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

Relevant Experience

UAB “Eksortus”
UAB “Specialus montażas – NTP”


Objective:
Development and comparison the alternative solutions for the management of the Large Components of Primary Circuits of the two Units of V1 NPP to allow their dismantling and subsequent waste management

Components to dismantle:
Reactor pressure vessels, reactor internal structures, main circulation pipelines, steam generators, main circulation pumps, main gate valves, pressurizer, pressurizer tank, annular water tank, Mogilink (storage facility in the reactor hall), reactor shaft protection lid, shielding assemblies

Scope of services:
1) Development and screening of alternatives for dismantling
2) Detailed analysis and selection of best alternative for dismantling
3) Elaboration of the pre-operational Safety Analysis Report upgrade proposal for concerned nuclear installations (National Radwaste Repository Mochovce and Radwaste Treatment Centre Bohunice) for the selected alternatives

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Transport and handling operations for removal of Steam Generator to transport corridor

Fragmentation of Steam Generator on 68 pieces

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Objective:
Design and construction of a new Landfill Disposal Facility
for short-lived very low level radwaste arising from INPP decommissioning

Scope of work:
- Engineering and geological studies on the Landfill site
- Technical design and detailed design for the Landfill and Buffer Storage
- Environmental impact assessment
- Nuclear safety analysis
- Buffer Storage construction and commissioning

Functions of the facility:
- Reception of treated conditioned very low level waste
- Characterization, labeling and keeping characterization records of waste packages
- Transfer and receipt of data from INPP local network and Decommissioning Management System and Database
- Interim storage of waste packages in the Buffer Storage
- Transfer of waste packages and final disposal of waste in Landfill Disposal Units

Future Landfill Facility
On the example of Landfill facility at OSKARSHAMN NPP territory, Sweden
Near-surface Repository for Low- and Intermediate Level Short-lived Radioactive Waste  

Objective: Design of new Near Surface Repository (NSR) and associated facilities in order to secure safe decommissioning of Ignalina Nuclear Power Plant

- Hill-type repository which contains up to 50 cells designed for final disposal of 100 000 m$^3$ of radioactive waste conditioned in concrete containers and immobilised in a cemented matrix.
- The repository and auxiliary structures will occupy an area of about 40 ha.
- The radioactive waste will be disposed in the NSR till 2030 until the INPP is fully dismantled.
- Having accepted the radioactive waste, the NSR will be sealed and its surface covered by corrosion resistant multilayer protective engineering barriers.
- After closure, NSR surveillance will be carried out for at least 300 years. NSR active surveillance during the first 100 years will ensure its physical protection, perform the necessary works on repository servicing and monitoring, store the documentation and, if needed, perform corrective measures. The organisation operating the repository – Radioactive Waste Management Agency (RATA).
- During the passive surveillance period (at least 200 years), the land utilisation on the repository site will be limited. If needed, the protective barriers will be topped up and the surveillance time might be extended.

Evaluation of the Radiological Inventory of KNPP Units 1-4  
(2012 – 2014), Client Kozloduy NPP

Objective: The VVER-440 Units 1-4 of the Kozloduy Nuclear Power Plant were stopped for decommissioning. The objective of this project is the evaluation of the radiological status of the buildings, systems and equipment of Units 1-4. The evaluation made by the Consultant will be used for the design of the dismantling process and the management of the waste streams generated.

The Consultant used a combination of measured data and historical operating data both provided by KNPP. Where measured data is missing, estimated data were obtained using accredited software provided by the Consultant.

Scope of work:

Services consist of four sections as follows:

Section 1: Evaluation of the induced activity for Units 1 to 4;
Section 2: Calculation of the radioactive contamination for Units 1 to 4, including Steam Generators;
Section 3: Radiological investigation for Units 3&4;
Section 4: Radiological characterization of RAW back-log from Units 1-4.
Design, Manufacturing and Supply of Equipment for Unit 1 Nuclear Fuel Transfer and Reuse at Unit 2 of Ignalina NPP (2003 – 2006), Client: Ignalina NPP

Objective:
After the shut-down of Ignalina NPP Unit 1 in 2004, approximately 1000 fuel assemblies from Unit 1 were re-used in Unit 2 reactor. During the project implementation a unique technology and set of equipment for nuclear fuel transportation and reuse at INPP were developed.

**Design**
- Technical and detailed design of modifications and technological systems
- Technical and detailed design of equipment installation.

