A routine radioisotope shipment by air. Generally the shipment of radioactive materials and other hazardous goods by air is regulated by the International Civil Aviation Organization (ICAO), which uses IAEA's transport rules as a basis. (Credit: AECL).

Towards greater regulatory harmony

Clarifying the roles of international organizations & Member States

by Ronald B. Pope

In concert with other international organizations, and the actions of regulatory bodies within many IAEA Member States, a sound basis for adequate regulation to assure the safe transportation of radioactive materials has been established over the past 25 years.

Adequate regulation, however, depends primarily upon the individual Member State and its willingness to adopt or otherwise properly implement regulations in a timely manner. For the international movement of radioactive materials, adequate regulation also depends upon a harmony between countries in the basic content of their regulations.

As explained in an accompanying boxed article, the IAEA plays a focal role in the harmonization process by establishing the *Regulations for the Safe Transport of Radioactive Materials*, also known as *Safety Series No. 6*. The regulations govern all IAEA activities, but serve only as *recommendations* for relevant international organizations and IAEA Member States.

An equally important role is played by modal and regional international organizations, such as the International Civil Aviation Organization (ICAO), the International Maritime Organization (IMO), the Economic Commission of Europe (ECE), and the Council for Mutual Economic Assistance (CMEA). They co-operate in the revision of the Agency's regulations and adopt them into their regulatory documents allowing for direct application by Member States.

Similarly, other international organizations are providing input to revisions of the Agency's regulations, allowing them to remain current with advances in

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technology. These organizations include the International Commission on Radiological Protection (ICRP), the World Health Organization (WHO), the International Organization for Standardization (ISO), and the United Nations Economic and Social Council (UN/ECOSOC) Committee of Experts on the Transport of Dangerous Goods.

Because of the complexities of establishing regulatory structures within the various countries worldwide, a single implementation procedure does not, and probably can not, exist. Therefore, co-operation between various international organizations is certainly desirable if changes are to be incorporated in their regulatory documents in a harmonized fashion. Unless the changes are put into force on an essentially simultaneous basis, many countries will be trying to regulate the transport of radioactive materials with different rules for different modes. Indeed, approximately 90% of the countries utilize, in some way, the regulations, instructions, codes, recommendations, standards, etc., from international

IAEA transport regulations

Today more than 10 million packages of radioactive materials are being transported each year worldwide.* This underscores that radioactive materials are part of our modern life and are becoming moreso as time progresses. Many technologies that use or produce radioactive materials are benefitting mankind in various ways.

To assure safety during the transport, handling, and storage of these hazardous materials, it was recognized decades ago that a very strict set of standards — developed and recognized on an international level — would be required. IAEA, which has played a focal role in this process, recently took steps to review and revise its *Regulations for the Safe Transport of Radioactive Materials, Safety Series No. 6,* a new edition of which will be published in 1985.

History of Agency role

The Agency's activities in transport safety, which are currently carried out by the Division of Nuclear Safety as part of a subprogramme of Radiological Safety, were initiated in the late 1950s. In view of the expanding use of radioactive materials for peaceful purposes at that time, IAEA undertook to develop harmonized safety rules for transport of those materials on as wide a basis as possible and for all modes of transport. Based on existing good practices and the few simple regulations already in effect, the Agency began to develop such rules in 1958.

The first edition of *Safety Series No. 6* was published in 1961. In addition to being applied to the Agency's operations, they were "recommended to Member States and to International Organizations concerned as a basis for national and international transport regulations".

The regulations were revised and updated in subsequent years to reflect experience in their application, new trends in radiation protection, and changes in methods and technology.

What the regulations establish

Safety Series No. 6 establishes basic requirements for limiting the exposure of persons to radiation; specifies general accident, quality control and compliance assurance provisions; and sets forth specific package design requirements and test and inspection procedures, package activity contents limits, controls for transport, controls for storage-in-transit, special controls for fissile materials, and various administrative requirements.

