Environmental Impact Assessment for disposal facilities: Lithuanian Experience

Stasys Motiejūnas

Lithuanian Radioactive Waste Management Agency (RATA),

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Near-Surface Repository development project: Initial implementation schedule

No.	Activities\Years	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
1	Conceptual and planning stage										
2	Area survey stage										
3	Site characterization stage										
4	Government decision to design the NSR										
5	Site confirmation stage										
6	Environmental impact assessment										
7	Basic design of the NSR										
8	Preliminary Safety Analysis Report										
9	Complex expertise of basic design										
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Conceptual and planning stage

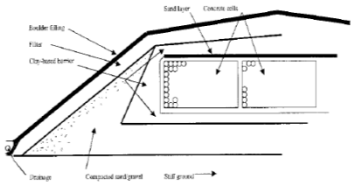
- Development of the Reference Design/ Disposal concept
  - Prepared by Swedish companies in 2002
- Development of Siting Criteria and a siting plan
  - Siting Criteria prepared by RATA in 2003
- Development of Generic Waste Acceptance Criteria
  - Prepared by RATA in 2003

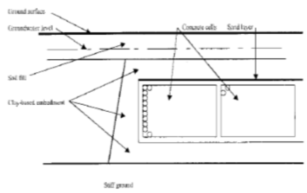
Features of the NSR Reference Design/ Disposal concept

- The preliminary design and site selection are interdependent and iterative processes
  - dependent on knowledge of:
    - **waste inventory and**
    - **local conditions**
- Reference Environment:
  - Sedimentary firm soil
  - Ground water at least 1 m below the surface
  - Tectonic movements up to 3.5 mm per year
  - Annual precipitation: 900 mm per year, 150 mm for a single day
  - Length of draught period up to 2 months

Selection of repository concept

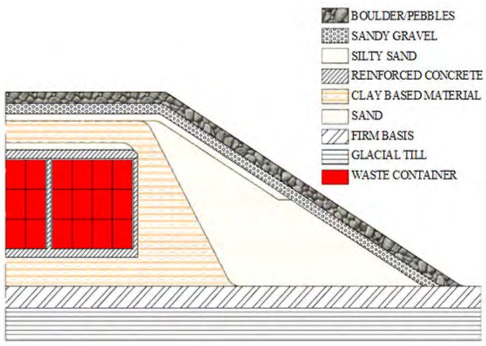
- Analysis of two alternatives was performed:
  - Installation above the ground water level
  - Installation below it
- The repository above the water table was found more suitable



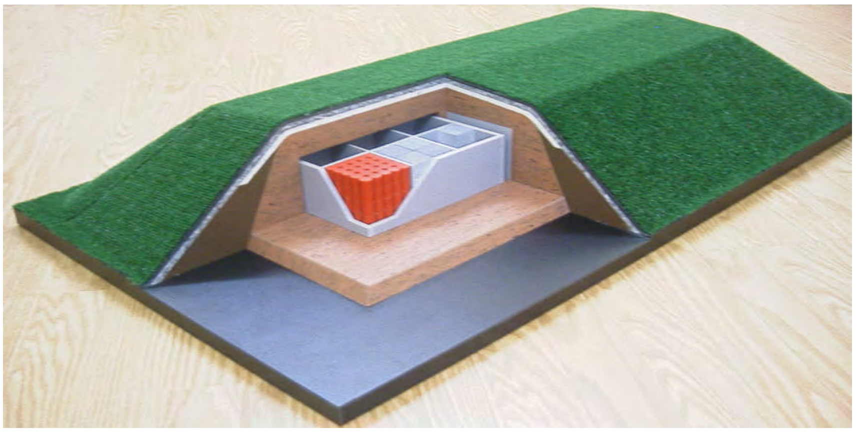


The proposed multi-barrier disposal system protects the environment during 300 years

- The waste matrix and packagings
- Backfill
- Concrete vaults
- Clay based barrier
- Natural ground



