РОСЭНЕРГОАТОМ
ЛЕНИНГРАДСКАЯ АЭС

VNIIAES

PLANNING OF LENINGRAD NPP's UNITS DECOMISSIONING

Deputy chief engineer of Leningrad NPP for Modernization

Alexander Ananyev

Head of the NPPs decommissioning Department, SC "VNIIAES"

Vladimir Zimin

Head of the methodological support of NPPs decommissioning department, SC "VNIIAES"

Ivan Korneev

International Conference on Decommissioning of Nuclear Installations: Strategies, Practices and Challenges

9 -11 November 2015

AtomEco 2015, Moscow

Table of contents

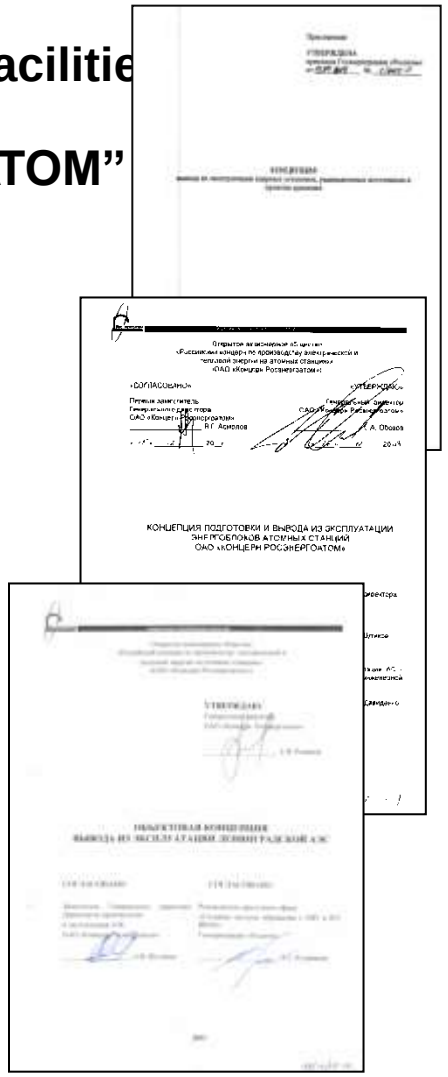
1 Decommissioning conception

- **«Decommissioning Conception of nuclear facilitie radiation sources and disposal facilities»– adopted by government corporation “ROSATOM”**

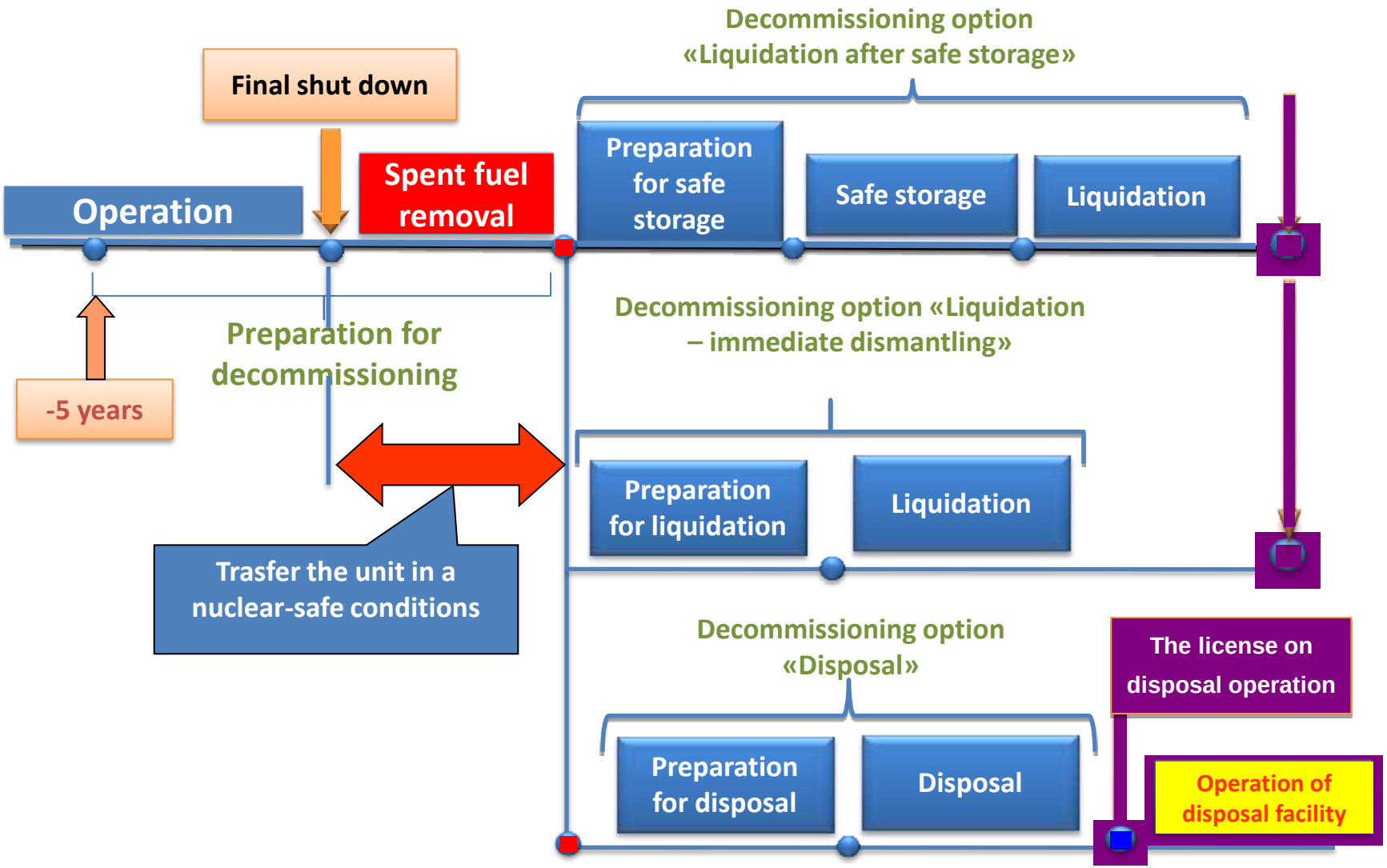
  15.07.2014.