The regulations are based upon two basic philosophical principles:

- First, they have been formulated to specify "what" is to be achieved rather than "how" it is to be achieved.
- Second, the burden for safety is placed — as far as practicable — upon the packaging containing the radioactive material, not on carriers or their procedures.

The first principle places a "burden-of-proof" upon the designers, fabricators, and users of packages to demonstrate that they have adequately satisfied the regulatory standards. The second principle minimizes the contribution to safety by the carrier, but does not remove from the carrier or the transport worker the responsibility to treat radioactive material consignments with care consistent with the requirements specified in the regulations. Generally, radioactive material consignments are to be treated with the same level of care accorded to any other shipment of dangerous goods.

Finally, the packaging requirements provide for adequate containment of contents; limitations on external contamination and emitted radiation; prevention of criticality if the contents are fissile; and proper heat management if the contents generate heat. Protection is provided through a graded approach, where the package strength requirements are related to the hazard posed by its radioactive material contents. The strength and the controls on the design and use of the package increase as the hazardous nature of the contents increases.

Are IAEA's rules mandatory?

Safety Series No. 6, issued under the authority of the IAEA Board of Governors, is mandatory for the Agency's own operations and Agency-assisted operations. Thus, although it has the status of a standard, it represents *regulations* which control Agency-related activities.

However, for Member States of the Agency, and for other international organizations, *Safety Series No. 6* serves as recommendations, *not regulations.* The document serves as the basis for the regulations for transport of radioactive materials in essentially all IAEA Member States, and also is the basis for the regulations, conventions, agreements, instructions, codes, acts or recommendations of the international organizations concerned with the transport of radioactive materials. Member States adopt *Safety Series No. 6* either by (a) directly copying it into their statutes; (b) referencing it in their statutes; (c) rewriting it into statutory formats acceptable to them; (d) referencing the international documents which are based upon *Safety Series No. 6*; or (e) by combinations of the above.

* Based on data available at IAEA.

organizations other than the IAEA to regulate the transport of radioactive materials.

In view of the importance of a harmonized adoption of *Safety Series No. 6*, a recent technical committee meeting at the IAEA recommended that international organizations should unify their implementation date of the 1985 edition of *Safety Series No. 6*, and a date of 1 January 1988 was recommended. IAEA now is taking steps to assess whether such a unified adoption date is feasible.

Following is a general review of how international organizations and Member States implement and apply IAEA regulations for transporting radioactive materials.

International bodies – applying the standards

Certain international organizations are responsible for establishing documents to control safety relating to modal or regional aspects of the transport of dangerous goods. Generally, these organizations implement *Safety Series No. 6*, in some form, into their controlling documents.*

The UN/ECOSOC Committee of Experts. This group produces the UN recommendations which currently define radioactive materials as "Class 7 – Radioactive substances."** In their December 1984 meeting, the group agreed that to be consistent with the new edition of *Safety Series No. 6*, this definition would be changed to read "Class 7 – Radioactive Materials." Other changes are much more substantive in nature, and involve revisions to seven chapters of the UN recommendations for reasons of consistency.

When published, then, these two documents (*Safety Series No. 6, 1985 Edition*, and the *UN Recommendations of the Committee of Experts on the Transport of Dangerous Goods, Revision 4*), will serve as the basis for recommendations for implementation of changes in the controlling regulatory documents of the other international organizations.

