РОСАТОМ

ГОСУДАРСТВЕННАЯ КОРПОРАЦИЯ ПО АТОМНОЙ ЭНЕРГИИ «РОСАТОМ»

Strategic Approaches and Challenges when Developing the Comprehensive Program of the Nuclear Facilities Decommissioning in the Russian Federation

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Nuclear Radiation Hazardous Facilities in the Russian Federation

Types of NRHF to be decommissioned

AMB 2

VVER 15

EGP 4

RBMK 11

RR 50

RW storage facilities 40

SNF storage facilities 39

Testing areas >20

Storage facilities >100

Territory remediation

Mining facilities 3

Metal industry 2

Radiochemistry 4

PPR 13

Scientific facilities 7

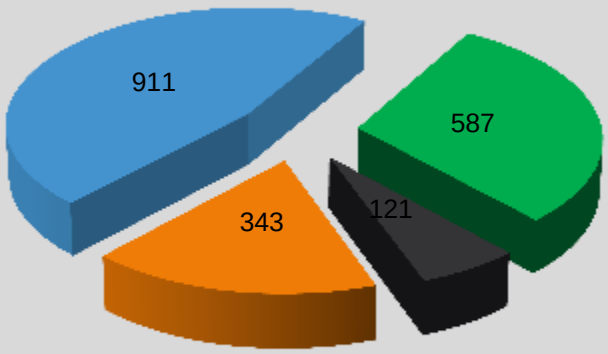
Prime Tool of the Decommissioning Strategy is Transfer from «Hands-on Control» to the «Long-term Strategy»

	“Hands-on Control”	“Long-Term Strategy”
Where Are We Going?	?	Safe condition of all NRGFs
What Are We Doing?	“Taking propmt actions”	Implementing the long-term plans
How much we are paying?	As much as available	As stipulated in the plan
What is the planning time-frame?	5 years	50 - 70 years

Long-term strategy is a new model of financing and interaction with the Government, as well as a tool for high-tech market development

Inventory & Ranking

There are about 2000 nuclear radiation hazardous facilities in the Russian Federation



Breakdown by NRHF types

1

Input data acquisition — data base creation ~2000 NRGFs

Scaled-up assessment of risks and ranking

2

Determination of high-priority facilities (~ 300 facilities)

Work planning for facilities (proposals generation)

3

Practical activities

Prioritizing in Decommissioning of the Nuclear & Radiation Hazardous Facilities

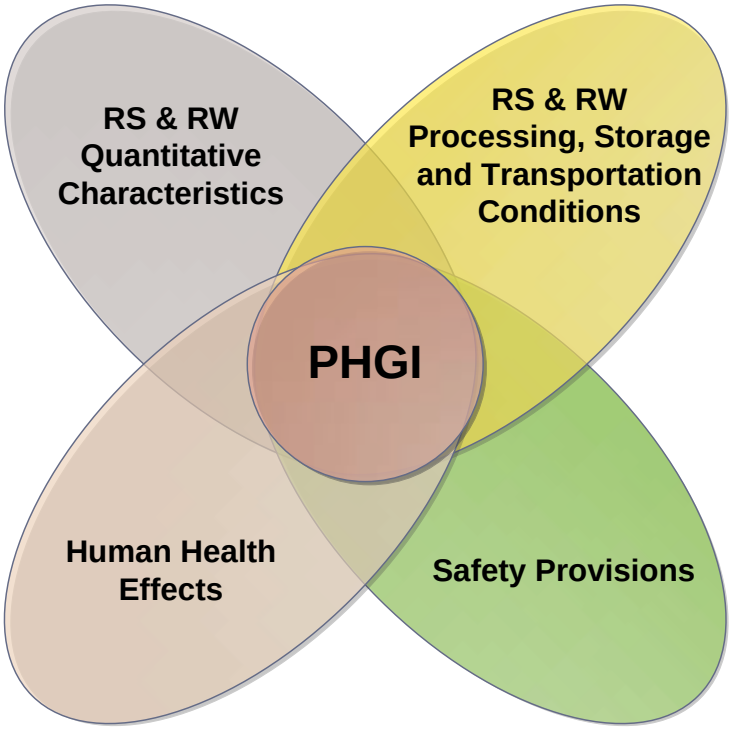
PHSI – **P**otential **H**azard **S**pecific **I**ndicators characterizing specific parts of nuclear facilities to be decommissioned and subject to ranking.
PHCI – **P**otential **H**azard **C**umulative **I**ndicator calculated based on certain PHSIs**.** Provides nuclear facility comparative estimate regarding nuclear and radiation safety.