- **«Conception of pre-decommissioning and decommissioning of NPP units of concern «Rosenergoatom», adopted by concern «Rosenergoatom», 17.12.2010**

- **«Local decommissioning conception for Leningrad NPP», adopted by concern «Rosenergoatom», 2011**

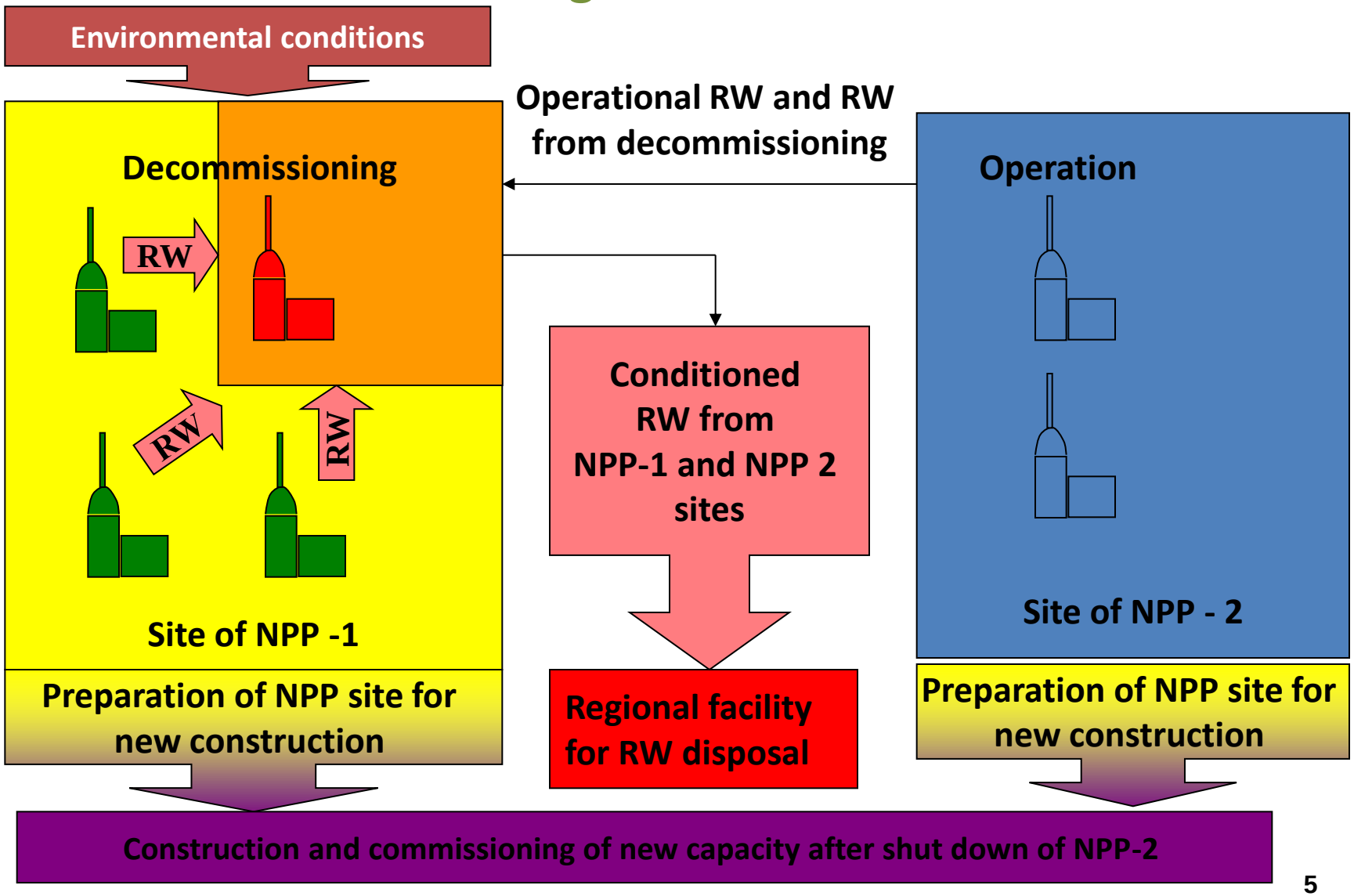


1 Decommissioning conception



1 Decommissioning conception

Decommissioning, as part of the lifecycle management of NPP site



1 Decommissioning conception

Including the process of the NPP's units decommissioning in the management of the NPP's site lifecycle, the decommissioning process should not be viewed as the final stage of the unit life cycle, but as the stage of the site preparation for a new NPP construction, renovation, conversion or the like, taking into account the characteristics of NPPs' sites and their placement regions.

The decommissioning process –

a preparation of the NPP's site to a new construction

2 Leningrad NPP's site general information

4 RBMK-1000 power units are exploited on the Leningrad NPP

Beginning of the construction – 1967

Power units service life – 30 years

All power units modernization and life extension were implemented.

