



DECOMMISSIONING RUSSIA'S OLD NUCLEAR POWER REACTORS

STATUS UPDATE ON KEY PROCESSES

RUSSIAN SOCIAL-ECOLOGICAL UNION / FRIENDS OF THE EARTH RUSSIA,
KOLA ENVIRONMENTAL CENTER, ZA PRIRODU/ FORNATURE,
PUBLIC COUNCIL OF THE SOUTH COAST OF THE GULF OF FINLAND,
NATURVERNFORBUNDET/ FRIENDS OF THE EARTH NORWAY

The report is part of the project “From closed rooms to openness”, financially supported by the Norwegian Radiation Protection Authority from the Nuclear Action Plan. Project partners from Russia, Ukraine and Norway cooperate to promote safe, social and environmentally acceptable decommissioning of old nuclear power plant reactors, including handling of radioactive waste and spent nuclear fuel. We believe in openness and participation of all stakeholders in the decision-making processes, including authorities at all levels, business and civil society.

Published by

- Russian Social-Ecological Union / Friends of the Earth Russia (Russia)
- Kola Environmental Center (Apatity - Murmansk oblast, Russia)
- Public Council of the South Coast of the Gulf of Finland (St. Petersburg – Leningrad Oblast, Russia)
- Za Prirodu/ For Nature (Chelyabinsk, Russia)
- Naturvernforbundet/ Friends of the Earth Norway (Norway)

Edited by Kjersti Album, Naturvernforbundet/Friends of the Earth Norway

Contributions by Oleg Bodrov, Yuri Ivanov, Dag Arne Høystad, Daria Matveenkova, Olga Senova, Vitaly Servetnik and Andrey Talevlin

Language editing by Aled D Fischer

Front page design by Kristine Kleppo og Kristian S. Aas

For more information, please contact the participating partners directly or refer to our reports, which can be found at the web site of Russian Social-Ecological Union (Friends of the Earth Russia) : <http://rusecounion.ru/decomatom> and at the web site of Naturvernforbundet (Friends of the Earth Norway): <http://naturvernforbundet.no/decommissioning-reports>

St.Petersburg, Sosnovy Bor, Chelyabinsk, Apatity/Murmansk, Oslo – March 2019



Naturvernforbundet
Friends of the Earth Norway

Russian Social-Ecological Union
Friends  of the Earth Russia

Decommissioning Russia's old nuclear power reactors

**Status update on key processes
2018**

Content

1. Introduction	5
2. Summary: Main developments in 2018	6
3. Current status of the nuclear power reactors in Russia	10
4. Radioactive waste and spent nuclear fuel	16
5. Nuclear-related laws and changes in policy	17
6. Expertise on Leningrad nuclear power plant's decommissioning plan.....	19
7. Rosatom in the Arctic	24

1. Introduction

Russia currently has 35 nuclear power reactors, of which 25 are operating beyond their designed lifetime. So far, 5 units have been shut down and the fuel has been unloaded, but dismantling has not started. In 2018, the first unit at Leningrad NPP was closed, which makes 6 units closed. In 2019, one additional Chernobyl type unit at Leningrad NPP – unit 2 - will be closed, or at least this is the plan.

At the same time, decommissioning plans are lacking. Unit 1 at Leningrad nuclear power plant was closed in December 2018, and a very general decommission plan has been made. Rosenergoatom will spend the next few years planning the dismantling of the unit. Several questions remain unanswered, for instance how to deal with the reactor graphite. Also, solutions are lacking for the handling of radioactive waste and spent nuclear fuel.

For our report this year, we have chosen to focus on the decommissioning plan for Leningrad nuclear power plant's first unit - the oldest Chernobyl type reactor in the world. We present excerpts from an expert analysis of the decommissioning plan in chapter 6.

But first, we present a short background and updates on the major developments in 2018 in chapter 3. Chapter 4 focuses on radioactive waste and spent nuclear fuel, and chapter 5 presents developments in nuclear-related policy as well as law. In chapter 7, we present the main findings from the recent report Nuclear in the Arctic. The report shows that Rosatom gained more responsibility and power.

Decommission plans should be good enough to endure review not only from authorities at all levels, but also civil society including trade unions, environmental groups and neighboring communities. The lack of information poses an obstacle to good solutions, as do decisions taken in closed rooms. There should be an aim to promote knowledge and participation.

All information in this report is collected from open and available sources. We have put it together in what we hope is understandable and readable form.

2. Summary: Main developments in 2018

The main developments in Russian nuclear decommissioning and related subjects in 2018 were

- Closing of unit 1 at Leningrad nuclear power plant (LNPP)
- Prolongation of unit 1 at Kola nuclear power plant
- A new policy on nuclear and radiation safety
- That Rosatom have become more powerful and more closed, in general and in the Arctic
- International expansion of Rosatom in Europe and Asia

The developments are briefly explained here and presented in depth later in the report.

Closing of unit 1 at Leningrad nuclear power plant

After operating for 45 years, the oldest Chernobyl type reactor in the world closed on December 21st, 2018. Five years will now be spent for extensive decommissioning planning, before the dismantling work will start. There is still a lot of uncertainty, such as what to do with the graphite moderator.

Decommissioning of nuclear power plants is a complex:

- Technological – there are no technologies for long-term isolation (for a hundred thousand years), or socially and environmentally acceptable technologies for the processing of spent nuclear fuel and high-level radioactive waste. There are about 7 thousand tons of radioactive graphite on the 4th reactor of the LNPP. The graphite is Carbon-14 with a half-life 5,700 years.
- Social – about a third of the 6,000 employees of LNPP can expect to participate in the decommissioning program. The rest will have to look for another job.
- Economic – the operator of the LNPP estimated the cost of the decommissioning of 4 power units at 725 million euros. For comparison, the cost of decommissioning only 2 similar units of Ignalina NPP (Lithuania) after 10 years of decommissioning is estimated to be 4 times higher.
- Environmental – because of the synergetic effects of radiation and chemical pollution in the area of the nuclear cluster on the southern coast of the Gulf of Finland, it seems that the limit of the ecological capacity of the habitat has been reached. The percentage of cytogenetic damage in seeds and pine needles in the nuclear cluster is 3 times higher than normal, and in the city of Sosnovy Bor (4 km from the nuclear facilities) is 2 times higher than on the border with St. Petersburg (40 km from the nuclear cluster).
- Moral – the transport of spent nuclear fuel from the Sosnovy Bor (South Coast of the Gulf of Finland, Baltic Sea) to the coast of Yenisei river to the temporary storage of spent nuclear fuel to the close nuclear city Zheleznogorsk (Krasnoyarsk territory) is perceived by the residents of the Krasnoyarsk territory as a demonstration of the

colonial policy of European Russia towards Siberia. More than 120,000 signatures have been collected against such a strategy.

