SAFETY FIRST

STATUS REPORTS ON THE IAEA'S SAFETY STANDARDS

RADIATION SAFETY

BY GEOFF WEBB

Documents in the IAEA's Safety Standards Series known as RASS (Radiation Safety Standards) are produced to develop an internally consistent set of regulatory-style publications that reflects an international consensus on the principles of radiation protection and safety and their application through regulation.

All IAEA Member States use radiation and radioactive sources for medical and industrial purposes and therefore have safety concerns. While many of the documents are intended for use by developing countries, the entire Series should serve as helpful guidance on the international state-of-the art for all Member States.

During the final stages of preparation and approval of the *International Basic Safety Standards for Protection Against Ionizing Radiation and for the Safety of Radiation Sources* (BSS) in 1994, a comprehensive review of all the publications in the Safety Series related to radiation safety was initiated. The review was carried out mainly by staff of the IAEA Radiation Safety Section with input from advisory groups, technical committees and consultants on particular topical areas. The results of the review included, for each existing document, an appraisal of its status, i.e. whether it is still valid, whether it should be revised and updated to comply with the BSS, or whether it should be declared obsolete and withdrawn.

The most important output from the review was an overall structural plan for the RASS documents which clearly indicates their relationship to the BSS and identifies those areas in which documents do not exist and should, in due course, be developed. This structural plan has been endorsed by the Radiation Safety Standards Advisory Committee (RASSAC). The procedure that was adopted in structuring the radiation safety documents was to recognize the importance and broad scope of the BSS and to carry through the structure of the BSS, especially the appendices.

During the second half of 1995, a substantial review of the waste safety documents in the RADWASS (Radiation Waste Safety Standards) programme was also undertaken. The results of the review have been presented to the Waste Safety Standards Advisory Committee (WASSAC).

In the course of the review, the opportunity was taken to clarify some areas in which there had been work on similar topics in the radiation and waste safety programmes. In particular the areas of discharges to the environment and interventions to deal with environmental contamination were identified. The RASS structural plan, and the corresponding revision of the structural plan for RADWASS, have been harmonized to eliminate duplication and to place all matters pertinent to waste safety in the RADWASS series.

SAFETY FUNDAMENTALS & REQUIREMENTS

Safety Fundamentals. A set of three documents has been issued in the category of Safety Fundamentals. One is entitled *Radiation Protection and the Safety of Radiation Sources*, (Safety Series No.120); the other two have been published as Safety Series No.110 and Safety Series No. 111-F, and they deal with nuclear safety and radioactive waste management.

Safety Series No. 120 explains the approaches to radiation protection and safety for persons in senior political or regulatory positions and persons who, although not safety specialists, make decisions relating to the uses of radiation in medicine,

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industry, agriculture and other areas. It states the principles that underlie the requirements of both the BSS and the Transport Regulations and was approved by the Agency's Board of Governors in June 1995. In the discussion at the Board, the possibility of working towards a single common document at the level of Safety Fundamentals was raised and the Secretariat accepted a commitment to work toward that end. A start on this procedure has been made by the International Nuclear Safety Advisory Group (INSAG).

Safety Requirements. Two documents have been issued in the category of Safety Requirements. One is the BSS, which were approved by the Board of Governors in September 1994. It followed a major effort over several years to achieve a consensus embracing the sponsoring organizations — the IAEA, Food and Agriculture Organization (FAO), International Labour Organization (ILO), OECD-Nuclear Energy Agency (NEA), Pan American Health Organization (PAHO), and World Health Organization (WHO) — and their Member States. After approval by the IAEA Board, the BSS were issued in English as an interim publication in 1994; the final publication in English was issued in April 1996 and other language versions are being published.

The BSS establish basic requirements for radiation protection and safety, specify obligations and responsibilities and set out the requirements for application to practices and in intervention situations.

The other document in this category is a new one. It is being developed to provide for a harmonized approach across all areas of nuclear, radiation, waste, and transport safety in the field of emergency preparedness and response. Possible co-sponsors for the document — provisionally entitled *International Safety Requirements for Nuclear and Radiation Emergency Preparedness and Response* — include the FAO, WHO and NEA.

SAFETY GUIDES

Co-sponsorship. Many of the guides described below are co-sponsored by one or more the BSS sponsoring organizations.

General Topics. A number of Safety Guides are being developed that deal with the interpretation or implementation of the BSS and related general matters. Guidance is being developed to assist Member States in establishing national infrastructures appropriate to the requirements of the BSS and to their level of radiation usage. The guidance will be related to a document being prepared as a Safety Requirement forming part of the General Safety Series.