Unit	Year of starting	End of service life	End of life extension
1	1973	2003	2018
2	1975	2005	2020
3	1979	2009	2024
4	1981	2011	2026

2 Leningrad NPP's site general information

Stages of the Leningrad NPP's unit 1 life cycle

Operating within the project lifetime

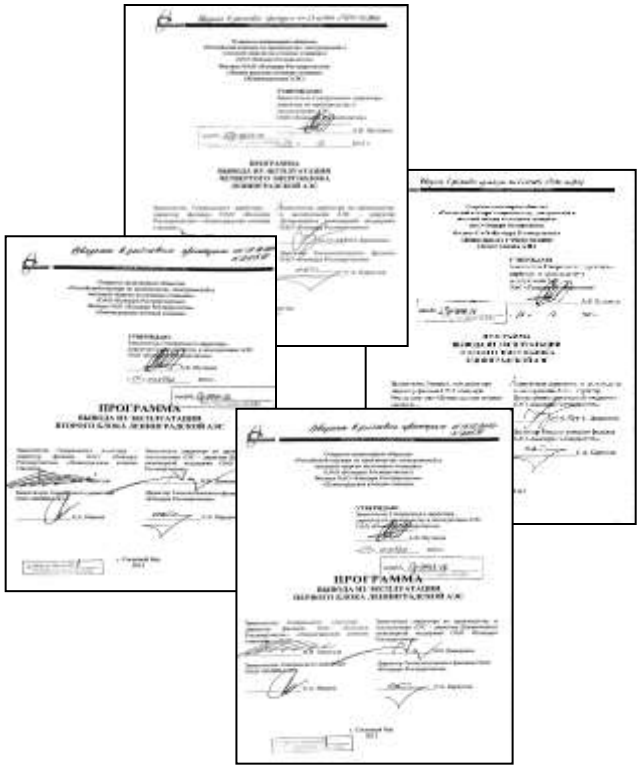
Unit transfer to the nuclear-safe state. Decommissioning project development and license acquisition

Design and construction

Exploitation within life extension period

Power unit decommissioning

3 Leningrad NPP's decommissioning programs

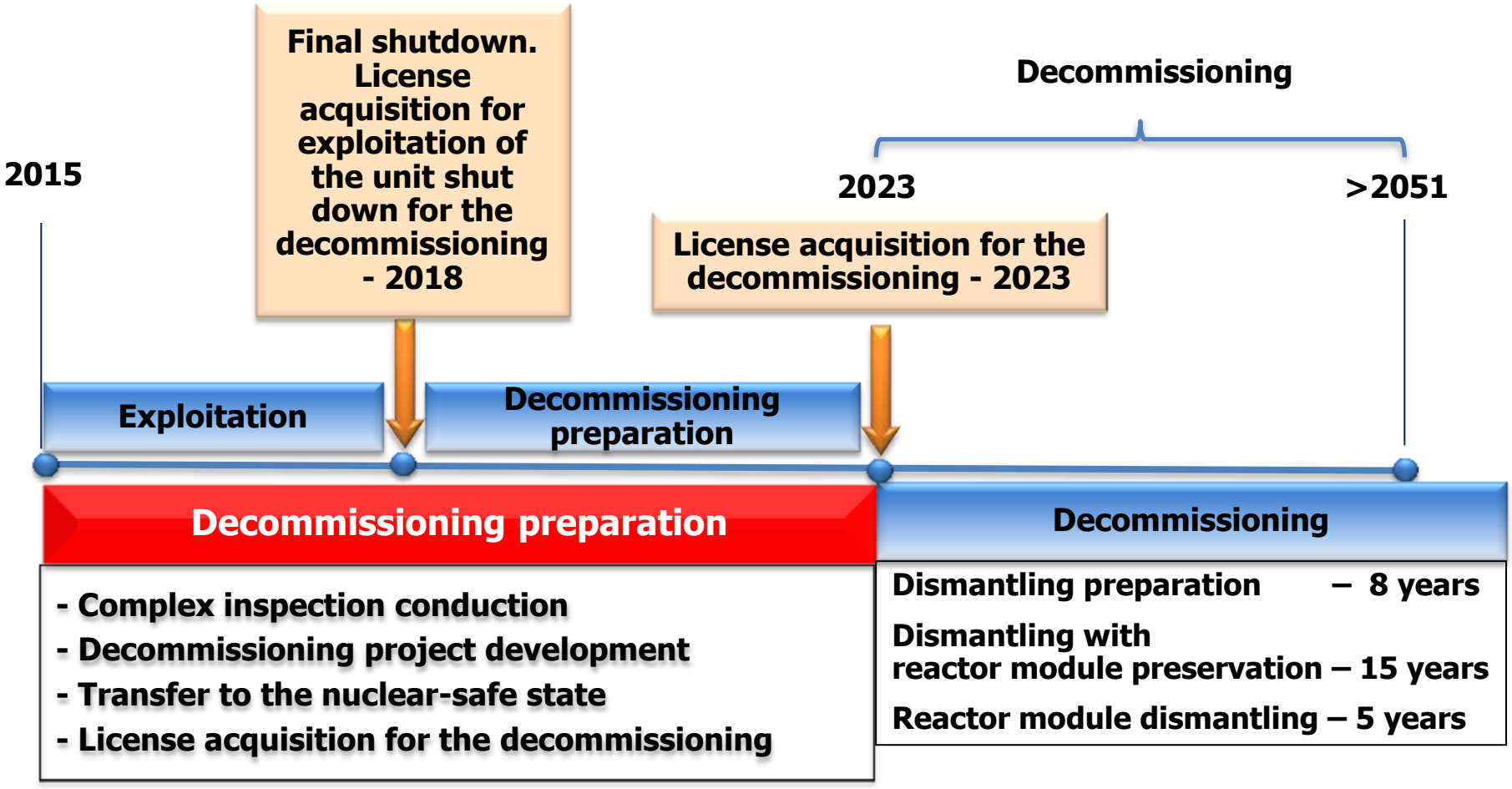


The decommissioning programs were developed for all 4 Leningrad NPP's power units:

Unit	Year of development	Year of revision
1	2000	2012
2	2001	2012
3	2003	2013
4	2005	2013

3 Leningrad NPP's decommissioning programs

The current decommissioning concept

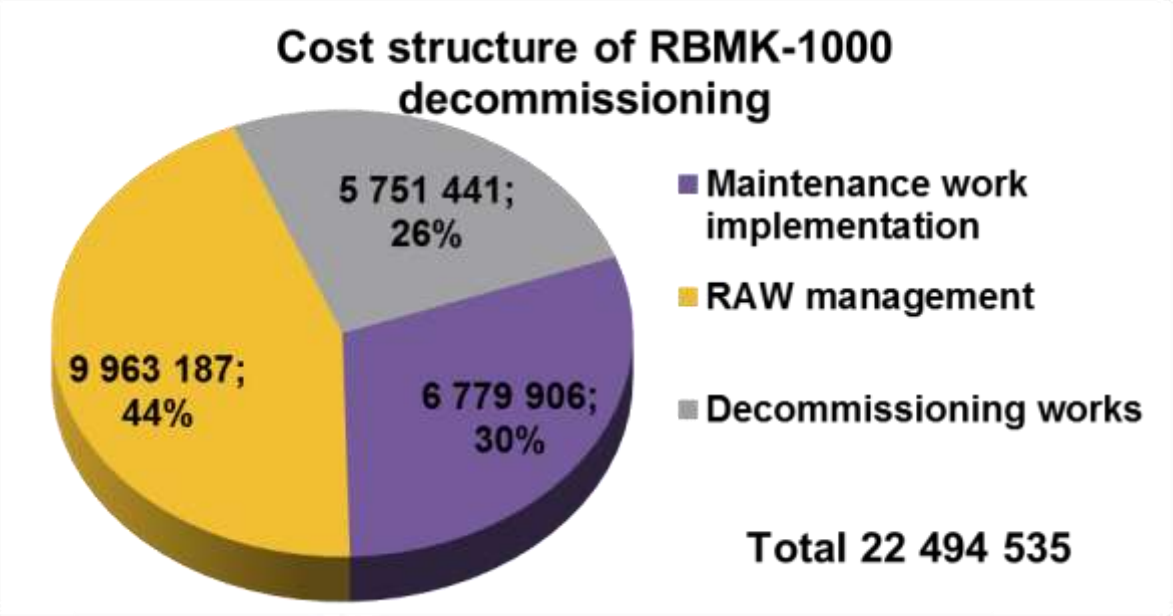


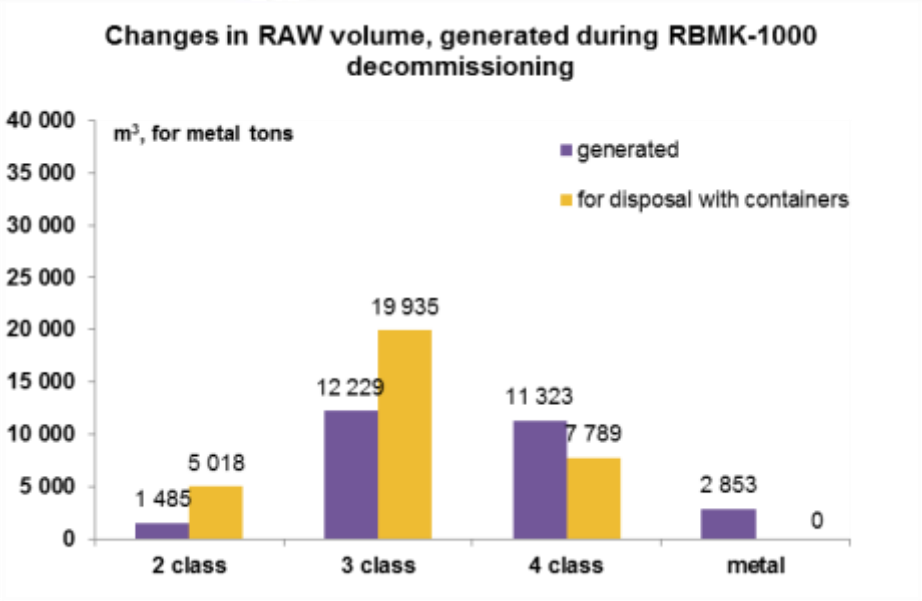
3 Leningrad NPP's decommissioning programs

The main characteristics of decommissioning process:

- **The total built-up area of the decommissioned buildings - 84,500 m2.**
- **The total construction volume of decommissioned buildings - 1636200 m3.**
- **Weight of dismantled reactor structures and equipment in the concrete shafts of units 1 and 2 - about 23,000 tons.**
- **The weight of dismantled equipment of reactor compartments of units out of the concrete shafts, equipment of turbine hall, deaerators - 45280 tons.**
- **Weight of dismantled auxiliary equipment on the site - 170 tons.**
- **The volume of dismantled concrete structures - 170 000 m3.**

3 Leningrad NPP's decommissioning programs





4 Spent fuel removing

Container storage complex of spent nuclear fuel was put into commission

4 Spent fuel removing

Division project capacity – 3600 SFA/year (50 metal-concrete containers)

