ROSATOM

ROS RAO

Iwaky 2019

RosRAO FSUE

Russian backend activity

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ROSATOM

ROS RAO

Rosatom Group

- Global leader in nuclear

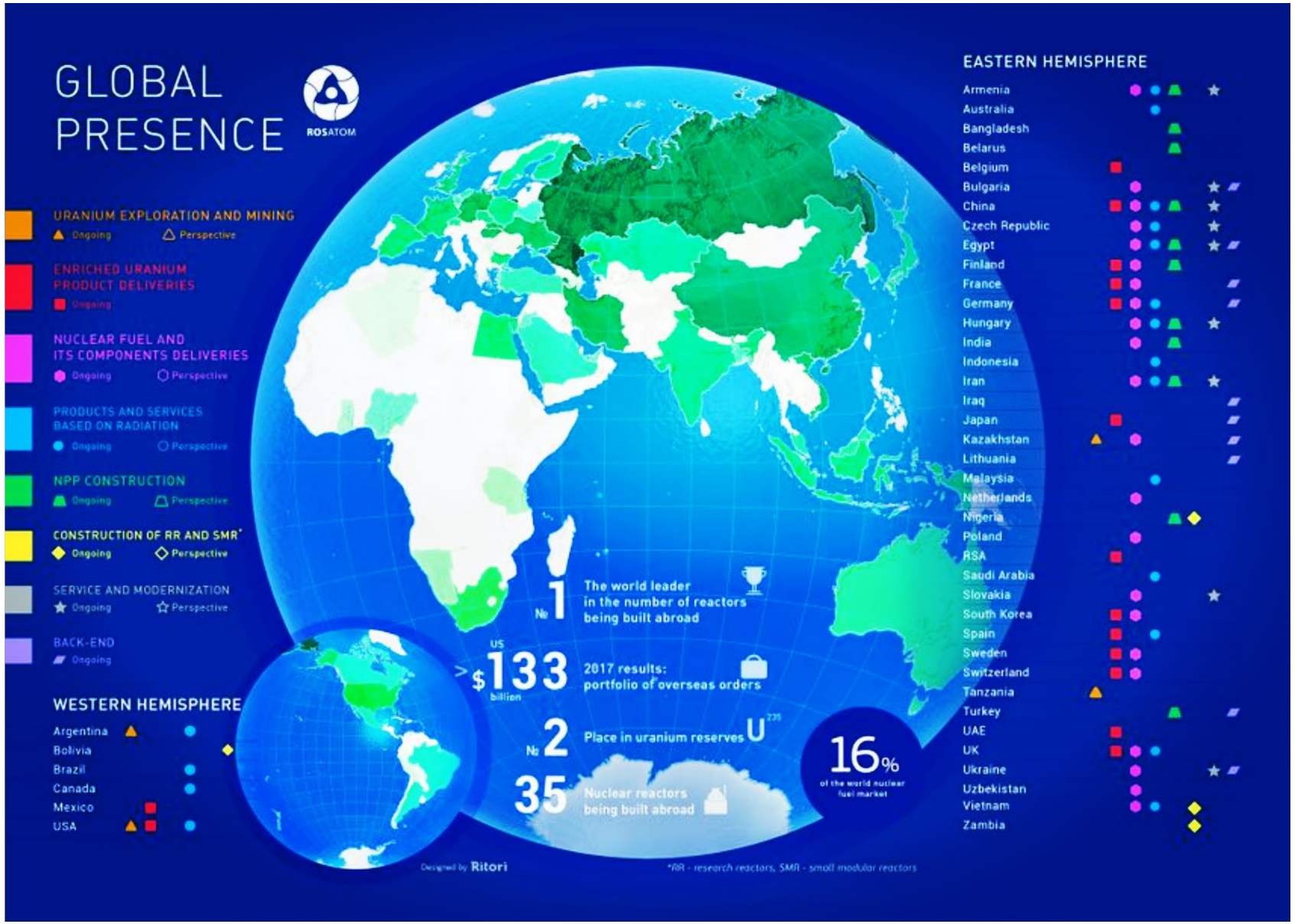
Full chain uranium mining to decommissioning of nuclear facilities and Radwaste & SNF management

NPP construction projects (6 in Russia and 36 abroad)

