

Safety standards for radioactive waste management: Documenting international consensus

Under the IAEA's RADWASS programme, a special series of safety documents covering six key areas is being prepared

Radioactive waste is generated from the production of nuclear energy and from the use of radioactive materials in industry, research, medicine, and other fields. The importance of its safe management for the protection of human health and the environment has long been recognized and considerable experience has been gained.

Over the past several years, the IAEA has been working to provide evidence that radioactive waste can be managed safely and to help demonstrate a harmonization of approaches at the international level. A special series of safety documents devoted to radioactive waste management is being prepared within the framework of the IAEA's Radioactive Waste Safety Standards (RADWASS) programme, which covers all aspects of radioactive waste management.

The programme's purpose is to document existing international consensus in the approaches and methodologies for safe radioactive waste management; create a mechanism to establish consensus where it does not exist; and provide Member States with a comprehensive series of internationally agreed upon documents to complement national standards and criteria. This article presents an overview of the programme's structure and status.

Programme structure

RADWASS publications are organized in a hierarchical structure following the general framework of IAEA Safety Series documents. (Specifically, they will be published as advisory documents under IAEA Safety Series 111.) The

top-level publication is a single Safety Fundamentals document which provides basic safety objectives and fundamental principles that should be followed in national waste management programmes.

Documents below this level — Safety Standards, Safety Guides, and Safety Practices — will be organized into six subject areas. The areas are planning; pre-disposal; near-surface disposal; geological disposal; waste from uranium/thorium mining and milling; and decommissioning and environmental restoration. Five Standing Technical Committees (STCs) have been established for these six areas to review the respective documents. (One STC covers both near-surface and geological disposal.) This will contribute to a consistent approach in the development of RADWASS documents and provide the national expertise of participating countries.

The entire RADWASS programme is overseen by the International Radioactive Waste Management Advisory Committee (INWAC), which consists of senior experts from selected IAEA Member States. With respect to RADWASS, the committee specifically provides advice on establishing the publication plan and schedules. It further reviews and approves the Safety Fundamentals and Safety Standards and the terms of reference for all other documents in the RADWASS series. The close and intensive co-operation among national senior experts thus is an important element in the elaboration of RADWASS documents.

Document preparation and review

Following its approval by the IAEA Board of Governors in September 1990, the RADWASS programme was established in 1991 to provide a series of documents incorporating international

by Ernst
Warnecke and
Donald E. Saire

Mr Saire is Head of the IAEA's Waste Management Section, Division of Nuclear Fuel Cycle and Waste Management, and Mr Warnecke is the RADWASS programme co-ordinator in the same Section.

Overview of RADWASS documents

Safety fundamentals

Phase-1 Principles of radioactive waste management

Planning	Pre-disposal	Near-surface disposal	Geological disposal	Uranium/thorium mining and milling	Decommissioning/ Environmental restoration
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Safety standards

