

International consensus for the safe transport of radioactive material: An experience to imitate

Over the past decades, a strong record of safety has been built

by R.A. O'Sullivan

The IAEA regulations for the safe transport of radioactive material have served successfully for more than 25 years as the basis for the regulatory control of radioactive material transport worldwide.

The task of preparing and maintaining safety standards for transport was entrusted to the Agency by the United Nations in 1959. In the years that have ensued, the support of the Agency's Member States, and the co-operation of UN agencies and other international organizations, have resulted in a consistent and appropriate safety regime. The widespread adoption of the Agency's recommendations represents a successful approach, demonstrated by an impressive safety record in the transport of radioactive material. With an estimated volume of traffic amounting to 38 million package-shipments of radioactive material per year worldwide — the majority of which is for medical or industrial uses often regarded as indispensable — effective control of safety is essential. Particularly for international transport, the safety provisions must be consistent among the different countries and by the different modes concerned. The extent of international co-operation underlying the acceptance of the Agency's regulations in this field provides an example worthy of imitation in other areas.

Historical development of the IAEA's regulations

In response to a resolution of the Economic and Social Council of the United Nations in 1959, the Agency first undertook the task of preparing model regulations for the safe transport of radioactive material.

The first edition of the IAEA regulations was published in 1961 as *Safety Series No. 6*. In the foreword, the then Director General, Sterling Cole, said:

"The expanding use of radioactive materials for peaceful purposes in most parts of the world demands

that the international transport of these materials should benefit from the adoption, on as wide a scale as possible, of uniform safety rules.

"In order that the procedures to be complied with by the users should not be too complex, the basic requirements of such rules must be applicable to a considerable extent to air, water, and land transport alike, whatever the method of carriage.

"In this new volume of the Safety Series, the International Atomic Energy Agency aims to propose safety regulations which can be applied to the national and international transport of radioactive materials by all means of transport. In presenting these regulations to the users, I am confident that they are based on a considered assessment of the problem and offer a practical and adaptable means of dealing with it."

Subsequent experience has fully justified this expectation. Indeed, since 1961, through four comprehensive revisions leading to new editions in 1964, 1967, 1973, and 1985, the regulations have been accepted as the basis for national and international controls, and as a practical, efficacious means to ensure safety.

Implementation through international co-operation

The Agency recently carried out an assessment of the application of the regulations, and published the results as a technical document (TECDOC). Although Member States control the transport of radioactive material in a variety of ways, depending on individual statutory requirements, the assessment found that some 80% used the IAEA regulations directly as a basis for their national regulations. A percentage did so directly or through the implementation of one of the international modal organization's regulations. Close collaboration between the Agency and concerned international bodies has been an important factor in the achievement of effective implementation of the regulations.

Even though they attract a disproportionate amount of attention, radioactive consignments constitute a small fraction of the large volume of dangerous goods which

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Procedures for adopting and implementing IAEA regulations

Member States of the IAEA implement international agreements, regulations, and recommendations for regulatory control of the transport of radioactive material in a variety of ways. Each country must act within its own statutory requirements. The IAEA, working with the individual Member States, undertook in 1984 to examine the manner in which domestic, import, export, and through-country shipments of radioactive materials are controlled and regulated worldwide. The information to be examined was collected using a questionnaire. By the end of January 1986, completed questionnaires had been received from 52 Member States.

The Member States which responded are: Argentina, Austria, Bangladesh, Belgium, Bolivia, Brazil, Bulgaria, Canada, Chile, China, Colombia, Czechoslovakia, Denmark, Ecuador, Egypt, Finland, France, German Democratic Republic, Federal Republic of Germany, Greece, Hungary, India, Indonesia, Israel, Italy, Japan, Malaysia, Mauritius, Mexico, Monaco, Netherlands, New Zealand, Norway, Pakistan, Peru, Philippines, Poland, Portugal, Romania, Singapore, South Africa,

Spain, Sweden, Switzerland, Syrian Arab Republic, Tanzania, Turkey, United Kingdom, United States of America, Uruguay, Venezuela, and Zambia.

The results of the examination indicate the important role international organizations play in the transport of radioactive materials. All the Member States involved in this examination regulate the transport of radioactive materials within their country on the basis of international agreements, regulations, and recommendations. *Safety Series No. 6* is the ultimate controlling document since it serves as the basis for the radioactive material portions of other international transport documents and is made directly binding in the regulations of many countries.* (See accompanying table.)

