IAEA Activities on Safety Assessment and Radioactive Waste Management

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Performance Assessment Community of Practice
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International Atomic Energy Agency

Outline

- Mission as per the Statute of the IAEA
- IAEA safety standards
- Safety standards for disposal
- How the standards are applied
- Emerging themes
- Projects
- Upcoming Events

From the Statute of the IAEA

Article III: Functions.

Para A.6. *The Agency is authorized to* ***establish or adopt … standards of safety*** *for protection of health and minimization of danger to life and property, and to* ***provide for the application of these standards*** *…"*

Para B.3. *In carrying out its functions, the Agency shall allocate its resources in such a manner as to secure efficient utilization and the greatest possible general benefit in all areas of the world,* ***bearing in mind the special needs of the under-developed areas of the world*****.**

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From the Statute of the IAEA

Article VIII: Exchange of information

"The agency shall take positive steps to encourage the ***exchange among its members of information*** *relating to the nature and peaceful uses of atomic energy and shall serve as an intermediary among its members for this purpose*."

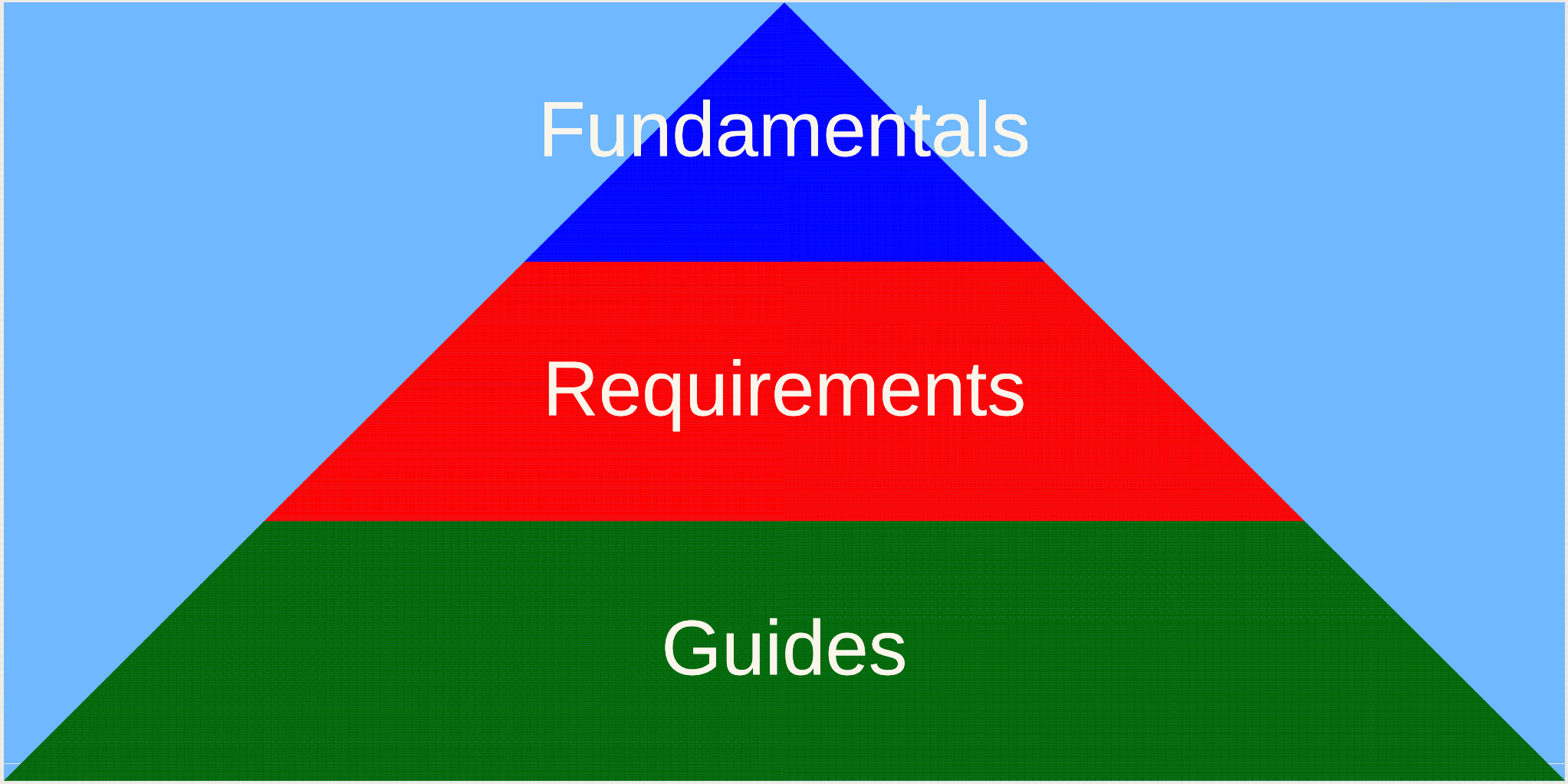
Some Historical Background

- 1957 : Programme commenced.
- 1961 : Safety Series no. 5 published (Disposal of radioactive waste in the sea).
- 1965 : Safety Series no. 15 published (Disposal in the ground).
- 1970 : Underground disposal approach internationally accepted, a specific programme for production of guides established.
- 1978 : Establishment of the Technical Review Committee on underground disposal of radioactive waste.

