

Problems of Nuclear and Radiation Safety in the Murmansk Region

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Nuclear and radiation safety is one of the most important components of national security of the Russian Federation. It belongs to prioritized directions of the state activity.

State interests of Russian Federation in the sphere of nuclear and radiation safety are determined by the topicality of the tasks of minimization of the risk connected with causing harm to life and health of the citizens and damaging the environment (including flora and fauna), possessions of physical or juridical persons and state or municipal properties in case of a nuclear accident or radiation situation, as well as upon liquidation of consequences of nuclear accidents and radioactive contamination of environment that have taken place both as a result of accidents and technological or defense activity that have been taking place during the former periods.

Generally, level of nuclear and radiation safety in the Murmansk region meets the demands of normative documents and the recommendations of competent international organizations.

However, systemic crisis taking place in Russia in the 1990es gave rise to a range of complicated problems, such as abrupt reduction of economic potentialities of the state for financing the operations connected with large-scale reduction of nuclear armament and decommission of nuclear submarines from Navy of Russia, as well as with liquidation of the consequences of the former defense activity. Part of the objects of these kinds of activity are in the condition close to breakdown and these are significant factor of

nuclear and radiation risks, especially for the regions of Russian North-West, Far East, Ural and Siberia.

One of the most potentially dangerous regions in respect to nuclear and radiation contamination is the Murmansk region. Accumulated radioactive wastes and spent nuclear fuel created serious problems for population and environment of the Kola Peninsula. More than 200 reactors are under exploitation on the territory of the region today. It is necessary to dismantle more than 100 nuclear submarines. 132 nuclear explosions have taken place on the archipelago Novaya Zemlya since 1955 till 1990. In adjoining area of water (Kara and Barents seas) several reactors and nuclear submarines have been submerged, as well as hundreds of containers with solid radioactive wastes. During 40 years of exploitation of nuclear reactors more than 10^{18} Bq of radioactive substances contained in radioactive wastes and spent nuclear fuel have been accumulated. More than half of these are stored in ecologically dangerous condition.

Beside decommissioned nuclear submarines, potential ecological threat is created by practically all the infrastructure for exploitation and serving of nuclear submarines. These are the territories of former coastal technical bases of Russian Navy's Northern Fleet, storages of spent nuclear fuel, solid and liquid nuclear wastes, vessels of nuclear-technical service. During the years of their use financial means necessary for technical provision of decommission of nuclear objects from exploitation have not been invested.

Nowadays, in the Murmansk region about 22 thousand storages of highly active spent nuclear fuel exist. As part of the storages is in close to breakdown condition, the problem of storing of spent nuclear fuel is most acute for the Murmansk region. Altogether at the enterprises of the region about 20 thousand cubic meters of nuclear wastes have been accumulated.

In the 1990es rate of decommission from exploitation of nuclear submarines essentially exceeded rates of their dismantling. Potentialities of shipyards allowed dismantling not more than 3-4 nuclear submarines per year. This led to swift accumulating the submarines planned for dismantling in settling points for submarines. By the end of 1997 on the bases on Russian Navy's Northern Fleet 96 submarines have been waiting for dismantling. Out of them 80 submarines have been kept floating with not removed active zones. Main reasons for low rates of dismantling of nuclear submarines have been absence of adequate capacities of industrial infrastructure for removal of spent nuclear fuel, absence of spare space in the storages and lack of financing.

Considering the situation described above, Government of RF on 25 May, 1998 has adopted decree No. 518 "On the measures of acceleration of dismantling nuclear submarines and vessels with nuclear energy compartments decommissioned from Navy and ecological rehabilitation of radioactively dangerous objects of Navy". In accordance with the decree, the Ministry of Atomic Energy (Minatom) of Russia received from the Ministry of Defense functions of state customer and coordinator of the program of complex dismantling decommissioned nuclear submarines and rehabilitation of radioactively dangerous objects of Navy.

In accordance with the estimations of the Minatom experts (since 2004 – Federal agency on atomic energy) 1,5 bln USD have been needed to solve radio-ecological problems in the Murmansk region.

Having in fact high indicators of safety of construction and exploitation of nuclear and radioactively dangerous productions and objects, Russia faced the problem connected with withdrawing them from exploitation, the problem she is not able to solve alone in a short period of time. International cooperation, thus, plays an important role for increasing

nuclear and radioactive safety in Russia, including the Murmansk region.

Today in the relations between Russia and international community the situation is formed so that majority of economically leading countries are ready to grant Russia a real assistance in solving the problems of nuclear heritage. A very important step in this direction was frame Agreement "Multilateral nuclear-ecological program in Russian Federation" and protocol to it signed in Stockholm, Sweden, on 21 May, 2003 by the representatives of Belgium, Great Britain, Germany, Denmark, Netherlands, Norway, the USA, Sweden, Finland, France and EU.