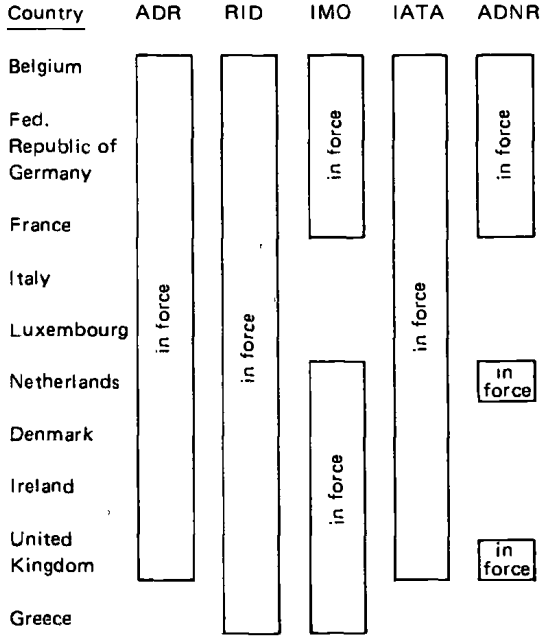
The International Civil Aviation Organization (ICAO) and the International Air Transport Association (IATA). For air carriage of dangerous goods, the ICAO and the IATA provide the controlling documents. ICAO annually issues its *Technical Instructions for the Safe Transport of Dangerous Goods by Air*, which carries the *Safety Series No. 6* recommendations in its Class 7 requirements to provide consistency.

IATA issues *Dangerous Goods Regulations* and these are generally consistent with the IAEA regulations, the UN recommendations, and ICAO technical instructions. Thus a great deal of harmony exists in the air transport mode.

It should be noted that close co-ordination between IAEA, ICAO, and IATA exists, that changes were made in the Agency's regulations regarding packages transported by air at the request of ICAO and IATA, and that liaison continues to assure accurate and timely implementation of the 1985 edition of *Safety Series No. 6*.

The International Maritime Organization (IMO). For carriage of dangerous goods by sea, IMO provides the *International Maritime Dangerous Goods (IMDG) Code*. This document is amended, page by page, on a periodic and continuing basis. The latest edition is issued