Particular Radionuclides Total Activity

RS & RW Physical and Chemical Characteristics

Population Number or Density within N&R Facility Emergency Planning Zone

N&R Facility Number of Employees

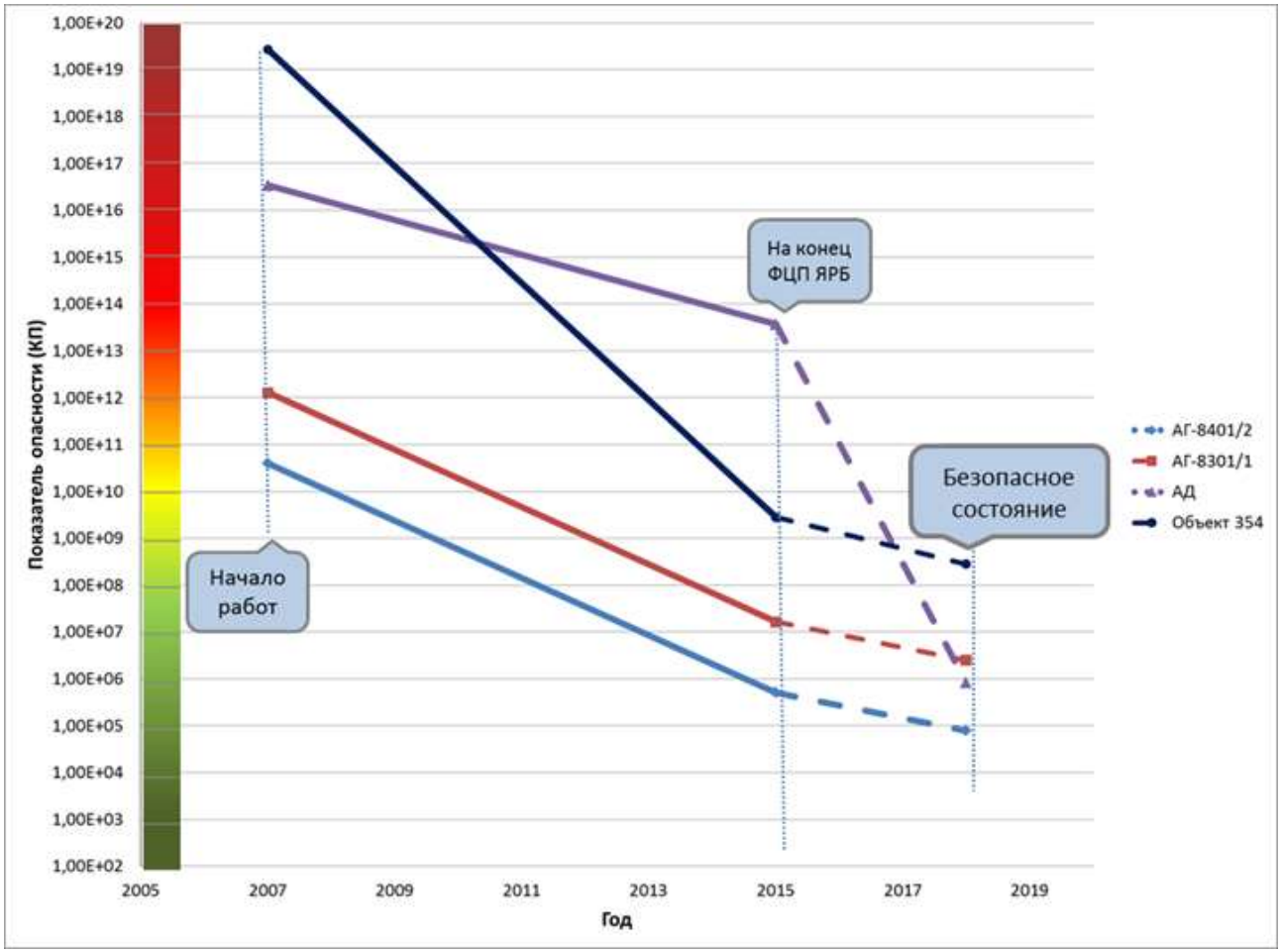


Liquid vs. Total RS & RW regarding specific radionuclides

Safety Measures

Safety Barriers Degradation

