RADWASS UPDATE

RADIOACTIVE WASTE SAFETY STANDARDS PROGRAMME

BY DOMINIQUE DELATTRE

Soon after the IAEA's creation in 1957, the management of radioactive wastes became an important element of Agency programmes. Many publications were issued over the years in the IAEA's Safety Series dealing with all aspects of the subject.

By the late 1980s, the issue of radioactive wastes and their management was becoming increasingly politically important. 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 well-established procedures for the safe management of radioactive wastes already were in place. The programme was intended to establish an ordered structure for safety documents on waste management and to ensure comprehensive coverage of all relevant subject areas.

In 1996, the RADWASS programme was amended to broaden its scope by giving new emphasis to discharges and environmental restoration and to reduce the number of documents by combining several of the previously planned Safety Guides. This article provides an update of the RADWASS programme and provides information on planned activities.

Subject Categories. RADWASS documents are categorized under four subject areas -- discharges, pre-disposal, disposal, and environmental restoration. The programme is overseen through a formalized review and approval mechanism that was established in 1996 for all safety standards activities. The Waste Safety Standards Committee (WASSC) is a standing body of senior regulatory officials with technical expertise in radioactive waste safety.

PROGRAMME STATUS OF RADWASS

The leading RADWASS document in the category of Safety Fundamentals — *The Principles of Radioactive Waste Management* — was issued as Safety Series No. 111-F in 1995. This document establishes the basic principles and concepts for safe radioactive waste management. Two other Safety Fundamentals publications exist in the Safety Series. They relate to the safety of nuclear installations and to radiation protection and the safety of radiation sources. In response to suggestions made in the IAEA Board of Governors, the three Safety Fundamentals publications are in the process of revision with a view to their amalgamation into a single Safety Fundamentals document.

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.

To date, three Safety Requirements and seven Safety Guides have been issued. *(See box, page 34.)*

COMMON DOCUMENTS

In addition to addressing specific subject areas, RADWASS documents provide generally applicable requirements and guidance for the entire area of waste safety.

Below the published Safety Fundamentals in the

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hierarchical order are the following documents:

■ The Safety Requirement on *Establishing a National System for Radioactive Waste Management* (SS111-S1). It sets out the necessary administrative arrangements in a country for ensuring safety in the management of wastes. It will be superseded by a publication under preparation (planned for issuance in the General Safety category of the IAEA Safety Standards Programme) as a Safety Requirement on legal and governmental infrastructure for nuclear, radiation, radioactive waste and transport safety.

■ The Safety Guide *Classification of Radioactive Waste* (SS111-G-1.1) sets out an international classification system for solid radioactive waste and is a basic reference document for RADWASS.

Controlling the removal of material from regulatory control is an issue which has been discussed in depth. As a result of discussions held by WASSC, a coherent system is in the process of being established for the management of removal from control of materials generated by regulated activities. It is considered to be of high priority to develop international recommendations in this area, including internationally agreed clearance levels.

DISCHARGES OF RADIOACTIVE WASTE

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 changes since 1986 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 was approved by the Commission on Safety Standards (CSS) that oversees all IAEA Safety Standards in June 1999. It was issued as Safety Standards WS-G-2.3, *Regulatory Control of Radioactive Discharges to the Environment*, in August 2000.

PRE-DISPOSAL MANAGEMENT OF RADIOACTIVE WASTE

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 was prepared. It sets out the essential and basic safety considerations for this area which includes the decommissioning of all types of nuclear facilities. The Safety Requirement was approved by the CSS in June 1999 and by the Board of Governors in September 1999. It was published as WS-R-2 in August 2000.

These basic recommendations are elaborated in several Safety Guides covering all important types of facilities and waste forms. Two Safety Guides on decommissioning were approved by the CSS in December 1998 and published in November 1999 (WS-G-2.1 entitled *Decommissioning of Nuclear Power Plants and Research Reactors,* and WS-G-2.2 entitled *Decommissioning of Medical, Industrial and Research Facilities*). The third document -- *Decommissioning of Nuclear Fuel Cycle Facilities* -- was submitted in February 1999 to Member States for comments and was approved by WASSC in December 1999 for submission to the CSS.