The principles for exemption are dealt with in an existing Safety Guide, but it will be revised and extended in order to cover the related but distinct topics of exclusion and clearance. Liaison with the proposed RADWASS Safety Guide on clearance levels (Safety Series No. S-111-G-1.5) will be maintained. The optimization of protection has for a long time been one of the main requirements of radiation protection, and general techniques for application are described in the existing Safety Guide. Consideration is being given to developing a revised Safety Guide to cover the principles, concepts and practical applications, in a year or two's time.

As part of the programme to combat illicit trafficking in radioactive materials, a new Safety Guide is being developed to offer advice especially to border officials on prevention, detection, and response to such incidents. It will be co-sponsored by the World Customs Organization.

A new Safety Guide will elaborate on the training requirements in the BSS and model programmes for post-graduate education. A Safety Guide also is being produced to elaborate on the requirements in the BSS related to the safety of sources. As a companion activity, a start has been made on the revision of Safety Series No. 104. It deals with extension of the basic principles to sources of potential exposure. Plans are being developed for its revision and updating to take into account recent publications by the International Commission on Radiological Protection (ICRP) on the topic.

Occupational Exposures. A set of three Safety Guides concerning the application of the BSS to the control of occupational exposures has been developed in a co-ordinated fashion. One will deal with overall implementation of the requirements in the BSS, explaining and advising on how they are to be converted into practical control measures. It will be supplemented by two Safety Guides, on the assessment of internal and external occupational exposures,

respectively. It is intended to publish these three Safety Guides together with the BSS and Safety Series No.120 in diskette or CD-ROM form as an interlinked set of searchable documents.

Another area that has recently been assuming importance is the control of exposures to natural radiation, especially radon, at work; this subject will be incorporated in the three Safety Guides described above. General guidance will be supplemented by specific guidance on protection in mining and milling of radioactive ores in the revision of Safety Series No.26.

Public Exposures. A Safety Guide dealing with the application of the BSS requirements in limiting releases of radioactive effluents — which is primarily a revision of Safety Series No.77— also is being developed. It will be linked to the proposed RADWASS Safety Standard on discharges to the environment and will be included in the RADWASS programme when it is completed. A Safety Guide is to be produced on environmental monitoring that will also cover the related topic of monitoring of discharges.

The safety of consumer products containing radioactive materials will be the subject of another Safety Guide. It has been in production for some time and can now be finalized in compliance with the BSS.

Medical Exposures. Although controlling the exposure of patients to radiation used for medical purposes is a very important aspect of radiation protection, it has only recently been fully dealt with in the BSS. There is now a need for a new Safety Guide to supplement and expand on the BSS requirements for radiation protection in the medical exposure of patients. An advanced draft has been approved by RASSAC and has been sent to Member States for comments.

Interventions. The systematization and extension of the approach to intervention — to cover both emergency and chronic circumstances — has been one major recent development reflected in the BSS. A Safety Guide (Safety Series No. 109) was developed in parallel with the BSS that is totally compatible with it.

A new Safety Guide covering all aspects of planning for emergency response will incorporate and replace Safety Series Nos. 55 and 91 and could also replace two documents in the Nuclear Safety Standards Series (numbers 50-SG-06 and G6) as well as an existing draft exi- document on research reactors.

While coverage of the BSS clearly includes the response to chronic exposure situation, it has been systematized only for radon in homes. The proposed Safety Guide is intended to elaborate on the BSS in this area.

See the Supplement in this edition for a listing of existing and planned Safety Series documents in this field.

NUCLEAR SAFETY

BY AHMAD KARBASSIOUN

In 1974, an ambitious programme known by the acronym NUSS (Nuclear Safety Standards) was started. Its objective was to establish internationally agreed safety standards for land-based stationary thermal neutron power plants. Since then, the programme — coupled with safety standards developed for research reactors — has served as the backbone of the IAEA's standards on nuclear safety.

In September 1974, a Senior Advisory Group of regulators from 13 IAEA Member States was set up to implement the NUSS programme. It was entrusted with the task of supervising, reviewing and advising on the programme at all stages and approving draft documents (for onward transmittal to the IAEA Director General) in five areas — namely, governmental organization, siting, design, operation, and quality assurance. Each area was to be governed by a specific standard called a Code. The Group selected topics to be covered by each Code and drew up a provisional list of subjects to be treated as Safety Guides. A Technical Review Committee composed of experts from IAEA Member States was created for each of the five areas covered by the NUSS programme.

