V1 NPP DECOMMISSIONING PROGRESS IN 2017 - 2019
Bohunice Programme

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Eastern and Central European Decommissioning
Trnava, 25 June 2019
**Basic Information about V1 NPP**

**Reactor Type:** 2 x WWER 440-V230

**Thermal Output:** 1375 MWₜ

**Fuel:** UO₂ (1.8 / 2.4 / 3.6 % U-235) (modified 3.82 % U-235)

**Moderator and Coolant:** H₂O

**Number of Loops:** 6

**Operation Licence Decommissioning Licence**

**Operation Termination**
- Spent Nuclear Fuel aftercooling and transport to ISFS
- Preparation for decommissioning
- NPP modifications
- Decommissioning licensing
- Monitoring

**Stage 1**
- Dismantling of non-active systems
  - Dismantling of non-active equipment
  - Demolition of non-active buildings
  - Monitoring systems
  - F&D equipment
  - Monitoring
  - Treatment of historical RAW (except for RH waste storage)

**Stage 2**
- Dismantling of active systems
  - Dismantling of contaminated and activated equipment
  - Demolition of buildings
  - RAW management
  - Free release of materials
  - Monitoring
  - Emptying and dismantling of RH waste storage

**Government Resolution No. 801/1999 on premature shutdown of both V1 NPP**

- Start of construction: 1972
- Unit 1 startup: 1978
- Unit 2 startup: 1980
- Minor reconstruction: 1992
- Gradual reconstruction: 1996
- Reconstruction complete: 1999
- Unit 1 shutdown: 2000
- Unit 2 shutdown: 2006
- 1 Stage - Decommissioning: 2008
- 2 Stage - Decommissioning: 2011
- Brown-field: 2015
- NOW: 2025
V1 NPP DECOMMISSIONING PROJECT STATUS

Number of projects

<table>
<thead>
<tr>
<th>Completed</th>
<th>Under implementation</th>
<th>Under procurement</th>
<th>Before granting</th>
</tr>
</thead>
<tbody>
<tr>
<td>December 2017</td>
<td>53</td>
<td>14</td>
<td>1</td>
</tr>
<tr>
<td>December 2018</td>
<td>59</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>June 2019</td>
<td>60</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Year</td>
<td>Project</td>
<td></td>
<td></td>
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<tr>
<td>------</td>
<td>-------------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td>C8</td>
<td>Interim Storage of RAW at Bohunice Site</td>
<td></td>
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<tr>
<td></td>
<td>D2–A</td>
<td>Decontamination of the Primary Circuit - II Stage</td>
<td></td>
</tr>
<tr>
<td>2018</td>
<td>A5–A3</td>
<td>Optimisation of Electric Scheme</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C15–A</td>
<td>Integrated Computer System for V1 NPP Decommissioning Logistic System</td>
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<tr>
<td></td>
<td>D2.1</td>
<td>Decontamination of Spent Fuel Pools and Other Contaminated Tanks – Part 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D3.1B</td>
<td>Dismantling and Demolition of V1 NPP Cooling Towers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D4.4A</td>
<td>Auxiliary Buildings System Removal – Stage 1</td>
<td></td>
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<tr>
<td></td>
<td>D19.1</td>
<td>Upgrade of the PMU hardware equipment</td>
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<tr>
<td>2019</td>
<td>C9.4</td>
<td>Design and Erection of New Disposal Facilities for LLW and VLLW from V1 NPP Decommissioning at NRR Mochovce</td>
<td></td>
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</table>
C8 INTERIM STORAGE OF RAW AT BOHUNICE SITE

**PROJECT SCOPE:**
- Erection of a new interim storage of radioactive waste at Bohunice site for solid RAW coming from A1 and V1 decommissioning – i.e. waste that can be released into the environment (decay function), RAW intended for further processing that can be disposed in the Mochovce NRR (buffer function) and wastes that require safe long-term storage (storage function). Its design life is 70 years.

The facility consists of two modular storage halls and a technical equipment annex building. Technological equipment enables storage and handling of RAW in approved package forms (FCC, CASTOR, ISO, 2EM-01, MEVA).
D2/D2-A DECONTAMINATION OF THE PRIMARY CIRCUIT

**PROJECT SCOPE:**
Pre-dismantling chemical decontamination of primary circuits of both V1 NPP units using the DfD decontamination facility in order to:

- **remove contamination** from the primary circuit components;
- **reduce the dose rates levels** around piping and equipment to minimize the potential for spreading contamination during following decommissioning activities;
- reduce the contamination of components to such levels that they may be disposed of at a lower waste disposal category.

