



Problems on Radioactive Waste and Spent Nuclear Fuel Management in the European-Arctic Region of Russia

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In the European-Arctic Region of the Russian Federation at territories of the Murmansk and Arkhangelsk Regions nuclear submarines and nuclear-powered above-water ships of the North fleet are based and operated, radiation hazardous enterprises of the Ministry of the Russian Federation for Transport, the Ministry of the Russian Federation for Atomic Energy and the Ministry of the Russian Federation for Economy are located here too. Considerable amount of radioactive waste (RW) and spent nuclear fuel (SNF), including non-reprocessing ones, is accumulated and steadily produced once again in this region. At present there is no any common RW and SNF management system in the region; separate complexes for RW reprocessing and temporary storage do not meet the updated requirements of ecological safety. Minatom of Russia as a state customer of the Federal purposeful program on RW and NSF management developed an Action plan for radioecological state improvements in the North region, but its realization is delayed because of deficiency in financing.

1. Analysis of Problems

The list of the main radiation hazardous enterprises and entities in the European-Arctic Region contains:

- coastal and floating technical bases, nuclear submarines and nuclear-powered above-water ships of the North fleet, ship-repairing plants of the Navy, as well as laid-up points for nuclear submarines taken out of the Navy effective (more than 200 nuclear reactors);
- ship-building and ship-repairing plants of the Ministry of the Russian Federation for Economy that provide for building, repairing, disposal of nuclear submarines and vessels for nuclear technological service (Industrial Association "Sevmashpredpriyatie" in Severodvinsk town, ship-repairing plant "Zvezdochka" in Severodvinsk town and ship-repairing plant "Nerpa" in Snezhnogorsk town);
- technological repairing plant "Atomflot" of the Ministry of the Russian Federation for Transport in Murmansk that provides for fuel charge exchange and the repairing of icebreakers in the civil fleet (13 nuclear reactors) and of vessels for nuclear technological service;
- Kola nuclear power plant of the Ministry of the Russian Federation for Atomic Energy in Polyarny Zory town where 4 VVER-440 type nuclear reactors are operated;
- Murmansk special plant "Radon" which had accepted radioactive wastes for storage from the enterprises of the Murmansk and Arkhangelsk Regions within the period from 1964 till 1994;
- more than 50 enterprises and organizations of the region use in their work ionizing radiation sources.

1.1 Situation with Radioactive Wastes

Amount of liquid RW accumulated at the entities of the European-Arctic Region for 1997 and forecast of its accumulation until 2020 are shown in Table 1.

Table 1

Enterprise	LRW volume, thousand cubic meters			
		1996	2020	
	Total volume (without special laundries)	LRW volume in groups		
		Operational	From the process of decommissioning	From special laundries and sanitary access premises
Objects of the North fleet and Mineconomiki	<u>9,85</u> 132,2	<u>9,85</u> 110,6	- 21,6	- 2640
RTP "Atomflot"	<u>0,564</u> 27,3	<u>0,564</u> 27,3	- -	- 7,2
Kola NPP	<u>6,39</u> 165,4	<u>6,39</u> 55,59	- 109,8	- -
TOTAL	<u>16,804</u> 324,93	<u>16,804</u> 193,53	- 131,4	- 2647,2

About 70 % of liquid RW is accumulated and produced in the Murmansk Region, in the Arkhangelsk Region liquid RW is produced at the enterprises located nearby Severodvinsk town.

Amount of solid RW accumulated at the entities of the European-Arctic Region for 1997 and forecast of its accumulation till 2020 are shown in Table 2.