History (cont'd)

- Late 1980s : Radioactive Waste Safety Standards (RADWASS) Programme established;
- 1991 : International Radioactive Waste Management Advisory Committee (INWAC) established;
- 1989: Safety Series No. 99 published on underground disposal of high-level radioactive wastes;
- 1994: Safety guide published on siting of geological disposal facilities (111-G-4.1);
- 1996 (January): Department of Nuclear Safety and Security created Mandate to prepare and review IAEA Safety Standards.

Hierarchy of IAEA Safety Standards



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Two categories of standards

Thematic Areas

- Legal and Governmental Infrastructure
- Emergency preparedness and response
- Management systems
- Assessment and verification
- Site evaluation
- Radiation protection
- Radioactive waste management
- Decommissioning
- Rehabilitation of contaminated areas
- Transport of radioactive material

Facilities and Activities

- Nuclear Power Plants: design
- Nuclear Power plants: operation
- Research reactors
- Fuel cycle facilities
- Radiation related facilities and activities
- Waste treatment and disposal facilities

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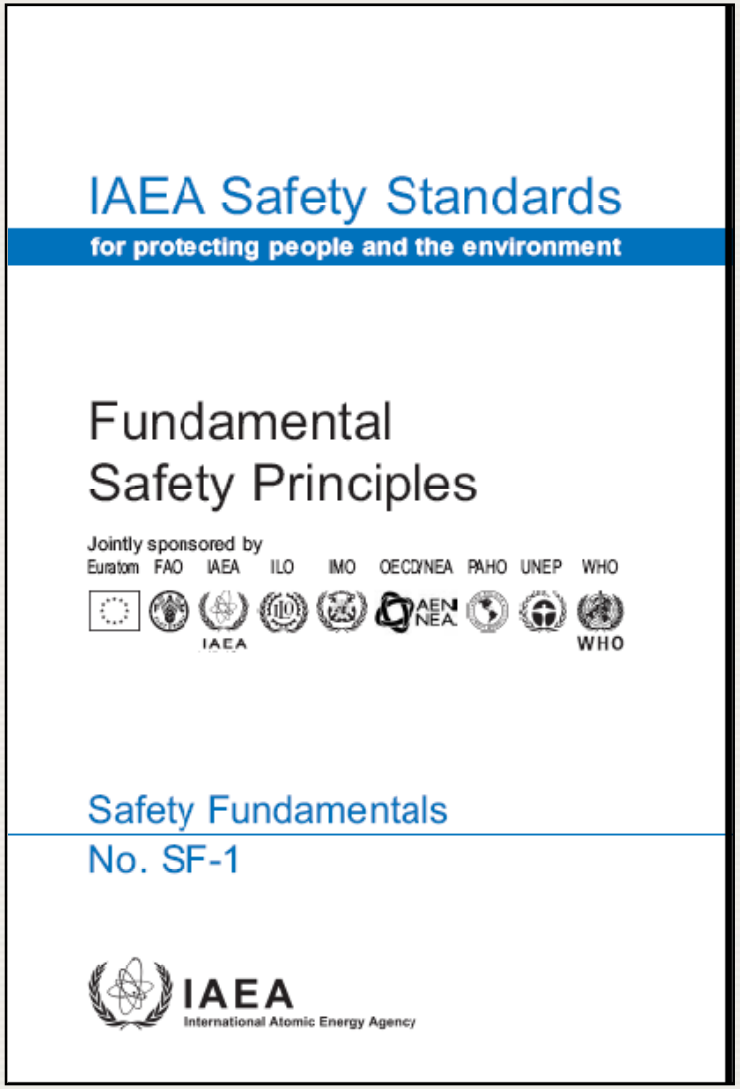
Safety Fundamentals

Policy document of the IAEA Safety Standards Series:

- State the basic objectives, concepts and principles involved in ensuring protection and safety;
- Comprised of 10 safety principles;
- **Principle 7: Protection of present and future generations.** People and the environment, present and future, must be protected against radiation risks.



