

International Atomic Energy Agency

Demonstrating the Safety of Radioactive Waste Disposal

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ANSN Training Course

Safety Assessment Near Surface Disposal 2 – 6 April 2007

Indonesia

AIM

- **To address the safety objectives of near surface disposal**
- **To introduce the safety standards relevant to disposal**
- **To introduce the safety assessment process**

Safety of Waste Disposal

- **Containment**
 - Within the waste matrix
 - Within the waste container
 - Within the engineered barriers
 - Within the host geology
- **Isolation**
 - Of radionuclides from the accessible biosphere
 - Of the waste and disposal facility from degrading influences

Demonstrating Safety

- **Compliance with safety standards**
 - **Site / Engineering**
 - Appropriate site
 - Good engineering
 - Scientific and engineering understanding
 - **Safety Assessment – performance / impact**
 - **Assuring the quality of all safety related work**

Safety Standards

IAEA Safety Standards

for protecting people and the environment

Fundamental Safety Principles

IAEA sponsored by
Austria, Belgium, Canada, China, Denmark, France, Germany, India, Italy, Japan, Korea, Mexico, Norway, Pakistan, Poland, Romania, Russian Federation, Sweden, Switzerland, Taiwan, Thailand, United Kingdom, United States of America, Viet Nam

Safety Fundamentals

No. SF-1



IAEA Safety Standards

for protecting people and the environment

Geological Disposal of Radioactive Waste

IAEA sponsored by
Austria, Belgium, Canada, China, Denmark, France, Germany, India, Italy, Japan, Korea, Mexico, Norway, Pakistan, Poland, Romania, Russian Federation, Sweden, Switzerland, Taiwan, Thailand, United Kingdom, United States of America, Viet Nam

Safety Requirements

No. WS-R-4



IAEA Safety Standards

for protecting people and the environment

Management of Waste from the Use of Radioactive Material in Medicine, Industry, Agriculture, Research and Education

Safety Guide

No. WS-G-2.7



FUNDAMENTAL PRINCIPLES

REQUIREMENTS - LEGAL, TECHNICAL & PROCEDURAL SAFETY IMPERATIVES

GUIDANCE ON BEST PRACTICE TO MEET REQUIREMENTS



Safety Fundamentals

Thematic Areas

Legal & governmental infrastructure

Emergency preparedness & response

Management systems

Assessment & verification

Site evaluation

Radiation safety

Radioactive waste management

Decommissioning

Rehabilitation of contaminated areas

Facilities & Activities

Nuclear power plants

Research reactors

Fuel cycle facilities

Radiation related facilities & activities

Waste disposal facilities

Transport of radioactive material

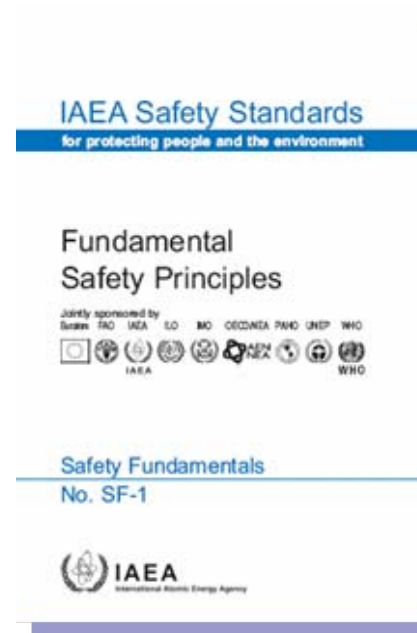
Around 150 standards



Disposal types

- **Mine tailings**
- **Near surface disposal facilities**
- **Intermediate depth caverns**
- **Borehole facilities**
- **Geological disposal**