Facilities by Potential Hazard

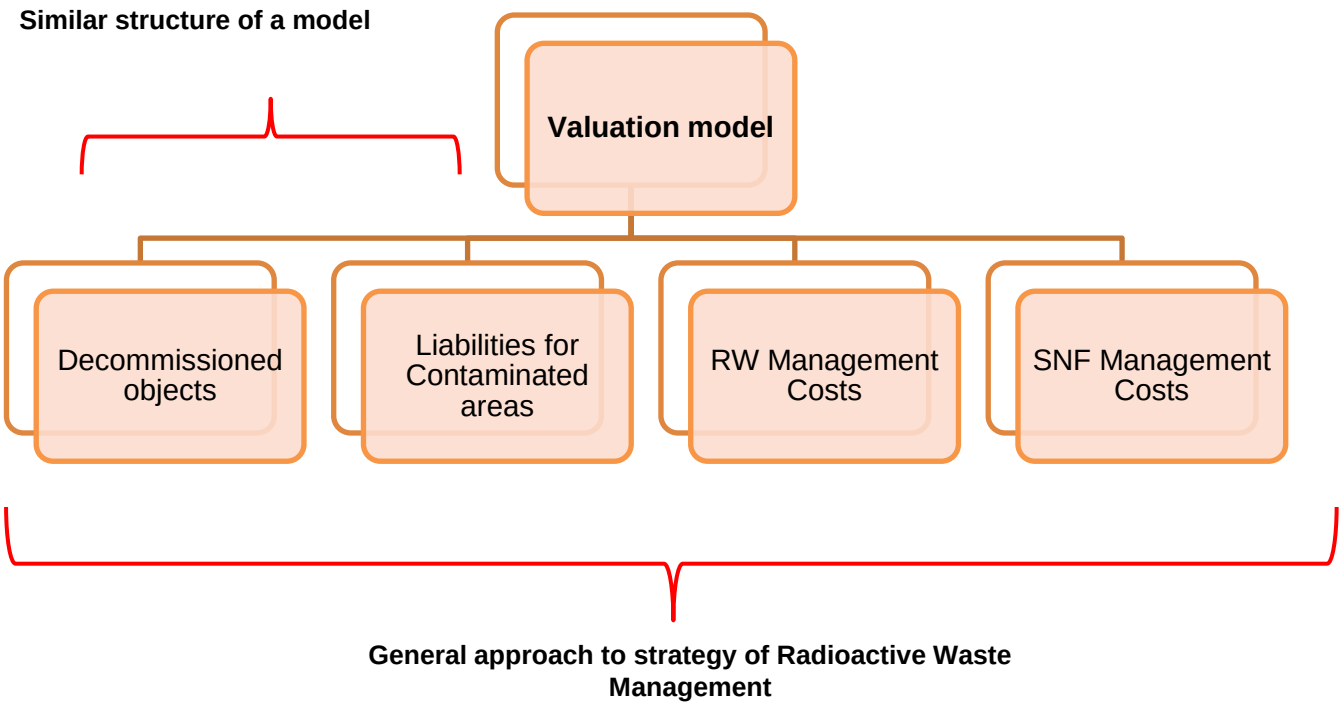


Variation in facility hazard change versus completed decommissioning activities

Decommissioning estimated costs. General Information

1. **A purpose of the modeling is –** to build up system of valuation of decommissioning costs and costs of waste management

