RUSSIAN FEDERATION

A. National Framework for Management of Radioactive Waste and Spent Fuel

The Russian Federation operates now:
33 nuclear power units with the overall installed capacity of 25.2 GW,
6 nuclear-powered icebreakers,
21 research reactors.

The following institutions are recognized as state management authorities in the field of atomic energy use:

- State Atomic Energy Corporation «Rosatom» (Rosatom);
- Ministry of Industry and Trade of the Russian Federation (Minpromtorg of Russia);
- Ministry of Healthcare and Social Development of the Russian Federation (Minzdravsocrazvitiya of Russia);
- Ministry of Regional Development of the Russian Federation (Minregion of Russia) (deals exclusively with LLW and ILW and sources of ionizing radiation that do not pertain to nuclear, power and military complexes of the country);
- Ministry of Energy of the Russian Federation (Minenergo of Russia);
- Ministry of Education and Science of the Russian Federation (Minobrnauki of Russia);
- Federal Agency for Subsoil Use (Rosnedra);
- Federal Agency for Technical Regulation and Metrology (Rosstandart);
- Federal Agency for Marine and River Transport (Rosmorrechflot);
- Federal Medical and Biological Agency (FMBA of Russia).

B. National Legal and Regulatory Framework

B.1 National Legal Framework

The following Federal laws form the legislative framework for safety regulation in the field of atomic energy use in the Russian Federation:

- Federal Law № 170-FZ «On the Use of Atomic Energy» of November 21, 1995;
- Federal Law № 3-FZ «On the Radiation Safety of Population» of January 9, 1996;
- Federal Law № 7-FZ «On the Environmental Protection» of January 10, 2002;

- Federal Law № 190-FZ «On the Management of Radioactive Waste and Amendments to Certain Legislative Acts of the Russian Federation» of July 11, 2011.

To elaborate provisions of the federal laws, the President of the Russian Federation and the Government of the Russian Federation adopt normative legal acts (by-laws) in form of Presidential decrees and resolutions of the Government of the Russian Federation.

Normative regulation of safety in the field of atomic energy use is effectuated through federal norms and rules in the field of atomic energy use, in accordance with the Federal Law № 170-FZ «On the Use of Atomic Energy» of November 21, 1995 (Article 6), and sanitary norms and rules, in accordance with the Federal Law № 3-FZ «On the Radiation Safety of Population» of January 9, 1996 (Article 9). Provisions of these norms and rules have binding nature.

According to the Federal Law «On the Use of Atomic Energy» (Article 6), federal norms and rules in the field of atomic energy use specify the requirements for the safe use of atomic energy, including safety requirements for nuclear facilities and activities in the field of atomic energy, involving safety objectives, principles and criteria that shall be observed when performing any activity in the field of atomic energy use. Federal norms and rules in the field of atomic energy use are developed and approved according to the procedure established by the Government of the Russian Federation.

Requirements of the federal norms and rules shall be abided by all legal entities and private persons performing activities in the field of atomic energy use and are valid throughout the territory of the Russian Federation.

According to the Federal Law «On the Radiation Safety of Population», state regulation of radiation safety is effectuated through the establishment of sanitary rules, standards, hygienic standards, radiation safety rules, codes of rules, occupational safety rules and other regulations governing radiation safety. Sanitary rules, standards and hygienic standards for radiation safety are approved in accordance with the procedure established by the Russian legislation.

Safety guides and guideline documents developed by state safety regulatory authorities, as well as instruments developed by state management authorities in the field of atomic energy use (institutional documents), state and industry-wide standards regulate the safety of SNF and RW management in the Russian Federation.

Now some important amendments have been introduced to the legal and regulatory instruments, including federal norms and rules, as well as regulatory technical documents in the field of atomic energy use.

B.2 National Regulatory Framework

The following authorities shall exercise state regulation of safety in the Russian Federation:

- Federal Environmental, Industrial and Nuclear Supervision Service (Rostechnadzor);
- Ministry of the Russian Federation for Civil Defense, Emergencies and Elimination of Consequences of Natural Disasters (EMERCOM of Russia);
- Ministry of Natural Resources and the Environment of the Russian Federation (Minprirody);
- Federal Service for Supervision of Natural Resources (Rosprirodnadzor);
- Federal Supervisory Service for Consumers Rights and Health Protection (Rospotrebnadzor)
- Federal Medical and Biological Agency (FMBA of Russia).