The first step was to collate information on the safety of (thermal) nuclear power plants. Account had to be taken of the amount of relevant knowledge and experience (non-proprietary information) available as a basis for useful recommendations and of the expert staff and

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other resources available for implementing the programme. In determining what was necessary, three types of recommendations had to be considered — the recommendations most important for the safety of nuclear power plants, recommendations requested by States seeking advice or assistance from the IAEA, and recommendations needed by the IAEA for its own projects.

In 1979, NUSS oversight bodies re-evaluated the programme's documents, on the basis of the results of investigations into the accident at Three Mile Island. The conclusion was that the accident did not invalidate any NUSS document and that the IAEA had shown foresight in setting up the NUSS programme, providing a good basis for the safety of nuclear power plants.

After the completion in 1985 of the first set of documents (five Safety Codes and 55 Safety Guides), the Senior Advisory Group and five Technical Review Committees were disbanded. In 1988 a Nuclear Safety Standards Advisory Group (NUSSAG) was established to oversee the maintenance of the programme documents. Composed of 16 senior regulators from IAEA Member States, the group met once a year to provide advice on the revision of the documents and from time to time to propose the development of new documents to supplement the existing set.

As with radiation safety standards, the basic standards for nuclear safety were based on the recommendations of the International Commission on Radiological Protection (ICRP). However, the standards now also follow the principles recommended by the International Nuclear Safety Advisory Group (INSAG) — an independent body of experts established in 1985 under IAEA auspices — which has developed nuclear safety concepts. They include the *Basic Safety Principles for Nuclear Power Plants*, which have greatly influenced the development of the NUSS programme. While INSAG reports have been published in the IAEA Safety Series, as elements of Safety Series No. 75, they are not IAEA safety standards.

One of NUSSAG's first activities was to develop a document to encompass the full programme of nuclear safety standards. This document inaugurated the category of Safety Fundamentals in the IAEA Safety Series. Entitled *The Safety of Nuclear Installations*, it eventually became the basis for drafting the international Convention on Nuclear Safety. NUSSAG also revised the five NUSS Codes, which had then been in effect for about ten years.

It should be mentioned that the NUSS documents are not expected to tell designers how to design plants or operators how to operate their plants. They do not, and cannot, replace technical norms and procedures. They explain what has to be considered (e.g. when judging the design ideas with respect to plant safety). They serve as advisory documents for designers, operators, and regulators, allowing them to check their relevant activities against what is considered internationally to be good practice. Similarly, these documents can be used by licensing authorities to provide guidelines on a comprehensive and systematic approach to analysing the adequacy for safety of an application for a construction or operation permit.

Following are brief outlines of the five Codes in the NUSS programme. They are now in the process of being revised for issuance as Safety Requirements:

■ **Governmental Organization.** The Code provides guidance on establishing a regulatory body, covers aspects related to the radiological safety of the general public and site personnel and gives general recommendations for organization of the regulatory body, the role and responsibilities of the regulatory body, the basic requirements imposed on an applicant, the licensing process and licensing decisions, and inspection and enforcement by the regulatory body.

■ **Siting.** The Code deals with the evaluation of site-related factors to be taken into account to ensure that the plant–site combination does not constitute an unacceptable risk during the lifetime of the plant. This includes evaluation of the potential effect on the site of natural and other phenomena that might affect the area (i.e. earthquakes, floods, aircraft crashes, chemical explosions), evaluation of effects of the plant itself on the site (i.e. dispersion of effluents in air and water), and consideration of population distribution and emergency planning. The Code also covers the role of the owner of the future plant and the regulatory body in siting.

■ **Design.** The Code gives the basic safety requirements which must be incorporated in the concept and detailed design in order to produce a safe plant. Following general practice, the Code recommends the concept

of successive barriers to prevent the escape of radioactive material, i.e. the "defense-in-depth" philosophy. In case of the failure of a barrier, design provisions are made available to mitigate the consequences of such failures.

■ **Operation.** The prime responsibility for the safety of the plant rests with the operating organization. This is the basic concept underlying the requirements presented in this Code. The Code gives requirements for safety related aspects of operation including: operating limits and conditions, commissioning, structure of the operating organization, operating instructions and procedures, maintenance, testing, inspection, core management and fuel handling, review of operation and feedback of experience, emergency preparedness, radiation protection and decommissioning.