2. **A structure of the valuation model**



Valuation model of Decommissioning Costs

Representation of Information

Valuation models

- liability for nuclear facilities (Reactor Module, uranium-graphite reactors, nuclear installation, nuclear icebreaker fleet)
- liability for storage facilities
- liability for industrial areas
- liability for contaminated areas

Summary file for Organization

- Current value
- Present value
- Sensitivity analysis
- Accrued liabilities schedules

Summary file for State Corporation “Rosatom”

- Current value
- Present value
- Sensitivity analysis
- Accrued liabilities schedules

Capability of data analysis

Valuation model of Decommissioning Costs

Difference between a new model from the previous one

Valuation Model till 2014

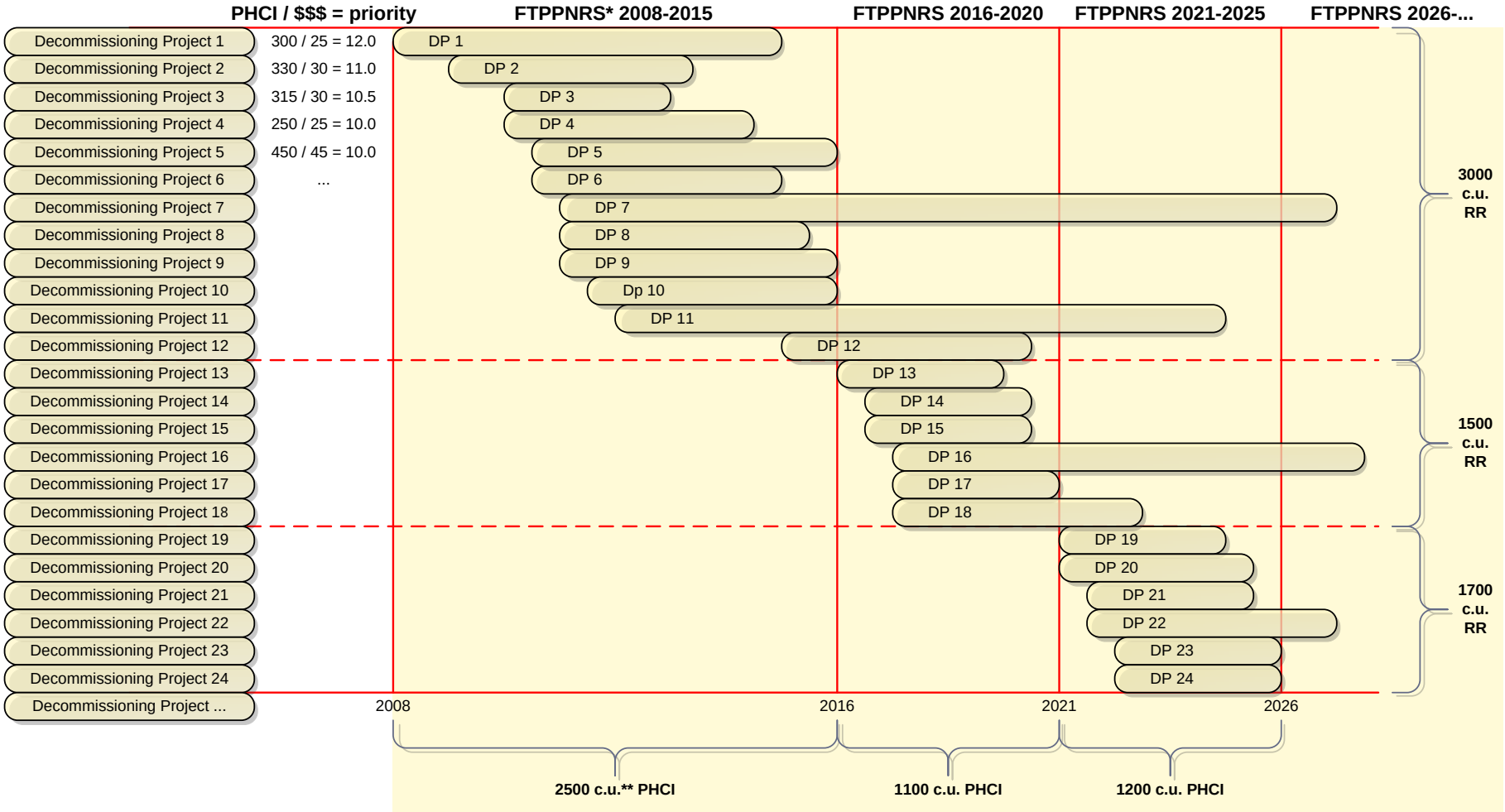
- Integrated calculation of costs
- Only one conception is used
- High-level classification of activities
- High-level rates of activities
- Lack of flexibility in selection of duration of decommissioning stages and technologies
- One conception of RW management for all objects