C. Waste Management, Decommissioning, Spent Fuel Strategy, Current Practices and Technologies

C.1 Strategies and Current Practices

At present, Russian national practices of SNF management involve controlled storage and reprocessing of SNF and provide for addressing the priority tasks enabling to ensure safe management of the accumulated SNF inventory under the FTP «NRS»

The practice of RW management is currently under revision - organizations are now responsible for RW conditioning (in accordance with the waste acceptance criteria for disposal) and its further transfer to the national operator for disposal. RW conditioning shall be performed before expiration of the interim storage period established by the state management authority in the field of RW management. At present time, in accordance with the transitive regulation, interim storage life for unconditioned RW is limited to 10 years for organizations operating particularly hazardous nuclear and radiation facilities. For other organizations this period, in accordance with the FZ-190, is limited to 5 years.

Practices of RW management have been brought in line with the requirements of the Unified State System for RW Management (USS RW) which is currently being developed. It should be noted, that USS RW establishment is a priority task for the State Corporation «Rosatom» acting as the state management authority in the field of RW management. Certain components of the system have already been established.

C.1.1 Radioactive Waste

Enforcement of the Federal Law «On the Management of Radioactive Waste» has become the key element of the State policy in this field. The law provides for RW

disposal requirements, requirements to the management of the accumulated RW inventory and storage facilities; it also sets up financial fundamentals for all RW management activities. In addition, adoption of this law codified the transition from RW storage practice to RW disposal.

According to the Federal Law, a Unified State System for RW management has been established in order to arrange for and ensure safe and cost-effective management of waste.

USS RW also provides for cooperation between the state management authority in the field of RW management, the state management authorities in the field of atomic energy use, the state safety regulatory authorities in the field of atomic energy use, the national operator for RW management, specialized RW management organizations, as well as organizations generating RW.

C.1.2 Spent fuel

The basic concept determining the policy of the Russian Federation in the field of SNF management is that SNF is not considered to be radioactive waste.

Main principles of SNF management in Russia are established in the Concept for Spent Nuclear Fuel Management of the State Atomic Energy Corporation «Rosatom» approved by decree № 721 of December 29, 2008.

Priority tasks for managing the accumulated SNF inventory are discussed in the FTP «NRS».

The core principle of the state policy of the Russian Federation in the field of SNF management involves SNF reprocessing to ensure ecologically sound management of fission products and to recycle the recovered nuclear material into nuclear fuel cycle.

At present, Russian national practices of SNF management involve controlled storage and reprocessing of SNF and provide for addressing the priority tasks enabling to ensure safe management of the accumulated SNF inventory under the FTP «NRS»

C.1.3 Decommissioning

Pre-decommissioning activities at 160 nuclear facilities (according to Russian terminology — nuclear installations, radiation sources and storage facilities), including more than 40 research complexes and facilities, nuclear power plants (Beloyarsk and Novovoronezh NPPs), over 50 NFC facilities (PA «Mayak», MCC, TVEL), storage facilities and nuclear icebreaker fleet facilities are currently underway.

C.2 Overview of Main Waste and Spent Fuel Issues

The Russian Federation adhered to a comprehensive approach in SNF and RW management:

«Long-Term Action Program for the State Atomic Energy Corporation «Rosatom» (2009-2015) was being carried out,

the Federal Law № 190-FZ «On the Management of Radioactive Waste and Amendments to Certain Legislative Acts of the Russian Federation» of July 11, 2011 was adopted,

the Russian Federation was actively involved in international cooperation on comprehensive solution of the existing nuclear fuel cycle (NFC) safety issues.

The discussion of the third National Report of the Russian Federation and its results highlighted the need of implementing the already planned arrangements to improve the safety of SNF and RW management, including:

- establishment of the Unified State System for RW Management (USS RW);
- improvement of the regulatory framework in the field of SNF management;
- completion of the bulk import of highly-enriched fuel from foreign research reactors in accordance with the Global Threat Reduction Initiative;
- follow-up of the FTP «Nuclear and Radiation Safety in 2008 and until 2015»;
- implementation of measures to improve SNF and RW management safety at MCC:

1) to complete the construction of a centralized «dry» SNF storage facility;
2) to reconstruct and upgrade the «wet» SNF storage facility;
3) to develop the design and construct PDC for SNF reprocessing.

- to establish RW management facilities at PA «Mayak»;
- to upgrade and improve the system of federal norms and rules in the field of SNF and RW management.