One of the major directions of realization of this Agreement is solving the problems of nuclear and radiation safety in the Murmansk region. Let's focus on the main ways of handling the problems discussed.

By 1 January 2004 in the Russian North 117 nuclear submarines have been decommissioned, out of them 60 submarines have been dismantled with the forming three- and many-blocks reactor compartments. 57 nuclear submarines are waiting for dismantling; out of them 38 submarines contain spent nuclear fuel in their reactors.

Nuclear submarines with not removed spent nuclear fuel represent most serious ecological threat, as unsatisfactory technical condition of decommissioned nuclear submarines does not exclude a possibility of their accidental sinking, followed by all ensuing consequences.

During the last three years it became possible to break this negative tendency. Infrastructure along all technological chain has been created: nuclear submarine – reshipment of spent nuclear fuel on a vessel of nuclear-technical service – reloading of spent nuclear fuel in transport container – transportation to "Mayak", in the Chelyabinsk region, for reprocessing. In 2001 spent nuclear fuel has been removed from 12 submarines. It is planned that a further spent nuclear fuel will be removed from 10-12 submarines a year. This rate will allow removing spent nuclear fuel from all submarines collected in settling points for nuclear submarines by the year of 2007.

Speeding up of the rates of removal of spent nuclear fuel became possible due to the increase of national budget financing and attraction of means of international technical assistance in the frames of the AMEC program. This is a program of cooperation in

military area on the environmental issues in the Arctic between the Ministries of Defense of Russian Federation, the United States of America and the Kingdom of Norway adopted in 1996.

Dismantling of the nuclear submarines takes place at the shipyards of the Murmansk region. Main shipyard is the Federal state unitary enterprise "Nerpa" located in the town of Snezhnogorsk. Here some indicators of submarines' dismantling by years are presented: 1998 – 1 submarine, 1999 – 2 submarines, 2000 – 5 submarines, 2001 – 3 submarines, 2002 – 8 submarines, 2003 – 7 submarines, 2004 – 9 submarines (planned). It is planned that in future 8 submarines at average will be dismantled each year to accomplish dismantling of all decommissioned by today submarines by the year of 2010.

Significant assistance to dismantling of nuclear submarines has been given by the USA in the frames of the program "Cooperative Threat Reduction Program", or the Nunn-Lugar Program (corresponding frame agreement was signed in 1992. The result of it was, in particular, financial assistance given to Russia to dismantle 25 strategic nuclear submarines). Since 2003 Norway takes part in financing dismantling of submarines.

At the final stage of dismantling a reactor compartment is usually formed, where significant amount of radioactivity is left even after removing spent nuclear fuel. Today reactor compartments are stored in floating condition due to absence of specially equipped coastal storage points. It is necessary to secure safe storing of radioactively dangerous reactor compartments in the coastal storages.

The decision to construct in Saida bay a complex for long-term ground storing of 120 reactor compartments of nuclear submarines has been taken. Germany suggested to finance this project with total amount of 300 million Euros.

In the Murmansk region in the 1960es two coastal technical bases of the Russian Navy's Northern Fleet that provided exploitation of submarines, receiving and storing of fresh and spent nuclear fuel, liquid and solid nuclear wastes have been constructed. These bases were located in Andreeva bay and village of Gremikha on the coast of Barents Sea. Since 1985 the functioning of these bases as those receiving spent nuclear fuel and nuclear wastes has been stopped.

At the final stage of their existence as the objects of the fleet providing exploitation of submarines, operations of sending spent nuclear fuel for reprocessing, conditioning and reprocessing of nuclear wastes have not been done. As a result considerable amount of spent nuclear fuel, solid and liquid radioactive wastes has been accumulated.

In the process of long-term exploitation protecting walls of the storages for spent nuclear fuel and radioactive wastes degraded, partly lost their ability to carry out their functions. This resulted in penetration of nuclear wastes into the soil, contamination of the constructions of the buildings, territory and area of water; sources of radioactive contamination of the territory and ecological threat have appeared.

Significant amount of spent nuclear fuel and radioactive wastes has defective condition that creates real threat of radiation impact on environment and people.

For realizing rehabilitation operations restoration of functioning the infrastructure for safe radioactively dangerous operations and conducting norms and rules of protection of the personnel and environment is needed.

In accordance with a directive of the government of RF mentioned bases have been subjected to Minatom of Russia in 2001 for their ecological rehabilitation. Now the bases are managed by the Federal state unitary enterprise "SevRAO"¹ (Murmansk) via its branches: №1 (storage in Andreeva bay) and №2 (storage in the village of Gremikha).