New Valuation Model

- Detailed calculation of costs
- Capability of conception selection
- Detailed classification system on the basis of singular activities
- Detailed rates of activities
- Selection of technologies and duration of stages
- Selection of conception of RW management according to the specifics of an object

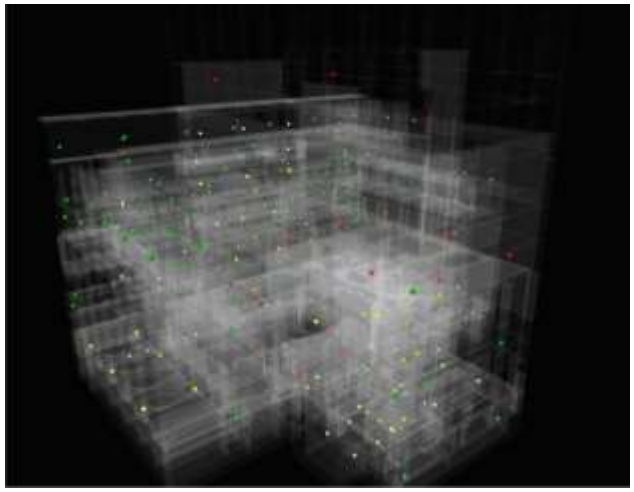
Long-Term Program Based on Nuclear Radiation Hazardous Facilities Ranking