Prolongation of unit 1 at Kola nuclear power plant

In January 2018, unit 1 at the Kola NPP was stopped for repair work to prolong its work for another 15 years before 2033. In July, Rostekhnadzor issued a license which gives Rosenergoatom the right to operate the Kola nuclear power unit number 1 for an additional period of 15 years - until 2033 and for 60 years it total. This kind of prolongation took place for the first time in the history of the Russian nuclear power industry.

On July 22nd, 2018, Naturvernforbundet's partner EPS sent an official letter to Rostekhnadzor about the prolongation of operation of 1 reactor of the Kola NPP. But the State Ecological Expertise and public hearings on this prolongation were not conducted. On September 20th, we received a response from Rostekhnadzor. In the response letter, Rostekhnadzor replied that the public hearing and environmental impact assessment (EIA) are not necessary because the works are done on the nuclear object that has already been constructed. The hearings and EIA are required only for new objects, so it was not a violation of the law.

December 24th, after large-scale modernization, power unit No. 1 of the Kola NPP was switched on to the network. For the first time in the Russian nuclear power industry, the VVER-440 power unit was launched after a second extension of its service life. New systems for emergency cooling were introduced, as well as safety systems. Radiation monitoring systems and diagnostic systems were upgraded. «This is important for the region as uninterrupted and reliable energy supply for the development projects of the Arctic zone of Russia - the creation of the Murmansk transport hub and the Kola support zone of the Arctic», officials said¹.

Change in state policy in the nuclear field

In October 2018, the president issued a decree on state policy on nuclear and radiation safety. One of the objectives of the policy is ensuring compliance with Russian legislation on the availability and openness of information on state of nuclear and radiation safety.

One of the evaluations of the effectiveness of the program is the amount of spent nuclear fuel. From our point of view, an increase in the reprocessing of spent nuclear fuel will not improve the state of nuclear and radiation safety due to the large amount of radioactive waste generated from reprocessing.

Rosatom more powerful and more closed, in general and in the Arctic

In the third quarter of 2018, the State Duma of Russia adopted a law that made corporation Rosatom the Russian Arctic operator. This news has been published in all official media (newspapers, TV) and in internet media. Rosatom will have a great influence over state policy in the Arctic region. The influence of other state structures will be significantly reduced compared to Rosatom. Taking into account the lack of transparency of this state corporation, all Rosatom projects will likely be coordinated with the federal authorities

¹ Source: <https://tass.ru/ekonomika/5948414>

without regional participation. In fact, a non-transparent monopoly is born in the Arctic region, and this causes doubts that the current strategy is correct.

Rosatom sees its main task in the Arctic as providing year-round navigation on the Northern Sea Route using icebreakers.

In addition, it is worth noting one large Rosatom project - the construction of the floating nuclear power plant Akademik Lomonosov to replace the Bilibino NPP in Chukotka. Currently, the floating unit, loaded with nuclear fuel, is on the quay in Murmansk. On November 2nd, the reactor facility begun its operation on very low capacity, without generating electricity – a standard procedure. In 2019 Akademik Lomonosov will go far – 6,000 kilometers - along the Arctic coast along the Northern Sea Route to the city of Pevek.

The project of the floating station means the expansion of the influence of Rosatom in the Arctic. The power unit will have to provide nuclear electricity to port cities, gas and oil platforms in the open sea.

The Kola nuclear power plant has already operated for more than 40 years. Therefore, Rosatom plans to build Kola NPP - 2 to replace the old plant, which will be gradually decommissioned. Rosatom plans to create small nuclear reactors for use in hard-to-reach places on the Arctic coast.

International expansion of Rosatom in Europe and Asia

State Corporation Rosatom ranks first in the world in terms of the number of nuclear power plants under construction in other countries. In 2018, projects for the construction of 36 power units in twelve countries – in Europe, the middle East, North Africa, and the Asia-Pacific region – are at different stages of implementation².

The portfolio of foreign orders for a ten-year period, according to the General Director of Rosatom Alexei Likhachev, now exceeds 133 billion dollars³.

Russian projects for the export of NPPs are based on the provision of state financial and technological support for NPP projects, including the design, construction and operation of NPPs (training of students and advanced training of specialists), the supply of fresh nuclear fuel, as well as the decommissioning of NPPs after the development of the resource, and handling radioactive waste and spent nuclear fuel.

To provide such comprehensive support, technologies that can be used both for civil and military nuclear purposes are used, as well as enterprises of Russian closed nuclear cities.

² Source: <http://www.rosatom.ru/production/design/stroyashchiesya-aes/>

³ Source: <https://sdelanounas.ru/blogs/94603/>

One of the important advantages of Russian projects compared to competitors from other countries is that Russia offers reprocessing of spent nuclear fuel on its own territory. Thus, Russia transfers to its territory the risks and environmental pollution associated with these technologies.

This expansion is promoted by Rosatom at climate talks and as part of the sustainable development goals. Rosatom during recent years has actively promoted nuclear energy as a climate solution.

On December 13th, 2018 in Katowice (Poland) during the COP-24, Rosatom arranged a round table of the Russian Federation "Russian investments for development with low greenhouse gas emissions". The idea to link nuclear technology with sustainable development and "contribute to SDGs" is reflected in the new governmental strategy approved in 2018.

Overview of current projects of VVER-1200:

Rooppur NPP, Bangladesh: Construction of two power units with VVER reactors (2,4 GW total capacity). The first concrete was poured on November 30th, 2017. January 30th, 2019 saw the completion of concrete works for the Unit No. 1 of Rooppur NPP turbine hall foundation slab.⁴

Belarusian NPP, Belarus: 2 power units with VVER-1200 (PWR) reactors; 2,400 MW total capacity launched on November 6th, 2013. Russian credit for the NPP and infrastructure is 10 billion USD

The first power unit is planned to be launched in 2019, and the second in 2020.

Russia will take spent nuclear fuel to Russia for reprocessing if fresh fuel is supplied by Russian producers.

