Developing repositories for VLLW and LILW: challenges and solutions

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Lithuania is the only nuclear country within the Baltic States

Lithuanian Profile

- From 1984 till 2009 Lithuania operated single Nuclear Power Plant – Ignalina NPP
  - The NPP was the main source of electricity in Lithuania
  - it has generated 80-85% of the total electricity production
- Lithuania has no uranium mining and nuclear fuel fabrication industry
  - The nuclear fuel was supplied by Russia
  - There are no plans for fuel reprocessing
- Lithuania has no research reactor

WASTE SOURCES IN LITHUANIA

- **Ignalina Nuclear Power Plant consisting of two RBMK-1500 type reactors, commissioned in December 1983 and August 1987**
- **Unit 1 was closed down for decommissioning in 2004 while the unit 2 was stopped in 2009**
- **Former operator of the NPP is responsible for decommissioning/ dismantling activities**
- **Maišiagala repository for institutional waste - operational period: 1963-1989, - capacity: 200 m³ - in 2006 reconsidered as storage facility**

Waste sources in Lithuania

- In Lithuania more than 99% of waste is generated by Ignalina NPP
  - Operation
  - Dismantling
- Institutional waste, orphan sources

Policy

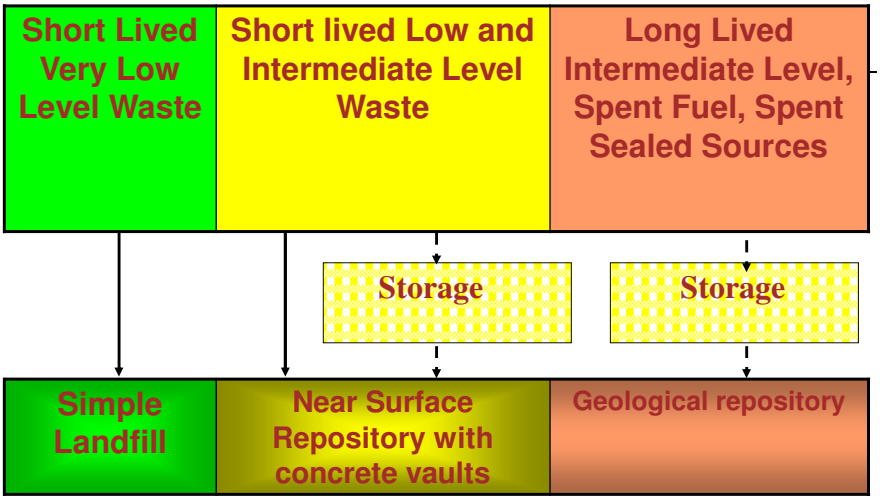
- The **Joint Convention** represents an incentive instrument which aims at achieving and maintaining a high level of safety worldwide in spent fuel and radioactive waste management
- EU **Directive 2011/70/Euratom** establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste

Classification of solid waste in Lithuania and waste disposal ways

Class	Final processing	Disposal way
Short-lived waste		
A – Very low level	Unnecessary	Simple landfill
B – Low level	Required	Near surface
C – Intermediate level	Required	Near surface
Long-lived waste		
D – Low level	Required	Near surface or intermediate depth
E – Intermediate level	Required	Geological
F – Spent sealed sources	Required	Geological
Spent fuel	Required	Geological

Nuclear Waste Management in Lithuania

Three waste streams



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Three disposal facilities

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Preliminary waste amounts at Ignalina NPP

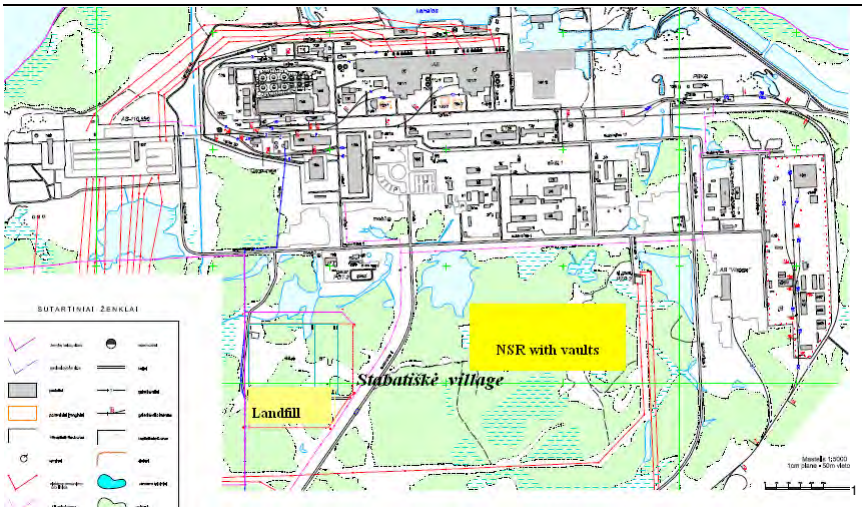
- ~ 60 000 m^3 of VLLW will be disposed of in the Landfill type repository
- ~ 100 000 m^3 of LILW will be disposed of in the m^3 repository with concrete vaults
- ~ 17 000 m^3 of bituminized waste will be left in the upgraded storage facility or disposed of in the LILW repository, depending on the investigation results
- ~ 6 500 m^3 of Long-Lived wastes (including graphite waste) will be stored

