PRELIMINARY STUDIES FOR THE DECOMMISSIONING OF THE REACTOR COMPARTMENTS OF THE FORMER PALDISKI MILITARY NUCLEAR SITE AND FOR THE ESTABLISHMENT OF A RADIOACTIVE WASTE REPOSITORY

Working approach to Task 4: Determining the possibilities of the disposal of Radioactive Waste

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EKSORTUS SPECIALUS MONTAŽAS-NTP TASK 4 A.L.A.R.A. As Low As Reasonably Achievable
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Disposal of Radioacvtive Waste

Content of presentation:

- objectives of the Task
- implementation plans
- implementation means
- any relevant unresolved issues
- required Client's inputs

Task objectives (1)

4.1 Analysis of radioactive waste disposal options

- overview of international experience in the disposal of radioactive waste & possible disposal options
- methods of radioactive waste disposal that are the most suitable for Estonia:
  - single repository for all waste types, and
  - separate repositories for different wastes
- comparative analysis of the both disposal methods

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Task objectives (2)

4.2 Strategic concept of waste disposal in Estonia

- waste disposal facility accommodating the following wastes:
  - available legacy waste (institutional and from the reactors operation)
  - reactor decommissioning waste
  - potential waste from operation and decommissioning of the future NPP
- suitability of available waste packages/containers for disposal
- three most optimal disposal options proposed taking into consideration economic, technical and safety factors. The selection is dependent on:
  - waste amount and characteristics, especially content of long-lived radionuclides
  - environmental conditions (geological, hydro-geological, hydrological and other)
  - socio-economical conditions
  - existing infrastructure

Task objectives (3)

4.3 Disposal facility sitting/mapping of suitable areas using GIS software/database

- considerations of Pakri Peninsula suitability and technical possibilities of eliminating adverse natural and other factors
- at least 3 possible locations selected for future EIA

Implementation of 4.1. Analysis of radioactive waste disposal options

Disposal options will be identified:

- on the basis of Estonian legal requirements, international obligations, best international practice, and
- inventory of all waste streams

Disposal of Radioacvtive Waste

- The term 'disposal' refers to the emplacement of radioactive waste into a facility or a location with no intention of retrieving the waste
- A disposal facility is designed to contain the waste and to isolate it from the accessible biosphere to the extent demanded by the hazard of the waste
- The emphasis in radioactive waste disposal is on the provision of long term safety through passive means
  - the radiological hazard presented by radioactive waste can extend over many generations, depending on the radionuclides involved

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Disposal options: types of disposal facilities (according IAEA)

- **Landfill disposal**
  - a facility similar to conventional landfills
  - may be designated for waste with very low quantities of radionuclides
- **Near surface disposal facility**
  - facility consisting of engineered trenches or vaults constructed on the ground surface or up to a few tens of meters below ground level
  - may be designated for low level radioactive waste
- **Caverns, vaults, tunnels or silos** at few tens or hundreds meters below ground level
  - for disposal of intermediate level waste
- **Disposal boreholes**
  - for disposal of disused sealed sources
- **Geological disposal facility**
  - at a depth of several hundred meters
  - designated for Spent Nuclear Fuel, high level waste from fuel reprocessing and other long lived waste

