Transition from operation to decommissioning of NPP units in the Russian Federation on the example of units 1 and 2 Leningrad NPP

D.V. Adamovich, S.V. Tretyakov

ROSENERGOATOM, JOIN-STOCK COMPANY, 25 Ferganskaya Street, 109507, Moscow, Russian Federation

adamovich-dv@rosenergoatom.ru, tretyakov-sv@rosenergoatom.ru

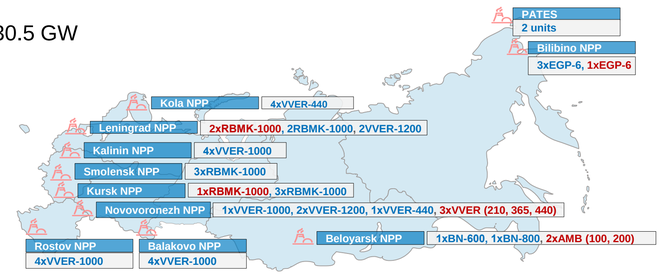
INDICO#101

1. Introduction

About ROSENERGOATOM

- In operation - 11 NPPs (**37 power units**), 30.5 GW
- Over 20% of all power generated in Russia

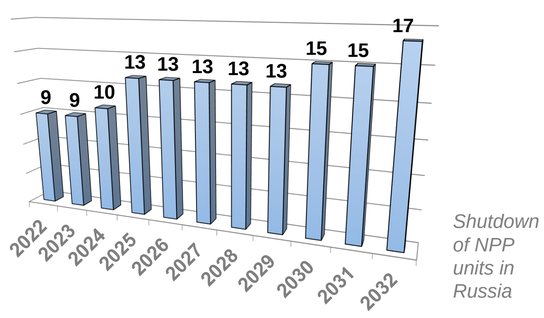
ROSENERGOATOM is one of the largest electric power generation companies in RUSSIA, and **RUSSIA'S NUCLEAR PLANT OPERATOR**



Nuclear plants and units in Russia

DECOM process in Russian Federation

- **2023** – 9 power units are shutdown for decommissioning, of which
  - 2 – at decommissioning stage (decommissioning license granted)
  - 7 – at decommissioning preparation stage
- **2032** – 17 power units are to be shut down for decommissioning
- **9 years** – preparedness for mass-scale decommissioning of NPP power units



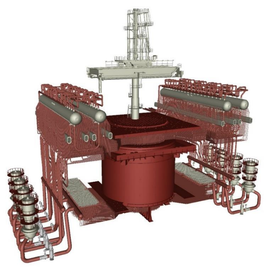
Shutdown of NPP units in Russia

About LNPP

- Start of construction – 1967
- 80 km to St. Petersburg
- 4 RBMK-1000 Units (1000 MW each)
- Total area - 454 ha
- Staff number ~ 5 500 persons
- Sosnovy Bor population ~ 70 000 people

Power unit general data

- Thermal power – 3200 MW
- TG – 2 x 500 MW
- Coolant – water
- Moderator – graphite
- Number of FAs – 1693



Unit	Startup	Design lifetime	Life extension until
1	1973	2003	2018
2	1975	2005	2020
3	1979	2009	2025
4	1981	2011	2025

2. Regulatory Framework

Main documents

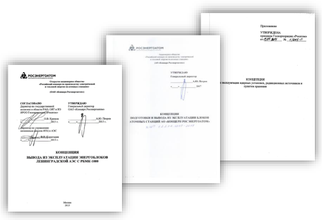
- Federal Law on the Use of Atomic Energy No. 170-FZ (∑ ~ 16 Federal laws and decrees)
- Safety Rules for Decommissioning of a Nuclear Power Plant Unit, NP-012-16 (∑ ~ 19 Codes/ Rules and Safety Guidelines)
- "Rosatom" Concept of Nuclear Facilities Decommissioning
- "Rosenergoatom" Concept of Power Units Decommissioning
- Leningrad NPP Concept of Power Units Decommissioning
- Programs of Leningrad NPP Power Units Decommissioning (individually for each Unit)

Key points following on from above regulatory documents

- RW from DECOM – disposable (including reactor graphite)
- RTN licenses regulate activities of DECOM preparation and DECOM:
  - Unit on-load operation license
  - Unit operation-without-generation license
  - Unit decommissioning license
- Unit, shut down for decommissioning until its defueling, is deemed to be in operation with all appropriate requirements retained
- DECOM completion – exclude from category "radiation-hazardous facility"
- No deferred solutions, i.e. DECOM option – "immediate dismantling"

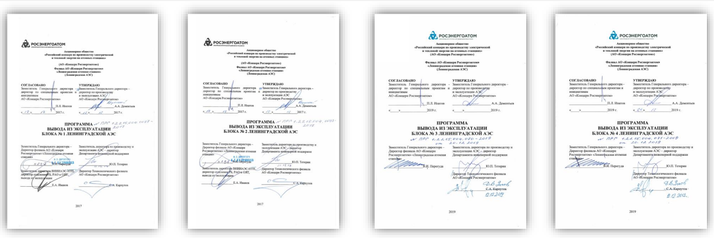
DECOM Concepts

- DECOM concept for nuclear installations, radiation sources and storage facilities. Approved by "Rosatom" in 2014
- Concept of decommissioning preparation and decommissioning of "Rosenergoatom" NPPs power units. Approved by "Rosenergoatom" in 2017.
- Concept of Leningrad NPP RBMK-1000 Units. Approved by "Rosenergoatom" in 2015.