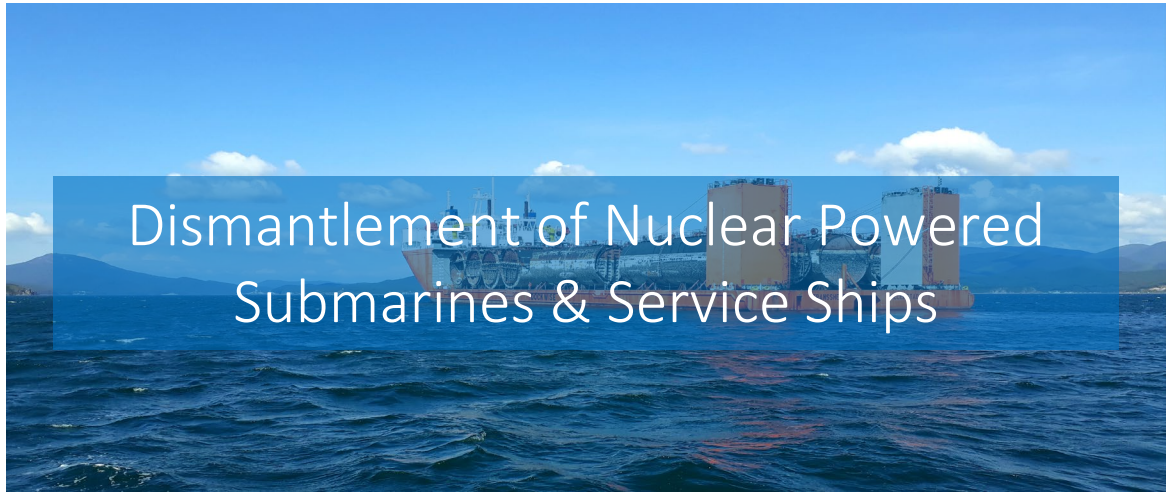
16% of the global nuclear fuel market

- Russian State Corporation

- 400 affiliate companies
- & 200 K employees



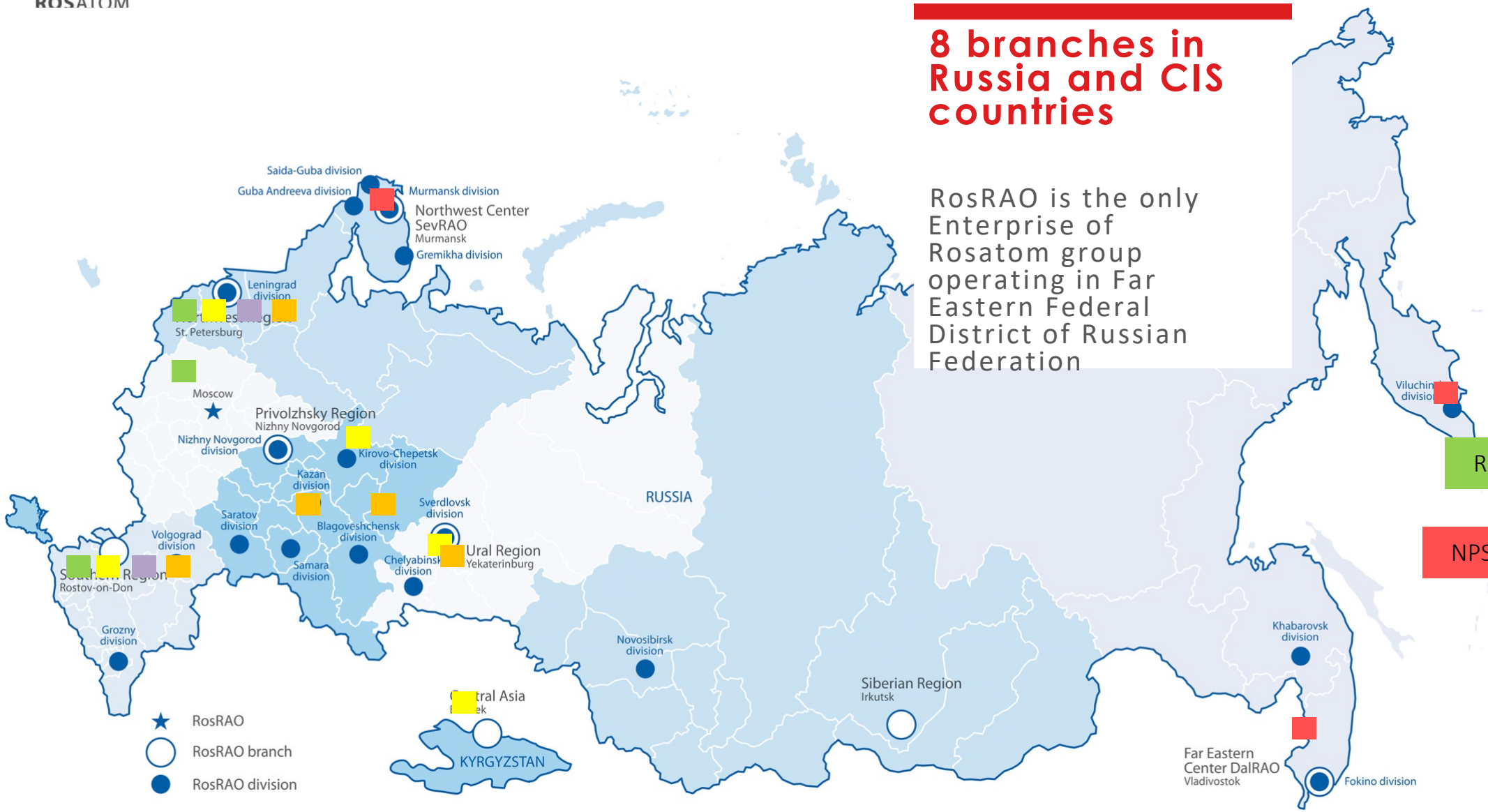
RosRAO business activities



RosRAO's Branches and Divisions

8 branches in Russia and CIS countries

RosRAO is the only Enterprise of Rosatom group operating in Far Eastern Federal District of Russian Federation



- Rehabilitation
- RW Management
- Decommissioning
- Research and Development
- NPS and NPSS dismantlement

RosRAO's outline

Nation-wide complex Radwaste management operator

8 Branches (Russia & Kyrgyz Republic)

21 sites & 2100 people

Own special vehicles and container fleet

Largest storage operator for LRW&SRW Radwaste and DSRS in Russia

Accumulated > 500K $\mathbf{m}^3$

Processing facilities for LRW&SRW hot cells to manage DSRS

Decommissioning and dismantling (D&D) Operator

Decommissioning of nuclear facilities

Rehabilitation of contaminated territories under intergovernmental and governmental frameworks

