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## GEOLOGICAL DISPOSAL SAFETY STANDARDS

### MONITORING, SURVEILLANCE AND THE SAFETY CASE

**Phil Metcalf**

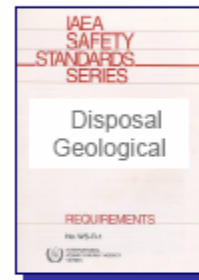
Sixth Meeting of the Integration Group for the Safety Case (IGSC)

2-4 November 2004, Paris



**Requirement 20: Monitoring programmes**

A programme of monitoring shall be defined and carried out prior to and during the construction and operation of the geological disposal facility. This shall be designed to collect and update the information needed to confirm the presence of the conditions necessary for the safety of workers and members of the public and protection of environment during the operation of the geological disposal facility and to confirm the absence of conditions that would undermine the post closure safety of the geological disposal facility.



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A.1.53. Monitoring is **required during each step** of the geological disposal facility development and operation. The purposes include providing **baseline information for later assessments, assurance of operational safety and facility operability, and confirmation that conditions are consistent with post closure safety.** Monitoring programmes must be designed and implemented so as **not to reduce the overall level of post closure safety.**

A.1.54. A discussion of monitoring related to post closure safety of disposal facilities is given in reference [19]. **Plans** for monitoring aimed at providing assurance of post closure safety must be drawn up **before construction** of the geological disposal facility to indicate possible monitoring strategies, but these need to remain **flexible** and if necessary revised and updated during the development and operation of the facility.

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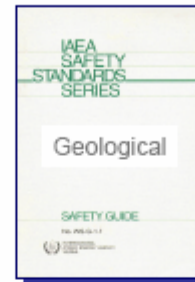
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## OVERVIEW OF GEOLOGICAL DISPOSAL AND ITS IMPLEMENTATION

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Setting up a quality management system

Working documents

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Organisational framework

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Regulatory framework

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## **DESIGN DEVELOPMENT FOR GEOLOGICAL DISPOSAL FACILITIES**

Conceptual design

Detailed design

Waste acceptance criteria

**Surveillance and monitoring programmes**

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Integration of knowledge

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### **CONSTRUCTION, OPERATION AND CLOSURE and CONSTRUCTION PERIOD**

Overview

Flexibility in design

Excavation disturbance

As-built design and the updated safety case

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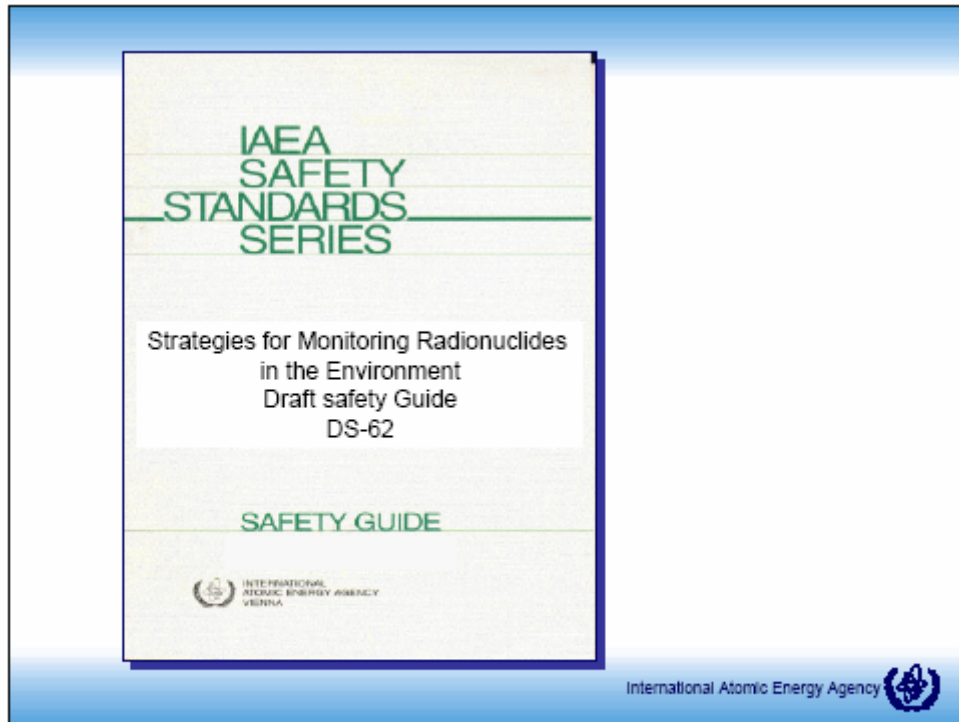
## **OPERATIONAL PERIOD**

- Overview
- Radiological protection
- Commissioning
- Written procedures
- Operational records
- Emplacement strategies
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- Design change procedures
- Safeguards

## **REPOSITORY CLOSURE AND POST-CLOSURE CONTROL**

- Considerations related to the decision to permanently close the repository
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IAEA TECHNICAL PUBLICATION

*Monitoring of geological repositories for high level radioactive waste*

  
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INTERNATIONAL ATOMIC ENERGY AGENCY  
Vienna, Austria