Modular structure easily adaptable to varying waste volume



SITING OF THE NSR

Legal framework

- A site for radioactive waste management facility has to be selected according Requirements of the Law on Environmental Impact Assessment
- The EIA process consists of:
  - analyze of alternative locations and
  - technical solutions
  - also, it includes public considerations

Applicable siting strategies

- Dedicated site
  - usually nuclear sites are used for waste disposal
- "Scientific" approach
  - Step-vise process:
    - regional screening, narrowing number of potential sites…
  - Arbitrary ranking of multiple parameters applying weighting factors
    - ambitious task to look for **"the best"** site!
    - **however, selection of the "best" is nether feasible, nor needed**
    - we have to look for an appropriate site
- Volunteering
  - Siting criteria must be developed in advance and
  - Compensation package should be proposed

Planning

- Pursuant to the IAEA recommendations the sitting of a near surface repository may be divided into four stages:
  - conceptual and planning stage
  - area survey stage
  - site characterisation stage
  - site confirmation stage

SITING CRITERIA APPLIED IN LITHUANIA

- **Technical/safety**
  - Geotechnically stable site
  - Small natural impacts on engineered barriers
  - Low transport risk level
- **Environmental**
  - Low environmental impact
  - exclusion of protected areas
- **Legal**
  - Meet all applicable Lithuanian legal requirements
  - Conform to signed international agreements
- **Public acceptability**

  Local, national and international acceptance

Assessment of geotechnical, hydrological, tectonic risks

Criterion	Effect	Riskiness
Slope stability	Strong break of cells	Highest risk
Settlement	Break of cells	Moderate risk
Flooding	Water intrusion into cells	Moderate risk
Tectonic (seismic)	Slight break of cells	Least severe consequences

Main technical site exclusion criteria and desirable site features

Main requirements for site	Site exclusion criteria	Desirable site features
Topographical features	Possibility for flooding of foundation	Surface inclination is sufficient and water can drain away into a surface water body. Preference should be given to a big hill.
	High erodability	High resistance to erosion – relatively smooth site, shallow water flow speed v is below the critical speed $v_{cr.}$
Geotechnical stability	Unstable slopes (safety factor $\mathbf{F}_{\tan\varphi}$ is less than 1.3)	Slope stability of friction material; safety factor $\mathbf{F}_{\tan\varphi}$.> = 1.5.*
Geotechnical stability	High compressibility of bottom bed (high volume compression coefficient β)	Compressibility, compression strength, shear strength, internal friction angle and stiffness (E-modulus) of bottom bed shall comply with requirements for massive constructions*.
	High liquefaction	1. Low pore water pressure. 2. The maximum seismic intensity on the MSK scale < =6.
	Bad constructability	Feasibility of excavation
	Variety of ground features	Homogeneous ground
Hydraulic conductivity	High hydraulic conductivity (filtration coefficient **k** is bigger than 10^{-5} m/s)	Low hydraulic conductivity. It is desirable that filtration coefficient **k** is less than 10^{-7} m/s or even 10^{-9} m/s*.
Impact from natural phenomena	1. Unfavourable climate 2. Unfavourable hydrological conditions	1. Low and steady groundwater level. It is desirable that groundwater level is at least 3 m below bottom barrier*. 2. No risk of being flooded.
Transport risks	Long distance to Ignalina NPP, transportation of waste through big settlements and protected or recreational territories.	1. Vicinity to Ignalina NPP. 2. Favourable infrastructure and logistics.