■ **Quality Assurance.** The requirements specified in the quality assurance (QA) Code provide an efficient management tool that could be used by both the plant management and the regulatory organization to gain confidence in the safety and quality of a nuclear power plant. The QA requirements oblige plant designers, constructors, manufacturers, installers and operators to plan, conduct, and document their work systematically. This allows the verification of all activities, not only by physical inspection or testing of hardware in the plant but also through indirect methods such as evaluation of the effectiveness of the respective QA programmes.

See the Supplement in this edition for a listing of existing and planned Safety Series documents in this field. Photo: Japan's Mihama nuclear power plant.

WASTE SAFETY

BY GORDON LINSLEY

The IAEA's involvement in the management of radioactive wastes started soon after its creation in 1957. At that time, the disposal of radioactive wastes in the sea was an option being favoured by countries developing nuclear power, and in 1961 the IAEA published Safety Series No. 5, which was concerned with establishing appropriate safety procedures and practices for the disposal of radioactive wastes in the sea. This was followed a few years later by international guidance on radioactive disposal in the ground (Safety Series No. 15, 1965).

By the late 1970s, it had become clear that underground disposal was the internationally accepted approach for most types of solid radioactive wastes. In 1977 the IAEA outlined a programme for the production of a set of guideline documents on the subject. A review committee was established to oversee the production of the documents. This committee, the Technical Review Committee on Underground Disposal of Radioactive Waste, came into existence in 1978 and continued its work until 1988. During this time, it approved the issuance of a comprehensive collection of Safety Series documents on the subject of underground disposal. Some of them established international norms for the planning and establishment of underground waste repositories.

The control of releases of radionuclides to the environment in gaseous and liquid forms was also the subject of early meetings at the IAEA. In 1978 the IAEA

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issued guidance on the concepts and principles for use by competent authorities in setting limits for planned releases of radioactive material into the environment. This guidance has subsequently been revised and updated on several occasions.

By the late 1980s, the issue of radioactive wastes and their management was becoming increasingly politically important. It was seen as one of the technically unresolved issues of nuclear power. The IAEA responded by establishing a high profile family of safety standards, the Radioactive Waste Safety Standards (RADWASS). By this means the IAEA intended to draw attention to the fact that there were already in existence well-established procedures for the safe management of radioactive wastes. The programme was intended to establish an ordered structure for the safety documents on waste management and to ensure comprehensive coverage of all relevant subject areas.

The initial concept of RADWASS was developed in 1988. The structure, content and scope of the programme was elaborated by international experts in 1990 and work on the programme started in 1991. Initially, the development of the programme included submissions to the IAEA Board of Governors at various stages, endorsement by an International Radioactive Waste Management Advisory Committee (INWAC), and in-house approval by the Director General. INWAC was composed of experts nominated by Member States from research, operational, and regulatory organizations. A formal review of the first phase of the programme (1990-93) was held in March 1993 by INWAC. It resulted in an expansion of the programme from 24 to 55 planned documents, mainly through the addition of Safety Practice documents and the inclusion of environmental restoration in the programme. Because of the emphasis on safety-related aspects, the composition of INWAC was extended in 1994 to formally include regulators from each country.

In 1995, the leading RADWASS document in the category of Safety Fundamentals — *The Principles of Radioactive Waste Management* — was issued as Safety Series No. 111-F. This document establishes the basic principles and concepts for safe radioactive waste management. These principles are being elaborated in standards and guides of the RADWASS programme. To date, one Safety Standard, three Safety Guides, and one Safety Practice have been issued.

In July 1995 the RADWASS programme, together with the other IAEA safety document programmes, was the subject of a review by senior international safety experts. As a result of the review, the RADWASS programme was amended to broaden its scope by giving new emphasis to discharges and environmental restoration and to reducing the number of documents by combining several of the previously planned Safety Guides. In addition, a number of "common" documents for the whole safety standards programme — covering topics such as national arrangements (for controlling radiation, waste, and nuclear safety), quality assurance and a glossary of terms — were planned so as to remove the need for them to be developed separately in each of the safety document programmes. RADWASS documents are categorized under the subject areas of discharges, pre-disposal, disposal, and environmental restoration.