Phase-1 Establishing a national legal system for radioactive waste management	Phase-1. Pre-disposal management of radioactive waste	Phase-1: Near-surface disposal of radioactive waste	Phase-2: Geological disposal of radioactive waste	Phase-2: Management of waste from mining and milling of uranium and thorium ores	Phases-2 & 3: Decommissioning of nuclear facilities (to include environmental restoration)
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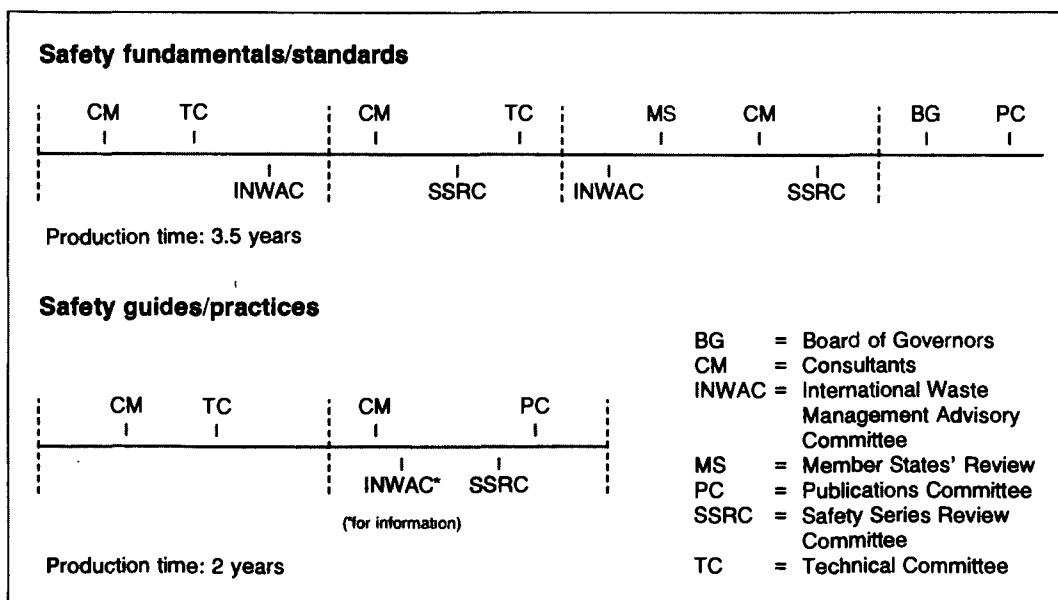
Safety guides

Phase-1 Classification of radioactive waste	Phase-2: Collection and treatment of low- and intermediate-level waste from nuclear fuel cycle facilities	Phase-1: Siting of near-surface disposal facilities	Phase-1 Siting of geological disposal facilities	Phase-2: Siting, design, construction, and operation of facilities for the management of wastes from mining and milling of uranium and thorium ores	Phase-2: Decommissioning of nuclear power and large research reactors
Phase-2: Planning and implementation of national radioactive waste management programmes	Phase-1. Pre-disposal management of radioactive waste from medicine, industry, and research	Phase-2: Design, construction, operation, and closure of near-surface repositories	Phase-3: Design, construction, operation, and closure of geological repositories	Phase-2: Decommissioning of surface facilities and closeout of mines, waste rock, and mill tailings from mining and milling of uranium and thorium ores	Phase-2: Decommissioning of medical, industrial, and small research facilities
Phase-2: Licensing of radioactive waste management facilities	Phase-2: Conditioning and storage of low- and intermediate-level waste from nuclear fuel cycle facilities	Phase-2: Safety assessment for near-surface disposal	Phase-2: Safety assessment for geological disposal	Phase-3: Safety assessment for the management of waste from mining and milling of uranium and thorium ores	Phase-2: Decommissioning of nuclear fuel cycle facilities
Phase-2. Quality assurance for the safe management of radioactive waste	Phase-2: Treatment, conditioning, and storage of high-level reprocessing waste				Phase-2: Safety assessment for the decommissioning of nuclear facilities
Phase-1 Clearance levels for radionuclides in solid materials: Application of exemption principles	Phase-2: Preparation of spent fuel for disposal				Phase-2: Environmental restoration of previously used or accidentally contaminated areas
Phase-3: Derivation of discharge limits for waste management facilities	Phase-2: Safety assessment for pre-disposal waste management facilities				Phase-3: Recommended cleanup levels for contaminated land areas