Safety Fundamentals



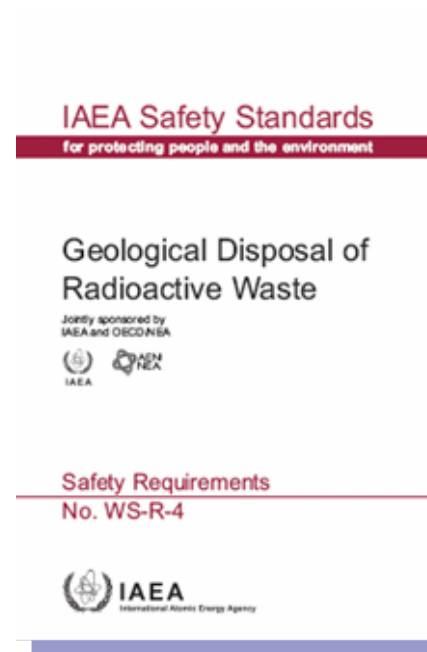
- 1. Responsibility for safety**
- 2. Role of government**
- 3. Leadership and management for safety**
- 4. Justification of facilities and activities**
- 5. Optimization of protection**
- 6. Limitation of risks to individuals**
- 7. Protection of present and future generations**
- 8. Prevention of accidents**
- 9. Emergency preparedness and response**
- 10. Protective actions to reduce existing or unregulated radiation risks**

3: Leadership and management for safety

Effective leadership and management for safety must be established and sustained in organizations concerned with, and facilities and activities that give rise to, radiation risks.

- Safety has to be assessed for all facilities and activities, consistent with a graded approach.
- Safety assessment involves the systematic analysis of normal operation and its effects, of the ways in which failures might occur and of the consequences of such failures.
- Safety assessments cover the safety measures necessary to control the hazard, and the design and engineered safety features are assessed to demonstrate that they fulfil the safety functions required of them.
- A facility may only be constructed and commissioned or an activity may only be commenced once it has been demonstrated to the satisfaction of the regulatory body that the proposed safety measures are adequate.

Safety Requirements for Disposal



Structure and content

- **Safety objectives and criteria for operational and post closure periods**
- **Safety requirements**
- **Appendix – assurance of compliance with safety objectives and criteria**

Safety Requirements

- **Planning**
 - Legal and organisational
 - Safety approach
 - Safety design principles
- **Development, operation and closure**
 - Framework for disposal facility development
 - **Safety case and safety assessment**
 - Steps in the development of a facility
- **Assurance**
 - Management system
 - Limits, conditions controls e.g. WAC
 - Regulatory control

Safety case and safety assessment requirements

Safety Case and Supporting Safety Assessment (1 of 2)

- **Safety arguments and supporting information for development, operation and closure of facilities**
- **Substantiate safety, contribute to confidence - essential to decision making**
 - **Design and design logic**
 - **Supporting evidence and reasoning on robustness and reliability of facility**
 - **Output of safety assessment**
 - **Quality of safety assessment and underlying assumptions**
 - **Perspective on results of safety assessment and issues to resolve**

Safety Case and Supporting Safety Assessment (2 of 2)

- **Justification**
 - explain basis for choices arguments for and against options
- **Traceability**
 - enable independent review
- **Clarity**
 - good structure and presentation at appropriate level of detail

Safety Assessment (1 of 1)

- **Systematic analysis of hazards and ability of facility to provide safety functions and meet safety requirements**
 - **Quantification of performance**
 - **Analysis of uncertainties**
 - **Compliance with criteria**
 - **Site/facility specific**
 - **Evolve with project**
 - **Identify areas for further work, guide research and provide basis for control and monitoring**

Safety Case and Safety Assessment Development

- **Prepared early and progressively developed**
- **Basis for licensing decisions and moving to next project step**
- **Guide research and development, siting and design**

Project stages / time frame

0 5 10 15 75 300?

Concept	Siting	Development		Operation	Post closure	
		Design	Excavation		IC	Beyond IC



Concluding remarks

- **Need for safety assessment capability and capacity to develop safety arguments as a basis for safety demonstration and licensing**
- **Need for systematic and structured safety assessment for waste disposal e.g. ISAM methodological approach**
- **Need for supporting analytical software tools**

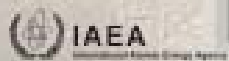
Safety Assessment Methodologies for Near Surface Disposal Facilities

Results of a co-ordinated research project

*Volume 1: Review and enhancement of
safety assessment approaches and tools*

Volume 2: Test cases

ISAM



The ISAM Safety Assessment Methodology