Russian RW Management System Evolution

1940-2011

Before State RW Management Law Approved

Legacy | **Operating RW**

There was not clear responsibility

- ✓ Enterprises have their own local RW management strategies
- ✓ There was not goal to RW treatment and conditioning for disposal
- ✓ The main local strategy is RW storage
- ✓ There was not long-term solution for RW management – legacy volume increases.
- ✓ No system management – no financial efficiency

2011 - currently

After State RW Management Law Approved

State budget	Operator's budget
Legacy	**Operating RW**
State responsibility	Operators responsibility

Removing → Treatment

Treatment

Conditioning

Storage & Disposal

- ✓ All RW must be disposed
- ✓ New financial mechanism
- ✓ Reduce RW volume for storage
- ✓ Reduce safety risks
- ✓ Transparent system

Government D&D programs and key goals


AMB 2


VVER 15

EGP 4


Rehabilitation


RW storages 40


SNF Storages 39


Test sites >20


R&D 7


Mining 3


Metallurgy 2


Radiochemistry 4


UGR 13


RBMK 11


RR 50

Landfills

more then 100 sites

2008-2015
Nuclear and Radiation Safety Program 1
(2,35 B$)

- Determination of the legacy challenges
- New nuclear and radioactive safety monitoring system development
- Created disposal infrastructure for LLW

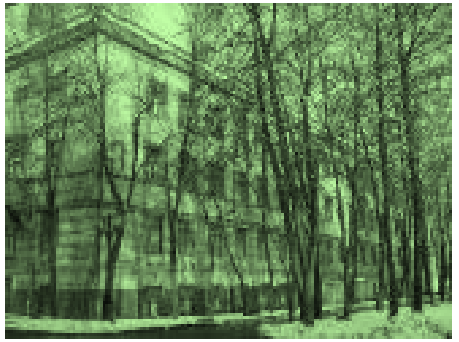
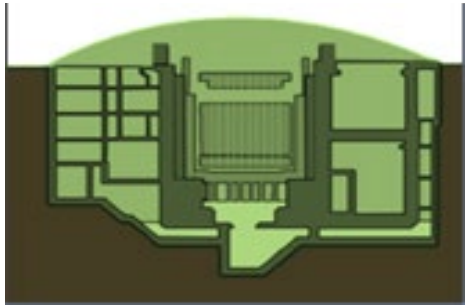
2016-2020
Nuclear and Radiation Safety Program 2
(9,6 B$)

- HLW disposal infrastructure
- The open pools of Liquide RW close
- SNF reprocessing infrastructure

Government D&D programs current performance

- 50 nuclear-hazardous sites decommissioned & rehabilitated
- New modern SNF dry storage facility in operation, 29 386 SNF assemblies transferred
- Closing down of Karachai Lake (=50 football fields).

- First Uranium-Graphite Reactor decommissioned
- Two historical nuclear research sites in Moscow decommissioned
- Rehabilitation of more than 2 mln.sq.m

SNF storages filled/ defected SNF	Uranium-graphite reactors shutdown	First research reactor in Moscow	Research plutonium centre	Karachai lake. 120 mln. Ci.
Before 				 Before
After 				 After
Most of the SNF placed in the new modern facilities	Decommissioned by “Entombment”	Dismantled	Decommissioned to “brown” field	Closed down

Bochvar Institute D&D current projects

Building 53 (1974) U, Pu works
Co-60, Sr-90 sources, ^{3}H, Be
High gamma
Area: 1121 м2
Characterization
Decontamination & Dismantling
License granted
2 years – project (2018)

Building B (1945) U, Pu labs
High alpha contamination
Area: 7 407 м2

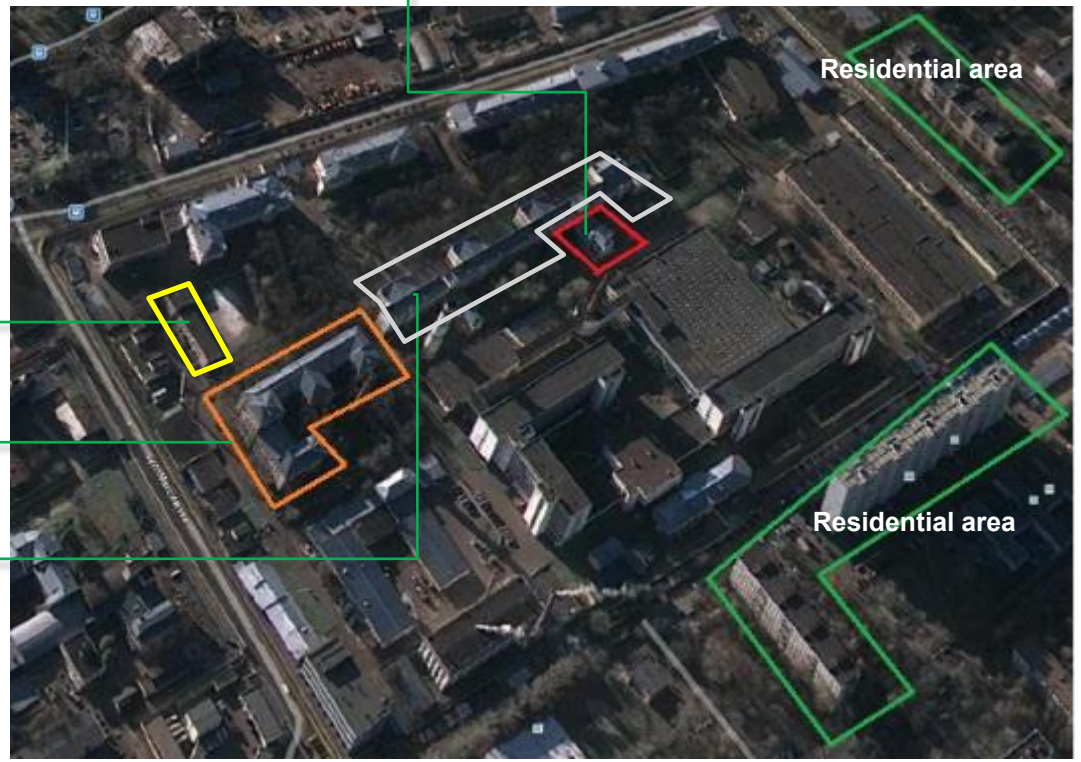
Characterization
Decontamination & Dismantling
Tanks and laboratory equipment dismantlement
Building dismantlement
Site rehabilitation
License granted
5 years (done)!
See next slide