Current rate of SFA delivery from units ~ 1200 SFA/year (~ 16 metal-concrete containers)

(300 SFA from unit per year)

protective chamber

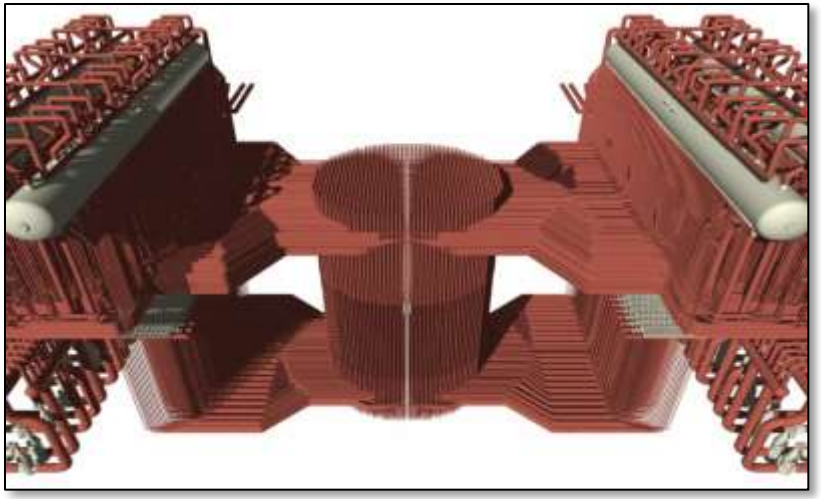
storage room

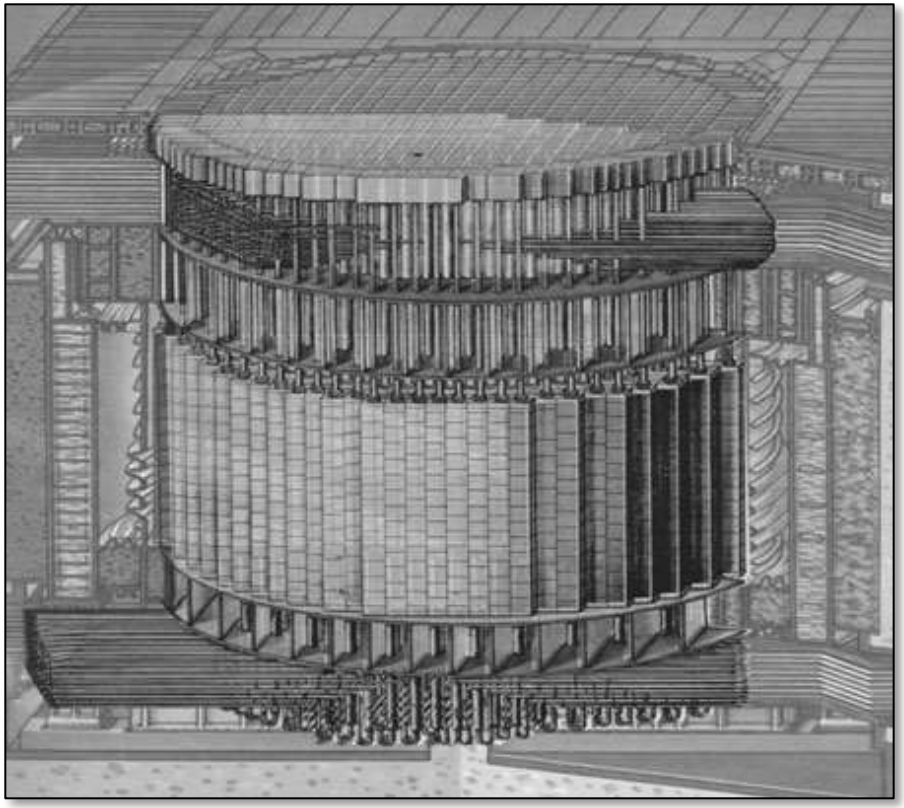
5 Radioactive waste management

Reactor graphite

Each RBMK unit contains approximately 1000 m^3 of graphite.

According to the Federal Law 190, NPP's unit graphite relates to the deep geological disposal waste, however to date there is no technology for treatment of RBMK radioactive graphite.





Radioactive waste (RAW)

RBMK units – single-circuit.

