THE FEDERAL STATE UNITARY ENTERPRISE
«NATIONAL OPERATOR FOR RADIOACTIVE WASTE MANAGEMENT»

Establishment of Underground Research Laboratory

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Moscow, 2015

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Basis for radioactive waste management

IAEA
International Atomic Energy Agency

Joint Convention on the Safety of Spent Fuel Management and on the Safety of radioactive waste management (ratified in Federal Law № 139-ФЗ at 04.11.2005)

FEDERAL LAW
№ 190-FL
"On radioactive waste management"

- ✓ **Move to practice the final isolation of radioactive waste**
- ✓ **Creating the unified state system for radioactive waste management and the national operator for radioactive waste**
- ✓ **Reducing the burden of environmental risks associated with radioactive waste for future generations**
- ✓ **The principle of the financial liability of owners of radioactive waste for the full cycle of RW**

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International practices on creation of Waste Management Organizations (WMO)

B a c k g r o u n d

- 50 - 60 years of nuclear energy development
- Large volume of accumulated problems in the final stages of the nuclear facilities life cycle

IAEA recommendations for a clear division of duties and responsibilities between the producers of RW, safety regulators and specialized organizations for radioactive waste management (WMO) "in order to avoid conflicting requirements that would violate the safety question"

All the countries using nuclear power have come to the need of establishment specialized institutions responsible for the final stage of nuclear facility life cycle

Areas of activity	FOREIGN ORGANISATIONS						
	France	Germany	USA	Great Britain	Sweden	Japan	Spain
Decommissioning	Operators ANDRA CEA	BfS (Federal Office for Radiation Protection) Operators	Operators	NDA (Nuclear Decommissioning Authority)	Operators	Operators	Operators
Spent nuclear fuel handling	AREVA ANDRA (SNF recognized as RW)	DBE TECHNOLOGY	DOE (Department of Energy)		SKB (Swedish Nuclear Fuel and Waste Management Company)	JNFL (Japan Nuclear Fuel Limited)	ENRESA
RW Management	ANDRA	BfS (Federal Office for Radiation Protection) DBE TECHNOLOGY		Nirex		NUMO (The Nuclear Waste Management Organization of Japan) JNFL (Japan Nuclear Fuel Limited)	

Governmental organizations

Private institutions

The main task - to find a place and to justify the possibility of creating deep geological disposal facility (DGR) for high-level radioactive waste (HLW) / SNF recognized as RW

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International practices on creation of Waste Management Organizations (WMO)

Underground research facilities created only for researches		
Name, country	Structure type	Rocks, depth
Asse, Germany	Former salts mine	Salt, 490 – 950 м
Tono, Japan	Former uranium mine	Sedimentary rocks, 150 м
Kamaisi, Japan	Former iron mine	Granite, 300 – 700 м
Grimsel, Switzerland	Workings out of the tunnel	Granite, 450 м
Mont Terri, Switzerland	Workings out of the tunnel	Hard clay, 250-320 м
Olkiluoto, Finland	Tunnel	Granite, 60 – 100 м
Turnemir, France	Former railway tunnel	Hard clay,, 250 м
HADES-URL, Belgium	Complex for experiments	Clay, 230 м
Whiteshell, Canada	Complex for experiments	Granite, 240 – 420 м
Äspö, Sweden	Complex for experiments	Granite, 200 - 450 м

Underground research facilities created for researches with possibility of creation DGR on the place	
ONKALO, Finland	Granite, 500 м
Meuse, France	Gault clay, 450 – 500 м
Gorleben, Germany	Saline dome, 900 м
Konrad, Germany	Developing in an iron mine in limestone, overlain by shales, 800-1300 м
Morsleben, Germany	Saline dome, about 500 м
WIPP, USA	Salines, 655 м
Yukka Mountain, USA	

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Creation of Underground Research Facility to study the possibility of 1,2 classes RW disposal (Krasnoyarsk region)

Current tasks:

Creation of an underground research laboratory in potentially suitable geological formations to study the possibility of disposal of 1,2 classes radioactive waste

- Clarification enclosing rock massif characteristics, confirming suitability for the safe disposal of long-lived HLW and ILW;
- Clarification of engineering barriers insulating properties;
- Testing of technical solutions, transport and technological schemes of operating the planned facility for final isolation of radioactive waste.