Hydrological criteria

- The hydrogeological setting of the region should include:
  - low ground water level
  - low groundwater flow
  - long flow pathways
  - long distance to "well"
- Preference should be given:
  - to regions that could make characterising or modelling of the hydrogeological system easy
  - to regions that have the main hydrological characteristics available

Stages in site selection for the Lithuanian NSR

- Regional mapping
- Characterization of Ignalina NPP region
- Identification of candidate sites
- Characterization of the candidate sites
- Comparison and analysis of the alternatives

- **3 sites were identified, characterized and compared**

Regional screening:
Ignalina NPP region was considered as the region best suitable for the repository

- According to the Master Plan of the Republic of Lithuania the vicinity of Ignalina NPP is appointed for energy production and industry development
- This region was very well characterised during previous investigations
- Proximity to the nuclear power plant significantly reduces risk during waste transportation
- **Public is familiar with nuclear activities and better accept the new plans**

- The detail investigations of potentially suitable sites were concentrated in the closest vicinities of Ignalina NPP, in a distance of ~30 km from the NPP
  - **3 sites were selected for the detailed investigations**

Site characterization

- In 2004 RATA started characterization of sites and assessment of the potential environmental impact
- In 2006 RATA completed comprehensive geological, hydrological and hydrogeological characterization of three candidate sites
- The siting process has been reviewed by international experts in December 2005
  - www.iaea.org/publications
- The Environmental Impact Assessment Report approved in 2007

IAEA PEER REVIEW MISSION

- Was held in December 2005
- Purpose of the mission:
  - an independent assessment of the safety of the considered sites and feasibility of the proposed reference design to local conditions;
- Mission result:
  - informed RATA whether its progrmme is consistent with international standards and with good practices from other disposal programmes

Consultations with the local public during Environmental Impact Assessment

Analysis of transboundary impacts

Information of neighboring countries and consultations

- Lithuania Latvia and Belarus are members of the Convention on Environmental Impact Assessment in a Transboundary Context (Espoo, 1991)
- The Ministry of Environment of Lithuania informed the counterparts in accordance with the Espoo Convention

Public information during the EIA process

September 2006	Public hearing in Visaginas, Lithuania
December 2006	Public hearing in Daugavpils, Latvia
December 2006	Public hearing in Braslav, Belorus

Public concerns

Risks indicated by the public:
- Seismic events
- Contamination of rivers, lakes and potable water

Real dangers:
- Human activities
- Human intrusion
- Bio-intrusion
- Erosion
- Flooding

The main challenges in site selection

- All pre-selected sites were in vicinity of the state border with Belorus and Latvia
- Byelorussia and Latvia as well as Ignalina municipality requested for compensations of psychological impact

Requests from Latvia and Belarus

- More comprehensive safety assessment including treatment of uncertainties is needed
- Installing monitoring system and free access to the monitoring data
- **To create a Test Ground for long-term field observations in order to demonstrate reliability of proposed structures**
  - Tests at prototype of engineered barriers must be performed
  - It should demonstrate performance and longevity of the barriers and
  - to provide accurate parameters for realistic safety assessment
- **Continuity of institutional control!** To prolong active institutional control period up to 200 years or as long as needed
- Duration of institutional control periods must be reassessed in the technical design
- To foresee in the design of repository a possibility to separate the waste even after 300 years
- To improve environmental monitoring in the territory of Belarus
- Public must be continuously informed in order to mitigate negative social impact

Planning of construction and cosure of the disposal vaults

- Closure of the vaults starts as soon as they are filled with waste
  - no prolonged storage of unsealed vaults
  - reduction of maintenance costs
  - better safety performance
    - **the vaults are protected against harmful atmospheric impact**
- During the closure of the repository the sides and top of vaults should also be covered by low-permeable smectite clay barriers
  - **The clay barrier should have a hydraulic conductivity of no more than 10^{-10} m/s**
- The whole system should be covered by a long-lasting erosion-resistant cover

Institutional control will be required after closure

- to prevent intrusion,
- to perform monitoring and surveillance
- to confirm the satisfactory performance of the repository by monitoring,
- to perform remedial actions, if necessary

Content of the Design development Contract

- Basic Design
- Technical Design
- Preliminary Safety Assessment
- Final Waste Acceptance Criteria

- Technical supervision during construction

Initial project implementation schedule & Reasons for the delays

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