the world as the uniform basis for both national and international transport safety requirements in this area. Requirements based on the IAEA regulations are known to have been adopted in 59 countries, as well as by the International Civil Aviation Organization, the International Maritime Organization, and regional transport organizations.

Recognizing the need to keep the regulations up-to-date with the latest radiation protection principles and evolving transport technologies, the IAEA has regularly issued revisions to the transport regulations. Most recently the revisions have taken place at approximately 10-year intervals and the latest revision began in 1986. The revision process involves a comprehensive series of technical committee and consultants meetings which are mainly comprised of representatives of regulatory agencies in the IAEA's Member States and international safety agencies. The outcomes of these meetings are reflected in drafts of the revised regulations that are circulated for comment and further consideration. In September 1996 the IAEA Board of Governors approved the 1996 draft for publication, and for application to the Agency's operations, and recommended the revised regulations to Member States and international organizations for their adoption.

From a technical perspective, this article briefly reviews the major changes incorporated in the latest revision of the newly issued regulations.

## Technical overview of main revisions

There are numerous minor changes, as well as several major ones, embodied in the 1996 edition. They include those relating to:

**Air transport of radioactive material.** The new regulations require a more robustly designed package type, called a Type C package, for high-activity packages transported by aircraft. Many of the design and performance requirements for Type C packages recommended in an IAEA technical document (TECDOC-702) were adopted. Type C package requirements apply to all radionuclides. The new performance requirements include:

- those applicable to Type B(U) packages and, if appropriate, packages for fissile materials;
- a puncture/tearing test;
- an enhanced thermal test, with the same technical specifications as the Type B package thermal test but with a duration of 60 minutes;
- a 200 meter water immersion test; and
- an impact speed of 90 meters per second for the "drop" test.

**Low dispersible radioactive material.** Since the primary hazards being addressed in Type C requirements are dispersion and radiation levels, provisions have been made for materials which exhibit limited dispersibility, solubility, and radiation levels. These provisions are contained in a material category known as "low dispersible radioactive material" (LDM). It was accepted that material (without any packaging) that has limited radiation levels, which when subjected to the Type C impact and thermal tests, would only produce limited gaseous, fine particulate, or dissolved aqueous activity and should be excepted from the Type C packaging requirements. Test specifications for LDM material are included in the regulations and

Mr. Rawl is a senior staff member in the IAEA's Division of Radiation and Waste Safety.

Type B packages are authorized for their transport by air, with the limit on total activity being that specified in the approval certificate for the Type B package. Multilateral Competent Authority approval of the Type B package design and the design of the LDM is required.

**Provisions for the safe transport of uranium hexafluoride.** The technical committees which developed the revised regulations dealt with a number of difficult items concerning uranium hexafluoride (UF<sub>6</sub>). Uranium hexafluoride is a unique material since its chemical toxicity is generally of more concern than its radiotoxicity and the material is routinely shipped in large volumes. No specific provisions for UF<sub>6</sub> existed in the 1985 edition of the transport safety regulations and a number of issues were considered. Provisions were adopted requiring that UF<sub>6</sub> packages:

- must withstand an internal test pressure of at least 1.4 MPa, but cylinders with a test pressure less than 2.8 MPa require multilateral approval;
- designed to contain 0.1 kg or more but less than 9000 kg of UF<sub>6</sub> must meet the "Type B" thermal test of 800°C for 30 minutes;
- designed to contain 9000 kg or more must either meet the thermal test requirements or have multilateral approval;

**Incorporating the exemption values from the *International Basic Safety Standards for Protection Against Ionizing Radiation and for the Safety of Radiation Sources (BSS)*.** One of the major topics considered in the revision process was the incorporation of the new BSS. The BSS were revised to reflect the consensus surrounding the latest recommendations of the International Commission on Radiological Protection and the transport regulations call upon them as a general provision for radiological protection. Consequently, the transport regulations need to take account of the revised BSS requirements. The most contentious aspect was the adoption of the exemption values given in the BSS.

The transport regulations have always contained an exemption criterion which defined materials subject to their requirements. The current regulations define radioactive material as any material having a specific activity greater than 70 Bq/g. The BSS, however, use a radionuclide-specific approach which leads to derived exemption values spanning seven orders of magnitude, and straddling 70 Bq/g in the case of activity concentration. The BSS also present exemption values for total activity quantities (Bq).

It was recognized that the single exemption level of 70 Bq/g has no dose basis and that it was unlikely that this level satisfied the primary dose criterion of 10 microsievert in a year for exemption for all radionuclides. A set of transport-specific scenarios were developed which reflected various exposure situations (exposure times, distances, source geometries, etc.). Based on these scenarios, both activity concentration and total activity values were calculated which would result in meeting the 10 microsievert per year value. These transport derived values were comparable to the exemption values in the BSS and resulted in recommended activity concentrations ranging from 1 to 10<sup>6</sup> Bq/g.

Given the difficulty in technically justifying the 70 Bq/g value and the similarity in results from the transport scenarios and the BSS scenarios, it was determined to be preferable to simply adopt the BSS derived exemption values. Consequently, the regulations contain both activity concentration and "total activity per consignment" exemption values. For mixtures of radionuclides, the "ratio rule" must be applied so that the sum of the activities (or activity concentrations) present for each radionuclide divided by the applicable exemption value is less than or equal to one.

**Other changes.** Other changes of interest to shippers and package designers involved in the nuclear fuel cycle include revisions to the requirements applicable to fissile materials. Fissile material exceptions (those conditions under which special packaging is not needed to account for the fissile nature of the contents) were amended and in one case now include consignment as well as package limits. Consideration of accident conditions such as crush and the Type C test conditions were also added.

### Implementation of the revised regulations

It will take a number of years for IAEA Member States and international organizations to implement supporting revisions to their regulations based on the 1996 edition of Safety Series No.6.

In the past, it has taken approximately five years for this process to be reasonably complete. The international transport organizations are striving to meet a target date of 1 January 2001, and the Agency's Member States will likewise need to issue revisions in order to remain consistent with the international requirements. □