Table 2

Enterprise	SRW volume, thousand cubic meters			
	1996		2020	
	Total volume	SRW volume in groups		
		I	II	III
Objects of the North fleet and Mineconomiki	<u>10,2</u> 36,292	<u>3,9</u> 9,073	<u>5,6</u> 21,775	<u>0,7</u> 5,444
RTP "Atomflot"	<u>0,826</u> 5,365	<u>0,33</u> 2,145	<u>0,472</u> 3,065	<u>0,024</u> 0,155
Kola NPP	<u>6,606</u> 17,74	<u>5,517</u> 15,12	<u>1,017</u> 2,46	<u>0,072</u> 0,108
TOTAL	<u>17,632</u> 59,34	<u>8,747</u> 26,33	<u>7,089</u> 27,3	<u>0,796</u> 5,77

About 80 % of solid RW is accumulated and produced in the Murmansk Region, in the Arkhangelsk Region solid RW is produced at the enterprises located nearby Severodvinsk town.

Serious problem in the region is safety ensuring for long-term storage of reactor compartments cut out of disposed nuclear submarines and large sections of disposed nuclear technological service vessels. At present in the process of disposal of nuclear submarines they cut out units containing a reactor compartment and two adjacent compartments for lack of transport and technical means for reactor compartments treatment and absence of a storage point for them. Such three-compartment units are stored on-float.

The main problems connected with RW are as follows:

- temporary storage facilities for liquid RW are nearly filled in full, and many of them are in the emergency condition;
- greater part of floating means for liquid RW transportation became obsolete;
- improvements of the pilot /experimental & industrial/ facility for liquid RW reprocessing at RTP "Atomflot" have not been yet completed till the present time; construction of a complex for liquid RW reprocessing has not been yet started at the ship-repairing plant "Zvezdochka" in frameworks of the Cooperation Program with the USA in realization of the Treaty on Limitation of Strategic Offensive Arms;
- the existing temporary storage facilities for solid RW are in the emergency state and overfilled, wastes are stored non-packed and non-sorted;
- large amount of solid RW is stored on open grounds; contamination of the adjacent territory by radionuclides occurs nearby such sites;
- there are no any industrial complexes for solid RW conditioning in the region;
- there are no any facilities for final disposal of solid and solidified RW in the region;
- only special transport means "Amur" may be used for solid RW transportation; at present it is at the stage of modernization;
- there are no any transport and technical means for treatment of reactor compartments of disposed nuclear submarines, and any special facilities for their long-term and safe storage;

- at the Murmansk special plant “Radon” RW storage facilities are in the emergency state and are sunk a little by ground waters.

1.2 Situation as regards Spent Nuclear Fuel

In connection with realization of the Treaty on Limitation of Strategic Offensive Arms nuclear submarines in the North fleet are taken out of the Navy effectives in mass scale, and they are transferred for disposal. Economic difficulties burdened on Russia at present do not allow to speed up improvements of the available equipment and to build new facilities for unloading, transportation and temporary storage of SNF from disposed nuclear submarines. At present it is urgently necessary to unload SNF from more than 90 nuclear submarines that have been already taken out of the North fleet effectives. Spent fuel assemblies unloaded earlier from nuclear submarines and above-water ships with transport nuclear-powered facilities are stored in temporary storage of the coastal technical bases of the North fleet. SNF unloaded earlier from the nuclear vessels of the Murmansk Shipping Company has been stored on the floating technical bases “Lotta” and “Lepse” for a long time. Greater part of SNF which will be unloaded from nuclear submarines taken out of the North fleet effectives, as well as from coastal and floating storage facilities is planned to transfer for reprocessing to PO “Mayak”. However a part of spent fuel assemblies which have got damages or complicated composition can not be sent to PO “Mayak” for reprocessing. Such fuel is intended to leave in the region providing long-term safe storage of SNF in special facilities. According to assessments about 3,500 damaged and non-reprocessing spent fuel assemblies are accumulated now in the region.

The main problems connected with SNF are the following:

- the available equipment for SNF unloading from nuclear submarines taken out of the North fleet effectives requires major overhaul, and the ship-repairing plants dealt with nuclear submarines disposal have not at all got any equipment for SNF unloading;
- SNF coastal storage facilities are filled in full, engineering facilities are in the emergency conditions;
- fuel assemblies are in the poor state at the floating technical base “Lepse”;
- any transport vessel to remove SNF from damaged coastal storage facilities is not available in the conditions of lack of railway and motor-car communication;
- there is no any point for long-term and safe storage of damaged and non-reprocessing SNF in the region;
- shortage of railway transports does not allow to speed up removal of SNF for reprocessing to PO “Mayak”;
- SNF temporary storage facility at the PO “Mayak” is filled in full.