Building A (1945) Radiochemical labs, Pu contamination

Area: 11 667 м2

Characterization
Project development
Legacy waste retrieval
License to apply
5 years – project (2023)

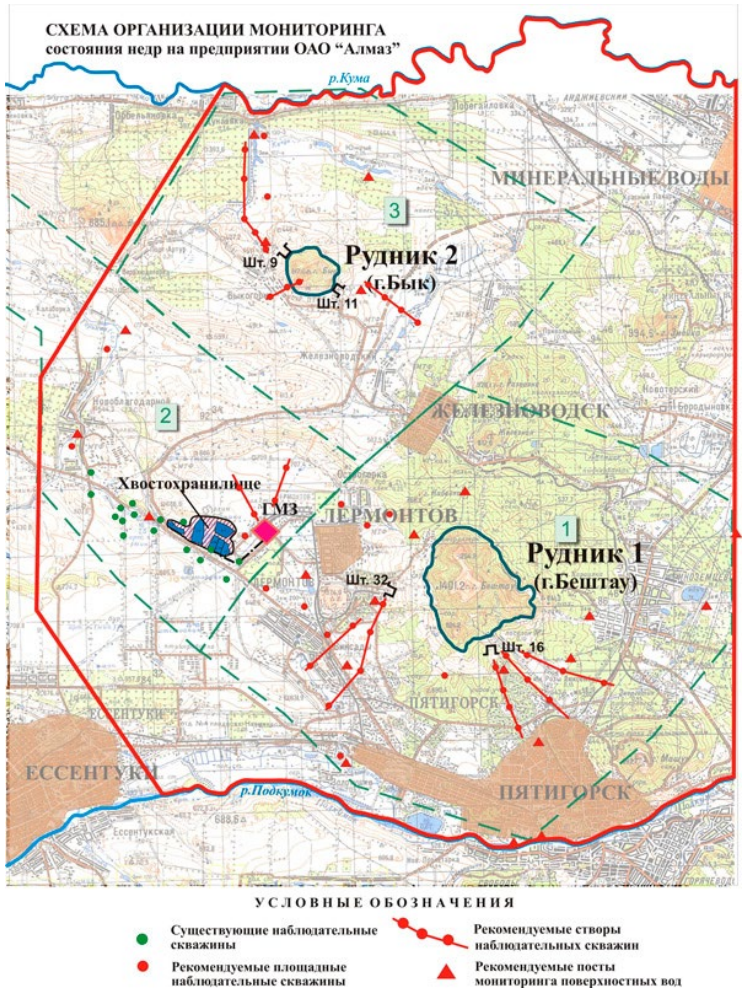
U-5 Facility (1946) Pu-plant prototype
Area: 750 м2
Characterization
Decontamination & Dismantling
Legacy waste retrieval
License granted
3 years – project (2020)



Project “Rehabilitation of uranium mining company Almaz”

Uranium mining and processing company “Almaz” was established in 1952.
Due to economical reasons, mining was completed in 1975 (mine 1) and in 1988 (mine 2).