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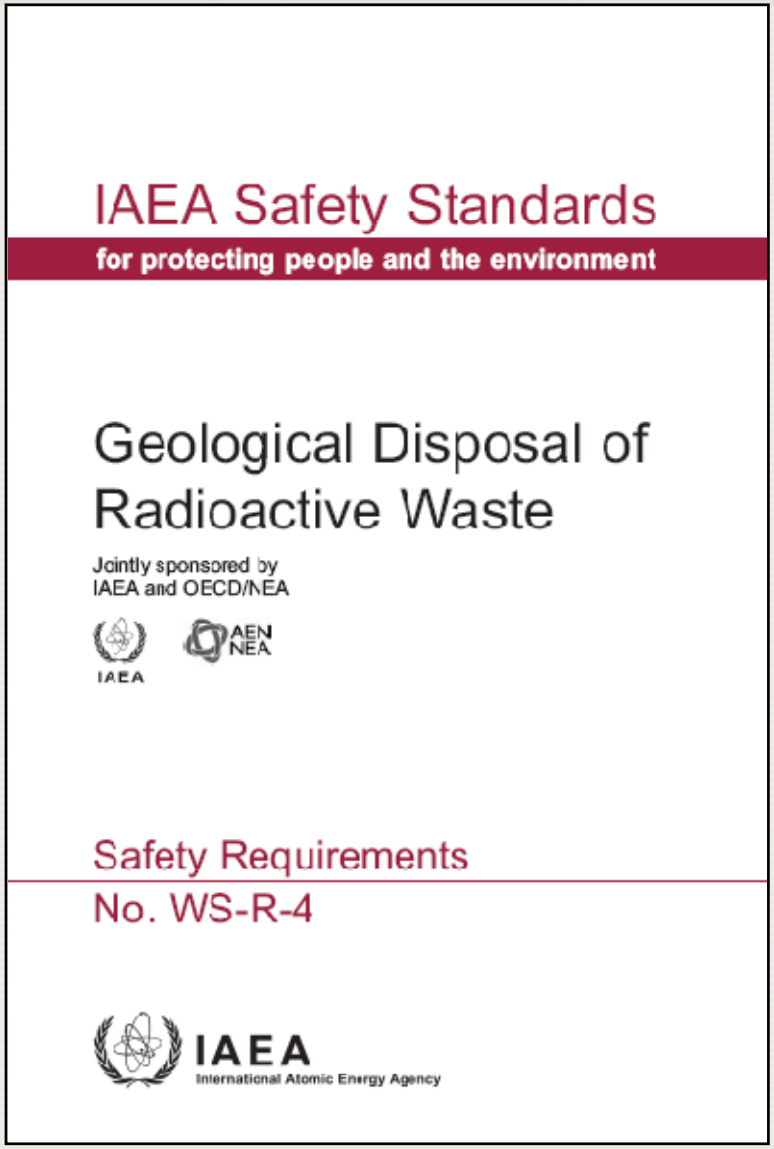
Safety Requirements

Safety Requirements:

- Elaborate on the basic objectives and concepts of SF-1 as they apply to a specific activity or facility;
- Should be concise and reflect the 'What' and 'Who' of safety management – associated explanatory text should describe 'Why' the requirements exist.
- Use "shall" statements.



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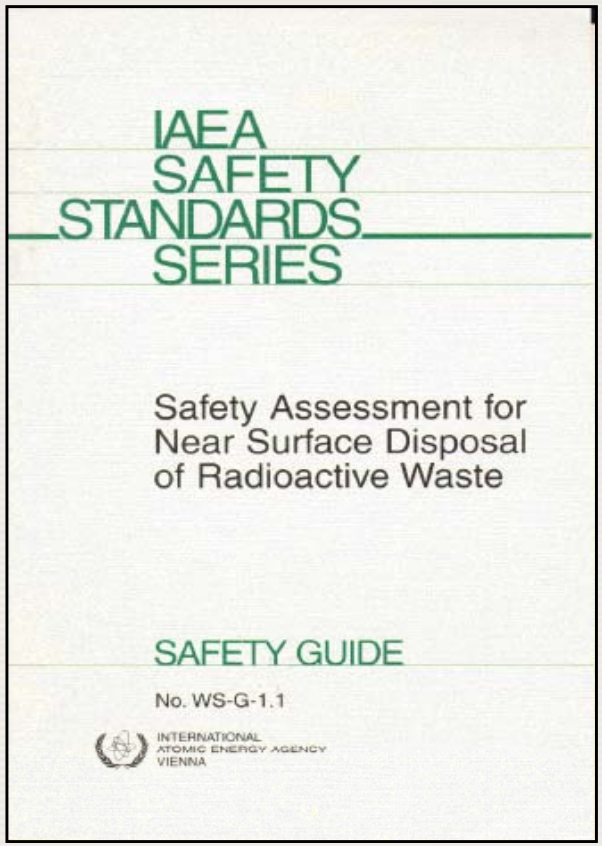
Safety Guides

Safety guides:

- Focus on ‘How’ safety requirements can be met;
- Suggest one or several ways to meet the requirements, but not the only way;
- Use “should” statements.