In many areas of radioactive waste management, there is experience of the successful and safe operation of facilities; for example, in the areas of waste processing and storage, near-surface disposal, and gaseous and liquid discharge. In other areas, notably geological disposal and environmental restoration, little or no experience has yet been gained. Safety concepts and methodologies are still developing in these areas and the RADWASS programme has to reflect this fact — it is not possible to be definitive on all relevant safety issues at the present time. A working group has been established to explore and, where possible, develop consensus positions on issues related to the disposal of radioactive wastes in geological formations. Most of the safety issues relate to the problem of assuring safety over the long timescales for which high-level radioactive wastes remain hazardous.

COMMON DOCUMENTS

In addition to addressing specific subject areas, RADWASS documents provide generally applicable requirements and guidance for the entire area of waste safety. They include the document entitled *Establishing a National System for Radioactive*

Waste Management (a Safety Requirement document) and the Safety Guide entitled *Classification of Radioactive Waste*.

The former document, which was published in 1995, sets out the necessary administrative arrangements in a country for ensuring safety in the management of wastes. It will be superseded by the planned Safety Requirement on governmental organization, which will be applicable to radiation, nuclear, waste, and transport safety.

The Safety Guide sets out an international classification system for solid radioactive waste and is a basic reference document for RADWASS.

DISCHARGES

As mentioned earlier, the Agency has had a leading role in providing guidance on the control of radioactive discharges. The existing Safety Guide on the subject — Safety Series No. 77 entitled *Principles for Limiting Releases of Radioactive Effluents into the Environment,* published in 1986 — has been revised. It now takes account of recent changes in the recommendations of the International Commission on Radiological Protection (ICRP) but also, more importantly, makes the guidance more practically applicable and useful to national regulators. The revised document is in the final stages of the consultation process with Member States and should be ready for issuance in 1999.

Several Member States consider that there is a need for international guidance on the protection of the environment from ionizing radiation. To this end a discussion document on the subject has been prepared and it is likely that it will be issued as an informal publication to aid the ongoing debate on the subject. For the time being, the question of whether a Safety Requirement in this subject area is needed is being kept in abeyance.

IAEA guidance on environmental monitoring is outdated. As a result, a new Safety Guide covering procedures for monitoring effluent releases at the source and in the environment is in preparation.

PRE-DISPOSAL

This is an area of waste management where considerable experience has already been gained in Member States. It covers all stages of waste management before disposal or discharge and includes waste collection, treatment, conditioning, packaging and storage.

A number of documents are in preparation, in many cases updating guidance contained in Safety Series documents of the 1980s. In addition, for the first time, a document at the level of a Safety Requirement is being prepared. It sets out the essential and basic safety considerations for this area which includes the decommissioning of all types of nuclear facilities. These basic requirements are elaborated in several Safety Guides covering all important types of facility and waste form. The Safety Requirement is in the final stages of the approval process with Member States and it is expected that approval from the Board of Governors will be sought in 1999.

Options for managing radioactive wastes include discharge, storage, disposal and clearance. This latter option involves the free release of materials from regulatory control and is relevant to materials containing very low levels of radionuclides. A large proportion of the materials coming from the decommissioning of nuclear facilities is suitable for being managed in this way. The Agency has provided guidance on radiological criteria for exemption and clearance in the BSS and has proposed clearance levels in an interim document (TECDOC-855).

Discussions are continuing in WASSAC on developing appropriate guidance for the management of materials containing very low levels of radioactivity. It is also noted that the revision of Safety Series No. 89, *Principles for the Exemption of Radiation Practices and Sources from Regulatory Control,* is under way as a joint activity by RASSAC and WASSAC. In this revision, it is expected that the resulting clarifications in terminology and elaboration of the clearance concept will prove helpful in developing specific guidance on managing very low activity materials.

DISPOSAL

Over the last two or three decades, experience in the disposal of low- and intermediate-level wastes in near-surface repositories has been gained in many countries; however, to date, no deep geological repositories for high-level wastes have been established. As a reflection of this situation, new safety standards have been developed for near-surface disposal but not yet for geological disposal.

A document at the level of a Safety Requirement on near-surface disposal is expected to be submitted to the Agency's Board of Governors for approval early in 1999. It establishes the essential radiological criteria governing this practice and the basic safety considerations for all stages of the development, operation and closure of the repository. It is supported by two Safety Guides, one on siting, published in 1994, and the other on safety assessment. The latter document is expected to be issued at the same time as the Safety Requirement.