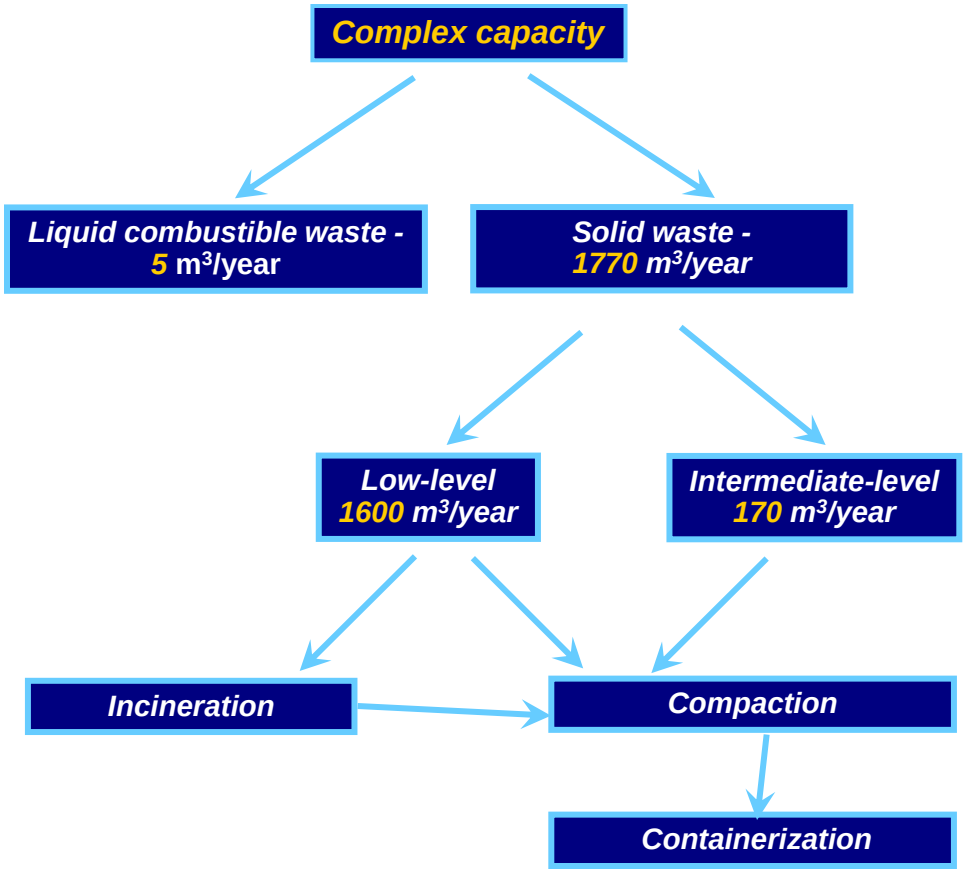
During the RBMK units decommissioning process a considerable amount of radioactive waste are generated.

5 Radioactive waste management

Solid RW treatment complex

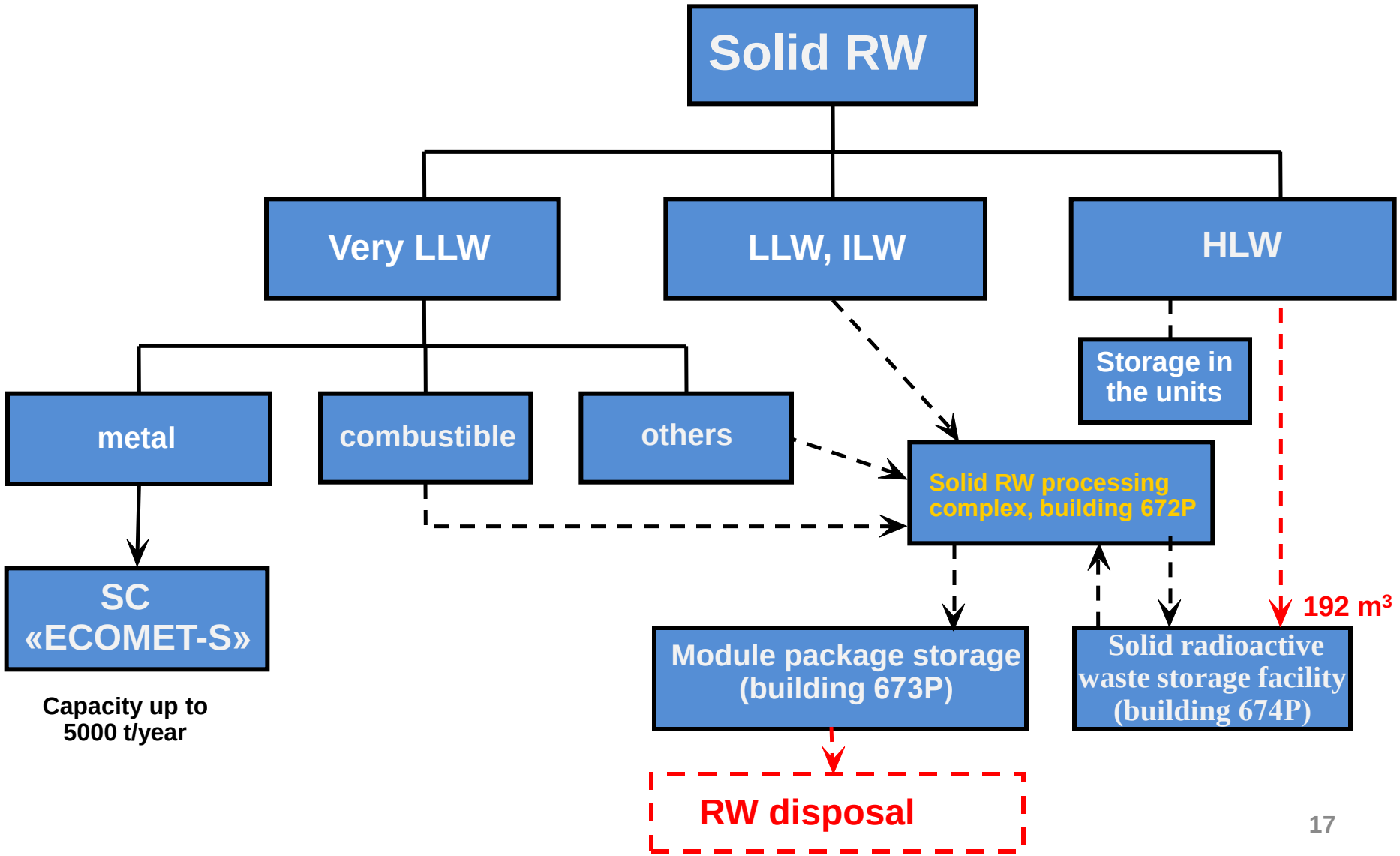
Solid RW treatment complex was put into commission.
The complex is equipped with modern facilities for RW treatment and reduction to the safe form for final disposal