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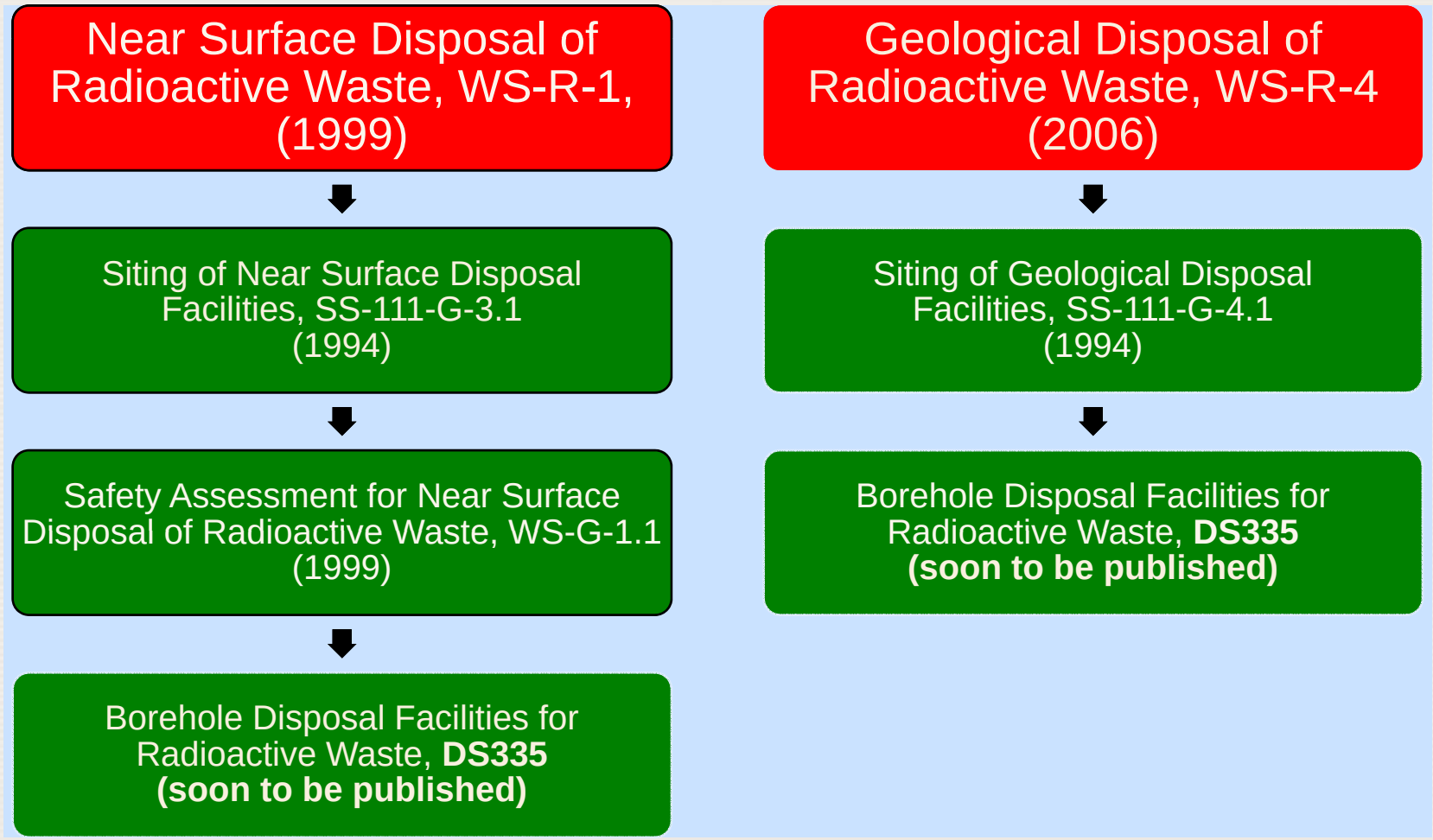
The RADWASS Series of Safety Standards

1. PLANNING	2. PREDISPOSAL	3. NEAR SURFACE DISPOSAL	4. GEOLOGICAL DISPOSAL	5. U/Th MINING AND MILLING	6. DECOMMISSIONING
111-P-1.1 Application of exemption principles to the recycle and reuse of materials from nuclear facilities	**111-P-2.1** Off-gas treatment and air ventilation systems at nuclear facilities	**111-P-3/4.1** Validation and verification of models for long term safety assessment of radioactive waste waste disposal facilities		**111-P-5.1** Procedures for closeout of mines, waste rock and mill tailings	**111-P-6.1** Techniques to achieve and maintain safe storage of nuclear facilities
111-P-1.2 Application of exemption principles to materials resulting from the use of radionuclides in medicine, industry and research	**111-P-2.2** Characterization of raw waste	**111-P-3/4.2** Procedures for closure of radioactive waste disposal facilities		**111-P-5.2** Operational and post operational monitoring, surveillance and maintenance of facilities for the management of waste from mining and milling of U/Th ores	**111-P-6.2** Procedures and techniques for the decommissioning of nuclear facilities
111-P-1.3 Data collection and record keeping in radioactive waste management	**111-P-2.3** Control of waste conditioning processes	**111-P-3.3** Waste acceptance requirements for near surface disposal of radioactive waste	**111-P-4.3** Waste acceptance requirements for geological disposal of radioactive waste		**111-P-6.3** Methods for deriving cleanup levels for contaminated land areas
	111-P-2.4 Testing of radioactive waste packages	**111-P-3.4** Selection of scenarios for safety assessment of near surface disposal facilities	**111-P-4.4** Selection of scenarios for safety assessment of geological disposal facilities		**111-P-6.4** Monitoring for compliance with cleanup levels
		111-P-3.5 Systems for operational and post-closure monitoring and surveillance of near surface disposal facilities			

IAEA Safety Standards for Disposal of Radioactive Waste, Before Comprehensive Plan