NATIONAL STRATEGY FOR RADIOACTIVE WASTE MANAGEMENT

Aproved by the Government in 2002 and updated in 2008

- It is foreseen to establish:
  - landfill repository for VLLW (60 000 m³); by 2017
  - near surface repository for LILW (100 000 m³); by 2020
  - new dry spent nuclear fuel storage for all spent fuel; by 2012
  - interim storage for long-lived waste; by 2017
- Disposal of SNF and other LLW is not planned in the nearest future
  - The Spent Fuel and Long Lived Waste will be stored until future disposal in a geological disposal facility will be available

Sites selected for the repositories



Conceptual and planning stage

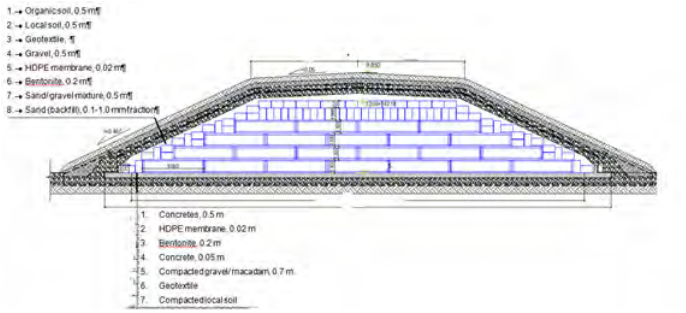
- Development of the NSR Reference Design/ Disposal concept
  - Prepared by Swedish companies in 2002
- Development of Siting Criteria and a siting plan
  - Siting Criteria prepared by RATA in 2003
- Development of Generic Waste Acceptance Criteria
  - Prepared by RATA in 2003

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 1 m below the surface
  - Tectonic movements up to 3.5 mm per year
  - Earthquake magnitude on Richter scale is 4
  - Annual precipitation: 900 mm per year, 150 mm for a single day
  - Length of draught period up to 2 months

Technical design of the Landfill: cross section

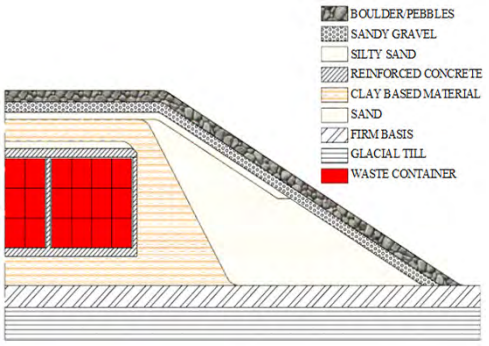
- Containers do not fulfill safety function



NSR: A ”hill”-type repository with reinforced concrete vaults constructed above the groundwater level

Proposed multi-barrier disposal system protects the waste during 300 years

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



Applicable siting strategies

- Dedicated site
  - to use nuclear sites
- “Scientific” approach
  - Step-vise process:
    - regional screening, narrowing number of potential sites…
  - Arbitrary ranking of multiple parameters applying weighting factors
  - Nether look for the best site!
- Volunteering
  - Siting criteria must be developed in advance and
  - Compensation package should be proposed

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

Consultations with the local public during Environmental Impact Assessment

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

NSR Technical Design development

- Development of Technical Specification, in 2008
- Procurement of services
- Conclusion of a contract with AREVA, ANDRA and Lithuanian companies
  - Ignalina NPP is responsible for management of the Contract

Content of the Design Contract

- Final site characterization
  - **Geotechnical investigations**
- Basic Design
- Technical Design
- Preliminary Safety Assessment
- Final Waste Acceptance Criteria

- Technical supervision during construction

Repository for Very Low-Level Waste

- Development of the Landfill type repository dedicated for disposal of VLLW is in design phase
- Waste will be disposed of in a very simple manner without conditioning

The compressible waste bales are placed in a landfill

Packages of Very Low-Level Waste

There are three types of package foreseen for disposal in the Landfill:

- Half ISO containers filed with waste (pieces of concrete, metal)
- Boundless of compressed waste (organics and other compressible wastes)
- Big bags with ion exchange resins

Waste Acceptance for disposal Development of WAC

- RATA prepares draft of the WAC
- Nuclear authority approves

- Operational safety
- Post-Closure safety
  - intrusion
  - radionuclide migration
- Step-vice approach in development of WAC
  - From generic to site/facility specific

Control of Waste Packages

- Waste generator is responsible for the QA measures
- RATA – the operator of disposal facility performs inspections at waste producer site
- Verification of waste packages will be performed during waste acceptance to the repository

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- It is foreseen to establish:
  - landfill repository for VLLW (60 000 m³); by 2017
    - **However, according current assessment the volume will be significantly bigger**
  - near surface repository for LILW (100 000 m³); by 2020
  - new dry spent nuclear fuel storage for all spent fuel; by 2012
  - interim storage for long-lived waste; by 2017
- Disposal of SNF and other LLW is not planned in the nearest future
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The main challenges

- Lack of public acceptance
- Unfavorable geography: proximity to national border
- Complicate environment (high ground water table)
  - Designing robust surface water draining system
- Not well known waste volume and properties
  - According newest assessment volume of VLLW will significantly exceed Landfill capacity
- Delays
  - Due to wrong planning
  - Limited project management experience
  - Institutional framework

IAEA PEER REVIEW MISSION IS AN IMPORTANT TOOL FOR CONFIDENCE BUILDING

- 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

Thank you!