* See "Worldwide application of IAEA Safety Series No. 6: Regulations for the safe transport of radioactive material, 1985 edition", by M. Rosen, R.B. Pope, H. Koponen, and R.R. Rawl, *Packaging and Transportation of Radioactive Materials, PATRAM '86*, IAEA, Vienna (1987).

are shipped continually worldwide. The international nature of the transport of dangerous goods requires that safety standards be prepared internationally, rather than by individual countries acting unilaterally and without co-ordination. The United Nations, through the Economic and Social Council, has assumed general responsibility for developing internationally-agreed safety provisions in this field. The United Nations Committee of Experts, and the relevant committees of the other international regulatory bodies, have successfully developed consistent regulatory standards which have been widely implemented in the legislation of Member States. The Agency maintains close collaboration with these organizations to ensure that its regulations are reflected accurately in international codes and regulations. (See accompanying box.)

Philosophy of the regulations: Reason for consensus

In common with the regulations for other dangerous goods, the basic principle underlying the Agency's regulations is that protection against the hazards of radioactive material in transport should be mainly provided by the packaging in which it is carried. The consignor of the radioactive material has primary responsibility for safety and must declare in the transport documents that it is packed, marked, and labelled in accordance with the applicable regulations. This ensures that the onus for providing safety in the transport of individual consignments falls mainly to the person most likely to have the necessary knowledge of the special hazards presented by the radioactive material, as well as the resources to cater to them.

A lesser degree of responsibility is assigned to the carrier who must take appropriate precautions to protect workers and the public during transit. Where the intrinsic level of hazard of the contents requires it, the protection afforded by the packaging is required to remain effective, even under the conditions of a severe accident. For more hazardous contents, the extra safeguard of independent review and approval of the transport package design by appropriate national authorities is required.

The regulations also require stringent quality assurance measures to avoid inadvertent non-compliance with safety features, and appropriate emergency response arrangements to confront the consequences of accidents or incidents. The effective and comprehensive nature of the regulatory system recommended by the Agency has been a significant factor in achieving its global implementation.

The safety record

The Agency's regulations seek to control the radiological impact of the transport of radioactive material on workers and members of the public. The chief cause for concern with most members of the public is accidents. The record, however, speaks for itself. In more than 40 years of experience, there have been no known deaths or injuries due to the radioactive nature of material being transported under the provisions of the regulations. Even the accidental sinking and destruction of the ill-fated *Mont Louis* in 1984, which gave rise to intensive media interest, evidenced the successful operation of the transport safety standards. In fact, the radio-

active hazard resulting from the accident might justly be said to have been in inverse proportion to the magnitude of the press reaction to it.

There is substantial evidence that doses due to transport under normal conditions are also low. In 1985, an Agency technical committee assessed the radiological impact of transport under normal conditions and from accidents. It concluded from available information that it could be reasonably asserted that exposures of most workers and of the public due to normal transport were low; moreover, the risks to workers and the public due to potential accidents and incidents in transport were also low.

The excellent record in transport justifies the confidence which has led to the wide adoption of the Agency's regulations. It should not, however, be a basis for complacency. The Agency is taking further measures to systematically monitor the performance of the regulations to respond to needs for information about their efficacy, and to discern when, and in what respect, changes are necessary.

Regulatory review

The Agency's Standing Advisory Group on the Safe Transport of Radioactive Material (SAGSTRAM) was founded in 1978, to advise the Agency on all aspects of its work on transport safety. Although it has advised on many transport issues in the transport safety programme, its most significant work to date has been to guide the review of *Safety Series No. 6* which gave rise to the 1985 edition. Its advice, based on the experience of that review, has now resulted in the newly-adopted concept of a continuous regulatory review.

A key recommendation of the fifth meeting of SAGSTRAM was that the Agency should adopt procedures to ensure that future regulatory revisions proceed on a continuous, structured basis.

The experience of the development of the 1985 edition of the regulations showed that to delay reviews for too long can result in an onerous task for review meetings and the Agency. Furthermore, the ensuing process of implementation can be extremely burdensome for Member State authorities and international regulatory bodies. To produce revised editions of the regulations too frequently, however, can be equally difficult for regulatory bodies. Recognizing this, SAGSTRAM recommended a new procedure for continuous review of the regulations to be implemented by a review panel which would meet every 2 years to consider current needs for changes to the regulations. The first meeting of the review panel took place in June 1987.

SAGSTRAM generally meets in intervening years, also on a 2-year cycle, to monitor the review process and to recommend actions necessary to resolve any major problems which arise. The solutions to such problems are incorporated in the regulations when a new edition is published.

Transport documents of international organizations

● International organizations

Recommendations on the Transport of Dangerous Goods, Committee of experts on the transport of dangerous goods, United Nations (UN), New York.

Technical Instructions for the Safe Transport of Dangerous Goods by Air (TI), International Civil Aviation Organization (ICAO), Montreal.

Dangerous Goods Regulations, International Air Transport Association (IATA), Montreal.