Solid RAW processing complex, building 672P



5 Radioactive waste management

Scheme of the radioactive waste management



5 Radioactive waste management

Solid RW treatment complex

Combustible solid RW incineration facility with gas purification

Compaction facility

Sorting system

5 Radioactive waste management

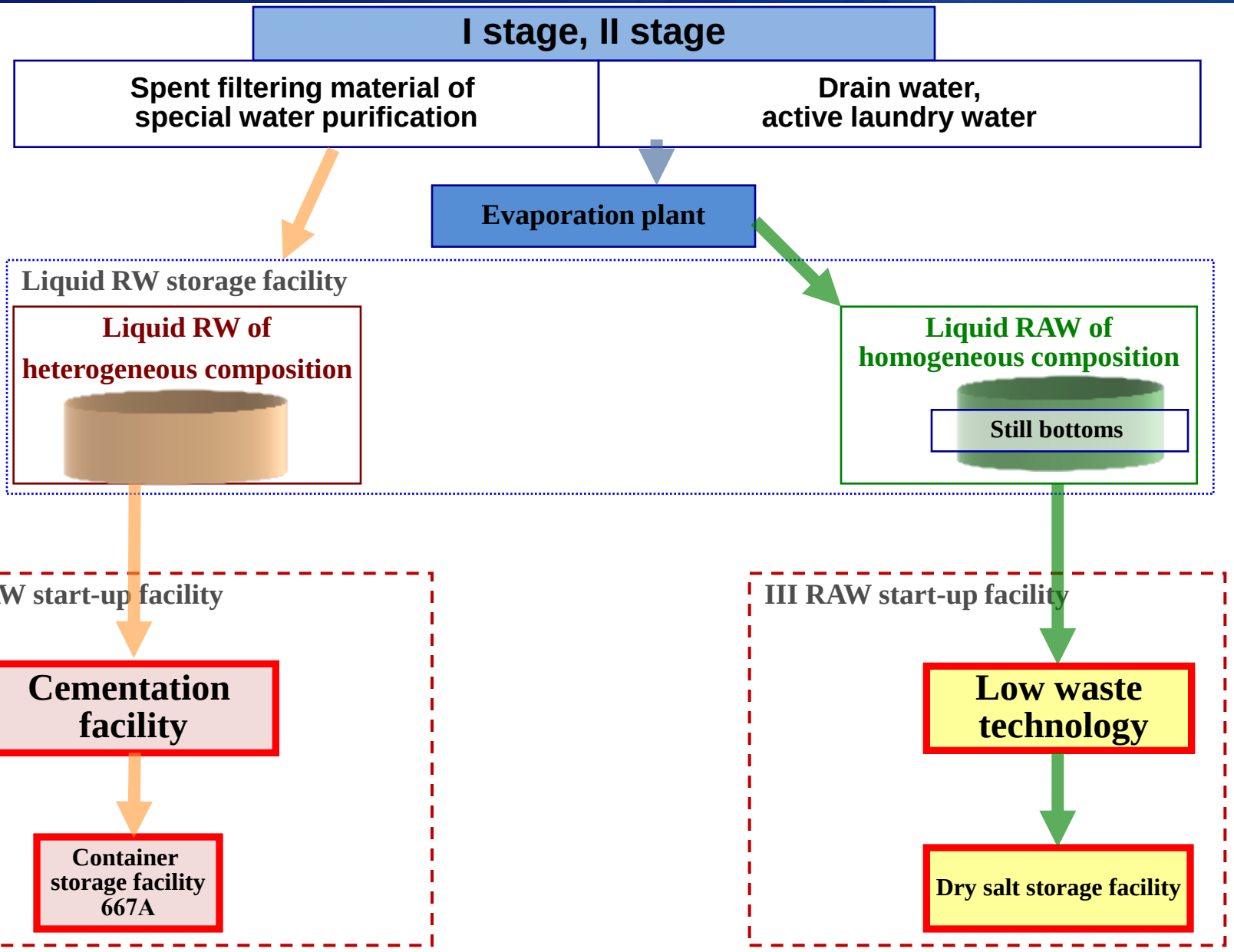
Liquid RAW processing complex

Current work on the creation of:

- **ion exchange resins pulp and filter perlite powder treatment facility (cementing method)**
- **still bottoms treatment facility**
- **additional liquid RAW storage tanks**

Module storage of solidified liquid RAW (building 667a)