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**DESIGN DEVELOPMENT FOR GEOLOGICAL DISPOSAL FACILITIES**


- Conceptual design
- Detailed design
- Waste acceptance criteria
- Surveillance and monitoring programmes**

**SITE CHARACTERISATION**

- Site characterisation
- Other research activities
- Safety case development
- Integration of knowledge
- Assessments and evaluations
- Scientific investigations during the construction, operational, and post-closure phases

**CONSTRUCTION, OPERATION AND CLOSURE and CONSTRUCTION PERIOD**

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## Surveillance and Monitoring Programmes

### 1.1 Monitoring is defined as [26]

*The measurement of dose or contamination for reasons related to the assessment or control of exposure to radiation or radioactive substances, and the interpretation of the results.*

### 1.2 And surveillance is defined as [26]

*Activities performed to ensure that conditions at a nuclear facility remain within the authorised limits. For a near-surface repository, surveillance normally continues past the periods of operation and closure.*

1.1 The **starting point** in planning all monitoring activities **is the safety case**, which should contain a clear monitoring plan that describes the rationale underlying the monitoring activities. A programme of surveillance and monitoring should form part of the safety case and should commence before a disposal facility becomes operational - usually during the site characterisation programme. The repository design may also include a period of subsurface monitoring of the disposal facility after the waste has been emplaced but before the access tunnels or shafts have been backfilled and sealed.


1.2 As the disposal programme moves from one phase to the next, the objectives of the surveillance and **monitoring programme will change** and additional surveillance and monitoring activities will be added [27]. Some of these activities will continue through into the period of post-closure institutional control. Through the various phases of facility development, the surveillance and **monitoring objectives should be set to allow the surveillance and monitoring programme to build confidence in the safety case** by testing assumptions and demonstrating compliance. For example, reference [27] lists the main objectives of the post-closure surveillance and monitoring phase as:

- to show compliance with reference levels established by the Regulatory Body for the purposes of providing protection of human health and environment;
- to confirm, as far as possible, relevant assumptions made in the safety assessment;
- to provide indications of any malfunctioning of the containment leading to unpredicted radionuclide releases; and
- to provide reassurance to concerned persons living in the vicinity of the waste disposal facility.

1.3 An important principle of the surveillance and monitoring of facilities is that the programme should be designed and implemented so as not to reduce the overall level of post-closure safety. The surveillance and monitoring programme should not place an undue burden on the Operator by being too elaborate.

1.4 As part of the site characterisation phase, a baseline of environmental radiation and activity concentration levels should be established for the purpose of subsequently determining the changes (if any) brought about by the emplacement of the waste. These data might include results from borehole testing such as pressure and flow, surface radiological data such as gamma radiation fields, radionuclide content of airborne dust, and radionuclide (including radon) content of the soils, water and air on and around the site. These data should be used to gain an understanding of likely radionuclide transfer pathways, especially in areas where radionuclides from the facility could discharge. The monitoring should also cover wider environmental information such as local ecology, chemical pollutants, population habits and density, local agriculture, and natural and artificial features of the environment that might affect radionuclide transfer pathways [27].


1.5 The results of pre-disposal surveillance and monitoring should assist in building confidence in the safety and post-closure performance of the facility and aid decisions for its future development. The monitoring programme should also be useful in creating the geosphere and biosphere models to be used in post-closure safety assessment.

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1.6 Where there is a possibility that migration of radionuclides could reach an aquifer, consideration should be given to monitor the aquifer for potential radionuclide releases using boreholes sunk into the water bearing horizons (even though releases of activity are not expected to occur, except possibly in the distant future). Such monitoring boreholes should be sealed after use.

1.7 The Regulatory Body should provide guidance on the establishment of a surveillance and monitoring programme to be used to (i) demonstrate compliance with the regulatory constraints and any other licence conditions, (ii) monitor any releases of radioactivity to the environment, and (iii) assess the environmental impact of construction, operation, closure and post-closure activities. This programme would normally be carried out by the Operator who would take the necessary actions to ensure that the requirements established by national authorities are met. The Regulatory Body should:

- check the surveillance and monitoring data provided by the Operator;
- regularly review surveillance and monitoring arrangements including arrangements for emergency monitoring;
- audit the management systems; and
- provide evidence that can satisfy public opinion that there are no unauthorised sources of exposure.

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1.8 In addition, the **Regulatory Body** should carry out an **independent surveillance** and monitoring programme.

1.9 If the waste management **concept foresees a pilot or demonstration** facility within the repository, where a small amount of waste is emplaced in a separate storage room equipped with monitoring instrumentation or having borehole accesses to the near-field barriers, the Operator should **backfill and seal this facility at the earliest possible time in order to have the best chance of obtaining information** to guide the further emplacement activities.

## SCHEDULE FOR DS 334

- **TECHNICAL MEETING VIENNA 29 NOVEMBER – 3 DECEMBER**
- **REPORT TO WASSC MARCH 2005**
- **SUBMIT TO WASSC FOR APPROVAL TO MEMBER STATES OCTOBER 2005**
- **POSSIBLE SAFETY REPORT ON SURVEILLANCE AND MONITORING OF GEOLOGICAL DISPOSAL FACILITIES**