Scheme of ground water monitoring system



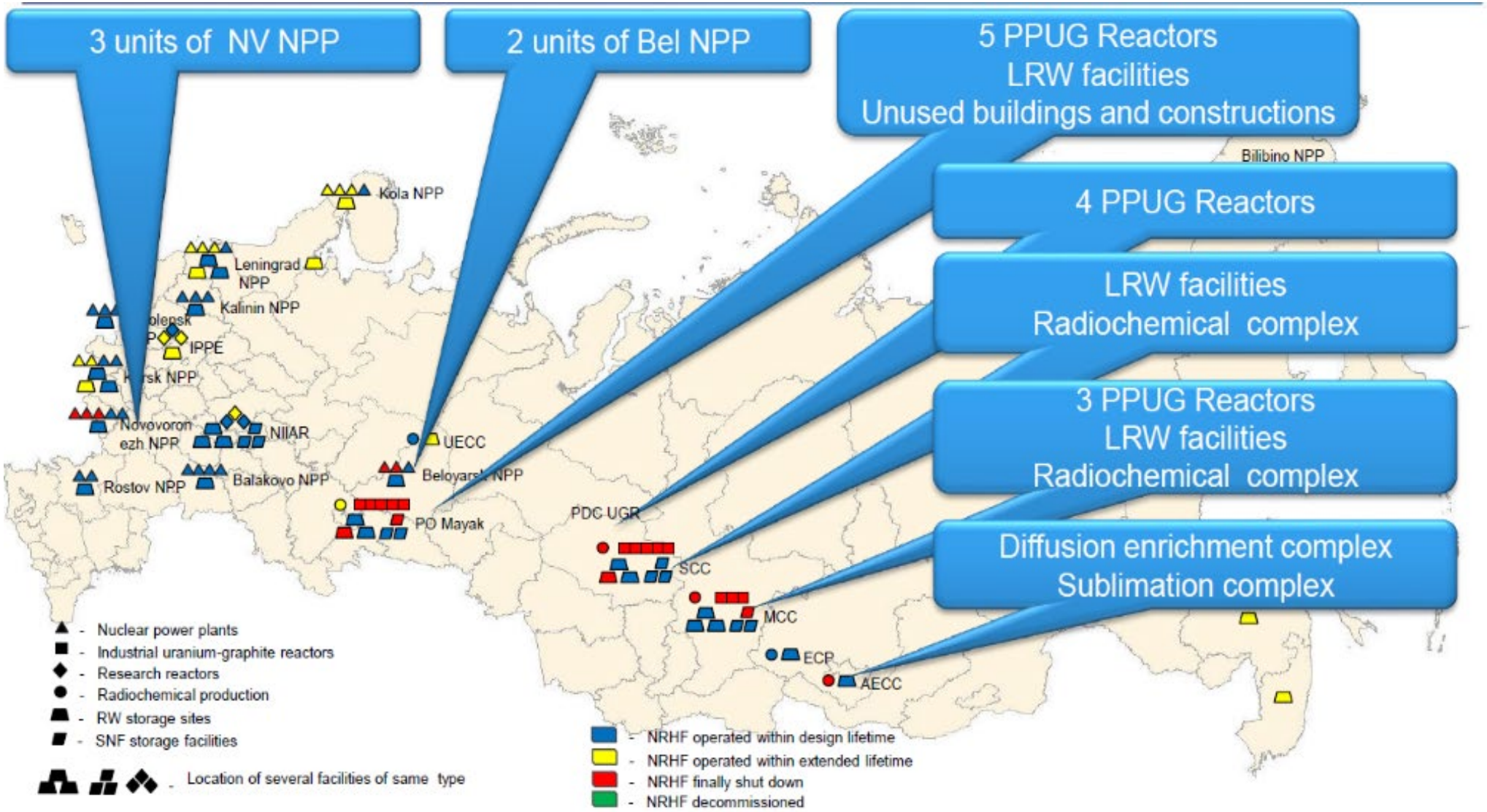
Rehabilitation area – 922 000 m^2

Building and adits dismantlement. Elimination of the ventilation ducts, crosscuts; filling adit’s entrances;rock dumps remediation.

Remediation of the tailing dumps of the hydrometallurgical plant.

Reconstruction of the radon pipline (adit No16).

Main Sources of RW Generation in Future



Mean values for D&D of 1 NPP unit:

20 000 tons of accumulated RW

Specific amount of metal 15 000 tons

Labor capacity 5600 personnel years

New-generated RW 14 000 tons

Impediments in RW Management

Typical Radwaste generated from decommission

Concrete structure


Metal structure


Equipment


Wood and organic waste


Soil and concrete sand


Other
(wire, glass, insulations, etc)

RosRAO average capacity of segregation and characterization ~ 0.2 m^3/(man·hour)

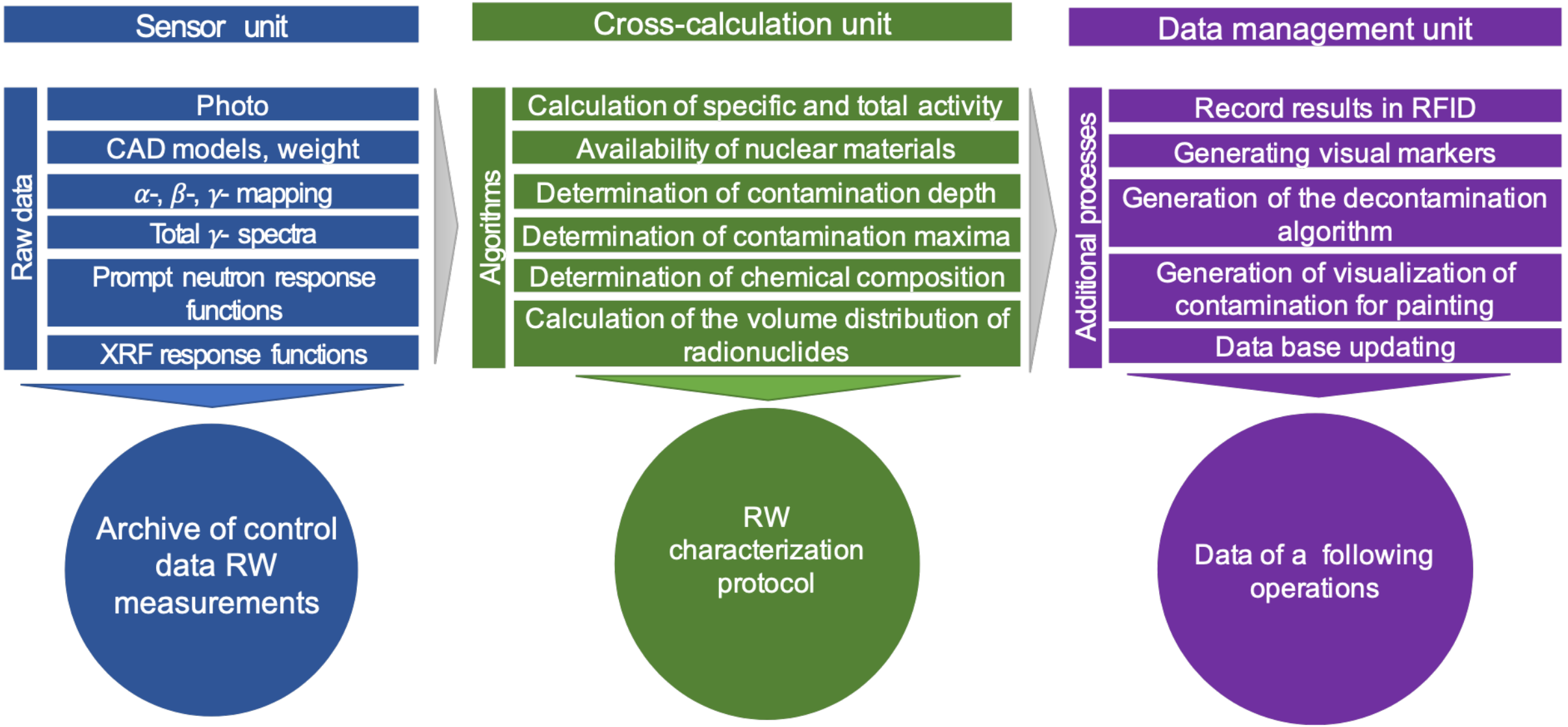
The main challenges faced by RosRAO to raise of the capacity :