Akkuyu NPP, Turkey: The intergovernmental Agreement was made in May 2010. On April 3rd, 2018, the first concrete pouring ceremony took place. The project involves the construction of 4 VVER-1200 power units, which are planned to be commissioned in 2023, 2024, 2025 and 2026. Russia allocated from the national budget an interest-free loan of 22.4 billion USD. In this case, about half of the funds will go to pay for Turkish companies that will participate in the construction. It is assumed that Russia will own 100% of the shares. Subsequently, it is possible to sell about half of the shares to Turkish companies.

Uzbek NPP: The First Uzbek NPP with two VVER-1200 power units is planned to be built with the support of Russia (11bn USD loan) in the South-East of Uzbekistan (Jizzakh region, Aydarkul lake). It is planned to start construction in 2022. Commissioning of the first power unit will begin in 2028, with the second in 2030.

Tianwan NPP, China: in cooperation with China National Nuclear Corporation (CNNC) Phase one and two includes 4 units in operation. According to strategic agreement, two new reactors VVER-1200 of Generation III+ will be built (Units 7 and 8 of Tianwan NPP).

⁴ Source: <https://rosatom.ru/en/press-centre/news/end-of-concrete-works-for-the-unit-no-1-turbine-hall-foundation-slab-and-of-soil-stabilization-works/>

Dabaa NPP, Egypt: Rosatom will build four VVER-1200 reactors and supply nuclear fuel throughout the plant's entire lifetime. An intergovernmental agreement was signed November 2015. El Dabaa will be the same kind of reactor as unit 1 of the Leningrad II nuclear power plant.

Hanhikivi-1 NPP, Finland: One power unit with VVER-1200 reactor. Rosatom's share in the project is 34% (2.5 billion euros). The preparatory phase of construction is underway. It is expected that the Finnish regulator will decide to issue a license for the construction of nuclear power plants after the parliamentary elections in Finland, Spring 2019. According to the preliminary agreement between the company Fennovoima and Rosatom, a monopoly supply of fresh fuel from Russia is expected, and in the first years it will be fresh fuel from uranium extracted during the processing of spent nuclear fuel in Russia.

Paks II, Hungary: Phase II is planned with two power units (Units 5 and 6); they will be built to VVER-1200 design.

Other projects with other reactor types⁵:

Kudankulam NPP, India: Units 3 and 4 are currently under construction with VVER-1000 reactors (2,100 MW total capacity) from 17th February 2016. On June 1st, 2017 signed the General Framework Agreement for construction of the Kudankulam NPP third stage (units 5 and 6 with VVER-1000 reactors).

Bushehr-2 NPP, Iran: In 2014 a contract was signed to build two VVER-1000 units as a on turnkey project. The ceremony of official start of Bushehr-2 project took place in September 2016. In October 2017, the start of construction and installation on the construction site of Bushehr-2 was announced.

3. Current status of the nuclear power reactors in Russia

The all-Russia operator Rosenergoatom has 10 nuclear power plants with 35 power units totally. Below is information on all Russian nuclear power plants. A summary of the information can be found in our updated table of Russian nuclear power plants (table 1).

⁵ Source <https://www.rosatom.ru/en/investors/projects/>

Table 1 Russian Nuclear Power Plants (NPPs)⁶

Red - power units operating on extended lifetime
 Black - power units operating within the design operation time;
 Green - power units stopped, fuel unloaded;
 Blue - power units under construction

Name of Power Unit	Satellite cities and regional centers with distance	Type of power unit	Power Gross MW	Generation of power unit	Year of commissioning	Year of the end of the designed lifetime	First year without electricity generation
Kola 1	Polyarnye Zori, 11 km Murmansk - 170 km	VVER-440/230	440	1	1973	2003	2034
Kola 2		VVER-440/230	440	1	1974	2004	2035
Kola 3		VVER-440/213	440	2	1981	2011	2036
Kola 4		VVER-440/213	440	2	1984	2014	2040
Leningrad 1	Sosnovy Bor - 3.5 km Saint Petersburg 35 km	RBMK-1000	1000	1	1973	2003	2019
Leningrad 2		RBMK-1000	1000	1	1975	2005	2021
Leningrad 3		RBMK-1000	1000	2	1980	2009	2025
Leningrad 4		RBMK-1000	1000	2	1981	2011	2025
Leningrad NPP - 2-1		VVER-1200	1200	3+	2018	2068	
Leningrad NPP - 2-2	VVER-1200	1200	3+	2020	2070		
Smolensk 1	Desnogorsk - 3 km away Smolensk 150 km	RBMK-1000	1000	2	1982	2012	2027
Smolensk 2		RBMK-1000/	1000	2	1985	2015	2029
Smolensk 3		RBMK-1000	1000	3	1990	2020	2034
Kursk 1	Kurchatov - 4 km Kursk - 40 km	RBMK-1000	1000	1	1976	2006	2021
Kursk 2		RBMK-1000	1000	1	1979	2009	2023
Kursk 3		RBMK-1000	1000	2	1983	2013	2028
Kursk 4		RBMK-1000	1000	2	1985	2015	2030
Kursk 5		VVER TOI	1255	3+	2020		
Kursk 6		VVER TOI	1255	3+	2022		
Novovoronezh 1	Novovoronezh 3.5 km Voronezh - 45 km	VVER-440/210	417	1	1964	1984	End 1984*
Novovoronezh 2		VVER-440/365	417	1	1969	1989	End 1990*
Novovoronezh 3		VVER-440/179	417	1	1971	2001	End 2016*
Novovoronezh 4		VVER-440/179	417	1	1972	2002	2032
Novovoronezh 5		VVER-1000-187	1000	2	1980	2010	2036
Novovoronezh 6		VVER-1200	1114	3+	2016	2076	
Novovoronezh 7		VVER-1200	1114	3+	2018	2078	
Kalinin 1	Udomlya - 4 km Tver - 125 km	VVER-1000	1000	2	1984	2014	2044
Kalinin 2		VVER-1000	1000	2	1986	2016	2047
Kalinin 3		VVER-1000	1000	2	2004	2034	2065
Kalinin 4		VVER-1000	1000	2	2011	2041	2073
Beloyarsk 1	Zarechnyy -3 km Ekaterinburg - 15 km	AMB-100	100	1	1964	1981	End 1988*
Beloyarsk 2		AMB-200	200	1	1967	1989	End 1989*
Beloyarsk 3		BN-600	600	2	1980	2010	2025
Beloyarsk 4		BN-800	880		2015	2075	
Balakovo 1	Balakovo -12.5 km Saratov - 145 km	VVER-1000	1000	2	1985	2015	2046
Balakovo 2		VVER-1000	1000	2	1987	2017	2048
Balakovo 3		VVER-1000	1000	2	1988	2018	2049
Balakovo 4		VVER-1000	1000	2	1993	2023	2054
Bilibino 1	Bilibino - 4 km Anadyr - 610 km	EGP-6	12	1	1974	2004	2019
Bilibino 2		EGP-6	12	1	1974	2004	2022
Bilibino 3		EGP-6	12	1	1975	2005	2022
Bilibino 4		EGP-6	12	1	1976	2006	2022
Rostov 1	Volgodonsk - 11 km Rostov-on-Don - 250 km	VVER-1000	1000	2	2001	2031	2062
Rostov 2		VVER-1000	1000	2	2010	2040	2071
Rostov 3		VVER-1000	1000	2	2014	2044	2075