The Agency's existing safety guidance on the underground disposal of high-level radioactive wastes is contained in Safety Series No. 99 published in 1989. However, this is an area in which safety concepts are still developing and both the ICRP and the Agency are contributing to the achievement of consensus by supporting international expert working groups on the subject. Developments within the RADWASS programme on new safety standards for the geological disposal of high-level wastes will take account of the conclusions of these international working groups.

The IAEA's Working Group on Principles and Criteria for Radioactive Waste Disposal has issued three reports which address many of the important and difficult issues associated with providing assurance of safety at times far into the future. The documents are entitled *Safety Indicators in Different Time Frames for the Safety Assessment of Underground Radioactive Waste Repositories* (TECDOC-767), *Issues in Radioactive Waste Disposal* (TECDOC-909) and *Regulatory Decision Making in the Presence of Uncertainty in the Context of the Disposal of Long Lived Radioactive Wastes* (TECDOC-975). The approaches and concepts developed in these documents will be taken into account, together with the guidance of the ICRP group, when drafting the new Agency standards on high-level waste disposal.

The problems caused by wastes from the mining and milling of uranium and thorium ores affect many countries and in some they have not been well managed. The wastes are in the form of large volumes of low-activity concentration materials containing radionuclides with very long radioactive half-lives. In many countries the wastes are stored at the surface in large piles and represent a long-term potential health and environmental hazard.

Because of the large volumes, radiologically effective waste management solutions are usually difficult and expensive. Issues of long-term radiation protection arise in devising appropriate strategies for the management of these wastes. A new Safety Guide is in preparation on the management of these wastes; this will be an update of Safety Series No. 85 issued in 1987.

ENVIRONMENTAL RESTORATION

The need for international safety guidance in this area has only become evident in recent years. This is due especially to changes brought about by the ending of the Cold War and attention now being given to cleaning up the environments of former nuclear test sites and weapons production facilities.

The Agency itself has been heavily involved in assessing radiological conditions at some of these sites and in advising on the need, or otherwise, for remedial actions. In addition, the decommissioning of more civil nuclear facilities has drawn attention to the need for agreed safety approaches to the remediation of contaminated areas.

The IAEA recently produced interim guidance on radiological criteria for aiding decisions on the clean-up of areas affected by residues from previous nuclear activities (TECDOC-987, issued in 1997). An ICRP working group is also developing guidance relevant to this subject. Within the RADWASS programme, work has started on the development of appropriate safety standards for the rehabilitation of areas affected by radioactive residues.

See the Supplement in this edition for a listing of existing and planned Safety Series documents in this field.

TRANSPORT SAFETY

BY RICHARD RAWL

As early as 1936, radioactive material was recognized to require special handling during transport, when it was realized that undeveloped films got damaged by "fogging" due to nearby packages containing radium. A few years later the protection of people from ionizing radiation became the main objective when transporting radioactive substances.

The number of shipments of radioactive materials increased rapidly with the development of new applications in science, medicine, and industry and with the increase of nuclear power plants in the time period 1940 to 1960. In the 1950s it was recognized that, in the interest of safety and commercial economics, regulations governing the transport of dangerous goods (including radioactive material) should be internationally harmonized, including between modes of transport (land, air, and sea).

In its founding Statute, the IAEA is authorized to "…establish or adopt, in consultation and, where appropriate, in collaboration with the competent organs of the United Nations and with the specialized agencies concerned, standards of safety…". In 1959, the United Nations Economic and Social Council recognized the desirability of having the IAEA prepare recommendations relating to the transport of radioactive material, and requested the IAEA to take on this responsibility. Subsequently, the IAEA established and first published its *Regulations for the Safe Transport of Radioactive Material* (Safety Series No. 6) in 1961, for application to the national and international carriage of radioactive material by all modes of transport. Subsequent reviews — conducted by the IAEA Secretariat in close consultation with IAEA Member States, the relevant specialized agencies and various other United Nations bodies — have resulted in five comprehensively revised editions (published in 1964, 1967, 1973, 1985, and 1996). All editions of the *Transport Regulations* have struck a balance between the need to take account of technical advances, operational experience and the latest radiation protection principles while maintaining a stable framework of regulatory requirements.