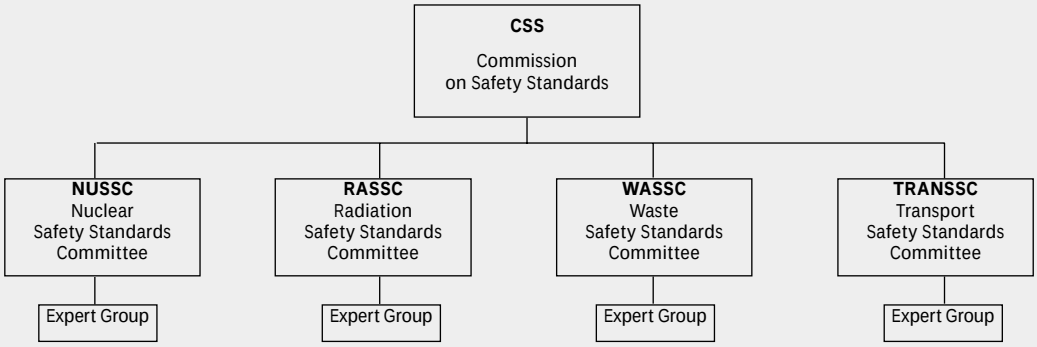
Five other safety guides on pre-disposal are in preparation. Two of them (on pre-disposal management of low- and intermediate-level waste and pre-disposal management of high-level waste) were approved by WASSC in April 2000 for submission to Member States for comments.

DISPOSAL OF RADIOACTIVE WASTE

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 are in operation. 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 (WS-R-1, *Near Surface Disposal of Radioactive Waste*) was issued in June 1999

ADVISORY BODIES FOR IAEA SAFETY STANDARDS



A number of bodies have been set up for the preparation and review of IAEA safety standards.

The *Commission on Safety Standards (CSS)* is a standing body of senior government officials holding national responsibilities for establishing standards and other regulatory documents relevant to nuclear, radiation, waste and transport safety. It has a special overview role with regard to the IAEA's safety standards and provides advice to the Director General on the overall programme related to safety standards.

The functions of the CSS are to:

- provide guidance on the approach and strategy for establishing the IAEA's safety standards, particularly in order to ensure coherence and consistency between them;
- resolve outstanding issues referred to it by any of the Committees; to endorse, in accordance with the IAEA's safety standards preparation and review process, the texts of the Safety Fundamentals and Safety Requirements to be submitted to the Board of Governors for approval and determine the suitability of Safety Guides to be issued under the responsibility of the Director General; and
- provide general advice and guidance on safety standards issues, relevant regulatory issues and the IAEA's safety standards activities and related programmes, including those for promoting the worldwide application of the standards.

In addition, four committees have been set up: the *Nuclear Safety Standards Committee (NUSSC)*, *the Radiation Safety Standards Committee (RASSC)*, the *Waste Safety Standards Committee (WASSC)*, and the *Transport Safety Standards Committee (TRANSSC)*. They are standing bodies of senior regulatory officials with technical expertise in nuclear safety, radiation safety, radioactive waste safety, and radioactive materials transport safety, respectively. They provide advice to the Secretariat on the overall programmes — and have the primary roles in the development and revision of the safety standards — in their respective areas of safety.

The functions of these Committees are:

- to recommend the terms of reference of safety documents in the IAEA's programmes on nuclear safety, radiation safety, radioactive waste safety, and radioactive materials transport safety, and of the groups involved in the development and revision of those documents, in order to promote coherence;
- to agree on the texts both of standards to be submitted to the Board of Governors for approval and of Safety Guides to be issued under the responsibility of the Director General and to make recommendations to the CSS, in accordance with the IAEA's safety standards preparation and review process;
- to provide advice and guidance on a continuous programme for reviewing and developing the safety standards and supporting documents; and
- to provide advice and guidance on safety standards in their respective fields, relevant regulatory issues, and activities for supporting the worldwide application of the IAEA's safety standards in those areas.

after its approval by the Agency's Board of Governors in March 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 (SS 111-G-3.1, *Siting of Near Surface Disposal Facilities*), published in 1994, and the other on safety assessment(WS-G-1.1, *Safety Assessment for Near Surface Disposal*), which was issued in July 1999.

The Agency's existing safety guidance on the underground disposal of high-level radioactive wastes is contained in Safety Series No. 99, *Safety Principles and Technical Criteria for the Underground Disposal of High-Level Radioactive Wastes*, published in 1989. However, this is an area in which safety concepts are still developing and the ICRP, the Nuclear Energy Agency (NEA) of the Organization for Economic Cooperation and Development (OECD) and the IAEA are contributing to the achievement of consensus by supporting international expert working groups on the subject. A new Document Preparation Profile for a Safety Requirement document was approved by WASSC in April 2000.

Extensive discussion on the safety of geological disposal has recently taken place in WASSC, particularly through the Committee's Subgroup on Principles and Criteria. The types of waste that are usually considered for deep geological disposal are characterized by their high activity (they may be heat producing) and by their long-lived radionuclides content. This requires that they be isolated and contained for very long times. Several new areas of concern were identified related to these characteristics. These were : institutional control, human intrusion, retrievability, indicators of long-term safety (including non-radiological aspects) and how to undertake safety assessments which provide confidence for both technical and non-technical stakeholders.