* Federal Target Program for Provision of Nuclear and Radiation Safety

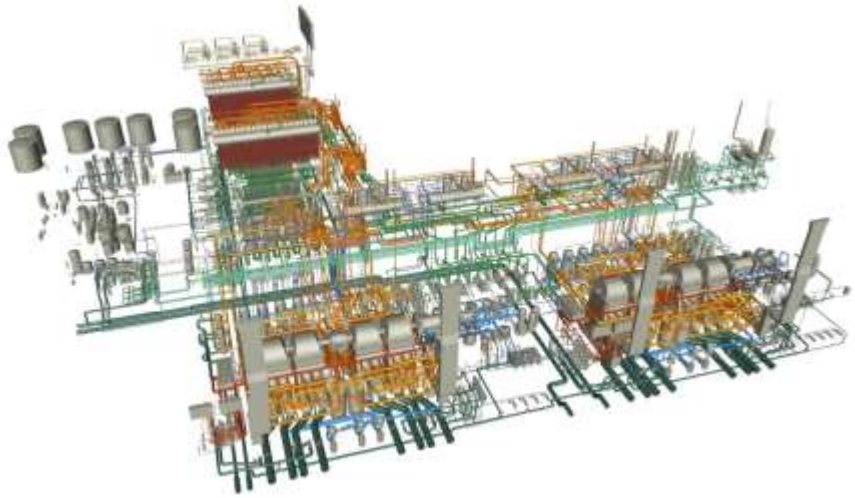


** conventional unit

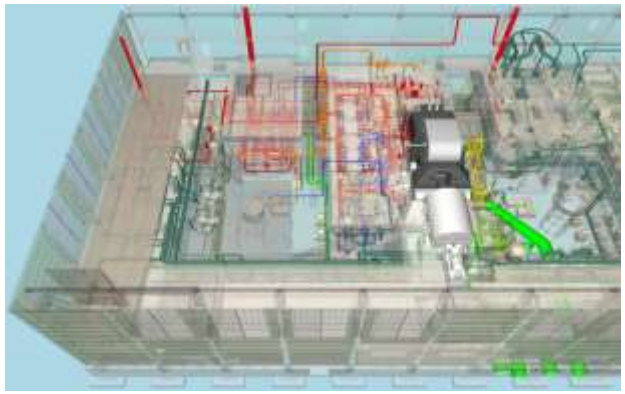
Informational Support of the Decommissioning Activities



Comprehensive survey



Utility lines



Planning of decommissioning activities

Estimate of RW generation

Centers of Competence in Decommissioning

Objective: Cost-cutting, centralization of the decommissioning experience

- **2011 — PDC UGR (SGChE) – Graphite reactors decommissioning**

  2015 — decommissioning completion of the first production uranium-graphite reactor (EI-2)

2012 - Pilot Demonstration Engineering Center (Novovoronezh NPP**, ROSENERGOATOM)**:

Decommissioning activities at VVER with further duplication of the technologies

2014 – start of decommissioning activities at nuclear power units 1 & 2 of Novovoronezh NPP

Progress in RW Management

Creation of the unified national system for RW management

Federal law «On radioactive waste management ...» was enacted in 2011.
Basic regulatory documents were accepted in 2011-2013.
National operator was determined in 2012.
An inventory of radioactive waste was made which fall into «nuclear legacy» in 2013-2014 («primary record-keeping of RW and determination of their location areas»).
Rates were prescribed for radioactive waste disposal (Decree of the RF Ministry of Natural Resources in 2013.
All operating companies developed strategies on RW management in 2013.
Payment for RW disposal started in 2014.

Activities on «nuclear legacy»

- Work is proceeded on safety improvement of RW disposal facility, including facilities under federal special purpose program (FSUE «PA «Mayak», FSUE «MCC», JSC «SGChE», tailing facility «Almaz», JSC «ChMZ»).
- Work is proceeded on RW retrieval and treatment (FSUE «RosRAO», «Rosenergoatom»).
- Work on remediation of the underground nuclear explosion facilities for civilian purposes.

Site Selection for short-lived ILW, LLRW & very LLRW disposal

1. North-West Federal District (Leningrad Region, Arkhangelsk Region)

1. Central FD, Povolzhskiy FD, Southern FD (Republic of Kalmykia, Moscow Region at FSUE «RADON» site)

1. Urals FD, Povolzhskiy FD,– a site was determined at FSUE PA «Mayak» (Chelaybinsk Region)

1. JSC «UEIP» - phase 1 is completed (Sverdlovsk Region.)

1. Siberain FD – a site was determined at the JSC «SGChE» (Tomsk Region)

NPP in operation

Primary producers of RW

RW disposal facility

Expected coverage area of RW disposal facility

Building up an underground research laboratory to study a potential for highly radioactive waste (HRW) and long-lived intermediate level waste ILW) disposal