Disposal examples

Disposal examples: South Africa, Vaalputs

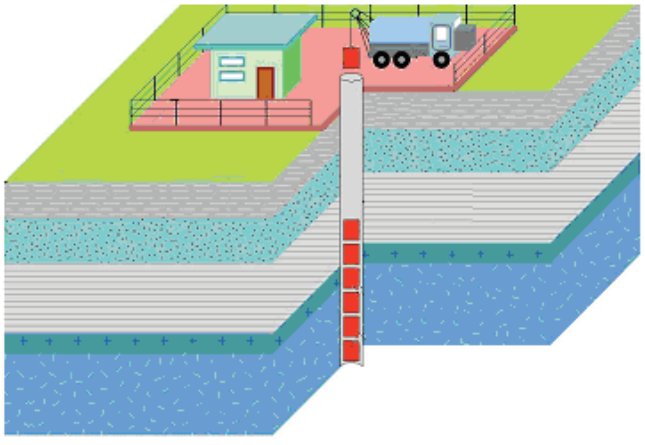
Disposal examples: Sweden

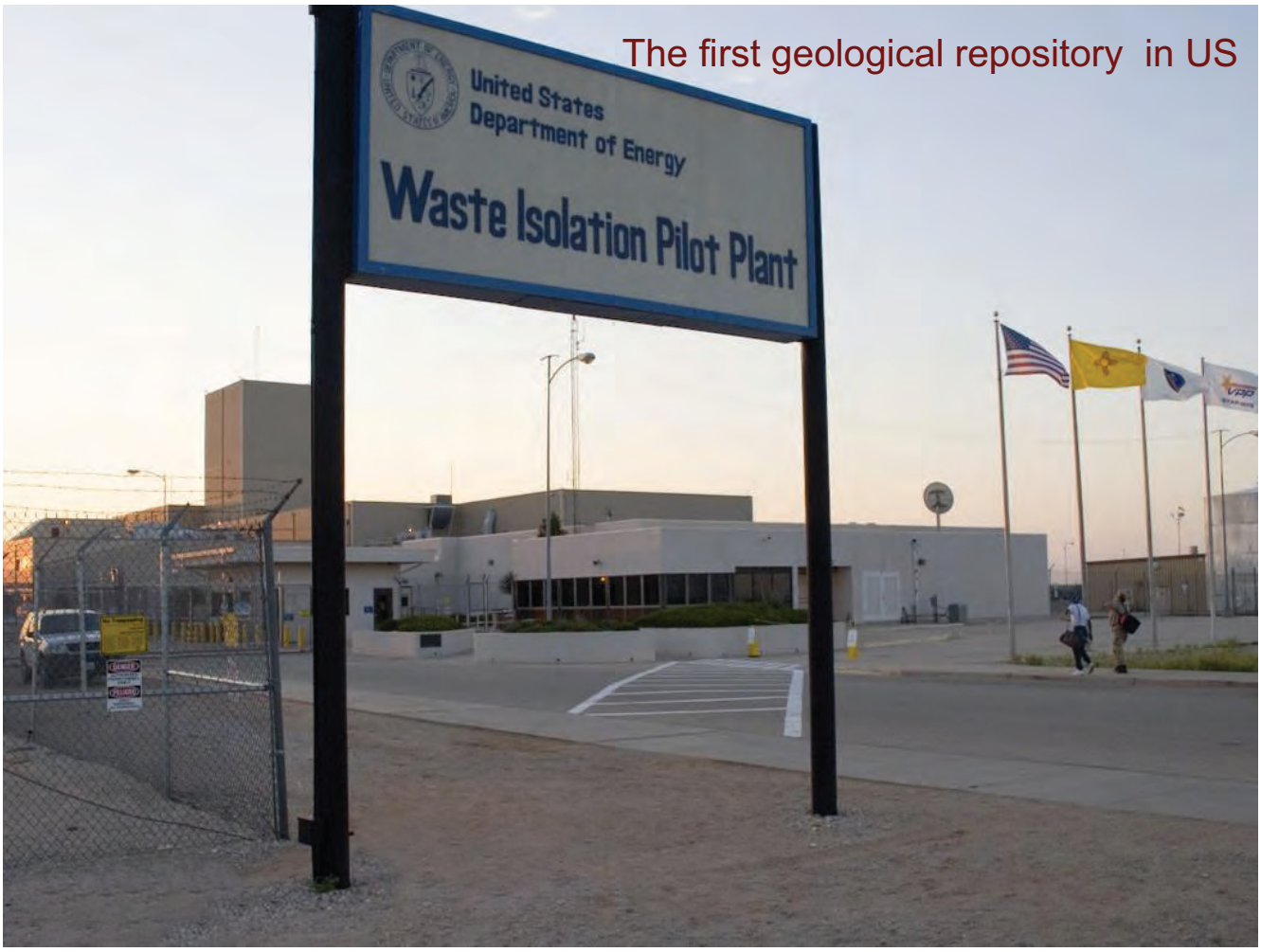
Disposal examples: Spain, El-Cabril

The concrete vaults will be covered by clay

Disposal examples: Hungary, Bataapati

Disposal examples: borehole disposal concept (IAEA&S. Africa)