⁶ Source: Концепция подготовки и вывода из эксплуатации блоков атомных станций АО «Концерн Росэнергоатом» (Concept of preparation of decommissioning of nuclear power plant reactors of Rosenergoatom Concern JSC). Rosenergoatom, 3. July 2017. Available for download here:

zakupki.gov.ru/223/purchase/public/download/download.html?id=43042182 -

and web version here:

<http://webcache.googleusercontent.com/search?q=cache:6iT6D0N8yIUJ:zakupki.gov.ru/223/purchase/public/download/download.html%3Fid%3D43042182+&cd=1&hl=ru&ct=clnk&gl=ru>

Explanation to the right column: The years represent the first year without electricity generation, as presented in Rosenergoatom's conception in footnote 6. This differs from the closing year which we previously used in our reports, by one year. In Rosenergoatom web page, information is still given for the closing year. According to the Russian regulator, Rostekhnadzor, nuclear power plants without electricity generation have license like an operating power plant, but without generating electricity. The reactors will typically have the same amount of personnel. When all fuel is removed, the reactor gets another status, like the first three at Novovoronezh and the first two at Beloyarsk NPP.

** Exception: The reactors marked with "end" and a year, are not presented in Rosenergoatom's conception. These reactors are indeed stopped and is not operating anymore, but the status of their decommissioning process is not clear.*

Today, Russia has 25 nuclear power reactors that are operating beyond their designed lifetime, more than 70% of the total number of operating units. Generally, reactors have been prolonged for an additional 15 years, but some have received longer time, even as much as 30 years, double the operation time envisaged in the original designed lifetime.

During the last 33 years, 6 power units have been shut down for good. The fuel is unloaded, but no dismantling process has started. Along with the power units that will need to be closed during the next 15 years, a huge decommission challenge is piling up. At the same time, plans and money are lacking.

Leningrad NPP

Leningrad NPP (Sosnovy Bor) has four RBMK-1000 reactors, of which the first was finally stopped December 21st, 2018. *Rosenergoatom* has begun its planning for decommissioning to the state of a "brown field", meaning that the site will be released with restrictions (contrary to a "green field" end stage, where the site is released without any restrictions and in principle can host a kindergarten). All four reactors of RBMK-1000 LNPP are planned to be stopped by December 2025.

In 2018, we have organized an expert analysis of the decommissioning concept of the operator. The analysis is summarized in chapter 6 of this report.

For more information, please see our previous report "Decommissioning Russia's old nuclear power reactors. Status update on key processes 2017," available at www.naturvernforbundet.no/decommissioning-reports/

Kola NPP

In January 2018, unit 1 at the Kola NPP was stopped for repair work to prolong its work for another 15 years before 2033. This reactor was commissioned in 1973 and has been operating for 45 years. This reactor was in repair and upgrading for 250 days. On December 23rd, 2018, 1 reactor of the Kola NPP began to be exploited for another 15 years⁷.

In July 2018, *Rostekhnadzor* issued a license which gives the right to operate the Kola NPP power unit №1 for an additional period of 15 years - until 2033 and for 60 years it total.

⁷ Source: <http://tass.ru/ekonomika/4864663>

This is in line with the plans of the power plant operator; in December 2017, the director of the Kola NPP Vasily Omelchuk said in an official statement that the plans for closing Kola NPP reactors were 1st reactor – 2033, 2nd reactor – 2034, 3rd reactor – 2041 and 4th reactor - 2044.

This kind of prolongation takes place for the first time in the history of the Russian nuclear power industry⁸.

Before the renewed license, an inspection of this power unit was carried out. It indicated that the state of the power unit, its elements and systems, comply with all requirements of federal norms and rules. Rostekhnadzor has decided to give Rosenergoatom Concern the license for further operation of power unit No. 1 of the Kola NPP.

No state environmental assessment process was carried out, and no public hearings. We requested an explanation about this, and asked whether this contradicted Russian law. Rostekhnadzor answered that it did not contradict any law, such expertise or hearings were not necessary. The explanation they gave seems strange: power unit No. 1 of the Kola NPP was commissioned in 1973, and was operated from 1973–2018, and the power unit is currently in operation. Therefore, this is not a “planned” new economic and other activity; therefore, no environmental expertise assessment needed to be carried out.

The federal and regional mass media did not publish information about the lack of environmental expertise. We wrote about this on the website of the KEC⁹.

Plans for the construction of the Kola NPP - 2. Type of VVER reactor - 600/498, power (net) - 600 MW; (gross) - 675 MW. The start of construction is not known, but the start of operation is planned for 2031 or 2035. The feasibility of the plans to build a new Kola NPP is questionable.

Other nuclear power plants with changes in status during 2018

Kursk NPP: April 29th, 2018 the construction of the first power unit of Kursk NPP-2 began¹⁰. The two new reactors at Kursk 2 are VVER TOI of 1255 MW capacity. They will be commissioned in 2020 and 2022.

Rostov NPP: April 14th the fourth power unit of Rostov NPP reached the designed capacity and operated on 100%. The commissioning of power unit No. 4 for commercial operation is scheduled for 2018¹¹. The new fourth power unit of Rostov NPP is technically ready for commissioning, the station's press service said on June 20th¹².