Principal characteristics of the facility

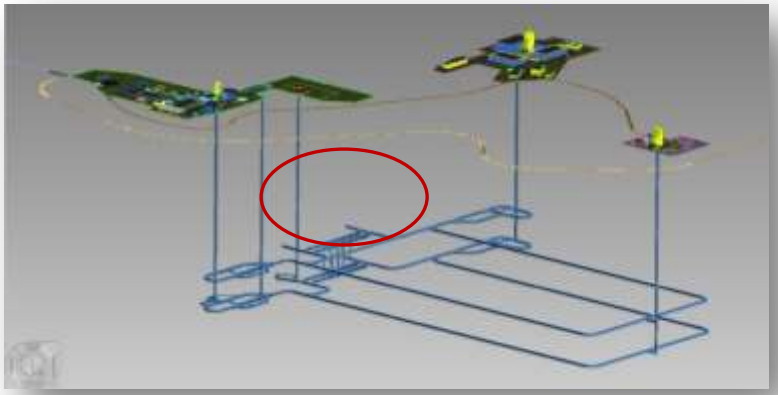
Depth of the underground structures location is 450-525 m

Amount of disposed RW (net):
- **Vitrified HRW of class 1 – 4500 m^3 (7500 canisters),**
- **ILW & HRW of class 2 – 155 000 m^3**

Disposal of class 2 ILW & HRW in stock-piles in horizontal workings at depth of 450 m & 525 m

Class 1 HRW are located in vertical wells up to 75 m deep (depth range of 450-525 m) and 1,3 m in diameter

Estimated cost of the facility construction is 23 billion rubles (in ten-years rubles)



Layout of the underground research laboratory , Nizhne-Kansk solid mass

3 vertical well bores up to 525 m deep and about 5,5-7,0 m in diameter

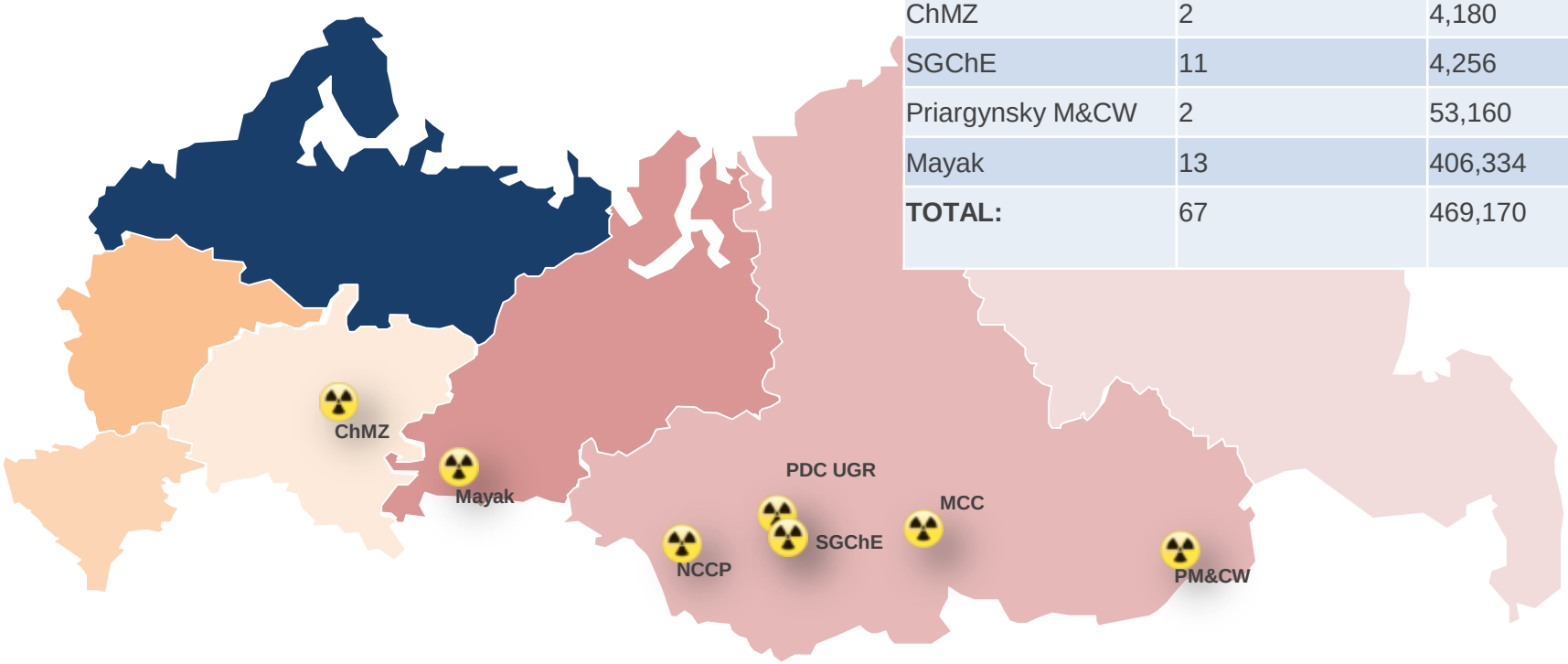
Above-ground infrastructure including building and constructions at nearwellbore areas