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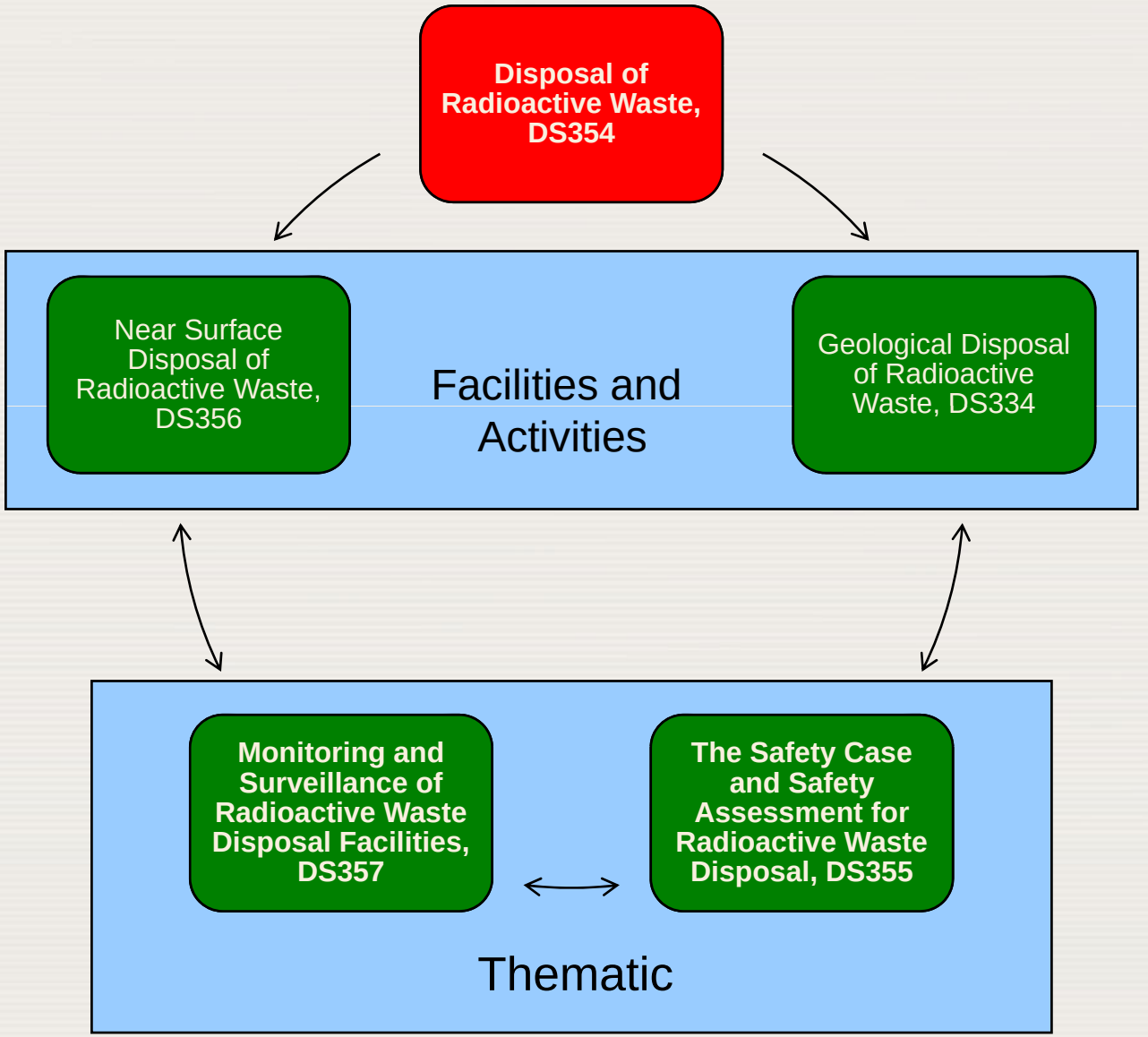
Going forward – an integrated package of standards for disposal of radioactive waste



The Commission and Technical Committees

Of Note

- Requirements are to be reviewed on a 10 year cycle, Guides on a 5 year cycle.
- Readers are invited to comment on draft and published standards through the IAEA website.
- Recently adopted a new format for Safety Requirements: concise statement of requirement followed by explanatory text. Initiated with WS-R-4.
- The IAEA is bound by statute to apply the safety standards for application work carried out with IAEA funds.

How the standards are applied

- IAEA Safety standards are not binding on the Member States - often used as a benchmark.
- “Newcomers” to nuclear power /and or disposal – usually developing countries.
- Basis for peer reviews.
- Basis for regulations in developing countries.
- Integrated Regulatory Review Service (IRRS)
- Technical Cooperation Fund (TCF) work

An International Peer Review of the Programme for Evaluating Sites for Near Surface Disposal of Radioactive Waste in Lithuania

Report of the IAEA International Review Team

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DS354:

Draft Safety Requirements for

Disposal of Radioactive Waste

Safety requirements for disposal (DS354)

LEGAL AND ORGANIZATIONAL FRAMEWORK

Requirement 1: Government responsibilities
Requirement 2: Regulatory body responsibilities
Requirement 3: The responsibilities of the operator

SAFETY APPROACH

Requirement 4: Importance of safety in the development process
Requirement 5: Passive safety
Requirement 6: Understanding and confidence in safety