2017
COMPLETED PROJECTS - HIGHLIGHTS

D2/D2-A DECONTAMINATION OF THE PRIMARY CIRCUIT

### Activity removed after decontamination of Unit 2

<table>
<thead>
<tr>
<th>LOOPS</th>
<th>Removed activity from loops</th>
<th>Removed activity from SGs</th>
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</thead>
<tbody>
<tr>
<td>1 &amp; 4</td>
<td>99.3 %</td>
<td>98.2 %</td>
</tr>
<tr>
<td>3 &amp; 6</td>
<td>99.4 %</td>
<td>93.5 %</td>
</tr>
<tr>
<td>2 &amp; 5</td>
<td>98.2 %</td>
<td>91.8 %</td>
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</table>

### Activity removed after decontamination of Unit 1

<table>
<thead>
<tr>
<th>LOOPS</th>
<th>Removed activity from loops</th>
<th>Removed activity from SGs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 &amp; 4</td>
<td>98.6 %</td>
<td>99.2 %</td>
</tr>
<tr>
<td>3 &amp; 6</td>
<td>94.7 %</td>
<td>87.3 %</td>
</tr>
<tr>
<td>2 &amp; 5</td>
<td>91.5 %</td>
<td>95.3 %</td>
</tr>
</tbody>
</table>

**Activity removed in loops ranges from 91.5 % to 99.4 %**

**Activity removed from SGs ranges from 87.3 % to 99.2 %**

**Reduction of workers’ dose rates**
**D2.1 DECONTAMINATION OF SPENT FUEL POOLS AND OTHER CONTAMINATED TANKS (P1)**

**Project Scope:**

- Remove the loose surface contamination of internal surfaces of the tanks, storage pool and universal pit to reduce the risk of spreading radioactive contamination of workplaces, working environment and workers during decommissioning as well as was to prepare the technologies for further dismantling and disposal to be implemented in other projects.

- Remove sludge, sediments, etc. of the tanks, storage pool and universal pit.
D3.1B DISMANTLING AND DEMOLITION OF V1 NPP COOLING TOWERS

**Project Scope:**
- Demolition of the V1 NPP cooling towers (CT) and connecting channels;
- Dismantling of all equipment installed in buildings and surroundings;
- Backfilling, surface grading and grassing, waste disposal, etc.

The demolition attracted widespread attention of the public since it was a visible demonstration of the site's progress towards its clean up.

**Parameters:**
- Height of towers: 120 m
- Base diameter: 84.4 m
- Diameter in the highest part: 53 m
- Thickness of reinforced concrete: 15 - 60 cm
- Depth of the pool: -5m
- Asbestos: 4,800 tons (all 4 towers)
- Volume of concrete debris per tower: 20,500 m³
- Pool capacity: 26,400 m³
- Demolition duration: 02/10/2017 – 01/10/2018
- Demolition of 1 tower: approx. 3 months

**Before Dismantling (2017)**  **Tower Crane**  **“Fly Demolition System”**  **All Cooling Towers demolished**
D4.4A AUXILIARY BUILDINGS SYSTEM REMOVAL – STAGE 1

**Project Scope:**

- Dismantling and removal of technological equipment within the Controlled area of V1 NPP;
- Modification of emptied spaces for the purpose of handling and temporary storage of very low-level radioactive waste originated from V1 NPP decommissioning;
- The subject of dismantling and modification were: Annex of Auxiliary Building (CB 801a:V1) Cementation Facility Building (CB C809:V1).

**2018**

- Dismantling of Equipment (Cementation Facility)
- Dismantling of Silos (Cementation Facility)
- Application of Decon-Gel
- Fragmentation of the Tank
C9.4 DESIGN AND ERECTION OF NEW DISPOSAL FACILITIES FOR LLW AND VLLW FROM V1 NPP DECOMMISSIONING AT NRR MOCHOVCE

**Project Scope:**

- Erection of facility for disposal of Low Level Waste (LLW) originated from V1 NPP decommissioning based on the existing disposal system (double-rows of reinforced concrete vaults) at NRR Mochovce – commissioned in 12/2017;
- Erection of facility for disposal of Very Low Level Waste (VLLW) originated from V1 NPP decommissioning based on a multi-barrier shallow landfill concept preventing radionuclides from migrating into the environment – commissioned in 04/2019.
PROJECTS UNDER IMPLEMENTATION - HIGHLIGHTS