⁸ Source: <http://tass.ru/ekonomika/5336728>

⁹ Source: <https://kec.org.ru/prodlena-licenziya-na-energoblok-1-kolskoj-aes/>

¹⁰ Source: <http://tass.ru/ekonomika/5169106>

¹¹ Source: <https://eadaily.com/en/news/2018/04/16/chetverty-energoblok-rostovskoy-aes-vyveden-na-polnuyu-moshchnost>

¹² Source: <http://tass.ru/ekonomika/5306840>

Novovoronezh NPP: Novovoronezh – 4 is a VVER-440 reactor of the same type as Kola nuclear power plant. It was commissioned in 1972 and originally meant to close 2002. It had already been prolonged to 2017. After modernization work, it now is expected to run until 2032. The 3 first reactors at Novovoronezh are all stopped and the first two are being prepared for decommissioning.

Kalinin NPP: on June 14th, the power unit No. 3 of the Kalinin NPP was put into commercial operation at 104 percent of the designed capacity of the reactor facility¹³.

New construction

4 new nuclear power units are currently in the process of being built in Russia. They are mentioned in the table: Leningrad NPP-2, Kursk -2 and Novovoronezh-2.

Leningrad-2:

New Leningrad nuclear power plant 2 (LAES-2) started up early in 2018. It reached 100% capacity before summer and at the end of the year it received license for commercial operation.

VVER-1200 reactor of power unit No. 1 of LNPP-2 was launched on February 6th, 2018. On March 9th, it was connected to the network. On October 15th, 2018, key documents were signed confirming the completion of construction of power unit No. 1. On October 29th, the first power unit of the Leningrad NPP-2 with a VVER-1200 reactor was put into commercial operation.

The construction of power unit No. 2 with the VVER-1200 reactor of Leningrad NPP-2 continues.

Filters were installed to clean the turbine condensate of power unit No. 2 and the construction of the basement of the evaporative cooling tower was completed¹⁴.

Kursk-2:

The construction of power unit No. 1 and 2 with the WWER-TOI reactor of the Kursk NPP-2 continues. During 2019, construction works will be performed at the construction site. In mid-2020, it is planned to mount the reactor vessel of the first power unit¹⁵.

Novovoronezh-2:

On December 3rd, 2018, at the Novovoronezh NPP-2, the Rostekhnadzor commission began preparation for the beginning of operation of unit No. 2 (No. 7 NV NPP).

On December 21st, 2018, at Novovoronezh NPP, pre-launch partner verification of readiness for the start of power unit No. 7 (No. 2 of NV NPP-2) was completed. The audit was carried out by a team of international experts from the Moscow WANO-Center, which included 14 specialists from eight countries - Ukraine, the Republic of Korea, France, Belarus, Slovakia, Bulgaria, the USA and Russia.¹⁶

¹³ Source: <https://vedtver.ru/news/society/na-kalininskoy-aes-nachata-promyshlennaya-ekspluatatsiya-energobloka-3-na-moshchnosti-104/>

¹⁴ Link <http://www.lnpp2.ru/?q=news>

¹⁵ Source <https://www.kursk.kp.ru/daily/26926/3973932/>

¹⁶ Source <http://www.abireg.ru/newsitem/72533>

Floating NPP Akademik Lomonosov:

The floating NPP Akademik Lomonosov has been built and transported to Murmansk in summer 2018. It will be test-run in winter/spring 2019. It will be transported from Murmansk and further east to Pevek in summer 2019. Specifications are KLT 40 S, 2 x 45 MW, 90 MW. The length of the vessel - 144 meters, width - 30 meters, displacement - 21.5 thousand tons. The lifetime of the floating NPP will be at least 36 years: three cycles of 12 years each, between which it is necessary to reset the nuclear fuel of the reactor cores.

On December 6th, the first reactor installation was launched with participation of JSC "Baltic Plant" engineers. Rosenergoatom are planning to transfer the floating unit "Akademik Lomonosov" to the customer before July 1st, 2019.

4. Radioactive waste and spent nuclear fuel

Solutions are lacking for the handling of radioactive waste and spent nuclear fuel. Spent nuclear fuel from European NPPs with VVER-440, VVER-1000 and RBMK-1000 reactors are being transported to the closed nuclear towns Ozersk (Ural, Chelyabinsk oblast) and Zheleznogorsk (Siberia, Krasnoyarsk krai) regions of Russia for reprocessing and temporary storing. This strategy of transporting nuclear risk from Europe to the Urals and Siberia is being promoted without transparency and without real participation of the society and the authorities of the regions in which this takes place.

Radioactive waste developments in 2018

Ecomet-S, the only plant in Russia for processing metal radioactive waste (the town of Sosnovy Bor), began transporting secondary radioactive waste received after the reprocessing of radioactive waste to the Ural region of Russia, to close nuclear city ZATO Novouralsk.

In Novouralsk, the first Russian waste disposal facility was commissioned in 2018. Thus, a new business model for radioactive waste management in Russia began to work. Previously, it was assumed that radioactive waste will be permanently isolated in the places of their greatest concentration, and now it has become a convenient business: first, Ekomet-S transported tens of thousands of tons of radioactive waste from all over Russia, processed it on the Baltic coast, and now it transports secondary waste to the Urals. At the same time, neither the Leningrad Region, nor St. Petersburg, nor the Urals regions are involved in the security assessment of this business. All safety discussions take place only in closed nuclear cities where these enterprises are located¹⁷.

Public hearings are being prepared on issuing a license for the construction of a radioactive waste disposal facility in Ozersk (Chelyabinsk region). The date is unknown. Unfortunately, the hearings themselves could not be reached because permission to enter was not granted.

There is no publicly available information on the decommissioning of the Kola NPP, icebreakers. There is no information in the media of the Murmansk region about the repository of radioactive waste in Monchegorsk or elsewhere. This is not discussed in society.

Spent nuclear fuel developments in 2018

Spent nuclear fuel to Zheleznogorsk: In 2018, the transport of the spent nuclear fuel from the cooling pools of Leningrad NPP (building 428) to the close nuclear city ZATO Zheleznogorsk, Krasnoyarsk region, continued.

Environmental activists from Zheleznogorsk forced the regional legislators of Krasnoyarsk region to investigate the situation with nuclear safety and plans to construct the high-level radioactive waste repository on the coast line of Yenisey River, close to Zheleznogorsk. More

¹⁷ Source: https://novikvsluh.blogspot.com/2018/11/blog-post.html?fbclid=IwAR0In5RzrT6o-B_od9DRfgqhQ7h8vTKzisbwAWSPvuqEQ3kaLrKImAixZF1

than 130,000 Russian citizens signed a petition to the Russian authorities against this plans.
18

Spent nuclear fuel to Mayak: On 4th September 2018, spent nuclear fuel that was damaged, arrived from the Leningrad Nuclear Power Plant at PO Mayak for reprocessing¹⁹.