Decommissioning programs

- Decommissioning programs were developed and updated for each power unit, individually

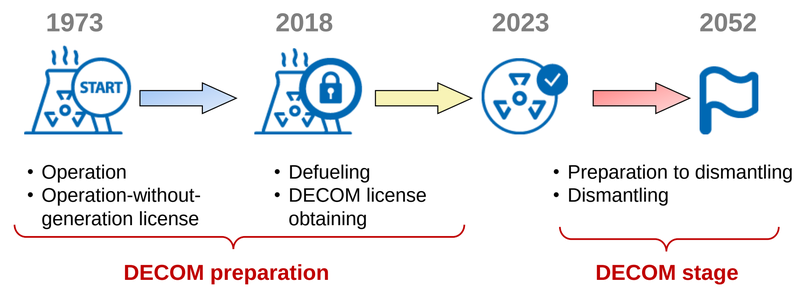


3. DECOM Preparation and DECOM Stages

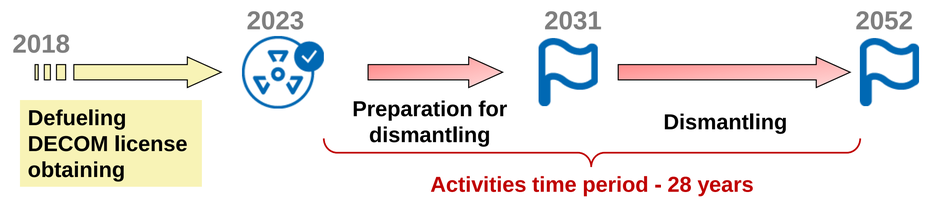
Rationale for "immediate dismantling" selection:

- Lower costs
- Higher radiation and technical safety
- Possibility for the NPP workforce retention

DECOM preparation and DECOM stages timeframes



DECOM stage timeframes



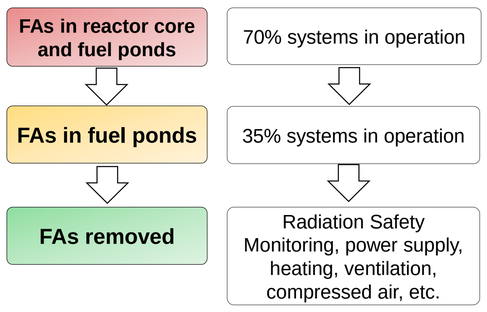
Preparation for dismantling ~ 8 years

- Dismantling of clean and low-contaminated equipment
- Rooms repurposing
- Installation of facilities for decontamination, fragmentation, data sheets arrangement, etc.

Dismantling ~ 20 years

- Dismantling of reactor equipment and reactor plant
- Decontamination/demolition of buildings and structures
- Area remediation

4. Completed Activities



The following documents have been developed for Unit 1 shut down for decommissioning
Operation configuration, SAR (including Radiation Safety and Water Chemistry), Unit Operating TechSpec

- Operation – in compliance with OpTechSpec of a power unit shut down for decommissioning
- Taking out of operation – in line with configuration and based on Decisions (technical solutions)
- **Main objective – reduction of DECOM preparation stage time**

Integrated Engineering & Radiological Survey (IERS) of Unit 1

14 developed individual IERS programs were used to carry out

- inventory ~ 40000 elements
- preliminary radiological survey
- assessment of SRW and LRW storage capacity at preparation and DECOM stages

IERS main objectives:

- Collect input data for DECOM design
- Collect input data for life extension of elements

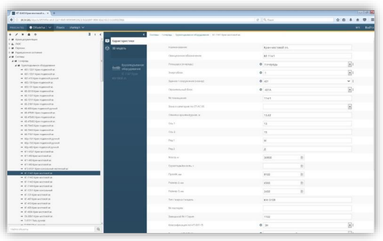
DECOM database

Used for:

- Storage and presentation of engineering information on the Units components
- Storage of regulatory, design, operating and other documentation
- 3D models of buildings, structures and equipment
- Automatic generation of reports and multiple-parameter search

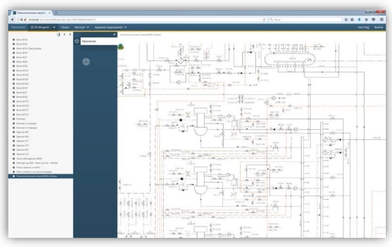
Engineering information:

- Weight-size and life parameters
- Equipment locations
- Materials characteristics
- Links to documentation and 3D models

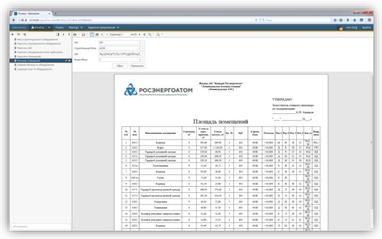


Documentation:

- Process flow diagrams
- Reports
- Operating documentation
- Design documentation

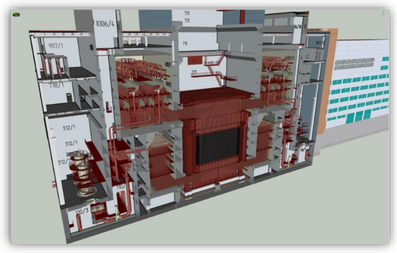


- Automatic generation of reports of a set format upon preset parameters



3D models:

- All buildings and structures
- Main equipment
- Axial, columns, elevations cross sections



5. Prospects

- Development, try-out, implementation and improvement of new technologies for uranium-graphite reactors decommissioning
- Extension to other NPPs
- Personnel training in new technologies and techniques
- RW interim storage and processing
- Waste decontamination, fragmentation and conditioning facility

International Conference on the Safety of Radioactive Waste Management, Decommissioning, Environmental Protection and Remediation:
Ensuring Safety and Enabling Sustainability, CN-318
Vienna, Austria; 6-10 November 2023