Aspect	Challenge to be resolved
1) Irregular shape	Impossible to perform surface activity measurement; change of distance between detector and object causes error in measurement
2) Mixed morphological composition	Unknown morphologic composition does not allow to define correctly the binding constant and estimate amount of nuclear materials in the object
3) Inaccessibility of interior of the equipment for measurements	Impossibility to measure internal surface activity of contaminated process equipment leads to false reduction of RW class
4) Integral character of the measured values	Conservative approach to detect total activity of the object leads to false increase of RW hazard class.
5) Absence of correlation between portions of waste	Knowing specific activity of a large amount of RW, it is impossible to guarantee that the specific activity of a portion will be similar
6) Huge amount of manual operations	Low rate of characterization

Ways to solve the problem:

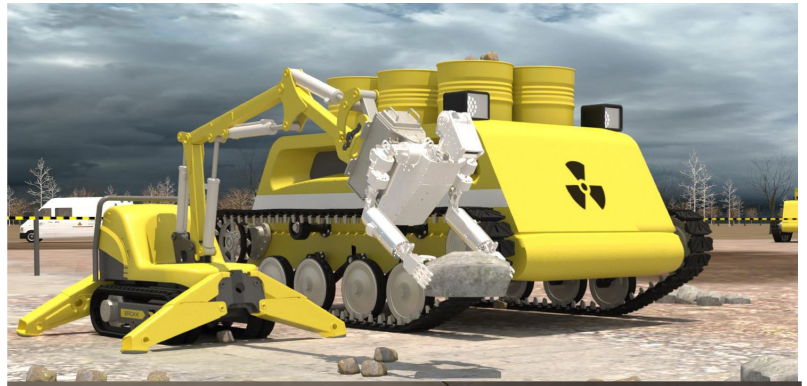
- **minimization of measurement time (combined measurements);**
- **reduction of the segregated portion (accounting for internal activity of nuclides);**
- **refusal of manual labor (unification and automation of operations).**