Application of international transport regulations in European Community

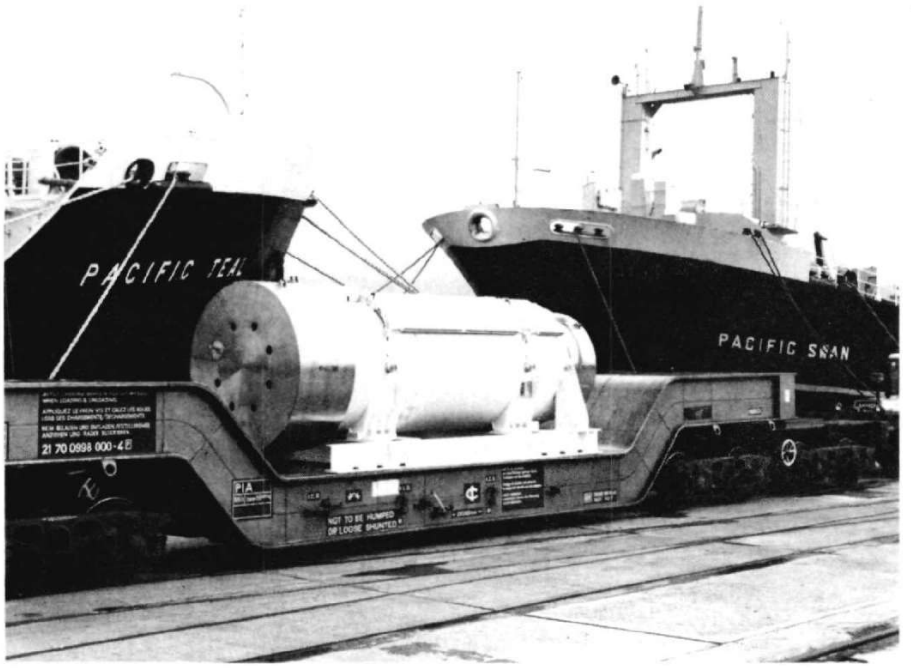


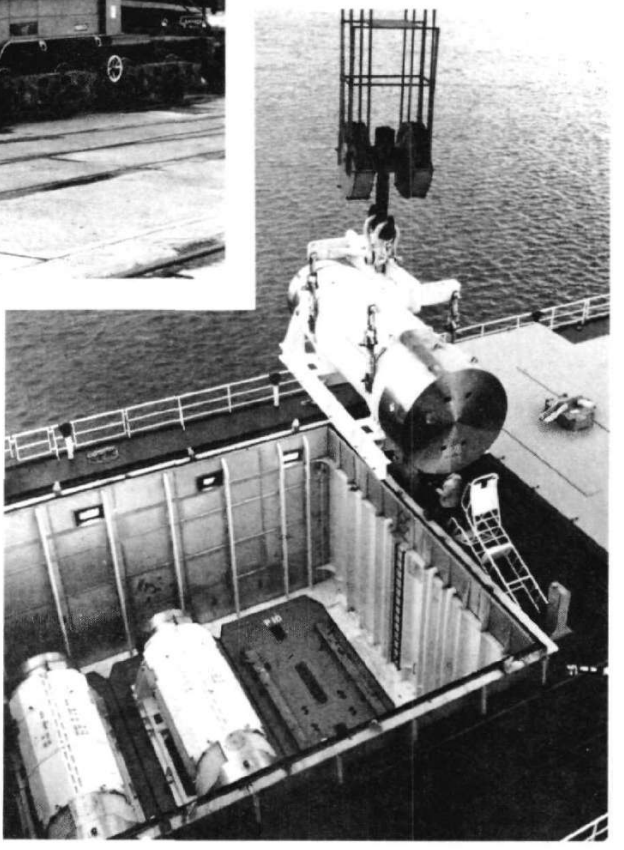
ADR: European Agreement Concerning the International Carriage of Dangerous Goods by Road.
RID: International Regulations Concerning the Carriage of Dangerous Goods by Rail.
IMO: International Maritime Organization.
IATA: International Air Transport Association.
ADNR: European Agreement Concerning International Carriage of Dangerous Goods on the Rhine.

Source: "Carriage of Radioactive Materials in Europe in Consideration of the Provisions Concerning Traffic, Including the Possibilities of a Transformation of the 1984 Edition of the IAEA Regulations, K. Ridder, *Proceedings* of the 7th International Symposium on Packaging and Transportation of Radioactive Materials (PATRAM '83), New Orleans, La., USA (May 1983).

* For an excellent summary, see "Carriage of Radioactive Materials in Europe in Consideration of the Provisions Concerning Traffic, Including the Possibilities of a Transformation of the 1984 Edition of the IAEA Regulations," by K. Ridder, in *Proceedings* of the 7th International Symposium on Packaging and Transportation of Radioactive Materials (PATRAM '83), New Orleans, La., USA (May 1983).

** *Transport of Dangerous Goods, Recommendations of the Committee of Experts on the Transport of Dangerous Goods*, AAT/SG/AC.10/1/Rev.3, United Nations, Geneva, Switzerland (1984).





After arriving at the dock by rail, a spent-fuel cask is loaded for marine transport. Sea shipments of radioactive and other hazardous materials are regulated by the International Maritime Dangerous Goods Code; rail shipments regionally through various agreements.
(Credit: BNFL)

as a 5-volume looseleaf set, and amendments issued thereto are easily added. The requirements for radioactive materials are set forth, again, under Class 7 within the IMDG Code. The IMO is working closely with IAEA to incorporate changes to the 1985 edition of *Safety Series No. 6* into the IMDG Code.

Regional organizations. The transport of dangerous goods by the road, rail, and inland waterway modes is not covered by an international organization on a *worldwide* basis. Rather, these are covered by regional organizations such as the Council for Mutual Economic Assistance (CMEA) for Eastern Europe, and by the following for Western Europe:

- *For road* – the ADR, European Agreement Concerning the International Carriage of Dangerous Goods by Road, promulgated by the Inland Transport Committee (ITC) of the Economic Commission of Europe (ECE).
- *For rail* – the RID, International Regulations Concerning the Carriage of Dangerous Goods by Rail, promulgated by the Central Office for the International Transport by Rail (OCTI).
- *For inland waterways* – the ADN, European Agreement Concerning the International Carriage of Dangerous Goods on Inland Waterways (in draft form), promulgated by ECE's Inland Transport Committee (ITC).
- *For the Rhine* – the ADNR, European Agreement Concerning the International Carriage of Dangerous Goods on the Rhine, promulgated by the Central Commission for Navigation on the Rhine (CCNR).

