CONSTRUCTION OF THE VLLW REPOSITORY AT THE MOCHOVCE SITE

Vienna
November 25 - 28, 2013

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Introduction

- JAVYS, the owner and operator of NRR at Mochovce, is preparing repository enlargement.
- The current capacity of the NRR was calculated to be sufficient for the expected volume of waste resulting from decommissioning the Bohunice A-1 NPP and all operational LLW routinely produced in Bohunice and Mochovce NPPs until approx. 2020.
- Effort to optimize waste management and disposal by distinguishing between LLW with lower activity called VLLW and LLW with higher activity content.
  - It is expected considerable reduction of the total volume required repository capacity, economical efficiency.
- The last IAEA and NRA SR waste classification (decree 30/2012 Coll.) introduced VLLW class into waste classification scheme.
- Decommissioning of the Bohunice A1 and V1 NPPs require additional disposal capacity.
# NPPs in the Slovak Republic

<table>
<thead>
<tr>
<th>NPP</th>
<th>Power MW(e)</th>
<th>Type</th>
<th>Current Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bohunice A-1 NPP</td>
<td>150</td>
<td>HWGCR</td>
<td>Decommissioning</td>
</tr>
<tr>
<td>Bohunice V-1 NPP (V-1 NPP)</td>
<td>2X440</td>
<td>WWER 400/230</td>
<td>Decommissioning</td>
</tr>
<tr>
<td>Bohunice V-2 NPP (V-2 NPP)</td>
<td>2X440</td>
<td>WWER 400/213</td>
<td>Operation until 2020s</td>
</tr>
<tr>
<td>Mochovce -1,2 NPP (EMO12 NPP)</td>
<td>2X440</td>
<td>WWER 400/213</td>
<td>Operation until 2040s</td>
</tr>
<tr>
<td>Mochovce -3,4 NPP (EMO34 NPP)</td>
<td>2X440</td>
<td>WWER 400/213</td>
<td>Under construction</td>
</tr>
</tbody>
</table>
Required capacity

- the required capacity for disposal of RAW from the operation and decommissioning of A-1, V-1, V-2, EMO12, MO34 NPPs, plus an insignificant amount of institutional RAW is: 68 000 m³ for VLLW and 50 000 m³ (7.5 double-rows) for LLW

- According to the “Feasibility Study of Enlargement of the NRR Mochovce” prepared in 2007-2009 within the project BIDSF C9.1 as the optimal for implementation of a VLLW repository is Mochovce site where a LLW disposal repository is already located
Current situation

• commissioned in September 2001
• NRR covers 11,2 ha out of which currently only 20% are used
• site includes:
  - repository structure
  - operational building
  - a security fence
  - access and interplant roads
  - system of internal open retaining ditches, rainfall water basins
Process of NRR completion

- consists of the construction of new structures (double rows) like the ones existing for LLW and of a new installation specifically designed for the disposal of the VLLW
  - new double rows of vaults for LLW will be constructed next to the existing parts of the vaults
  - part of the area foreseen to host the VLLW modules is being used for a field test to study the characteristics of the planned covering layers for the LLW repository
Process of completion of the disposal structures of the NRR

- Termination of the operation of 1\textsuperscript{st} double row
- Commissioning of the 2\textsuperscript{nd} double row
- Building the 3\textsuperscript{rd} and other double rows
- Start of disposal of VLLW
- To terminate the operation of the cover model
- To continue disposal of VLLW
LLW disposal facility concept

- technical solution of the LLW facility is based on the multi-barrier approach
- system of barriers preventing uncontrolled release of radionuclides consists of waste form, FCC, reinforced concrete construction of vaults, clay bath, drains and cap
- current repository consists of two double-rows of concrete vaults, there are 20 vaults in one row
- inner space of every vault provides space for disposal of 90 containers
- the first double-row is covered by a steel structure
- 7200 of FCC with total volume of 22 320m³ can fit into existing double-rows (80 vaults).
- first double-row is in operation (90% filled), after its filling the operation of the second double row will start (2014)
**VLLW repository**