SAFETY DESIGN PRINCIPLES

Requirement 7: Multiple safety functions
Requirement 8: Containment
Requirement 9: Isolation
Requirement 10: Surveillance and control of passive safety features

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Safety requirements for disposal (DS354)

FRAMEWORK FOR DISPOSAL

Requirement 11: Step by step development and evaluation

THE SAFETY CASE AND SAFETY ASSESSMENT

Requirement 12: Preparation, approval and use of the safety case and safety assessment
Requirement 13: Scope of the safety case and safety assessment
Requirement 14: Documentation of the safety case and safety assessment

STEPS IN THE DEVELOPMENT, OPERATION AND CLOSURE OF DISPOSAL FACILITIES

Requirement 15: Site characterization
Requirement 16: Design
Requirement 17: Construction
Requirement 18: Operation
Requirement 19: Closure

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Safety requirements for disposal (DS354)

ASSURANCE OF SAFETY

Requirement 20: Waste acceptance
Requirement 21: Monitoring programmes
Requirement 22: Post-closure and institutional controls
Requirement 23: Consideration of the System of accounting for and control of nuclear material
Requirement 24: Requirements in respect of security measures
Requirement 25: Management systems

EXISTING DISPOSAL FACILITIES

Requirement 26: Existing disposal facilities

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Example, Requirement 13

Requirement 13: Scope of the safety case and safety assessment

The safety case for a disposal facility shall describe all the safety relevant aspects of the site, the design of the facility, and the managerial and regulatory controls. The safety case and supporting safety assessment shall demonstrate the level of protection provided and shall provide assurance to the regulatory body and other interested parties that safety requirements will be met.

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DS334:

Draft Safety Guide for

Geological Disposal of Radioactive Waste

Contents

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Graphics for Timelines

Figure 1 is a timeline for the entire repository development process, with some emphasis on decision points and points in time where the minimum number of three safety cases need to be made.

Figure 2 gives special emphasis to the stages in the pre-construction siting process (the first block in the Figure 1 timeline). Figure 2 was been added to the document to support the text on site characterization and siting.

Figure 1: Timeline to illustrate the development of a geological disposal facility.