**Equipment manufactured**
- transporter
- transport container
- mobile biological shield
- guide shielding shafts
- grabs

**Safety justification**
- Description of technological process,
- Analysis of failures and accidents,
- Safety justification during unloading of spent fuel assemblies
- Safety assessment of fuel combustion in Unit 2 reactor

TRANSPORTATION OF NUCLEAR FUEL BY THE ON-SITE TRANSPORTER FROM UNIT 1 TO UNIT 2

POSITIONING OF THE CONTAINER IN VERTICAL POSITION

INSTALLATION OF THE SHOCK ABSORBER INSIDE CONTAINER

2013 – 2015. Assistance to ministries and organizations responsible for radioactive waste management in Ukraine

2013 – 2015. Support the Bulgarian agency for radioactive waste management (SERAW) in the frame of the Dismantling program of the Kozloduy Nuclear Power Plant


2007 – 2008. Design and supply of fuel element cladding leak-tightness inspection system for spent nuclear fuel assemblies in hot cells of Ignalina NPP after extended storage

THANK YOU FOR ATTENTION!
Ignalina NPP short overview

Ignalina Nuclear Power Plant was an important part of Lithuania’s Energy Sector since 1983 (Unit 1 – 1983, Unit 2 – 1987, design lifetime was projected out to 2013 and 2017 respectively)

As a result of the political dialogue leading up to EU enlargement, Lithuania agreed to the early decommissioning of its reactors

- Unit 1 shutdown – 2004 (~ 9 years lost operation benefit)
- Unit 2 shutdown - 2009 (~ 7.5 years lost operation benefit)

Construction and assembling:
- INPP gained and kept unique site-specific experience with regard to RBMK-1500 assembling (only two reactors in European Union countries)

Operation:
- INPP fulfilled operational safety requirements
- INPP gained relevant experience to manage Spent Fuels and operational radwaste safely and efficiently
- INPP experienced in the field of safety assessments and maintenance development
Ignalina NPP decommissioning

Decommissioning works at Ignalina NPP was divided into the separate D&D Engineering projects according to the NPP Buildings:

- Project B9-0 “Ignalina NPP Building 117/1 Decontamination and Dismantling Project Development”.
- Project B9-2 “Ignalina NPP Building V1 equipment Decontamination and Dismantling Design Development”.

The objective of these Projects was the development of an optimal dismantling and decontamination strategy, basic and detail design with safety justification and environmental impact assessment reports.
Project B9-0 “Ignalina NPP Building 117/1
Decontamination and Dismantling Project Development

The main systems in building 117/1 (Project B9-0):
- The Emergency Core Cooling System (ECCS) components (e.g. sixteen ECCS Pressure vessels, 14 m height and 47650 kg mass each),
- Helium Facility (part of Reactor Gas Circuit).

For the ECCS dismantling special work flow charts was developed:
After Project B9-0 completion about **1000 tons** of equipment were decontaminated and dismantled in INPP Building 117/1, the main part of it are Emergency Core Cooling System pressurized tanks and pipelines.
Project B9-2 “Ignalina NPP Building V1 equipment Decontamination and Dismantling Design Development”.

The main systems in building V1 (Project B9-2):
- reactor gas circuit,
- exhaust gas cleaning system,
- system of maintenance cooling tanks (part of Main Circulation Circuit),
- different components of ventilation systems,
- part of emergency core cooling system.

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

For the current project two different work approaches was adopted. All D&D works were divided in two phases. During phase one - room by room approach was used and in the phase two – system by system basis was adopted.
Scope of B9-0 and B9-2 Projects

B9-0 and B9-2 scope includes:

- **Strategy** development
- **Basic Design** (incl. radioactive waste classification and characterisation),
- **Detailed Design** suitable for implementation of D&D works,
- **Safety Justification Report** (including radioactive waste management and radiological protection issues, analysis of possible accidents caused by drop of heavy items, etc.),
- **Environmental Impact Assessment**,
- **General Data Set** for the anticipated radioactive waste for Euratom Article 37 submissions,
- **Knowledge transfer** and **training** sessions providing Support to Ignalina NPP personnel.

Stress distribution in the ECCS vessel support in case of mishandling of load during D&D operations (B9-0)

Developed safety justification report also includes dose maps for working rooms and calculation of dose rates for each D&D activity.
**Scope of B9-0 and B9-2 Projects**

Quantities of D&D Wastes and necessary packages, according different nuclide vectors, was calculated as well.

### Multi-Criteria Optioneering (MCO)
- Applied for identification of the Best-fitted D&D Strategy
- For the analysis and evaluation of the identified D&D alternatives, special methodology - **Hazards and Operability Assessment (HAZOP)** study was applied.
Thank You for the attention