Horizontal capital mine roadways at depths of 450 m & 525 m, total length of 5000 m

Underground structures of the research laboratory:
- 4 horizontal roadways with the total length of 600 m and cross-section of 40-60 m^2,
- 4 vertical wells up to 75 m deep

Location of RW («nuclear legacy») storage facilities for on-site disposal

Company	Number of RW storage facilities	Amount of RW , mln. m³
PDC UGR	14	0,031
MCC	24	0,253
NCCP	1	0,956
ChMZ	2	4,180
SGChE	11	4,256
Priargynsky M&CW	2	53,160
Mayak	13	406,334
TOTAL:	67	469,170



Results by 2030. Dismantling of Nuclear & Radiation Hazardous Facilities

RW repositories decommissioning

Rate of decommissioning activities ensures safe demolition of nuclear legacy:

- Decommissioning of 82 NRHF, including 7 PUGR, 2 atomic icebreakers, 16 nuclear maintenance ships;
- Remediation of contaminated area (4 259 m^2)

Reactor graphite stack dismantlement

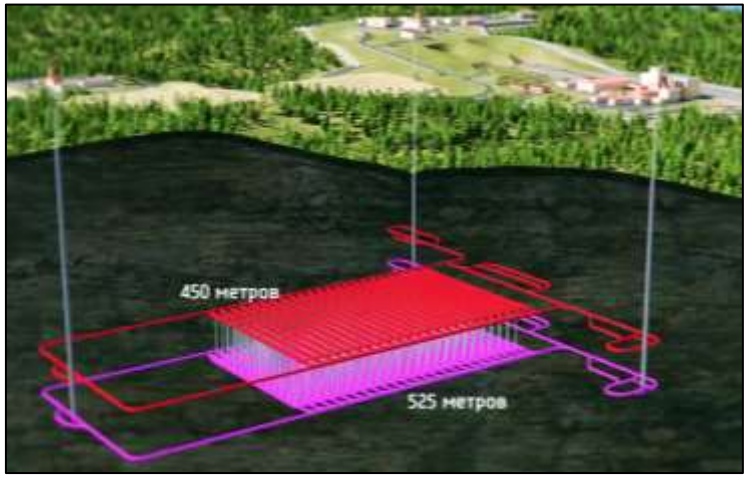
Protective shield building-up

Results by 2030
Radioactive Waste Management

RW storage

Excess of RW disposal over RW generation:

- operational commissioning of 4 subsurface RW repositories and 1 undersurface RW repository;
- operational commissioning of 6 regional complexes for RW treatment;
- disposal of more than 30% of solid RW which are in the federal ownership;
- cessation of use of open near-surface reservoirs for liquid RW.



Layout of the RW disposal facility
Nizhne-Kansk solid mass

RW treatment facility

THANK YOU FOR YOUR ATTENTION!