Phase-2
Radioactive waste management glossary

Overview of RADWASS documents

Planning	Pre-disposal	Near-surface disposal	Geological disposal	Uranium/thorium mining and milling	Decommissioning
Safety practices					
<i>Phase-1:</i> Application of exemption principles to the recycle and reuse of materials from nuclear facilities	<i>Phase-3:</i> Off-gas treatment and air ventilation systems at nuclear facilities	<i>Phase-3:</i> Validation and verification of models for long-term safety assessment of radioactive waste disposal facilities		<i>Phase-3:</i> Procedures for closeout of mines, waste rock, and mill tailings	<i>Phase-3:</i> Techniques to achieve and maintain safe storage of nuclear facilities
<i>Phase-1:</i> Application of exemption principles to materials resulting from the use of radionuclides in medicine, industry, and research	<i>Phase-3:</i> Characterization of raw waste	<i>Phase-3:</i> Procedures for closure of radioactive waste disposal facilities		<i>Phase-3:</i> Operational and post-operational monitoring, surveillance, and maintenance of facilities for the management of waste from mining and milling of uranium and thorium ores	<i>Phase-3:</i> Procedures and techniques for the decommissioning of nuclear facilities
<i>Phase-3:</i> Data collection and record keeping in radioactive waste management	<i>Phase-3:</i> Control of waste conditioning processes	<i>Phase-2:</i> Waste acceptance requirements for near-surface disposal of radioactive waste	<i>Phase-3:</i> Waste acceptance requirements for geological disposal of radioactive waste		<i>Phase-2:</i> Methods for deriving cleanup levels for contaminated land areas
	<i>Phase-3:</i> Testing of radioactive packages	<i>Phase-3:</i> Selection of scenarios for safety assessment of near-surface disposal facilities	<i>Phase-3:</i> Selection of scenarios for safety assessment of geological disposal facilities		<i>Phase-3:</i> Monitoring for compliance with cleanup levels
		<i>Phase-3:</i> Systems for operational and post-closure monitoring and surveillance of near-surface disposal facilities			



Process for the preparation of RADWASS documents

consensus on the safe management of radioactive waste. The first phase of the programme was developed to include 12 high priority documents to be published by the end of 1994. Phase 2 will be initiated with the development of additional documents in the post-1994 period.

At the time, it was already envisaged that a formal review of the programme would be undertaken in 1993 to define publication production rates and the resources needed for the post-1994 period. INWAC held this planned review in March 1993. It resulted in the completion and extension of the programme from 24 to 55 documents. (See table.) In particular, Safety Practices were defined for all six subject areas, and 11 Safety Guides were added, covering topics such as licensing, quality assurance, safety assessments, definitions, and environmental restoration. Additionally, some modifications were made in the area of decommissioning, which will include the subject of environmental restoration.

A standardized process is applied to the development of individual RADWASS documents. Additional steps may be added as necessary. A particularly elaborate process is applied in the preparation of the Safety Fundamentals and the Safety Standards, reflecting their high hierarchical level and the importance of achieving international consensus on the documents. Before these documents are submitted to the IAEA Board of Governors for approval, for example, they undergo three consultants' meetings, two STCs, two INWAC reviews, and finally are submitted to all IAEA Member States.

The RADWASS publication plan is split into three phases: the first phase extends to 1994; the second covers 1995-98; and the third covers the post-1998 timeframe.

Status of RADWASS documents

A number of RADWASS documents have been prepared, with many now in the review process.

In December 1992, the first document issued under the programme — *Application of Exemption Principles to the Recycle and Reuse of Materials from Nuclear Facilities* — was published as a Safety Practice. It assesses various scenarios for exposures of people to radionuclides from such nuclear materials.

During 1994, the revised draft of the Safety Fundamentals document is expected to be ready for submission to the IAEA Board of Governors. It has been reviewed by Member States and by consultants at meetings in late 1993 and early 1994 and was resubmitted to Member States in February 1994.

A number of other documents have been or are being submitted to Member States for review shortly. They include four Safety Standards: *National Legal System for Radioactive Waste Management*; *Pre-disposal Management of Radioactive Waste*; *Near Surface Disposal of Radioactive Waste*; and *Decommissioning of Nuclear Facilities*.

Additionally, two Safety Guides — namely *Classification of Radioactive Waste* and *Siting of Geological Disposal Facilities* — have been submitted for publication. A third Safety Guide — *Siting of Near Surface Disposal Facilities* — has been approved internally, while another — *Clearance Levels for Radionuclides in Solid Materials* — presently is under internal review. Being prepared for completion by the end of 1994 is the Safety Guide entitled *Pre-disposal Management of Low and Intermediate Level Waste from Medicine, Industry and Research*.

Another document — the Safety Practice entitled *Application of Exemption Principles to Materials Resulting from the Use of Radionuclides in Medicine, Industry and Research* — now is being prepared for internal review. It previously has been separately reviewed by consultants and national specialists participating in technical meetings and advisory groups.