5. Nuclear-related laws and changes in policy

In October, Russian president Vladimir Putin approved a decree which changed the state policy in the field of nuclear and radiation safety until 2025 and beyond. The content of the decree was coordinated with all government bodies, and the main developer was Rosatom.

In accordance with the Constitution of Russia, the president determines the foundations of domestic and foreign policy of Russia. On October 18th, 2018, the Presidential Decree approved the fundamentals of the state policy in the field of ensuring nuclear and radiation safety until 2025 and beyond. The previous decree was adopted in this area in 2012 and also defined the basis of policies until 2025. In connection with the decree, an action plan should be approved within three months. This will be done by the Russian government.

The decree confirmed the main problems in the field of nuclear and radiation safety, important among which are:

- Spent nuclear fuel and radioactive waste accumulation;
- increasing the average age of nuclear workers;
- the potential occurrence of nuclear accidents and catastrophes in the country and abroad.

The decree for the first time enshrines trends in the field of nuclear and radiation safety:

- the increasing role of nuclear energy and nuclear technologies in ensuring the sustainable development of the Russian Federation and the realization of its national interests
- the development of the foreign economic activity of the Russian Federation in the field of the use of atomic energy, including an increase in the volume of obligations to provide services to foreign countries in this area, including the reprocessing of spent nuclear fuel

One of the objectives of the new policy is ensuring compliance with the legislation of the Russian Federation, regarding legally protected secrecy and openness of information on the radiation situation, state of nuclear and radiation safety. This decree as well as law enforcement practice makes the activities of Rosatom less open and transparent to the public, regarding both activities in Russia and in other countries. One of the evaluations of the effectiveness of the program is the amount of spent nuclear fuel.

¹⁸ Source <https://www.change.org/p/%D0%BC%D1%8B-%D0%BF%D1%80%D0%BE%D1%82%D0%B8%D0%B2-%D1%8F%D0%B4%D0%B5%D1%80%D0%BD%D0%BE%D0%B3%D0%BE-%D0%BC%D0%BE%D0%B3%D0%B8%D0%BB%D1%8C%D0%BD%D0%B8%D0%BA%D0%B0>

¹⁹ Source: https://www.po-mayak.ru/press_center/press/news_mayak/?PAGEN_1=3

From our point of view, an increase in the reprocessing of spent nuclear fuel will not improve the state of nuclear and radiation safety due to the large amount of radioactive waste generated from reprocessing.

The decree contains provisions that impede public access to information in the field of nuclear and radiation information. And these steps are already being taken. On the website of the presidential administration, there are "recommendations" published about the concealment of information about legal cases for violations in the nuclear field.

The decree lays down a strategy for the construction of new nuclear facilities abroad, including nuclear power plants and the return of spent nuclear fuel to Russia, which, in our view, will not improve nuclear and radiation safety.

New rules on prolonged operation of nuclear power plants

Russian regulator on ecological, technological, and nuclear issues Rostekhnadzor approved new rules on the prolongation of operation of nuclear power reactors: For 5 years before the end of the term, the administration of the nuclear power plant must conduct safety expertise and answer the question whether it can be prolonged or not. The document contains clear criteria on the possibility of extending the operation. Previously, there were no such criteria in the law²⁰.

Nuclear projects get less transparent

Dangerous Russian nuclear projects are becoming even less transparent not only in Russia but also in other countries. Russian taxpayers lose the opportunity to find out where their money is spent:

The decree of the RF Government from 18.08.2018 N 1723-R "On amendments to the Decree of the RF Government from 24.12.2015 N 2662-R"²¹.

The list of goods, works and services in the field of nuclear energy, information on purchases that do not constitute a state secret, but are not subject to placement in a single information system in the field of procurement, has been clarified.

The Rosatom Supervisory Board (8 people, appointed by the President of Russia), gained full control over the Rosatom State Corporation. The Russian government has lost these powers²².

²⁰ Source: <https://rg.ru/2018/05/07/rostekhnadzor-prikaz162-site-dok.html>

²¹ Source: <http://www.rosatom.ru/about/management/supervisoryboard/>

²² Source: http://www.atomic-energy.ru/news/2018/01/09/82230?fbclid=IwAR3qG-Xka_lhF46Mr6o92atgqxSOGM2vpnPatnV1TXe-1xaBDCW8oWCzuvo

6. Expertise on Leningrad nuclear power plant's decommissioning plan

In 2018, the Russian NGO "Public Council of the Southern Coast of the Gulf of Finland" made an examination of the "Concept of Decommissioning of Leningrad NPP Units with RBMK-1000", developed by the operator of this power plant (Concern Rosenergoatom). The group of experts included experienced experts from Russia and Lithuania.

On December 21st, 2018 around midnight, the world's oldest RBMK-1000 reactor (Chernobyl series) at the Leningrad nuclear power plant was finally stopped. It has worked (from December 1973) for 45 years and will be decommissioned for approximately the same number of years.

Summary of the Concept of Decommissioning of Leningrad NPP Units With RBMK-1000

The Concept was developed by specialists of the Rosenergoatom Concern (Operator of Leningrad NPP), agreed with Vladimir Pereguda, Deputy General Director of Concern Rosenergoatom (director of the Leningrad NPP) and approved in 2015 A. Petrov by the Director General of Rosenergoatom.

The document contains 66 pages, 9 sections, bibliography, 2 applications.

During the development of the Concept of Leningrad NPP, the developers used the *Concept of Decommissioning Nuclear Installations, Radiation Sources and Storage Facilities*, approved on July 15, 2014 by Order of Sergey Kirienko, the Head of Rosatom No. 645.

The second power unit of Leningrad NPP is planned to be finally stopped in 2020, the third in 2024 and the fourth in 2025.

All power units operate in the mode of extending the operating mode from 30 to 45 years. The decommissioning is planned to be synchronized with the commissioning of new power units of the Leningrad NPP-2 with VVER-1200 reactors.

It was decided to decommission the Leningrad NPP under the "immediate liquidation" scenario. It is planned to make maximum use of operating personnel for decommissioning.

First stage of LNPP decommissioning (7 years)

After the shutdown, the unit will be prepared for decommissioning: unloading of spent nuclear fuel and development of project documentation.

Second stage of LNPP decommissioning (8 years)

Preparation for liquidation. Dismantling of non-radioactive equipment, decontamination, dismantling of non-radioactive equipment and engineering systems.