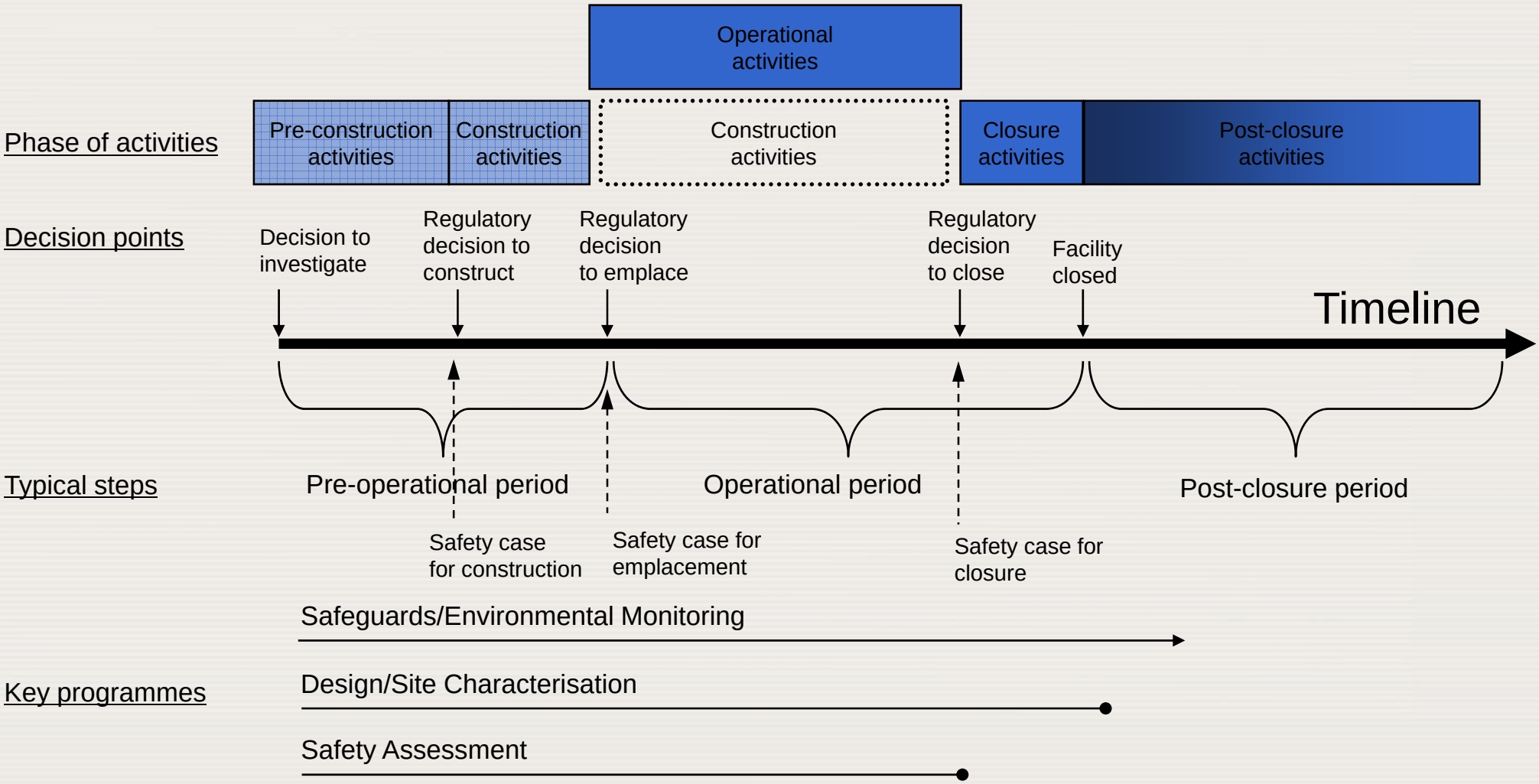
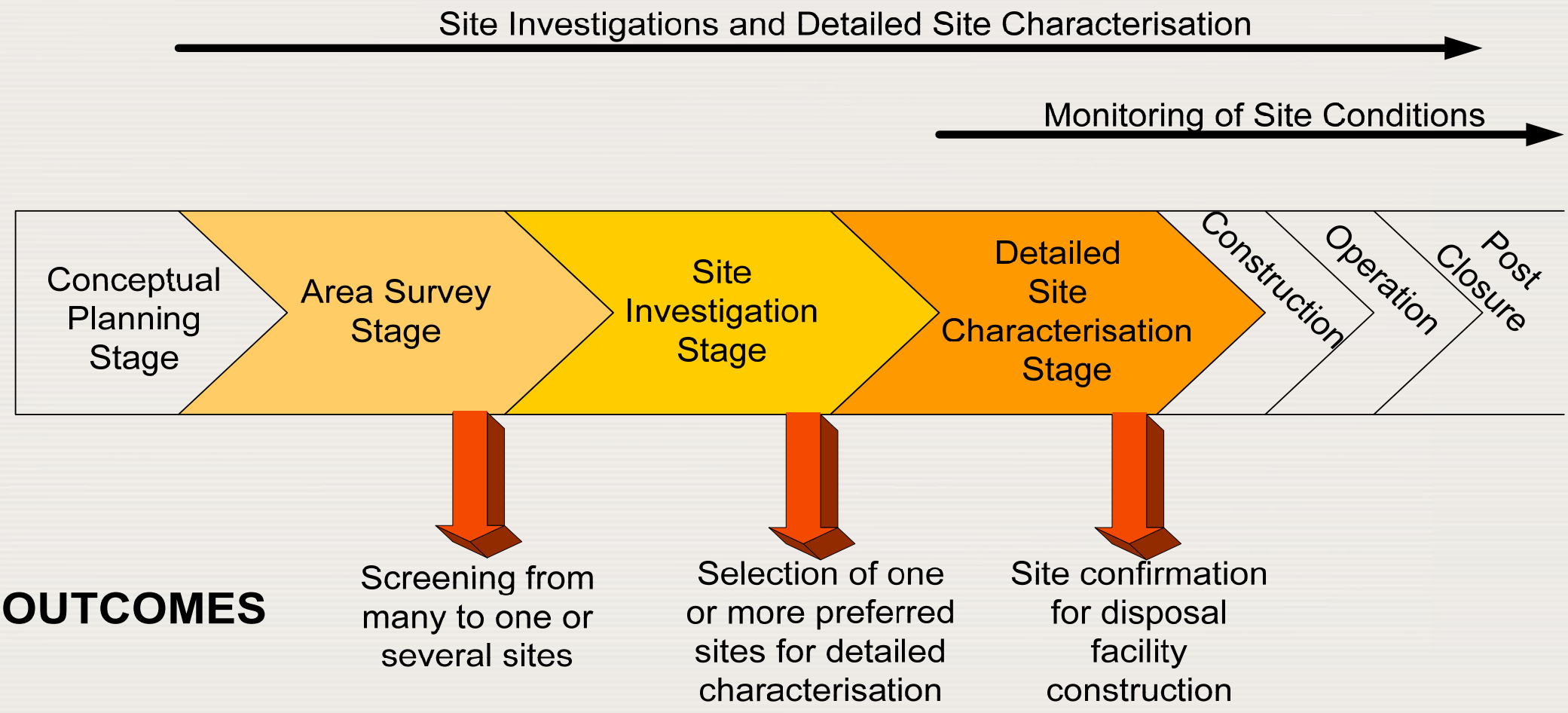


Figure 2: Stages in a siting process



Member State Feedback

Approval to send to MS in Oct 2006 (by WASSC).

At the end of the 120 day comment period (2007July 25), a total of 229 comments were received.

Australia	26	IAEA-WTS	3
Belgium	5	India	18
Brazil	4	Japan	18
Canada	55	Pakistan	19
Egypt	6	Russia	6
Finland	6	Switzerland	2
France	7	Ukraine	15
Hungary	26	USA	13

General Revisions

Almost 75% of the comments were to directed towards improving clarity of the document — accepted “as is” or accepted with minor changes.

These are important because most readers are ESL.

The 50 or so comments remaining were more difficult deal with.