The first geological repository in US

Disposal options: Entombment (on-site disposal)

- Entombment of a reactor can significantly reduce workers exposure and cost
- Entombment option has been considered by the IAEA /On-site disposal as a decommissioning strategy, IAEA-TECDOC-1124, 1999/
- Implemented in USA

Entombment concept

- Multibarrier engineered system similar to a Near Surface Repository with concrete vaults
- Two materials demonstrating excellent long- term performance should be use for robust engineered barriers:
  - good quality concrete
  - properly selected clay
- Longevity of such type repository: about 300 y

Entombment: potential challenges and obstacles

- Complexity of waste characterization& measurements
- Presence of long lived- radionuclides in the inventory
- Complicated quality assurance
- Questionable suitability of the site
- Lack of international experience
- Complexity to justify safety & Safety Case
- Negative public opinion

Implementation of 4.2. Strategic concept of waste disposal in Estonia

- The disposal facility should accommodate the following wastes:
  - available legacy waste (institutional and from the reactors operation)
  - reactor decommissioning waste
  - potential waste from operation and decommissioning of the future NPP
- The most optimal disposal options will be proposed taking into consideration economic, technical and safety factors
- The selection depends on:
  - waste amount and characteristics, especially content of long-lived radionuclides
  - environmental conditions (geological, hydro-geological, hydrological and other)
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Strategic waste disposal concept

- Selection of the concept is first of all defined by the Energy development strategy
- Option 1: the NPP is not constructed
- single repository could be preferred
- Option 2: the NPP will be constructed
  - three different repositories for different wastes would be recommended
  - Geological repository would be necessary for disposal of Long-Lived Wastes!
    - even if the Spent Fuel will be reprocessed abroad

4.3 Mapping of suitable areas

Disposal facilities sitting:

- Consideration of Pakri Peninsula suitability for waste disposal
- Overview of Estonian geology in connection with suitability for construction of geological repository
- Possible locations will be pre-selected for future EIA