Third stage of LNPP decommissioning (20 years)

Dismantling, decontamination and fragmentation of radioactive equipment. Remote dismantling and fragmentation of reactor equipment (including graphite moderator), packaging in containers and transport to temporary storage or disposal.

Problematic aspects of the Concept:

The spent nuclear fuel is planned to be stored for 10 years in the cooling pools close to each reactor, and then cut into two parts, placed in a special "dry" container and transported to a temporary (50 years) dry storage facility at the coast of Yenisei River at the Mining and Chemical Plant in close nuclear city ZATO Zheleznogorsk, Krasnoyarsk territory.

According to the Concept, the end of decommissioning of all four units of the Leningrad NPP will end at the end of 2059, that is, 41 years after the final shutdown of the first unit.

The volume of radioactive waste from four power units (without spent nuclear fuel and metallic radioactive waste) is estimated at more than 110.000 m³. In addition, the volume of metal waste for processing at Ecomet-S is estimated at 2853.4 tons.

There is no assessment of the radioactivity of the decommissioned waste.

The Concept does not describe final solutions for long-term isolation or socio-economically and environmentally acceptable technology for processing spent nuclear fuel and radioactive graphite, as well as location of the long-term disposal of radioactive waste.

The Concept also lacks a description of the mechanisms of interaction with the public, regional and municipal authorities, as well as social programs to support LNPP staff, who will lose their jobs during decommissioning.

The participants of the round table discussion in Lithuania mentioned that decommissioning of nuclear power plants is complex:

- Technological – there are no technologies for long-term isolation (for a hundred thousand years), or socially and environmentally acceptable technologies for the processing of spent nuclear fuel and high-level radioactive waste. There are about 7 thousand tons of radioactive graphite on the 4th reactor of the LNPP. The graphite is Carbon-14 with a half-life 5,700 years.
- Social – about a third of the 6,000 employees of LNPP can expect to participate in the decommissioning program. The rest will have to look for another job.
- Economic –the operator of the LNPP estimated the cost of the decommissioning of 4 power units at 725 million euros. For comparison, the cost of decommissioning only 2 similar units of Ignalina NPP (Lithuania) after 10 years of decommissioning is estimated to be 4 times higher.

- Environmental – because of the synergetic effects of radiation and chemical pollution in the area of the nuclear cluster on the southern coast of the Gulf of Finland, it seems that the limit of the ecological capacity of the habitat has been reached. The percentage of cytogenetic damage in seeds and pine needles in the nuclear cluster is 3 times higher than normal, and in the city of Sosnovy Bor (4 km from the nuclear facilities) is 2 times higher than on the border with St. Petersburg (40 km from the nuclear cluster).
- Moral – the transport of spent nuclear fuel from the Sosnovy Bor (South Coast of the Gulf of Finland, Baltic Sea) to the coast of Yenisei river to the temporary storage of spent nuclear fuel to the close nuclear city Zheleznogorsk (Krasnoyarsk territory) is perceived by the residents of the Krasnoyarsk territory as a demonstration of the colonial policy of European Russia towards Siberia. More than 120,000 signatures have been collected against such a strategy.

The group of experts included experienced experts from Russia and Lithuania, independent from the Leningrad NPP operator.

Russian NGO “Public Council of the Southern Coast of the Gulf of Finland” organized an examination of the "Concept of Decommissioning of Leningrad NPP Units with RBMK-1000", developed by the operator of this power plant (Concern Rosenergoatom).

The experts' recommendations will be handed over to the operator of LNPP (Rosenergoatom), the nuclear safety regulator (Rostekhnadzor), Russian national authorities, regional (Leningrad Oblast and St. Petersburg) authorities, local authorities of Sosnovy Bor, as well as interested public.

Some of the recommendations of the Russian-Lithuanian expert group:

For the Legislative Assembly of the Leningrad region:

- **Develop and adopt a law** on radiation safety of the Leningrad region with deeper involvement of legislative power in the decision-making process, a description of public participation procedures, as well as the need to coordinate with local authorities' EIA projects of potentially hazardous facilities on the southern shore of the Gulf of Finland (and decommissioning of nuclear power plants);
- **To act with legislative initiative** to develop a Federal law on social guarantees to employees of decommissioned nuclear power plants taking into account the recommendations of the "Concept of decommissioning of nuclear installations...Rosatom" on creation of a complex of measures of social protection of personnel of nuclear power plants output, as well as taking into account the experience of Lithuania, which adopted a law on social guarantees for employees of the Ignalina NPP, decommissioned.
- **To consider the establishment** (together with the Legislative Assembly of St. Petersburg and local authorities of Sosnovy Bor) of an interregional laboratory for integrated socio-environmental monitoring of the Southern Coast of the Gulf of

Finland, including the control of the safe decommissioning of power units of the Leningrad NPP and other nuclear cluster facilities. For the financial support of the laboratory, it is necessary to create a special Fund for the allocation of funds by nuclear enterprises.

For the Board of deputies and the administration of Sosnovy Bor urban district:

- **Develop and adopt** a Regulation on the "Public Council" for social and environmental monitoring of the decommissioning of the Leningrad NPP, with the inclusion of representatives of all interested parties. Such "Advice" was created in the city of Visaginas (Lithuania) and Greifswald (Germany) in the derivation of the Ignalina NPP and NPP Nord.
- **Achieve construction** (in the shortest possible time!) of the reserve underground source of drinking water supply for the city of Sosnovy Bor (67 thousand inhabitants) as that is demanded by the Water Code of the Russian Federation, article 34.
- **Organize a round-table discussion of the results of the examination** with the participation of representatives of the Leningrad NPP, the regulator (Rostekhnadzor), the expert group members of this expertise and the public concerned.