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Creation of Underground Research Facility to study the possibility of 1,2 classes RW disposal (Krasnoyarsk region)

The basic constructions of the URF

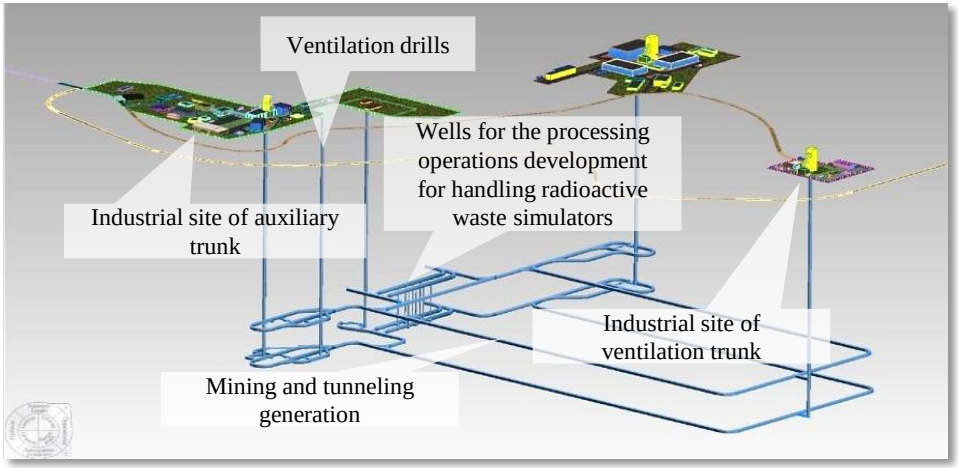
Three vertical shafts, depth to 525 m, diameter 5.5-7.0 m

Surface infrastructure, including ground-based buildings and structures on the shaft spaces

Horizontal workouts, depth 450 - 525 mm, length 5000 m

Wells for the processing operations development for handling radioactive waste simulators:
- Four horizontal workouts with a total length of 600 m cross-section of 40-60 m2,
- Four vertical wells with a depth of 75 m

Scheme of Underground Research facility in Nizhnekams massif



Integrated researches

- Geodynamic;
- Geomechanical;
- Hydrogeological;
- Hydro-geochemical and radiometric;
- Other special research methods.

A decision on the possibility of placing a deep geological disposal facility

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The results of the researches

The results of the operational phase research works will be the basis of forecast calculations to substantiate the safety of RW final isolation

Possible options:	**Further activities:**
1. Validation of design solutions, simulation results and long-term safety assessments	Obtaining a license for construction and operation of disposal facility. The transition to full-scale work on the placement of project volume and range of RW
2. The conclusion that there was insufficient production and / or long-term security provided by the design decisions on engineering protective barriers	Completion of the project to change the composition of geometry and / or the technology of the system of engineered barriers
3. The conclusion that there was insufficient long-term safety of the facility provided by the primary safety barrier - geological environment, ie, the conclusion on the impossibility of any reasonable revision of the system of engineered barriers safe placement of the proposed project volumes, nomenclature or the total activity of 1, 2 classes radioactive wastes	Refusal (for security reasons and / or economic aspects) from the hosting of any type of facility
	The change in nomenclature of the RW placement

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Environmental impact

The main effects of the object on the environment and human at all stages of the life cycle

	Stage of the lifecycle	Impact
1	Building	Chemical Acoustic Mechanical
2	Operation	Chemical Acoustic
After confirming the safety operation of the facility		
3	Operation	Chemical Acoustic Radiation Thermal
4	Closure	Chemical Acoustic Radiation Thermal
5	Postoperational period	Radiation Thermal

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Environmental impact

	Object	Impact	Impact assessment*
1	**Subsoil**	Digging change in the near field of hydrodynamics	In carrying out the necessary measures will not entail significant impact
2	**Soil cover**	The destruction of the layer to create mounds, polygonal objects; partial destruction in the band linear objects, chemical exposure	Implementation of environmental measures envisaged by the project minimizes this effect
3	**Flora**	Mechanical damage and contamination of vegetation	In view of the reforestation activities and the organization of biomonitoring - permissible
4	**Fauna**	Noise, vibration, light from operating transport construction equipment	The area of the object is located away from the migratory routes of large animals - the moderate impact

* According to the preliminary environmental impact assessment materials

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Environmental impact

	Object	Impact	Impact assessment*
5	Surface water	Accumulation of domestic, mining, industrial and storm water at its sites.	Minor, polluted water waste is excluded.
6	**Groundwater**	Extraction of groundwater, with the aim of using them for drinking and technical water supply facility, groundwater pollution by sewage from areas subject and mine waters	In order to protect groundwater against pollution and deterioration, establishes a system of production and environmental monitoring. The impact on the underground water is estimated as allowable.
7	**Air**	Using in the construction of road-building and special machinery, emissions associated with underground mining operations, refueling vehicles.	Assessment of the level of air pollution faces that maximum permissible concentration exceedence is not expected.
8	**Acoustic effects**	Noise on the border near residential areas	Estimated acoustic impact on the level does not go beyond the boundaries of maximum permissible.