Convention on the safety of radioactive waste management

In October 1993, the IAEA General Conference, in adopting a resolution for strengthening nuclear safety through the early conclusion of a nuclear safety convention, *inter alia* requested the IAEA Director General to initiate preparations for a convention on the safety of radioactive waste management. The preparations were to begin as soon as broad international agreement was reached from the ongoing process of developing the Safety Fundamentals document for waste management.

Such a convention would be a "stand alone" document legally binding for signatory States. Its preparation has to be initiated and carried out with great care, with respect to its timing as well as its contents. IAEA Member States are expected to provide further guidance in these areas. It now seems to be agreeable that work on a waste management convention can be initiated once the RADWASS Safety Fundamentals, and possibly also the Safety Standard on the national waste management system, have gained the approval of the IAEA Board of Governors. A "bridging process" will be able to identify those elements of the RADWASS documents that should be used for the formulation of the convention.

Further impetus for the convention can be expected from an international seminar — “Requirements for the Safe Management of Radioactive Waste” — being organized by the IAEA from 28 August to 1 September 1995. It will provide a forum for discussion of results from the first phase of the RADWASS programme, as well as for updating national experience in the field of waste management.

Safety principles and requirements

Safe management of radioactive waste involves the application of technology and resources in an integrated and regulated manner. The objective is to control occupational and public exposure to ionizing radiation and to protect the environment in accordance with national regulations and international recommendations. In furtherance of these objectives, a number of safety principles, to be agreed upon internationally, have been defined in the latest draft version of the RADWASS Safety Fundamentals document entitled *The Principles of Radioactive Waste Management*. The principles are:

Principle 1: Protection of human health. Radioactive waste shall be managed in a way to secure an acceptable level of protection of human health.

Principle 2: Protection of the environment. Radioactive waste shall be managed in a way that provides protection of the environment.

Principle 3: Protection beyond national borders. Radioactive waste shall be managed in such a way as to assure that possible effects on human health and the environment beyond national borders will not be greater than what is acceptable within the country of origin.

Principle 4: Protection of future generations. Radioactive waste shall be managed in a way that predicted impacts on the health of future generations do not exceed relevant levels that are acceptable today.

Principle 5: Burdens on future generations. Radioactive waste shall be managed in a way that will not impose undue burdens on future generations.

Principle 6: Legal framework. Radioactive waste shall be managed within an appropriate legal framework including clear allocation of responsibilities and provision for independent regulatory functions.

Principle 7: Control of radioactive waste generation. Generation of radioactive waste shall be kept to the minimum practicable.

Principle 8: Radioactive waste generation and management interdependencies. Interdependencies among all steps in radioactive

waste generation and management shall be appropriately taken into account.

Principle 9: Safety of facilities. Safety of facilities for radioactive waste management shall be appropriately assured during their lifetimes.

In order to put these principles into practice, countries must have an established national legal system for radioactive waste management. Such a system must specify the objectives and requirements of a national strategy for radioactive waste management and the responsibilities of the parties involved. It must also describe other essential features, such as licensing processes and safety and environmental assessments.

The elements of such a system are summarized in the latest draft version of the RADWASS Safety Standard, *Establishing a National Legal System for Radioactive Waste Management*, which is the leading publication in the subject area, “Planning”. The document assigns 10 responsibilities to the State, the regulatory body, or the operators.

Responsibilities of the State are to 1) establish and implement a legal framework; 2) establish a regulatory body; 3) define responsibilities of waste generators and operators; and 4) provide for adequate resources.

Responsibilities of the regulatory body are to 1) apply and enforce legal requirements; 2) implement the licensing process; and 3) advise the government.

Responsibilities of the operators are to 1) identify an acceptable destination for the radioactive waste; 2) safely manage the radioactive waste; and 3) comply with legal requirements.

The IAEA also is working to formulate as Safety Standards the definition of technical safety requirements for each of the other five RADWASS subject areas. This additionally will assist countries in implementing the safety principles outlined in *The Principles of Radioactive Waste Management*. □

Extensive experience has been acquired for the safe management of radioactive wastes.
(Credit: BNFL)