Co-ordination of implementation of revisions to *Safety Series No. 6* into the documents of these organizations are handled by representatives from Member States. In parts of the world other than in Europe, implementation is handled by national or multi-national bodies, although – as is noted later – documents from one region are being used to regulate the transport of radioactive materials in Member States of other regions.

Application of regulations by Member States

Member States of the IAEA implement international regulations, standards, codes, recommendations, etc., in a variety of ways. Each country must act within its own statutory requirements. Efforts are underway at the IAEA, working with individual Member States, to clarify the manner in which domestic, import, export, and through-country shipments of radioactive materials are controlled and regulated worldwide. Preliminary results are available from these efforts, and are summarized here.

Data have been obtained from 42 Member States representing all classes of countries: large and small; developing and advanced; and from Western Europe, Eastern Europe, Asia, North America, Central America,

Summary of preliminary survey results on implementation of Safety Series No. 6 through international organizations

International organization and form of document	Area of application	Percentage of Member States which regulate using this document*
IAEA *Safety Series No. 6* (Recommendations**)	Worldwide/all modes	81%
UN/ECOSOC Recommendations	Worldwide/all modes	17%
Union Postale Universelle (*Acts*)	Worldwide/all modes	31%
ICAO (Technical Instructions)***	Worldwide/air mode	52%
IATA (Regulations)***	Worldwide/air mode	50%
IMO (IMDG Code)	Worldwide/sea mode	62%
ECE/ADR (Agreement)	Regional/road mode	40%
OCTI/RID (Regulations)	Regional/road mode	45%
ECE/ADN (Agreement)	Regional/inland waterway mode	10%
CCNR/ADNR (Agreement)	Regional/ Rhine river	12%
CMEA	Regional	10%
SMGS (Provisions)****	Regional/rail mode	5%

* All countries surveyed regulate using internationally developed standards, either by using only documents from regional or modal international organizations, by using only *Safety Series No. 6*, or both.

** Regulations for the IAEA and its support activities; recommendations for all other activities.

*** 81% of countries surveyed use either ICAO technical instructions, IATA regulations, or both in regulating the air carriage of radioactive materials.

**** SMGS = Provisions for the Transport of Dangerous Goods by Rail (CMEA Governments).

Note: Data is preliminary based on responses from 42 IAEA Member States.

South America, and Africa. These data indicate the important role international organizations play in assuring implementation of the Agency's transport regulations within and between individual Member States.

For example, approximately 20% of the countries regulate radioactive material transport using *only* the regulatory documents of the modal international organizations; approximately 70% regulate using *both* domestic regulations based upon *Safety Series No. 6* and the regulatory documents of the modal international organizations; and approximately 10% regulate *only* with domestic regulations based upon *Safety Series No. 6.*

Of further significance are results indicating the number of countries which regulate using the regulations, codes, recommendations, etc., of each international organization, as summarized in the table. It is noteworthy that a very large percentage of countries regulate their modal traffic using the international modal regulatory documents. More than 80% of the countries included in the survey used ICAO and/or IATA regulatory documents to regulate the air carriage of radioactive materials; more than 60% use the IMO code to regulate sea carriage; and approximately 40% use the European-based agreements and regulations to regulate their road and rail carriage of radioactive materials.

One final point of significance from the data concerns the use of regional regulatory documents outside of the given region. Specifically, the ADR and ADN documents developed by the ECE are used by a significant number of countries outside of the ECE, including countries in Western Europe, Eastern Europe, and South America.

Although the transport of radioactive materials by a given mode is often regulated in a country using regulatory documents of the ICAO, IMO, etc., *Safety Series No. 6* is ultimately controlling since (1) it serves as the basis for the radioactive material-related portions of these international organization documents; and (2) many countries may, in addition, make *Safety Series No. 6*, or its principles, binding through other domestic regulations.

