URF program in the Russian Federation
1, 2 CLASSES (HLW) OF RADIOACTIVE WASTE. MAIN WASTE GENERATORS and PERSPECTIVE FINAL ISOLATION SITE

- Leningrad NPP
- Smolensk NPP
- Kursk NPP
- Novovoronezh NPP
- Balakovskaya NPP
- Beloyarsk NPP
- NizneKanskiy massif

Kursk NPP, Smolensk NPP, Leningrad NPP, Koliniskaya NPP, Smolensk NPP, Kalinin NPP, NizneKanskiy massif, Rostov NPP, Balakovskaya NPP.
## Feasibility study to select region for the URL siting

<table>
<thead>
<tr>
<th>Research period</th>
<th>Prospective sites location</th>
<th>Rock massif characteristics</th>
<th>Conclusion</th>
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<tbody>
<tr>
<td>1990s, 2006, 2017</td>
<td>Kola Peninsula</td>
<td>Hard-rock</td>
<td>Refusal of local authorities</td>
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<tr>
<td>1970s, 2014</td>
<td>Kalmykiya, «Stepnoe» site</td>
<td>Finely divided clay</td>
<td>Refusal of local authorities</td>
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<tr>
<td>1980s, 2015</td>
<td>Territory of Mayak production association</td>
<td>Hard-rock</td>
<td>Remoteness from radwaste sources. Disposal facility for radwaste of 3 and 4 class will be created.</td>
</tr>
<tr>
<td>1963-2001</td>
<td>Underground complex of Mining and Chemical plant</td>
<td>Hard-rock, gneiss</td>
<td>The potential feasibility of rock massif of NKM is justified for radwaste disposal</td>
</tr>
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</table>
Preliminary researches at Niznekan ski y to select the site of the URL

<table>
<thead>
<tr>
<th>Research periods</th>
<th>Prospective sites location</th>
<th>Works done</th>
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<tr>
<td>1992-1995</td>
<td>Within 100 km from MCP</td>
<td>Choice of 20 potential sites. Then 5 prospective sites were selected from those 20 5 potential sites</td>
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<tr>
<td></td>
<td></td>
<td>The most prospective were «Verkhneitatskiy» and «Yeniseiskiy».</td>
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<tr>
<td>1996-1999</td>
<td>«Verkhneitatskiy»</td>
<td>Complex survey on surface and in deep wells</td>
</tr>
<tr>
<td>2002-2008</td>
<td>«Yeniseiskiy»</td>
<td>Phased reduction of the area: 70 – 25 – 5 - 1.1 km², Increasing details of the researches on surface and in deep wells</td>
</tr>
<tr>
<td>Result</td>
<td></td>
<td>The Yeniseiskiy site was chosen to place the URL</td>
</tr>
</tbody>
</table>
Selection of a perspective site

**Site «Yeniseisky»**

Selected as a result of long geological studies conducted within the Niznekkansky rock massif in 1993 - 2005

**Perspective sites**

1 – «Southern»
2 – «Verkhneitatsky»
3 – «Nizhneitatsky»
4 – «Telsky»
5 – «Yeniseisky»
Implementation of the program for the creation of Underground Research Laboratory (URL) in the Russian Federation

The key focus areas at each phase:

- Management system and staff;
- R&D to demonstrate safety of the selected deep disposal concept;
- Design development;
- Practical surveys at the site;
- Pre-disposal management of RW;
- Stakeholder engagement.

Timeline:

- Development of Strategic Master Plan for R&D: 2008-2015
- Site selection and characterization: 1990s
- Development of the design for DGR: 2008-2015
- Pre-construction activities for creation of the URL: 2017
- Construction of the Underground Research Laboratory (URL): 2022
- The experiments and tests in Underground Research Laboratory (URL): ~2026
- Decision on repository construction: ~2031
- Operation of the first unit: ~2035
- Closure of the first unit: ~2065
Creation of the Underground Research Laboratory in Nizhnekanskiy rock massif for final RW disposal

General plan of ground facilities

Scheme of the Underground Research laboratory, Nizhnekanskiy rock massif

The basic construction of Underground Research Laboratory

- Tree vertical shafts: depth of 525 m, diameter 6.0 – 6.5 m
- Surface infrastructure, including surface buildings and structures on the site with shaft
- Horizontal capital mining galleries at a depth of 450 m and 525 m with the total length of 5 000 m
Basic rock massif

Gneiss (~80%)

Gneiss under microscope

Dolerite (~20%)

Dolerite under microscope

The rock massif is represented in varying degrees of metasomatic altered gneisses of deferent composition and dolerite dykes and is a stable block mountain.
The Underground Research Laboratory key objectives

- Sophisticated research of the host rock mass characteristics, confirmation (under natural conditions) of the rock mass suitability for safe deep disposal of long-lived conditioned radioactive waste
- Research and justification of the isolating properties of engineering barriers
- Testing of technical solutions for the construction of the object, including engineering barriers, on-site transport operations, final placement of waste packages and closure of disposal units
- Testing of transportation and technological schemes for the construction and operation of radioactive waste disposal facility, testing and development of non-standard equipment
- Demonstration to the experts and the public the safety case and operation of future radioactive waste disposal facility
- Training of operational personnel to perform work in the facility
Scenarios of the project further development

The results of the URL operational phase researches will form ground for the predictive calculations to prove the safety case of DGR

The following scenarios are possible:

1. Validation of design solutions, simulation results and long-term safety assessments

2. Conclusion that there is insufficient operational and/or long-term safety provided by the design of engineering protective barriers

3. Conclusion that safety case of the facility is not proved by the primary safety barrier - geological environment

Future steps under certain scenario:

- Applying for the DGR construction license
- Change of the composition, geometry or technology of engineering protective barriers construction
- Reconsider (for safety reasons and/or economical aspects) the decision to place the facility of any type of waste
- Change type of waste appropriate for disposal
Conclusions on the creation of the Underground Research Laboratory (URL) in the Nizhnekanskiy rock massif

1. The long term “Strategy for the development of Geological Disposal Facility” and the “Strategic Master Plan for Researches”, which provides a step-by-step implementation of researches in 150 areas, has been developed. The results of comprehensive researches will be regularly presented in open media and at international conferences.

2. It is planned to create a Ground Demonstration Research Center and Underground Research Laboratory (URL) to carry out comprehensive research of the rock massif, optimize engineering barriers, work out radioactive waste management operations, demonstrate operational safety.

3. Depending on the results of research in the URL and the justification of long-term safety, various options are possible for the creation of a Deep Geological Disposal Facility, including significant reduction in the range and volume of isolated radioactive waste.

4. Creation of Deep Geological Disposal Facility and it’s operation are possible only after receiving the entire set of licences, permits and public acceptance.