C7-A4  Metallic RAW Melting Facility
D4.1  Modification of the Plant and Installation of New Equipment

D4.4B  Dismantling of Systems in V1 NPP Controlled Area – Part 1

D4.2  Dismantling of Reactor Coolant System Large Components

Projects Timeline

- **2016**
  - Sept/2016: C7-A4

- **2017**
  - Feb/2017: D4.1
  - Sept/2017: D4.4B
  - Oct/2017: D4.2
  - Sept/2017: C7-A4

- **2018**
  - Feb/2020: D4.1
  - March/2021: D4.2

- **2019**
  - Feb/2020: D4.4B

- **2020**
  - March/2021: D4.2

- **2021**
  - Dec/2022: D4.2

- **2022**
  - Dec/2022: D4.2
V1 NPP DECOMMISSIONING

PROJECTS UNDER IMPLEMENTATION - HIGHLIGHTS

C7-A4 METALLIC RAW MELTING FACILITY

**Project Scope:**
- Provision of a workplace including facilities at Bohunice site for melting of metallic material coming from A1 NPP and V1 NPP decommissioning, which will complete the existing complex of technologies for treatment and conditioning of radioactive waste by RAW handling method. The melting facility will be located in the former A1 NPP turbine hall;
- To enable release of a considerable quantity of metal waste. For ingots exceeding limits for releasing, to achieve material decontamination and the minimization of the RAW volume, thus saving capacity of the RAW repository in Mochovce.

**Completion:**
2020
PROJECTS UNDER IMPLEMENTATION - HIGHLIGHTS

D4.1 MODIFICATION OF THE PLANT AND INSTALLATION OF NEW EQUIPMENT

**Project Scope:**
- Prepare reactor building, auxiliary building and other civil buildings or external areas for *dismantling of systems and equipment* and its consequent *decontamination and demolition*. These modifications will reduce the time demandingness of later implemented decommissioning works, minimize collective doses and increase the capacity of transport routes.

**Sub-projects in progress:**
- "Modification of cooled and demineralized water supply system for Interim Spent Fuel Storage (ISFS);
- "Modification of contaminated waters drainage from ISFS”;
- “Construction of the ISFS pumping station and installation of pipeline routes for pumping of regen./decont. solutions in ISFS.”

**Completion:**
- 2020
D4.4B DISMANTLING OF SYSTEMS IN V1 NPP CONTROLLED AREA – PART 1

**PROJECT SCOPE:**

- Pre-dismantling decontamination, dismantling and fragmentation, sorting and packaging, handling and transportation of components and systems located in the controlled area (outside the hermetic zone boundaries) that are *not essential* for further activities of V1 NPP Decommissioning.
- Works related to this project are mainly performed in: V1 NPP Reactor building (800:V1); V1 NPP Auxiliary building (801:V1).

**COMPLETION:**

2021
PROJECTS UNDER IMPLEMENTATION - HIGHLIGHTS

D4.2 DISMANTLING OF REACTOR COOLANT SYSTEM LARGE COMPONENTS

**Project Scope:**

- Dismantling of large components of the V1 NPP Nuclear Steam Supply System (Steam Generators, Reactor Pressure Vessels, etc.);
- Fragmentation of shielding assemblies (72 pcs.);
- Emptying of the contents of the remote-handled waste storage and its dismantling, etc.

Currently, it is the most important project with regard to scope of works, project duration and labour involved (200 workers per day).

After completion of the project, 99.9% of RA-activity will be removed from the V1 NPP site.
D4.2 DISMANTLING OF REACTOR COOLANT SYSTEM LARGE COMPONENTS

**Current Progress:**

- Dismantling of Reactor Shaft Protection Lids;
- Dismantling of Steam Generators and their transport to the former turbine hall;
- Removal and fragmentation of Emergency and Control Rod Drives;
- Dismantling of Thermal Insulation of Reactor Pressure Vessel, Unit I;
- Preparatory works for construction of a pool as part of Wet Cutting Workshop;
- Dismantling of Main Circulation Pumps;
- Preparatory works for dismantling of Bubble Tank and Pressurizer;
- Establishment of Dry Cutting Workplace in the former Turbine Hall;
- Dismantling of ionization chambers for neutron flux monitoring; etc.
THANK YOU FOR YOUR ATTENTION!