International Maritime Dangerous Goods (IMDG) Code, International Maritime Organization (IMO), London.

Universal Postal Convention of Rio de Janeiro 1979, Universal Postal Union, Bern.

● Regional international organizations

European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR) and Protocol of Signature, United Nations Economic Commission for Europe (ECE), Geneva (1957).

Règlement international concernant le transport des marchandises dangereuses par chemins de fer RID, Convention internationale concernant le transport des marchandises par chemins de fer (CIM), Office central des transports internationaux par chemins de fer (OCIT), Berne.

Regulations for the Transport of Dangerous Goods on the Rhine (ADNR), Central Commission for the Navigation of the Rhine (CCNR), Strasbourg.

European Provisions Concerning the International Carriage of Dangerous Goods by Inland Waterway (ADN), draft, United Nations Economic Commission for Europe, Geneva.

Regulations for the Transport of Radioactive Substances, Annex 4 to the Agreement on International Railroad Freight Traffic (SMGS), Railroad Co-operation Organization (OSZhD), Warsaw.

Regulations for the Safe Transport of Spent Nuclear Fuel from Nuclear Power Plants of CMEA Member Countries — Transport by Rail, Council for Mutual Economic Assistance (CMEA), Moscow.

SAGSTRAM recommended that any changes of detail in the regulations, approved by the review panel, should be published in the form of supplements to *Safety Series No. 6* — and its supporting documents — after Member State acceptance had been established through formal consultation during a 90-day period. A single substantive objection by any Member State suffices to disapprove a proposed change of detail. Therefore, such changes must be essentially non-controversial and without serious significance in relation to the principles of the regulations. Minor changes (typographical errors or minor editorial corrections) agreed by the review panel could be included in the supplements without further consultation.

A supplement was published in 1986. The outcome of the work of the June 1987 meeting is intended to be another supplement to the regulations, to be published later this year.

Current developments

In preparation for the meeting of the regulatory review panel in June 1987, the Agency requested

Member States to propose specific amendments to the regulations, for immediate effect, and to identify any problems which needed study in the longer term. Currently under study is the question of high consequence/low probability accidents in transport and additional provisions for the chemical hazards of uranium hexafluoride.

A fresh assessment has been undertaken of the adequacy of the Agency's regulations in the possible involvement of a package containing a particularly hazardous quantity of radioactive material in an accident of exceptional severity (a high-consequence accident). A programme of study on this subject was recommended by SAGSTRAM in response to some countries' concern about possible future disharmony in the international regulation of air shipments of plutonium. This concern arose from the difference between the provisions of the Agency's regulations and the qualification criteria applicable to packages used for the air transport of plutonium in the USA.* The objective is to decide whether existing provisions of the regulations are still adequate given the changing conditions of transport and the nature of material transported, taking into account the current availability of information on accident frequencies. A technical committee meeting, planned for December 1988 will discuss this question on the basis of the report of a group of Agency consultants and subsequent comments on it.

The interest caused by the Mont Louis accident highlighted the need to formalize packaging provisions to address the chemical hazards of uranium hexafluoride. In principle, the Agency's regulations control radiation hazards and, where these are significant, would

inherently also cover subsidiary chemical risks. Where the radioactive hazard is low, other regulations would normally apply. However, uranium hexafluoride is unique in its properties. Because it is carried solely on behalf of the nuclear energy industry, it can be considered appropriate for the Agency to act as the focal point to set formal requirements in this particular case. A *Safety Series* document in the 'recommendations' category is currently being prepared to embody such recommended requirements.

Future trends

A comprehensive collection of literature about the Agency's transport regulatory standards exists today. The continuous review procedure should ensure that this documentation is kept current. Moreover, the fact that the regulations have been developed, and have operated so well, for more than 25 years, gives good assurance that radical changes to the existing provisions are unlikely. Additions to the provisions are probable, but these should be merely to extend the usefulness of the regulations rather than to alter them fundamentally.

SAGSTRAM Chairman John Rolland, of the Australian Nuclear Science and Technology Organisation (ANSTO), said: "The IAEA transport regulations have probably been implemented more widely than any other set of Agency safety standards. They are frequently regarded as one of the Agency's showpieces in terms of an example in what international co-operation can achieve." Based on this foundation, the future trend in transport safety can be summed up in the words "stability" and "consolidation". The IAEA regulations have enabled the establishment of a stable and highly-satisfactory international regulatory system. What is needed now is to continue to ensure their full and effective implementation in national and international regulations — the focus of the Agency's programme on transport safety.

* *Qualification criteria to certify a package for the air transport of plutonium*, Office of Nuclear Material Safety and Safeguards, US Nuclear Regulatory Commission, NUREG-0360, Washington D.C. 20555 (1978).