In 1964, when approving the first revised edition of the *Transport Regulations,* the IAEA Board of Governors authorized the Director General to apply them to IAEA operations and to operations assisted by the IAEA. It also authorized the Director General to recommend to Member States and "the organizations concerned" that the *Regulations* "be taken as a basis for relevant national regulations and be applied to international transport". By 1969 they had been adopted by almost all international organizations concerned with transport and were being used by many States for their own regulatory purposes. *(See box, page 19.)* The *Transport Regulations* now have been adopted by more than sixty Member States. *(See map.)*

In addition to the *Transport Regulations*, guidance documents have been developed under IAEA auspices, in close cooperation with Member States, to advise on and facilitate the application of the regulations, and to improve the understanding of the requirements. These documents are closely related to each other and are under continuous review to keep them current with the latest edition of the *Transport Regulations*.

The family of transport safety documents consists of:

Safety Requirements.

■ *Regulations on the Safe Transport of Radioactive Material,* which the IAEA now issues as Safety Standards Series No. 1 (ST-1). It presents the latest revision of the basic transport regulations which are intended for direct use in IAEA operations and are recommended to be implemented in international agreements and national regulations.

Safety Guides

■ *Explanatory Material for the IAEA Regulations for the Safe Transport of Radioactive Material.* The most recent edition was amended in 1990 and issued as Safety Series No. 7. The basis of the *Transport Regulations* is given with information on the intent and rationale of the regulatory requirements; "why" the Regulations require what they do.

■ *Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material.* Now in its third edition, it was amended in 1990 and is issued as Safety Series

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AROUND THE WORLD
THE IAEA TRANSPORT REGULATIONS

More than 60 IAEA Member States are known to have adopted the Agency's *Regulations for the Safe Transport of Radioactive Material*. Additionally, the regulations are incorporated in many international agreements on the transport of dangerous goods, as noted below.

UNITED NATIONS RECOMMENDATIONS

■ UN Economic and Social Council Committee of Experts on the Transport of Dangerous Goods, ***Transport of Dangerous Goods- Model Regulations***

FOR TRANSPORT BY SEA

■ International Maritime Organization, ***International Maritime Dangerous Goods Code***

FOR TRANSPORT BY AIR

■ International Civil Aviation Organization, ***Technical Instructions for Safe Transport of Dangerous Goods by Air***

■ International Air Transport Association, ***Dangerous Goods Regulations***

FOR TRANSPORT BY POST

■ Universal Postal Union, ***Acts of the Universal Postal Union***

FOR TRANSPORT BY RAIL

■ Central Office for the International Transport by Rail, ***International Regulations Concerning the Carriage of Dangerous Goods by Rail***

FOR TRANSPORT BY ROAD

■ The UN/ECE's Inland Transport Committee (ITC), ***European Agreement Concerning the International Carriage of Dangerous Goods by Road***

FOR TRANSPORT BY INLAND WATERWAY

■ The UN/ECE's Inland Transport Committee, ***European Agreement Concerning the International Carriage of Dangerous Goods on Inland Waterways***