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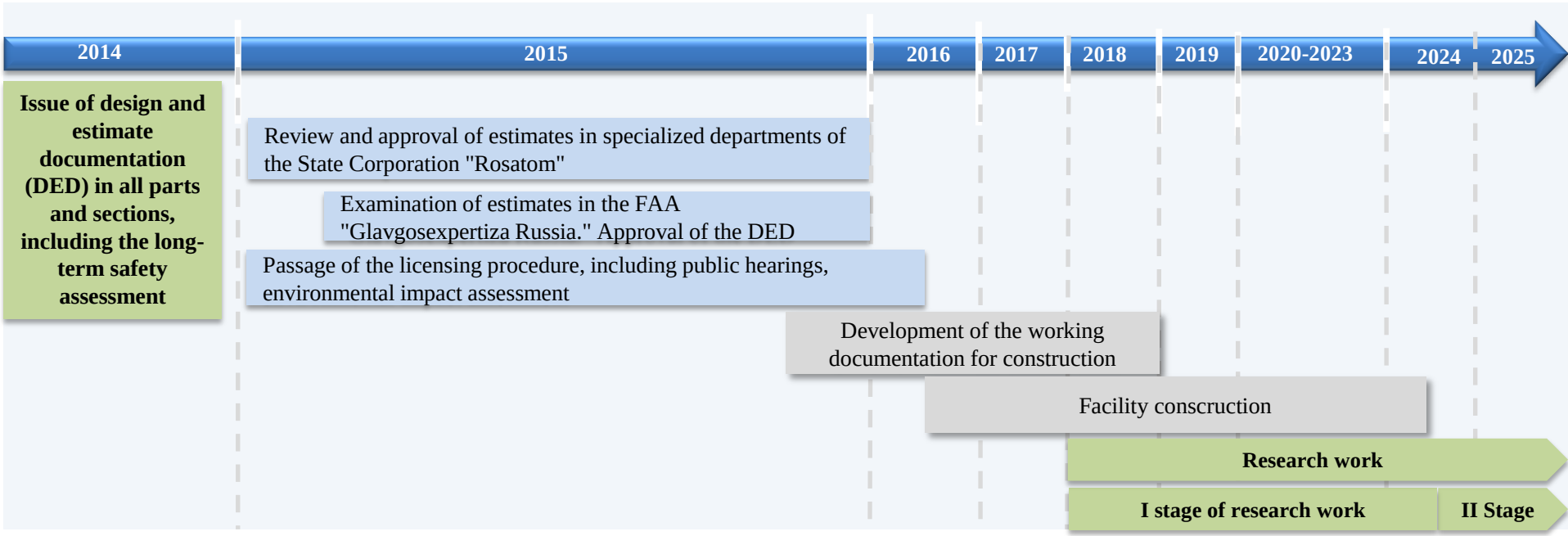
Stages and terms of underground research laboratory construction



Facility Features :

- object has no analogues in Russia,
- fully simulates the conditions of disposal of radioactive waste,
- It ensures maximum reliability of long-term safety assessments.

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Stages and terms of research work in underground research laboratory

Stage I - 2018-2024:

- **Research of rock mass to a depth of 520** meters during the construction of three vertical shafts to a depth of 520 m in diameter by 6.0 m.
- **Research of rock mass in the square 360 * 730** m in the 450-520 m depth range - Implementation of a complex engineering-geological surveys, field and laboratory research in the horizontal workings with a total length of 5000 m and drilled one exploration well.
- **Testing of technical operations building cameras** and radioactive waste disposal wells.

Stage II - from 2024

- **Testing of technical operations for handling radioactive waste simulators** - in underground structures underground laboratory.
- Technology research facilities and insulating properties of the elements of the system of engineered barriers in four horizontal workings with a total length of 600 m and four vertical wells to a depth of 75 m.
- Continued research of rock mass in horizontal transport and ventilating mines with a total length of 5000 m.

Thank you for attention!