2. Action Plan for Resolution of the Problems

For improvement of radiation and ecological situation in the European-Arctic Region of Russia the scientific institutes of Minatom of Russia carried out the technical & economic research works for substantiation of RW and SNF management industrial infrastructure development. The main technical proposals complied with the Defense Ministry of Russia, the Ministry of Russia for Economy, the Ministry of Russia for Transport, and the Murmansk and Arkhangelsk Administrations are as the following.

2.1 Concerning RW Management it is planned:

- In the Arkhangelsk region at the ship-repairing plant “Zvezdochka” (Severodvinsk town) to establish a specialized center for management of RW accumulated or newly produced during the process of disposal of nuclear submarines that would include:
 - ⇒ complex for liquid RW collection, reprocessing, solidifying and packing into standard containers;
 - ⇒ complex for solid RW compacting and packing into standard containers;
 - ⇒ warehouse for interim storage of containers with solid and solidified RW.
- At the repairing technological enterprise “Atomflot” (Murmansk) to create a complex for management of liquid RW produced in the military and civil nuclear fleets and at the ship-repairing plants that would contain:
 - ⇒ facilities for liquid RW collection, reprocessing, solidifying and packing into standard containers;
 - ⇒ warehouse for interim storage of containers with solid and solidified RW.
- In the Murmansk region at the ship-repairing plant “Nerpa” (Snezjnogorsk town) to establish a complex for management of RW accumulated or newly produced during the disposal of nuclear submarines that would include:
 - ⇒ complex for solid RW compacting and packing into standard containers;
 - ⇒ warehouse for interim storage of containers with solid and solidified RW.
- On Novaya Zemlya archipelago and/or at territory of the Kola peninsula to create an experimental & industrial /pilot/ object for final disposal of containers with solid and solidified wastes of low- and medium-level activity.
- To build a new vessel or to modernize the available one for transportation of liquid and solid RW to the sites of their reprocessing and final disposal.
- To conduct conservation of RW storage facilities which are in the emergency conditions at the Murmansk special plant “Radon”.

2.2. As regards SNF Management Problems it is planned:

- To construct and to start operation of a new railway wagons for SNF transferring to PO “Mayak” for reprocessing.
- To complete construction of a temporary SNF storage facility or to build a new one at PO “Mayak”.
- To build a new vessel or to modernize the available one for SNF removing from coastal storage facilities which are in the emergency conditions.
- To complete the licensing process and to start serial production of metal-concrete containers for transportation and/or for long-term storage of SNF.
- To create sites for storage of metal-concrete containers with SNF at the ship-repairing plants in the Murmansk and Arkhangelsk regions.
- To overload SNF from the emergency coastal storage facilities into metal-concrete containers and to transfer the latter to PO “Mayak” or for long-term storage.
- To unload SNF from the floating technical storage facility “Lepse” and to dispose the vessel.

3. Resources Support for Problems’ Solution.

Financing for development and realization of the projects on improvements of radiation and ecological state in the European/Arctic Region of Russia is carried out on means from the Federal budget of the Russian Federation distributed in frameworks of the federal purposeful programs on RW and SNF disposal and final disposal, as well as in frameworks of the program on disposal of nuclear submarines taken out of the Navy effectives. However these means are

insufficient. A number of the projects is financed from the means of international assistance in framework of the Government-to-government Agreements with the USA, Norway and Agreements with the European Community Committee. The important work on cooperation with Russia in the field of RW and SNF management is accomplished by the Contact Expert Group formed of the formal representatives of involved countries on the IAEA's initiative. Materials on the projects suggested by Russia in the field of RW and SNF management are available in the CEG's database. Till the end of 1998 it is planned to submit a detailed list of the projects connected with improvements of radiation and ecological state in the European/Arctic Region of Russia, for CEG's consideration .