Дорожная карта

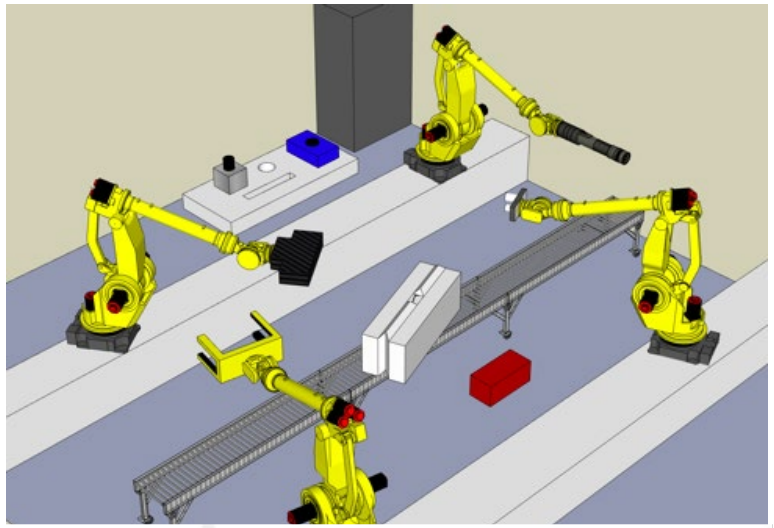


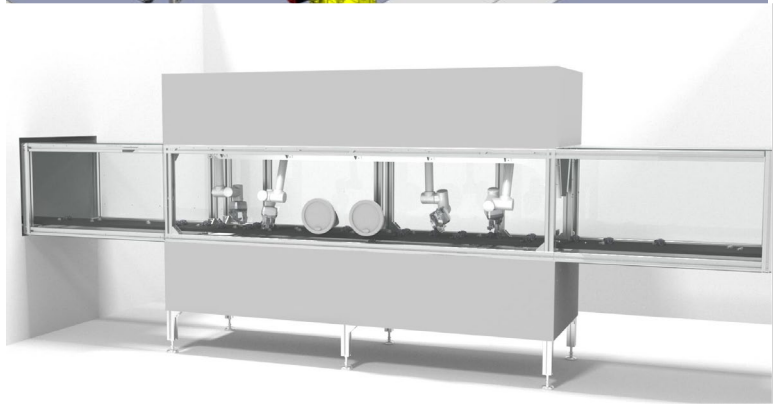
Technology future view

Retrieval and collection



Sorting and decontamination





Storage

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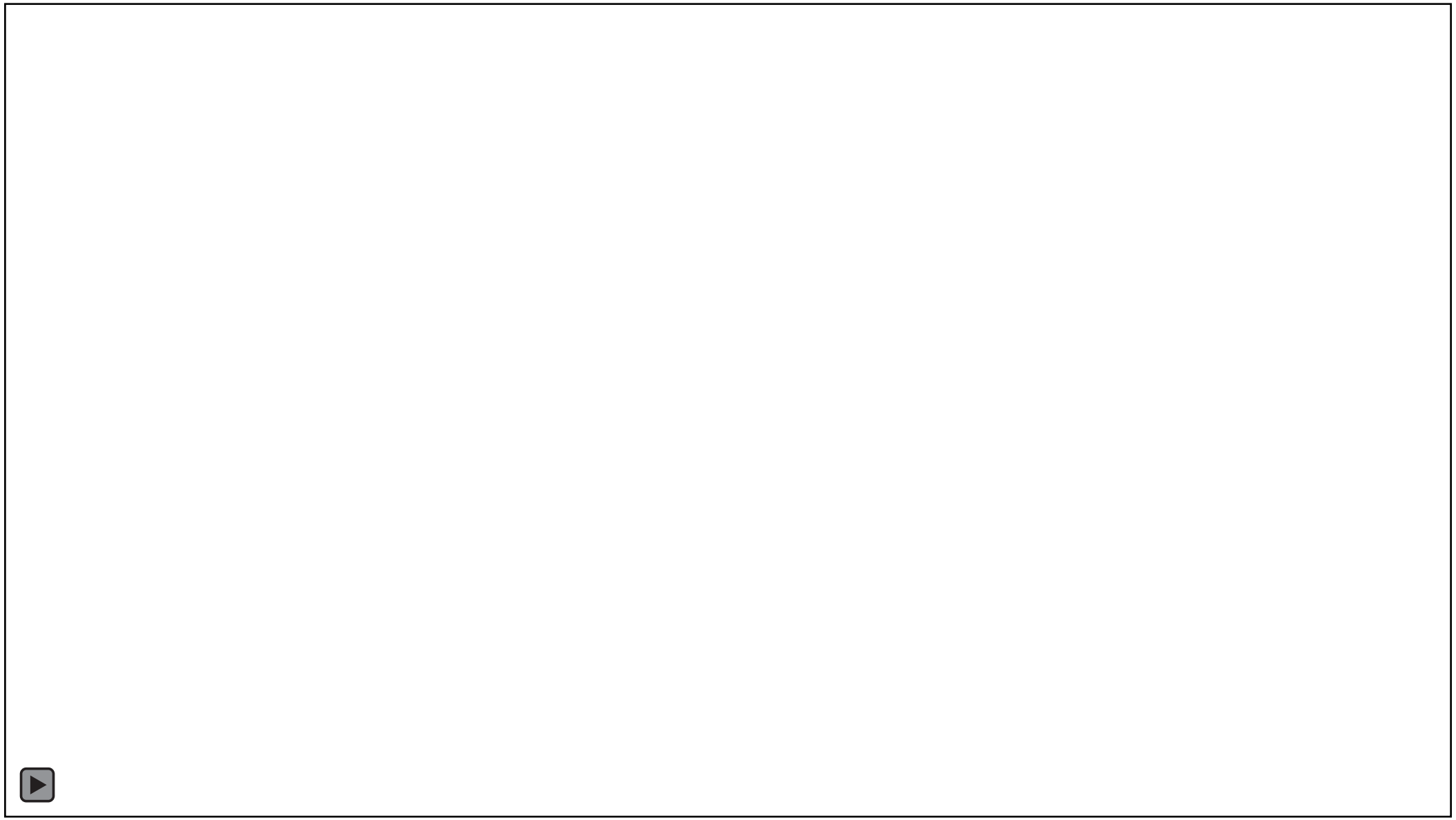
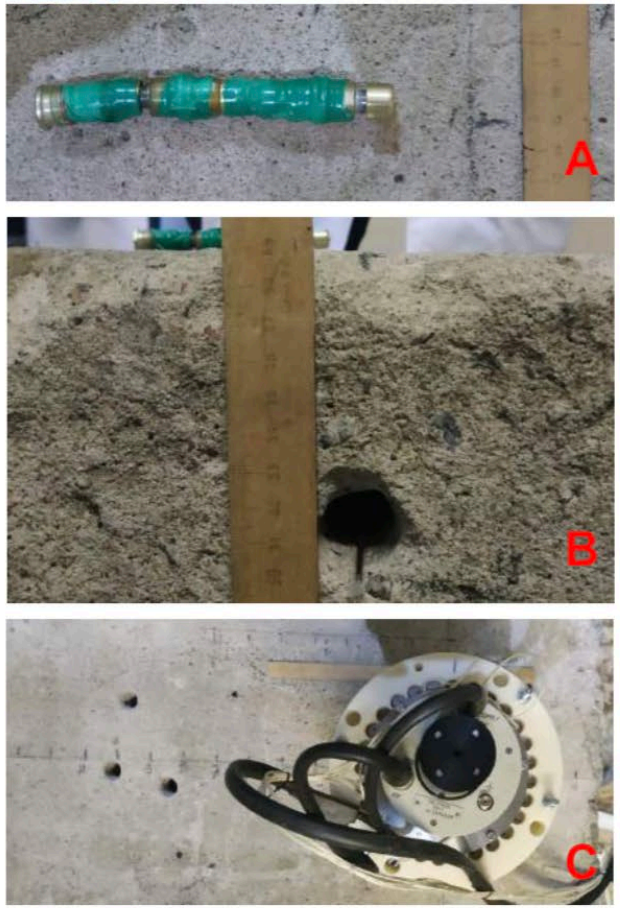
Today RosRAO R&D: anthropomorphic manipulator