For the operator of the Leningrad NPP (Rosenergoatom):

- **To create a Pilot demonstration center** for decommissioning of power units with RBMK - type reactors and solving the whole complex of technological, social and environmental problems on the basis of the NPP and the city of Sosnovy Bor:
 - **development, testing, improvement and implementation** of new technologies for decommissioning of power units with reactors of this type;
 - **accumulation of advanced** Russian and international experience of NPP power unit decommissioning technologies;
 - **organization of an industry training center** for the training of NPP personnel and dissemination of experience gained during the decommissioning of NPP units to other sites (Smolensk, Kursk NPP) and contractors;
 - **accumulation of experience** in the development and improvement of mechanisms of interaction with regional authorities, local authorities, the public in the decommissioning of nuclear power plants.
- **In the preparation of the updated version of the "Concept of Decommissioning of Power Units of LNPP" to complement it:**
 - **assessment of safety and socio-environmental acceptability** of decommissioning of the LNPP under the "on-site disposal" scheme provided for by regulatory documents and implemented in Russia;
 - **the conditions under which the revision** (clarification) of the "*Concept of Decommissioning of the LNPP*" unit should be undertaken to ensure the maintenance of the concept of the actual state, as required by the Concern's "*Concept of Rosenergoatom*";
 - **estimates of the total amount (volume and activity)**, type, category and classes of radioactive waste generated during the decommissioning of the unit

and planned for transfer to the National Operator for Radioactive Waste Management for disposal at radioactive waste repositories (requirement of article 12 of the Federal law *"on radioactive waste management and on amendments to certain legislative acts of the Russian Federation"* and relevant by-laws, including the "Rosenergoatom concept");

- **description of the types of radiation monitoring** and controlled radionuclides in the sanitary protection zone and urban Sosnovy Bor.

The expert opinion contains a number of technical recommendations describing the Russian and Lithuanian experience of decommissioning nuclear hazardous facilities.

Members of the expert group:

- Oleg Bodrov, physicist, ecologist, Chairperson of the interregional public movement "Public Council of the Southern Coast of the Gulf of Finland", General Director of LLC Decommission, Sosnovy Bor, Leningrad region, Russia;
- Viktor Shevaldin, an energy engineer, graduated from the Ivanovo Energy Institute in 1971. Chairperson of the "Public Council for Ecology and Energy under the Visaginas Municipality", former General Director of Ignalina NPP, who led the planning and the first 10 years of work on the decommissioning of Ignalina NPP units.
- Vladimir Kuznetsov, physicist, Chairperson of the "Association of Veterans of the Ignalina NPP", scientific secretary of the "International Union of Veterans of Nuclear Energy and Industry", former Deputy head of reactor departments of Leningrad, Ignalina and Chernobyl NPPs, a participant of the commissioning power units of Leningrad and Ignalina NPPs, as well as decommissioning of Ignalina NPP Visaginas, Lithuania;
- Boris Dizik, is a secretary of the "Public Council for Ecology and Energy under the Visaginas Municipality", Secretary of "Association of Veterans of the Ignalina NPP", a participant of the commissioning power units of Leningrad and Ignalina NPPs, as well as decommissioning of Ignalina NPP, Visaginas, Lithuania.
- Andrei Talevlin - PhD in Law, Associate Professor at Chelyabinsk State University, expert in international atomic law, chairperson of the regional public movement "For Nature". Currently, he is working on the problems of legal support for the decommissioning of nuclear facilities that have reached the design limits. Chelyabinsk, Russia.

7. Rosatom in the Arctic

The Russian strategy for the development of the Arctic gives great privileges to Rosatom State Corporation. These include obtaining funding from the federal budget for the development of support zones, as well as control on the Northern Sea Route. Rosatom is now empowered to receive applications and issue permits for the passage of vessels through the NSR, monitor hydrometeorological, ice and navigation conditions, coordinate the installation of navigation equipment, make recommendations on the development of navigation routes for ships and icebreakers, and assist in organizing search and rescue operations.

In 2018, we prepared the report Resource development of the Arctic region and NGO's opinion²³.

The main points of the report are that

- The Arctic region is especially vulnerable and must be treated most carefully.
- The Russian authorities' strategy is to exploit more of the resources
- To do so, Russian authorities have pointed to support zones, which are presented in the report.
- Rosatom has responsibility for handling the program of development.
- As environmentalists we are skeptical towards this industrialization of the Arctic and afraid that transparency will be even lower. Instead, more concern for the environment should be taken, and more stakeholders should be included.

Analysis and opinion of public organizations on the development of the Arctic

As mentioned above in our report, the nature of the Arctic is very vulnerable, even for small external influences. Kola Eco center, Russian Socio-ecological union: KEC, RSEU as well as many public organizations (Greenpeace Russia, WWF Russia, Union of Birds of Russia, Bellona) recognize that the Arctic is one of the few corners of the Earth where nature has remained almost intact, and implement projects to reduce emissions, mitigate climate effects and climate adaptation, minimize the negative impact of shipping in the Arctic, and introduce principles of responsible fishing.

The Russian strategy for the development of the Arctic gives great privileges to Rosatom State Corporation: Obtaining funding from the federal budget for the development of support zones, as well as control on the Northern Sea Route. The influence of other state structures will be significantly reduced compared to Rosatom. Taking into account lack of transparency of this state corporation, all Rosatom projects will likely be coordinated with the federal authorities without regional participation. In fact, a nontransparent monopoly is born in the Arctic region, and this causes doubts that the current strategy is correct.

²³ You can read more in the report Resource development of the Arctic region and NGO's opinion, available at http://rusecounion.ru/ru/decom_21219

Instead of trying to reduce the pressure on the Arctic region, the state corporation Rosatom is appointed as an operator for the development of the Arctic. This, in turn, is an indicator that shows that the Russian government views this region only in terms of mining. Otherwise, the Ministry of Ecology and Natural Resources could well become the Arctic operator.

Our opinion

It is relevant to see the operator in the form of an open organization or structure consisting of several organizations, for example, from the Ministry of Natural Resources for the Environment and the Ministry of Transport of Russia. Also, the Federal Service Rosprirodnadzor, Federal Service Rostekhnadzor could be integrated into such a structure.

It is necessary to involve local, regional and national environmental conservation organizations, which can contribute to environmental and technological control, as well as openness of processes in the Arctic. It is necessary to involve regional and local authorities, business and civil society.

As we have already mentioned, the nature of the Arctic is particularly vulnerable to industrial development. For the sake of preserving one of the most clean and untouched corners in the world, for the sake of climate stability, and for the sake of preserving valuable flora and fauna, it is necessary to reduce emissions, refuse oil production in the polar regions and carry out any projects for the development of subsoil as carefully as possible and only when absolutely necessary.

As a minimum, the territory around the high latitudes of the North Pole (the central basin of the Arctic Ocean, in international waters at a distance of more than 200 nautical miles from the shores of all Arctic states) should become a world natural reserve where access to industrial and fishing companies is closed - as was done in Antarctica. The Arctic may be a region of scientific research, but not an industrial region: for the sake of preserving pure nature and mitigating the effects of climate change.