Revising transport regulations: Who is involved?

Various international organizations – about 17 all told – play different roles in the revision of the IAEA's transport regulations. The IAEA, of course, plays the co-ordinating role, some organizations provide indirect input while others provide direct assistance.

The listing includes:

- Commission of the European Communities (CEC)
- Central Committee for Navigation on the Rhine (CCNR)
- Council for Mutual Economic Assistance (CMEA)
- Economic Commission of Europe (ECE)
- International Air Transport Association (IATA)
- International Civil Aviation Organization (ICAO)
- International Cargo Handling Co-ordination Association (ICHCA)
- International Commission on Radiological Protection (ICRP)
- International Federation of Airline Pilots Association (IFALPA)
- International Labour Office (ILO)
- International Maritime Organization (IMO)
- International Organization for Standardization (ISO)
- Nuclear Energy Agency of the Organisation for Economic Co-operation and Development (NEA/OECD)
- Central Office for the International Transport by Rail (European) (OCTI)
- United Nations Economic and Social Council (UN/ECOSOC)
- Union Postale Universelle (UPU)
- World Health Organization (WHO)

The 1985 revised edition: New features

In 1979, a comprehensive revision of *Safety Series No. 6* was initiated to allow it to stay current with the advances in technology, with changes in carriers' and regulators' needs, and with the evolving safety standards for radiation protection. This revision has been performed with the extensive co-operation and assistance of Member States and international organizations.

During the period 1980–84, approximately 150 persons from 22 Member States and 12 international organizations participated in 12 meetings in connection with the review and revision process. The revision was initiated upon the advice of an advisory body to the IAEA's Director General known as the Standing Advisory Group for the Safe Transport of Radioactive Materials (SAGSTRAM). The final draft of the revised regulations was considered and approved by the IAEA's Board of Governors in September 1984, and the new edition is expected to be available in 1985.

The revised edition contains several new features:

- It contains general principles which implement the *Basic Safety Standards for Radiation Protection*, the development of which was jointly sponsored by the IAEA, World Health Organization (WHO), International Labour Office (ILO), and the Nuclear Energy Agency (NEA) of the Organisation for Economic Co-operation and Development (OECD). The result was issued by the IAEA as *Safety Series No. 9, 1982 Edition.*
- Items formerly identified as being "exempt from the prescriptions of the regulations," are now specified to be carried in "Excepted Packages," and these packages must satisfy a minimal set of requirements.
- Materials formerly known as "Low Specific Activity" and "Low-Level Solid Radioactive Materials" have been redefined and reclassified as "Low Specific Activity (LSA) Materials" and "Surface Contaminated Objects (SCO)," and graded packaging requirements for these materials and objects have been added.
- The regulations now contain provisions requiring crush-testing for certain types of light-weight packages, and deep-water-submergence testing for certain types of irradiated fuel flasks. In addition, a few additional requirements for packages transported by air have been added to provide consistency with the International Civil Aviation Organization (ICAO) and the International Air Transport Association (IATA).
- The International System of Units (SI) has been used throughout, where the customary system of units has been retained as a "non-controlling" alternative to the SI units to assist in the transition from the old to the new system.
- The controls for packages containing fissile materials have been greatly simplified and integrated into the category descriptors utilizing the transport index.
- An appendix containing schedules that listed, in abbreviated form, the requirements to be met for the transport of specified types of consignments has been removed. These schedules will be issued as a separate Safety Series document to preclude their inadvertant use as regulations.
- Finally, the structure of the new edition has been significantly changed to make it more useful, and a comprehensive index has been provided.

The updating and development of two additional documents to support the implementation of *Safety Series No. 6* is now underway with worldwide contributions. Specifically, an explanatory document will be issued to replace IAEA's *Notes on Certain Aspects of the Regulations, Safety Series No. 7*, and an advisory document will be issued to replace the Agency's *Advisory Material for the Application of the IAEA Transport Regulations, Safety Series No. 37.*