Common theme – detail on siting

Concern with the level of detail on siting

- Too much detail in appendix on siting given that siting is but one aspect of the guide.
- Siting should expand on socio-political aspects of siting based on experience gained in last 10 years.
- If DS334 supercedes the existing guidance siting –it should be moved to the main body of the document.

Issues – independent regulatory capabilities

"The regulatory body should develop an independent capability..." is inconsistent with paragraph 3.8: "It may not be necessary to undertake independent research..."

This type of issue is a concern for developing countries, where resources are scarce.

DS356:

Draft Safety Guide, *Near Surface Disposal of Radioactive Waste*

DS356: Contents

1. Introduction
2. Overview of Near Surface Disposal and its Implementation
3. Legal and Organizational Infrastructure
4. Safety Approach and Design Principles
5. Safety Case and Safety Assessment
6. Implementation of the Disposal Project
7. Existing Disposal Facilities

Appendix I: Siting of Near Surface Disposal Facilities

Appendix II: Post-Closure Safety Assessment

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WASSC Review

- The present draft has taken over too much of the character of DS334.
- DS356 needs to better distinguish the unique aspects of near surface disposal (e.g., better reflect the *graded approach to safety*).
- Develop the guidance further so there is specific guidance for the different types of near surface disposal systems (concrete vaults, VLLW disposal and cavern type disposal).

WASSC Review

The discussion needs to be further developed and expanded in a number of areas, such as:

- Institutional controls
- Containment and performance of the engineered barrier system over time.
- Waste characterization and control of inventory
- What does retrievability might mean in practice.

Send to IAEA Member States for MS comments only after the new Requirements has been approved.

WASSC Review

- Should explain how only a subset of the radionuclide inventory is likely to be relevant for any given exposure scenario.
- Provide a detailed conceptual description of the singularities of a disposal facility when compared against other nuclear or radioactive facilities.
- No examples of conceptual design of typical near surface disposal systems are provided.

Emerging Themes

National policy and strategy for radioactive waste management.

In some Member States post closure **retrievability** is a legal requirement. It would have to be ensured that any such provision would not have an unacceptable adverse effect on safety or performance of the disposal system.

The **safety case** (the collection of arguments and evidence to demonstrate the safety of a facility) for a disposal facility will develop together with the development of the facility. This approach provides a basis for decisions relating to the development, operation and closure of the facility and allows the *identification of areas of uncertainty on which attention needs to be focused* …

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Emerging Themes

- From DS354… Experience to date in selecting sites for disposal facilities has shown that acceptance of a disposal facility by a broad range of **stakeholders** (interested parties) depends on a number of factors. The detailed consideration of such processes is, however, beyond the scope of this publication.
- **Graded approach to safety**. Covered by “Principle 5: Optimization of protection” in the safety fundamentals (SF-1). Specifically … The resources devoted to safety by the licensee, and the scope and stringency of regulations and their application, have to be commensurate with the magnitude of the radiation risks and their amenability to control.

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Emerging Themes

Safety functions. … fulfilled by means of a physical or chemical property of part of the disposal system, or by a process, or combination of processes, that contributes to containment and isolation of the waste (e.g. low hydraulic conductivity, slow corrosion rates, slow waste matrix dissolution, low radionuclide leaching rates, low radionuclide solubilities, high sorption).

- Each safety function should be as independent as possible from the others to ensure that they are complementary and unlikely to fail through a single failure mode.
- Safety assessment should assess whether the design of a disposal system is such that safety functions are complementary.

IAEA Projects

Projects:

- PRISM - near surface disposal
- GEOSAF – geological disposal
- SADRWMS – predisposal radioactive waste Management

Networks:

- DISPONET – International LLW Disposal Network
- ENVIRONET – Environmental Management and Remediation Network

PRISM: Practical Illustration and Use of the Safety Case Concept in the Management of Near-Surface Disposal

First Meeting: 30 March – 3 April 2009. Attended by 60 participants from 30 countries and chaired by Ms. Christine Gelles (US DOE)

The 4th in the series of near surface disposal projects that the Agency has had since the late 1980s. The experience base for near surface disposal covers the entire lifecycle of facility development.

Task Groups:

1) Understanding the safety case
2) Disposal facility design
3) Managing waste acceptance
4) Managing uncertainty

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Upcoming Events

- International workshop on *Post-closure monitoring and surveillance of repositories* to mark the 10th anniversary of the closure of Centre de la Manche, Cherbourg, France, 2009 September 22-25.
- *International Conference Effective Nuclear Regulatory Systems: Further Enhancing the Global Nuclear Safety and Security Regime*, 2009 December 14-18, Cape Town, South Africa.
- A one-day side event of the international conference in Cape Town is the *International Workshop on Demonstrating the Safety and Licensing of Radioactive Waste Disposal*. 2009 December 14.
- *International Conference on the management of spent nuclear fuel from nuclear power reactors.* 2010 May 31-June 3, Vienna.

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IAEA safety standards - download and comment

Comments on the draft safety standards are always welcome.

Download drafts and comment ….

1. **Web page**
2. **www-ns.iaea.org/standards/standards/**
3. **Click on “Draft Standards listed by number”**
4. **Click on “Standards Feedback “**


We welcome your input!