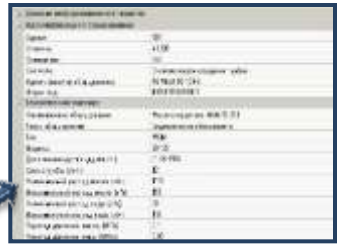
5 Radioactive waste management



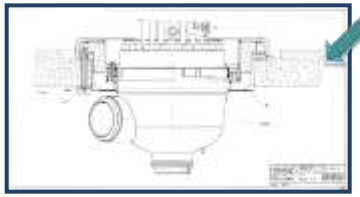
6 Decommissioning data base system

3D models

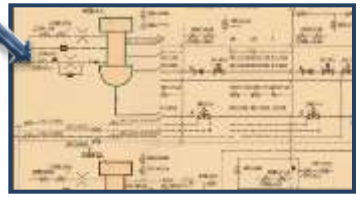
Object



Mass-dimensional and other characteristics

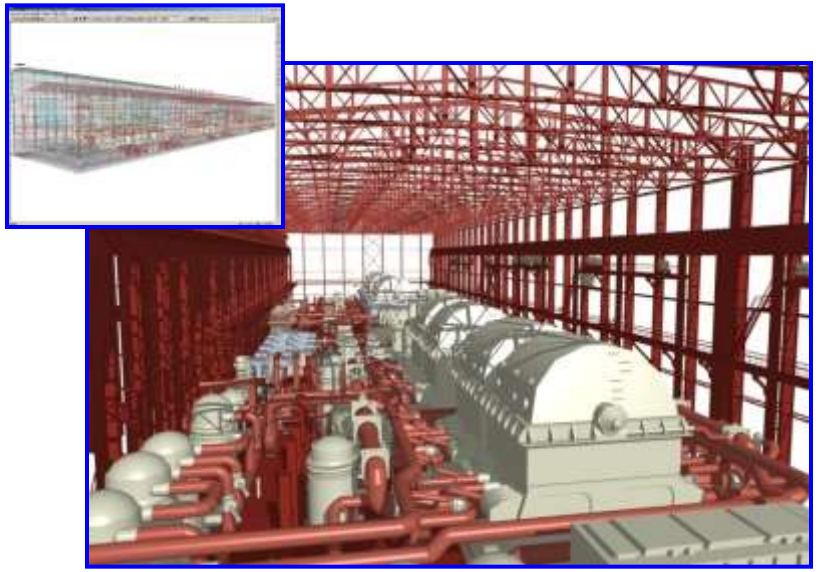


Project and construction documentation



Interactive technological scheme

- Created 3D models of:
  - NPP's site (more than 70 buildings and constructions)
  - NPP's power units with main equipment and piping
- Created electronic archive of project, construction and operating documentation (more than 25 000 pages)



7 Primary tasks

- **Terms of reference for the development of the Leningrad NPP's units 1,2 decommissioning project. Approved on May 2015.**
- **Conducting in 2015-2016 the complex engineering and radiation inspection of the unit 1, the further development of a database for the units decommissioning preparation.**
- **Set of supporting documents development during the period up to 2016, including Technological regulations for obtaining a license to operate the unit 1 after final shutdown.**
- **Units 1,2 decommissioning project development during the period up to 2020.**
- **Development and implementation measures to ensure leaking SFA removal from the unit 1 during the period up to 2018.**
- **Feasibility study development of the 1st stage industrial site utilization in the conversion purposes**

7 Primary tasks

- **Development of technology for the reactor graphite treatment**
- **Development of technology for the HLW treatment at NNP units**

(removal, fragmentation, containerization)

- **Creation of additional places for temporary storage of HLW**
- **Development and implementation of technologies for:**

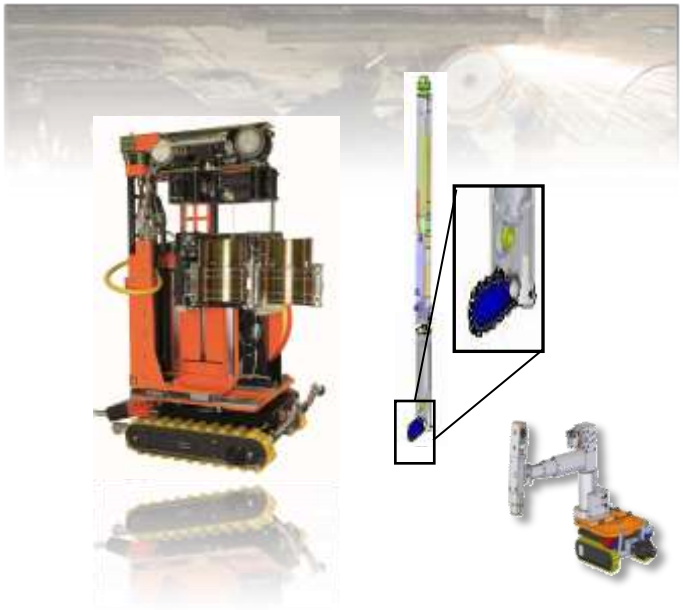
  - metal waste treatment, activity $10^5 \div 10^{10}$ Bq/kg;
  - waste sorting at the place of their formation in order to separate non-radioactive waste and to release waste from radiation control;
  - metal waste treatment in order to reduce amount of RW from the decommissioning and to return the metal to industry for unrestricted reuse.

8 Possible options of NPP's site reuse

INFRASTRUCTURE

During the operating lifetime, a stock of various equipment was accumulated (diagnostics, materials technology, measurement and control, etc.), including works related to tract telescopic joint of technological channels and life characteristic recovery of units 1,2 reactor facility.

It is important to utilize the Leningrad NPP's exist infrastructure as efficiently as possible



8 Possible options of NPP's site reuse

- **Using the reactor facility of the unit 1 for investigation of graphite, processing and testing technologies water chemistry of RBMK reactor facilities (including for extending the service life of Leningrad NPP units №№ 3, 4 over 45 years), training staff in new technologies and methods of activities.**

- **Testing of decontamination and utilization of reactor graphite (eg, the creation of a radiochemical plant for separation of long-lived isotopes, including 14C).**

- **Recycling of technological channels to return of zirconium for reuse in the nuclear industry.**

8 Possible options of NPP's site reuse

- Creation number of facilities for decontamination, fragmentation and RW treatment
- Temporary storage and treatment of radioactive waste using existing and advanced technologies. Provision of services for other enterprises in treatment of radioactive waste
- Training staff in new technologies and methods on decommissioning
- Accumulation and implementation of international best practices on decommissioning technologies
- Development, testing, implementation and improvement of new technologies for RBMK type NPP decommissioning
- Sharing the experience of Leningrad NPP units decommissioning to other NPPs

РОСЭНЕРГОАТОМ
ЛЕНИНГРАДСКАЯ
АЭС

VNIIAES

Thank you for your attention!