<table>
<thead>
<tr>
<th>Phase</th>
<th>1&lt;sup&gt;st&lt;/sup&gt;</th>
<th>2&lt;sup&gt;nd&lt;/sup&gt;</th>
<th>3&lt;sup&gt;rd&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>VLLW</td>
<td>20 000 m³</td>
<td>9 000 m³ + auxiliary building</td>
<td>39 000 m³</td>
</tr>
<tr>
<td>Operation</td>
<td>2016 – 2017</td>
<td>2018 -</td>
<td>2026 -</td>
</tr>
</tbody>
</table>

- **Auxiliary building provides:**
  - space for repacking of waste form in case its damage,
  - parking place for machineries and manipulation tools,
  - decontamination node,
  - registration of VLLW,
  - other activities according to requirements of legislation and authorities
  - is designed as a steel hall: w=18 m, L=30.8 m, h=8 m
VLLW facility disposal concept

- design corresponds - engineered landfill type disposal model
- design of the engineered barriers is based on the technical requirements of the current European and Slovak regulations for the final disposal of hazardous waste
Disposal space will contain several protection layers above and below the waste - cap protective layers - bottom protective layers
Water Control System

- **Infiltration water control**: two collection systems control the potential infiltration of water through the waste. Water is piped by gravity to a Final control tank.

- **Subsoil water control**: will be implemented to prevent lifting pressures from the bottom, due to water surges or possible increase of the groundwater table.

- **Rainfall water control**: in order to keep rainfall water away from the disposed waste, circumferential ditches are recommended around the disposal modul. They will work in open air during exploitation. When the upper protection layers are executed, those ditches will act as drains.
Mobile shelter

- will cover each line of operation in order to minimize the rainwater infiltration, length 117 m, width 25 m
- Once the lane is filled, after reaching of expected heights 6.7 m, the disposal lane shall be protected with a layer of HDPE and earth layer, light shelter will be dismantled and moved to the next lane
Documentation

- basic documentation for issuing approval for building and operation: EIA, General data in accordance with Article 37 of the Euratom Treaty and Safety assessment report were prepared
- Activity limits were determined
  - Scenarios analysed:
  - Normal operation – handling with a packed form, closing of the exploitation lane.
  - Operational events caused by internal factors (fall of packaged form affecting the person of the population and worker).
  - Operational events caused by external factors (fire, extreme precipitation).
  - Human intrusion - residence, road construction and a core drilling
Large volumes of radioactive waste

- Sources of LV of RW at the Bohunice site are associated with accidentally shut down NPP A1 in 1976 and following natural and radiological events
  - contaminated soil temporarily stored at the site (large amounts have been gathered during remediation activities in 1998-2008)
  - contaminated soil around underground tanks
- Significant volume is construction and concrete debris, concrete blocs
Management

• is very important to have suitable techniques for whole volume monitoring to reliably sort waste and determine waste for free release, VLLW and LLW disposal of

• WM begins with separation of loose waste to fractions under or over 20 mm, relocation of large concrete blocks to the work place for management with concrete

• the first separation is performed by sieving of sorting spoon of handling device

• dimensionally separated waste is measured on spoon monitor (primary separation of waste directly in operation)

• for final separation waste is measured at the workplace for soil or concrete separation
SOIL SORTING SYSTEM BASED ON A BELT CONVEYOR MONITOR

- The device is intended for soil sorting according to the specific activity of $^{137}$Cs in three classes:
  - up to 300 Bq/kg - to the environment,
  - from 300 to 10,000 Bq/kg - to repository of VLLW,
  - over 10,000 Bq/kg - to the processing as radioactive waste
Treatment of contaminated concrete

• The workplace consists two basic technological activities with the aim to release concrete into the environment:
  • Sorting of debris of contaminated concrete on a vibrating conveyer,
  • Decontamination of concrete blocks using dry methods (milling, slotting, etc.)
• Expected volume of VLLW from decommissioning of A-1 NPP is 20 000 m$^3$ and 8 000 m$^3$ from V-1
• Big bags, metal barrels or metal containers are considered as possible packing
• about 2500 big bags is prepared for disposal