Site characterisation in the Hungarian early-stage programme

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Paks NPP
- 4 VVER-440 type PWR blocks
  - 50 years of operation
- Planned: 2 VVER-1200 type reactors from late 20s
  - Final disposal of operational and decommissioning L/ILW

Paks ISFSF
- Final disposal of operational and decommissioning HLW
- Final disposal of SF

Bátaapáti NRWR
- Final disposal of operational and decommissioning L/ILW

Training and research reactors
- Interim storage of SF

Russia
- Final disposal of institutional L/ILW

Püspökszilágy RWTDF
- Interim storage of long-lived waste
- Final disposal of long-lived waste

Boda Claystone Formation
- Ongoing site investigation for DGR
RW classification and inventory (Without Paks2)

- **geological disposal in a domestic DGR (Boda Claystone F.)**
- **no final decision on back-end strategy yet**
- **direct disposal of SF is the reference scenario**
- 17,700 SF assemblies, 2100 tU, 4200 m³ (1400 m³ if reproc.)
- 600–800 m³ of other HLW and long-lived L/ILW

- **intermediate depth geological disposal (Bátaapáti)**
  - NPP operation: 13,000 m³ LLW and 2600 m³ ILW
  - decomiss.: 6000 m³ L/ILW

- **near surface disposal (Püspökszilágy)**
  - institutional waste: 5000 m³ SL L/ILW

- **near surface disposal (siting to be commenced)**
  - new waste category since 2018
  - decommissioning: 22,000 m³ VLLW
Boda Claystone Formation – Potential host rock for DGR

- Age: ca. 260 My (Late Permian)
- Thickness: 200–1200m
- Known area: 150km²
- Depth: 0–2,5km
- Formed in a shallow, saline playa lake
- Fine grained, highly undurated rock, fractured
- Very low porosity (0.5-2%) and hydraulic conductivity (10–14 m/s)
- Low diffusivity (10–11 m²/s)
History of siting (Boda Claystone Formation)

1990’s: in-situ investigation from a uranium mine, BCF is the underlying formation, URL on a depth of 1100m

2000-2003: country-wide screening and ranking of the potential host formations

2004-2010: 1st phase of surface investigation

2013-2018: 2nd phase of surface investigation
Potential Disposal Zone in a vertical cross-section

BAF-2 drillcore, 713.0m
Siting territory, Potential Disposal Area

- **87km² siting territory**
- **32km² Potential Disposal Area**

**Deep boreholes, in-situ testing**
- 600–1500m depth

**Trenches**
- 700–1500m length

**2D seismic profiles**

**Geological, hydrogeological, geomorphological mapping**
Requirement for RD&D Planning

establishing a Community framework for the responsible and safe
management of spent fuel and radioactive waste

Article 12: Contents of National Programme

1. (f): set out the „research, development and
demonstration activities that are needed in order to
implement solutions for the management of spent fuel and
radioactive waste „

Member States have to develop their own RD&D plan as part of the National Programme
The Plandis Guide

EURATOM FP7, SecI GD2 Project (2013–2015)

Member States with less-advanced National Programmes need help to develop an RD&D Plan

Guide has been developed by the Secretariat of IGD-TP, scope restricted to HLW and LL ILW, target end-users are WMOs

Usability testing: PLANDIS Workshop in 26 May 2015, Pitesti, Romania


PURAM reviewed and commented draft versions of the Plandis Guide, participated in PLANDIS workshop, and used it for the preparation of RD&D plans in the National Programme
Contents of the Plandis Guide

Establishing an RD&D plan
- Programme boundary conditions for waste disposal
- Milestones and timeframes
- Safety case as principal driver for RD&D
- Responsibilities and entities involved with RD&D
- Methodology for prioritising RD&D
- RD&D competence management, contractual mechanism and advisory support

Programme activities and RD&D tasks
- Inventory, Cost, Waste treatment and storage
- Implementation strategy, Generic Safety case development
- Competence development, Stakeholder engagement strategy
- Site characterisation, Post-closure safety assessment tools/methodology
- Environmental impacts and socio-economic effects
- Operational safety, Data management and preservation of records
**Application of the Plandis Guide for planning site investigation**

A new Governmental Decree was issued in Jun 2014, regulating safety requirements for RW disposal facilities:

- „A framework programme has to be developed and implemented for the investigation and evaluation of the potential site.”
- „The framework programme includes also the geological investigation programme.”
- The framework programme defines phases of the stepwise investigation.

**PURAM contributed to the formulation of legal requirements for site selection and characterisation**

- The Plandis Guide was used as a reference document to develop the scope and the contents of a framework programme.
- The framework programme was considered as a site-specific RD&D plan.
Application of the Plandis Guide for planning site investigation

The framework programme must specify the followings:
- geographical location and host rock formation
- category and volume of the RW to be disposed
- type of the planned facility and its life-cycle
- phases of the investigation, schedule, decision points, licencing

Topics of RD&D activities in the framework programme:
- inventory, treatment and conditioning, characteristics of RWs
- waste forms, packages, long-term behaviour and interactions
- elements of the EBS, long-term behaviour and interactions
- natural, societal and geological environment, long-term behaviour and interact.
- layout of surface and underground facilities, construction and closure methods
- operational safety, transport, disposal, retrievability of waste packages, prevention of accidents
- measurements, modelling, assessment tools and methods
- data management and preservation of records
Application of the Plandis Guide for planning site investigation

RD&D activities are scheduled according to the phases of the geological site investigation.

RD&D activities have to be prioritized:
- current understanding and knowledge gap, uncertainty
- importance and impact of the obtainable information
- time requirement, urgency

PURAM is now preparing the framework programme for the site investigation of the DGR for HLW in the Boda Claystone Formation.
Future plans for site characterisation

- The long-term site investigation framework program is compiled on the basis of the IGD-TP „PLANDIS” guide and will be licensed.
- Three phases were defined for surface based investigation until the URL construction.
- Preliminary safety case to be compiled at the end of each phase to define further RD&D activities and priorities.
- Final aim is to designate the location of the URL by the early 2030’s.

**Stakeholder engagement is essential!**

- Site investigation is fully supported by local people (informative and inspecting associations, financial promotion, open and authentic communication, activities, face-to-face channels).
- Abstention and opposition by the population of a nearby large city (**NI MBY** and also **NI MTO** – Not In My Term of Office!!)
- Revision of the country-wide screening and preliminary evaluation of an alternative host rock formation in 2019–2021.
Some questions in an early-stage site characterisation programme

At which stage the **inventory** has to be primarily defined?
- decision on the back-end strategy of the fuel cycle influences the heat production and volume of the waste, footprint of the facility

At which stage **type of waste packages** has to be basically specified?
- influences the size of the shafts and tunnels, excavation and support methods, facility layout, disposal equipment etc.

At which stage decision has to be taken about the **location of an URL**? What are the most relevant considerations?
- complexity of the geology, transposition of information from URL to DGR
- influences the facility layout, methods of closure and seals etc.

Experiences and lessons learned in advanced programmes would help for planning of further RD&D activities including site characterisation in an early-stage programme.
Thank you for your attention!