Rehabilitation of the bases makes it necessary to work out safe for the personnel, population and environment technologies of preparation for sending for reprocessing spent nuclear fuel packed in the containers of different types. Beside that it is planned to work out technologies of preparation for transportation for long-term storing different types of solid and liquid radioactive wastes, as well as technologies of localization (liquidation) of sources of radiation emission allowing for future rehabilitation of the territories.

Main problems related to rehabilitation of the storages and ensuring their safety are stipulated by poor condition of the infrastructure of these objects that is needed

¹ "SevRAO" - "North radioactive wastes"

for radioactively dangerous operations: it is destroyed and requires reinstating reparation.

Conditions of lodging and regime of storing necessitates working out special technologies meeting the demands of normative documents; these technologies would allow to avoid worsening of the conditions of stored spent nuclear fuel and radioactive wastes.

Work on rehabilitation of the base in Andreeva bay was started in 1995. The main part of financing infrastructure construction was invested by Norway on the base of bilateral agreement "Agreement between the government of the Kingdom of Norway and the government of Russian Federation on cooperation in environmental protection in connection with dismantling of Russian nuclear submarines decommissioned from Navy in the North and increasing nuclear and radiation safety", signed on 26 of May in 1998. At present the process of infrastructure construction is ending. Total amount of money received from Norway during 1998-2004 made up 43 million NOK. It is planned to start operations with spent nuclear fuel and radioactive wastes in 2005. Sweden takes part in operations to handle radioactive wastes. England offered help in operations with spent nuclear fuel. In accordance with the experts' estimations the whole complex of rehabilitating operations on the base in Andreeva bay might be finished not earlier than 2020.

Operations to reconstruct the infrastructure in the village of Gremikha have been started by the Federal state unitary enterprise "SevRAO" in 2000. Unlike the base in Andreeva bay Gremikha firstly needs realization of the complex of operations to unload of three nuclear reactor compartments from nuclear submarines with liquid-metallic heat-bearer. This is planned for realization before 2007. Only then operations to rehabilitate the base will start. France offered her participation in this work.

In Russia, as a rule, radio-isotopic thermo-electrical generators (RITEGs) are used as a source of electricity for navigational equipment (lighthouses, radio houses, luminous navigational signs) located in difficult-available districts of seaside. An active part of radio-nuclide source of heat on the base of radio-isotope of strontium-90 is the source of heat energy in radio-isotopic energetic devices. That is why they constitute a potential threat of radioactive pollution of the

environment. Majority of radio-isotopic thermo-electrical generators already have worked out their potential and are the subjects to dismantling. Besides, considering that RITEGs are located on unguarded objects, they constitute a potential threat of being used in purposes of terrorism.

By 01.01.2001 there were 153 radio-isotopic thermo-electrical generators in the zone of competency of Hydrographical service of Northern fleet on the seaside of Barents and White seas. Out of them 92 are in the Murmansk region and 61 are in the Archangelsk region. During 2001-2003, due to financial help from Norway, 45 RITEGs have been dismantled: 34 in the Murmansk region and 11 in the Archangelsk region.

The total amount of radioactive substances (considering their remaining activity) taken away from the territory of the Murmansk region and placed safely for long-term storing at "Mayak" in the Chelyabinsk region made up 6.3×10^{16} Bq (1.7 mln. Ci).

It is planned to dismantle 58 radio-isotopic thermo-electrical generators remained in the Murmansk region during 2004-2006. Need for search an alternative source of electric power has led to a variant of replacing RITEGs by solar energy installations. On suggestion of Norway where solar energy installations are traditionally used for power supply of lighthouses, in 1997-2002 five Norwegian solar energy installations have been fixed for use. The Russian-Norwegian project on installing 31 solar energy installations produced in Russia is under realization in 2004. Hereinafter all of the RITEGs will be replaced by solar energy installations.

An important element of infrastructure to handle solid radioactive wastes and the sources of ionizing radiation is Murmansk special integrated plant "Radon". The plant was built in 1961 and today it doesn't meet the requirements of normative documents on ensuring ecological safety. Total amount of radioactive substances in the storage (considering their remaining activity) makes 5.1×10^{14} Bq (13.8 thousand Ci).

In 2001 the government of the Murmansk region together with the Minatom and the Ministry of construction ("Radon" is subjected to the Ministry of construction) took a decision to conduct reconstruction of "Radon".

An agreement for cooperation between Russia, Norway and Sweden was signed in November 2002. In accordance with the agreement the sides took obligations to finance working out the project on reconstruction of “Radon” with total amount of 1,476,250 NOK. By now the project is fulfilled. The total cost of reconstruction is 3 million euros. An agreement with European Commission on financing the reconstruction of “Radon” within the TACIS program since 2006 is achieved.

The problems waiting for solving in the nearest future are those of dismantling old nuclear cruisers and nuclear icebreakers.