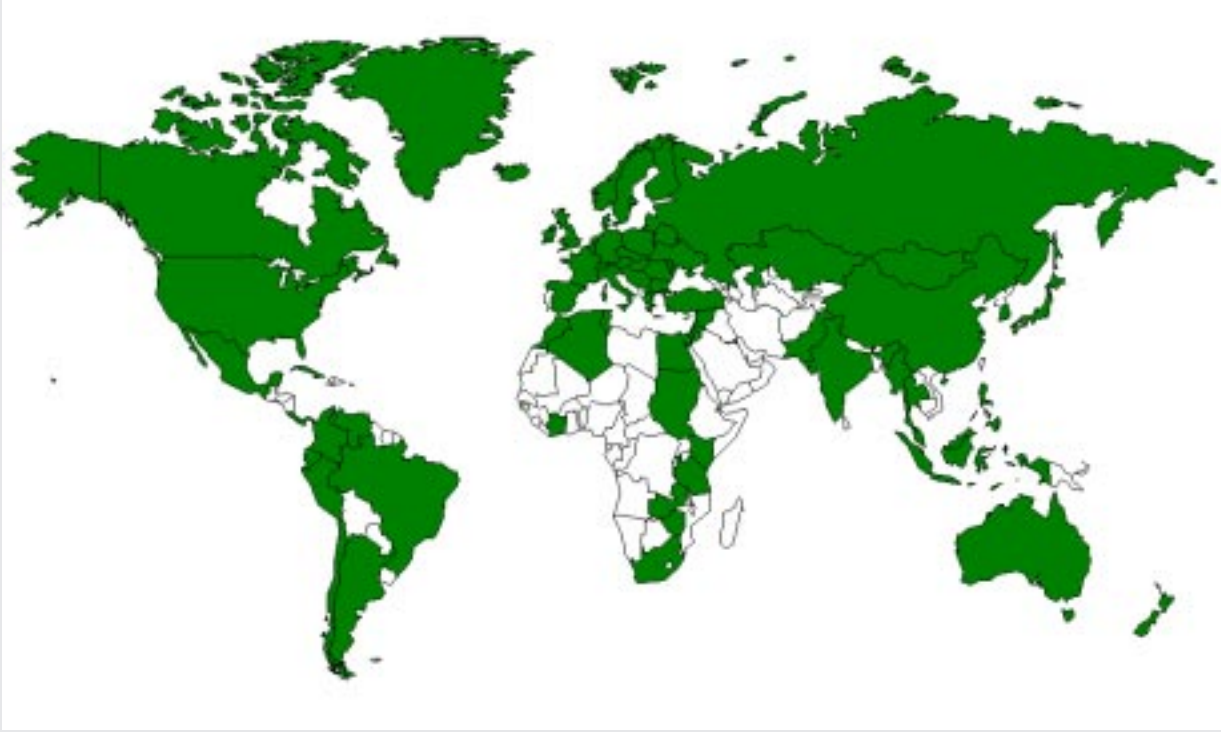
FOR TRANSPORT BETWEEN ARGENTINA, BRAZIL, PARAGUAY, AND URUGUAY

■ MERCOSUR/MERCOSUL, ***Agreement of Partial Reach to Facilitate the Transport of Dangerous Goods***

FOR TRANSPORT WITHIN THE EUROPEAN UNION

■ European Commission, ***European Council Directive on the Approximation of the Laws of the Member States with regard to the Transport of Dangerous Goods by Road***

■ European Commission, ***European Council Directive on the Approximation of the Laws of the Member States with regard to the Transport of Dangerous Goods by Rail***



No. 37. This document provides advisory information about the technical requirements of the regulations and about methods and technology that may be employed to fulfil them — "how" the regulations may be applied in practice.

■ *Emergency Response Planning and Preparedness for Transport Accidents Involving Radioactive Material.* These recommendations have been issued as Safety Series No.87. Guidance is given on the various aspects of transport emergency planning and preparedness, along with consideration of problems which might be encountered in a transport accident involving radioactive materials.

■ *Compliance Assurance for the Safe Transport of Radioactive Material.* These Safety Practices have been issued as Safety Series No.112. Information is given on establishing programmes to ensure compliance with the *Transport Regulations.*

■ *Quality Assurance for the Safe Transport of Radioactive Material. Safety Practices,* Safety Series 113. Advice is given for establishing quality assurance programmes for transport activities.

Photo: The IAEA's advisory regulations for safe transport of radioactive material are widely applied around the world.

PUBLICATION APPROACHES

Before the *Regulations on the Safe Transport of Radioactive Material* were revised in 1996, the Agency issued the document as Safety Series No. 6. In line with a new publications approach, it is now issued under the Safety Standards Series as Safe Transport No. 1 (ST-1).

The main changes introduced in ST-1 include new provisions in radiation protection which are consistent with the IAEA Basic Safety Standards; strengthened provisions for the transport of high activity packages by aircraft; and strengthened provisions regarding shipments of uranium hexafluoride. While the edition published as Safety Series No. 6 is still in use internationally and in most national regulations, ST-1 is presently being implemented; it is expected to come into force uniformly on 1 January 2001.

As a consequence of the changes in ST-1, the supporting documents Safety Series Nos. 7 and 37 need to be revised. They are being combined into one document, *Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material,* to be issued as ST-2, a Safety Guide.

Additionally, Safety Series No.87 will be revised and be issued under the Safety Standards Series as ST-3, a Safety Guide, entitled *Planning and Preparing for Emergency Response to Transport Accidents Involving Radioactive Material.*

ONGOING REVIEWS

It is estimated that well over 100 million packages containing radioactive material have been shipped throughout the world. The amount of radioactive material in these packages varies from negligible amounts as used in consumer products to very large amounts as in shipments of irradiated nuclear fuel.

In order to ensure the safety of people, property, and the environment, the IAEA regulations were established and have been regularly updated to provide protection during both the normal course of transport and in the event of accidents. The continuing review of the IAEA's *Regulations for the Safe Transport of Radioactive Material* and their supporting documents will help ensure they fulfill their purpose and provide the basis for maintaining an enviable safety record. ❐

See the Supplement in this edition for a listing of existing and planned Safety Series documents in this field.