Consideration of Pakri Peninsula

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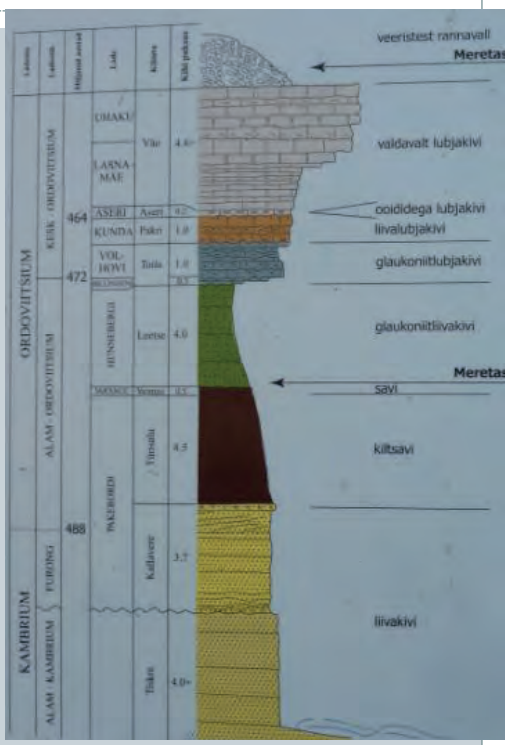
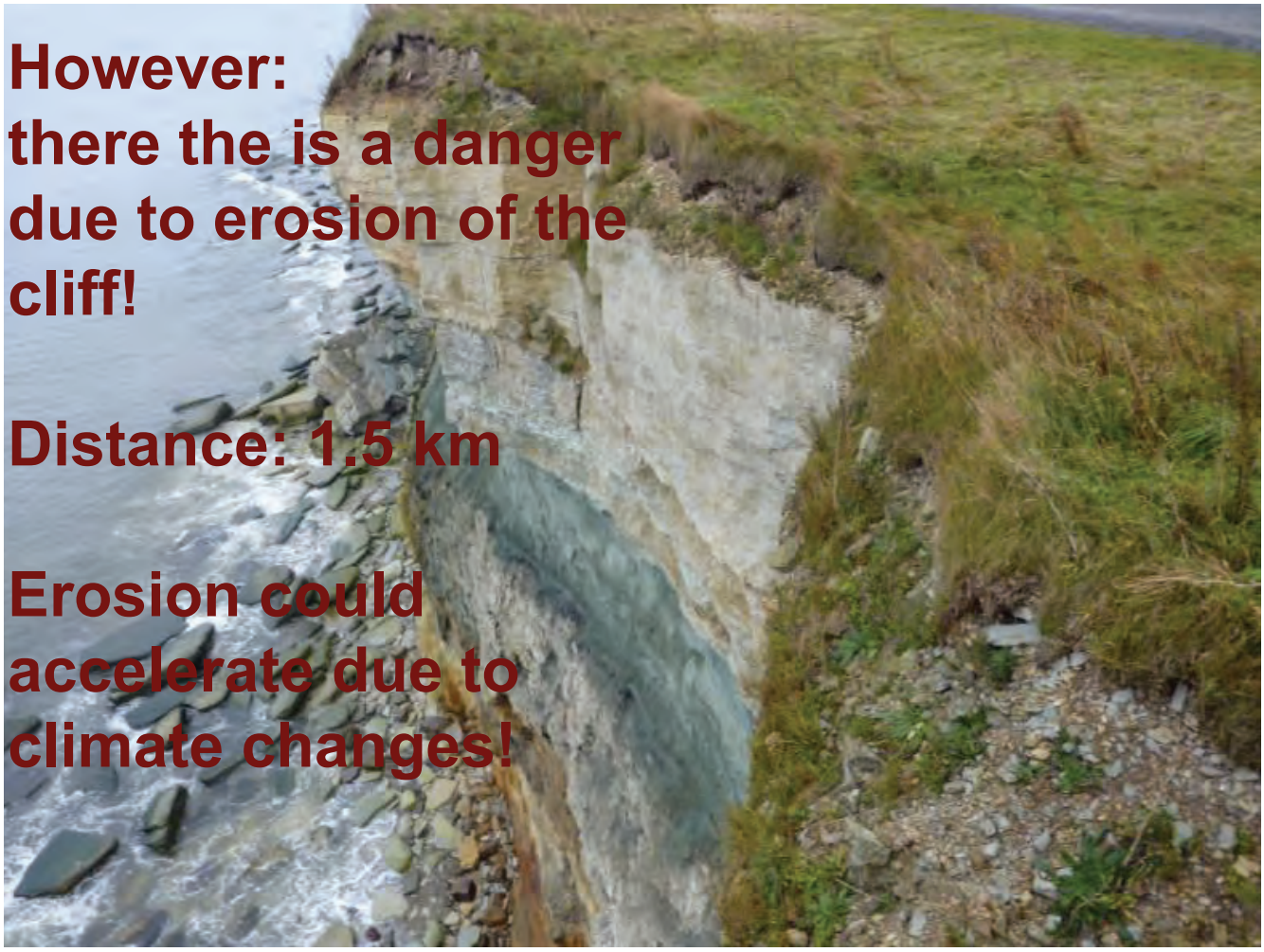
Favorable geological conditions:

- Good soil mechanical properties
  - Stable, stiff rocks
- No risk of flooding / good water drainage
  - Good surface water run-of
  - Short distance (1.5 km) to the sea
- Simple geology
  - reliable radionuclide migration modeling and safety assessment





Possible challenges and required Client's inputs

- Not clearly defined nuclear energy policy:
  - Will be the Spent Nuclear fuel reprocessed?
  - What will be done with secondary waste from the Spent Nuclear Fuel reprocessing?
    - According to an usual practice the secondary waste from reprocessing of Spent Nuclear Fuel is returned to the counties of origin!
- Incompleteness of waste characterization:
  - Lack of long- lived radionuclides in the inventory
    - No data for C-14 and some other relevant nuclides
- A need for additional site characterization


THANK YOU VERY MUCH!