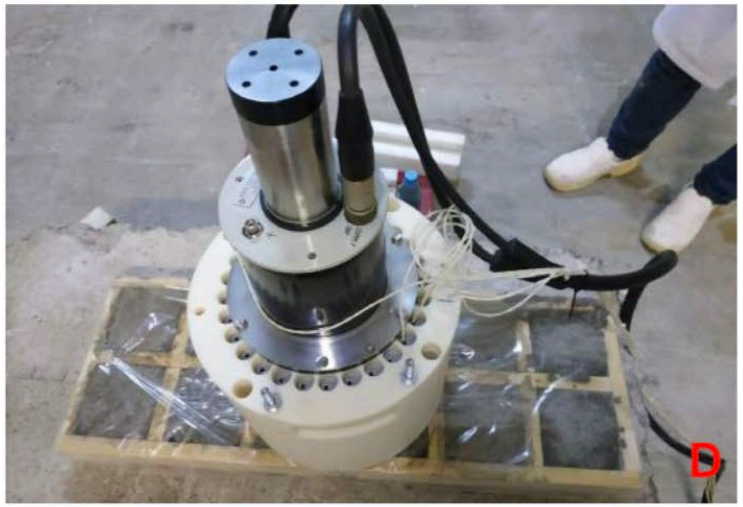
Today RosRAO R&D: Alpha deep Contamination Scanner

The following two groups of tests have been performed (neutron generator settings: flux $7 \cdot 10^8$ n/s, pulse time 30 μs, frequency 800 Hz)

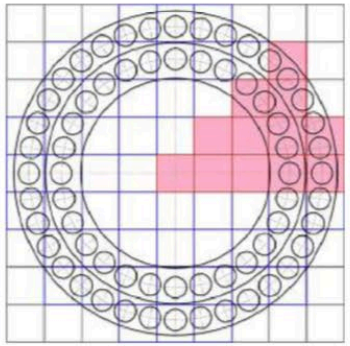
1) Dot sources ^{235}U (3.5 mg) at the amount of 42 pcs. Were placed at different distance and depth from AEDCS



2) Concrete bricks with homogeneous distribution of ^{235}U 6 mg/kg at the amount of 10 pcs.

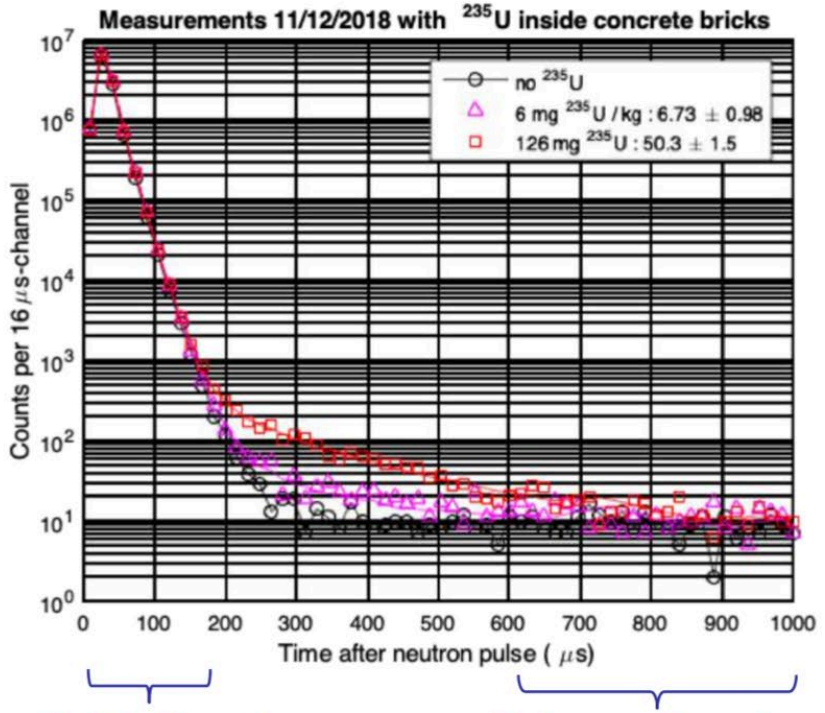


Verification test aimed at optimization of location of corona counters



Grid 9x9 (81 cells)
Pace: 33mm
Active cells: 61
Basic cells: 12

There has been verified the opportunity to define coordinates of dot uranium, optimum matrix made of downsized corona counters was selected



Minimum detected mass of ^{235}U verified:
- 2 mg/kg by homogeneous distribution in concrete;
- 5 mg for dot sources.

Outputs

Modern technologies allow performing D&D projects much faster however significantly more expensive.
Technologies aimed at reduction of RW storage areas are more risky.
Modern regulation doesn't meet modern technology.

Thank you for your attention!

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