Regarding institutional control, there is a consensus that safety should not depend on it and that safety is to be assured by a system of passive natural and engineered barriers. Institutional control for a limited period can complement these barriers. Thus there is a need to determine the nature and time period over which such control should be maintained taking into consideration the types of human intrusion scenarios to be investigated.

Assuring stakeholders has become an increasingly important issue. This leads to the need to consider waste retrievability and monitoring, and their possible effects on safety. It also leads to the need to consider a range of safety indicators and multiple lines of reasoning to support the safety assessments needed to help achieve a reasonable assurancee that a geological repository will be safe. The overall safety of a geological disposal repository requires a balance between the application of defense-in-depth principles in the selection and design of the barriers and the need to provide a simple, transparent and robust demonstration of the safety case to all stakeholders. *(See article, page 55.)*

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 naturally occurring 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 (*Management of Radioactive Waste from Mining and Milling of Uranium and Thorium Ores*) is in preparation on the management of these wastes; this will be an update of Safety Series No. 85, *Safe Management of Wastes from the Mining and Milling of Uranium and Thorium Ores*, issued in 1987. It will be submitted for approval for submission to Member States at the WASSC meeting in October 2000.

While the draft was developed with reference to uranium mining and milling operations, it is equally applicable to other processing activities involving enhanced concentrations of naturally occurring radioactive materials.

Numerous activities such as petrochemical production, phosphate processing and monazite processing give rise to significant quantities of

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Publications issued to date under the RADWASS programme include:

- Safety Fundamentals: *The Principles of Radioactive Waste Management* (1995)
- Safety Requirements: *Establishing a National System for Radioactive Waste Managment* (1995); *Pre-Disposal Management of Radioactive Waste, including Decommissioning* (2000); *Near Surface Disposal of Radioactive Waste* (1999).
- Safety Guides: *Classification of Radioactive Waste* (1994); *Regulatory Control of Radioactive Discharges to the Environment* (2000); *Decommissioning of Nuclear Power Plants and Research Reactors* (1999); *Decommissioning of Medical, Industrial, and Research Facilities* (1999); *Siting of Near Surface Disposal Facilities* (1994); *Safety Assessment for Near Surface Disposal* (1999); *Siting of Geological Disposal Facilities* (1994).

radioactive waste. The management of these waste is not explicitly covered by the present RADWASS programme. It seems likely, however, that this waste could be dealt within the same category as waste from the mining and milling of uranium and thorium ores.

ENVIRONMENTAL RESTORATION

The need for international safety guidance in this area has only become apparent in recent years. This is due especially to changes brought about by the ending of the Cold War and the 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 civil nuclear facilities has drawn attention to the need for agreed safety approaches to the remediation of contaminated areas.

In particular, the need for radiological criteria for aiding decisions on the clean-up of areas affected by residues from previous activities has been recognized. WASSC endorsed the development of Safety Standards on the rehabilitation of contaminated areas from past activities and accidents that will provide for the application of radiation protection principles to the rehabilitation of contaminated areas. This will be based on a technical document (TECDOC-987) which provided interim guidance on radiological criteria for aiding decisions on the clean-up of areas affected by residues from previous nuclear activities, as well as an ICRP publication on prolonged exposures.

A first draft on this topic, with the working title *Clean-up of Areas Contaminated by Past Activities and Accidents,* has been prepared and was reviewed by technical experts in July 1999. It will be submitted for a first review to WASSC and the Radiation Safety Standards Committee in October 2000. Following both Committees' approvals, the document will be sent to IAEA Member States for comment and review.

AN EVOLVING PROCESS

The development and application of safety standards for radioactive waste management and other areas has been an evolving process.

The first safety standards for waste safety were issued within a few years of the IAEA's creation. By the 1970s, a formal mechanism to review and supervise the production of safety standards on waste disposal had been set up. By then, public concern over radioactive waste issues had increased and, as a means of demonstrating that there were already well-established methods for managing wastes safely, the IAEA initiated a high-profile series on radioactive waste safety standards. The leading document -- *The Principles of Radioactive Waste Management* -- was issued in 1995 and formed the technical basis for the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, which States adopted in 1997.

Efforts now are focusing on formulating harmonized standards in the area of radioactive waste safety. These efforts are being complemented by programmes and activities on the application of safety standards in Agency Member States. This work encompasses technical cooperation activities, coordinated research projects, and the provision of integrated safety review services. ❐