It was particularly noted that the Russian Federation will have to address great challenges, including the nuclear legacy issues, and to lead ambitious efforts to improve the safety of SNF and RW management, such as:

- to follow-up decommissioning and remediation activities at PA «Mayak», MCC, SCC etc.;
- to make decisions on surface water reservoirs for LRW storage (conservation of industrial water reservoirs, including the *Karachai* water reservoir, ensuring safety of the Techa cascade of water reservoirs and etc.);
- to establish new RW processing facilities;
- to construct an underground research laboratory and explore the HLW disposal concept;
- to develop a system for RW classification relying on the disposal routes;
- to perform additional safety assessments for wet SNF storage offsite NPPs.

Actions taken to comply with the recommendations, as well as planned and already implemented efforts aimed to improve SNF and RW management safety, the necessity of which was highlighted in the findings of the Review Meeting on the third National Report of the Russian Federation, are presented in the relevant sections of this Report.

D. Radioactive Waste Classification, Quantities, and Inventory

D.1 Radioactive Waste Classification

In accordance with the Federal Law «On the Use of Atomic Energy», RW is defined as material and substances for which no future use is foreseen, as well as equipment, goods (including spent ionizing radiation sources) containing radionuclides at concentrations greater than clearance levels established by the criteria set up by the Government of the Russian Federation.

But now RW classification system has suffered certain changes. The Federal Law «On the Management of Radioactive Waste…» established new RW classification system according to which all radioactive wastes are divided into two groups: special and removable. Resolution of the Government of the Russian Federation №1069 specifies the criteria used to define waste as special or removable. According to the resolution, RW can be defined as special RW if it meets the following criteria:

- collective effective dose for the whole period of RW potential hazard and the risk of potential exposure associated with operations on RW removal are greater than the collective effective dose for the whole period of RW potential hazard and the risk of potential exposure associated with in situ disposal of such waste;
- costs of RW removal (including the costs for RW discharge, processing, conditioning, transportation to the disposal site and disposal itself) are greater than the aggregate possible damage inflicted to the environment in case of such waste disposal in situ and the costs for the RW disposal in situ (including the costs associated with transition of the RW storage facility to RW disposal facility, its operation and closure, as well as safety provision for the whole period of RW potential hazard);
- RW disposal facility and its sanitary-protection zone are located outside the borders of settlements, designated conservation areas, coastal buffer zones and water conservation zones, as well as other exclusive and protected areas established under the Russian legislation.

Resolution of the Government of the Russian Federation №1069 established classification criteria for removable RW based on appropriate disposal concepts. All radioactive waste defined as removable RW are divided into 6 classes:

Class 1 covers solid high-level RW requiring final disposal in deep disposal facilities after prior storage to reduce heat generation.

Class 2 covers solid high-level RW and intermediate-level long-lived RW containing radionuclides with half-lives greater than 30 years that require final disposal in deep disposal facilities and not subjected to prior storage to reduce heat generation.

Class 3 covers solid intermediate-level RW and low-level long-lived RW containing radionuclides with half-lives greater than 30 years that require final disposal in near-surface disposal facilities at a depth of up to 100 m.

Class 4 covers solid low-level RW and very low-level RW requiring final disposal in near-surface disposal facilities located at the ground level.

Class 5 covers liquid intermediate-level and low-level RW requiring final disposal in deep well injection facilities constructed and operated at the time the Federal Law «On the Management of Radioactive Waste and Amendments to Certain Legislative Acts of the Russian Federation» came into force.

Class 6 covers RW generated in mining and processing of uranium ores or during operations that are not associated with atomic energy use, namely, mining and reprocessing of mineral and organic raw materials with high concentrations of naturally occurring radionuclides that require final disposal in near-surface disposal facilities.

Numerical thresholds for the specific activity levels of radionuclides contained in RW provide distinction between classes 1-5 based on the period of RW potential hazard.

OSPORB-99/2010 establishes RW classification based on RW specific activity (with account of Amendment №1 to OSPROB-99/2010 introduced by the resolution of the Chief Public Health Official of the Russian Federation № 43 of September 16, 2013). Numerical values for these criteria are presented in Table B1.

Based on specific activity levels, solid radioactive waste containing man-made radionuclides, except for spent sealed radionuclide sources are divided into 4 categories: very low-level, low-level, intermediate-level and high-level waste, whereas liquid waste are divided into 3 categories: low-level, intermediate-level and high-level waste. If, according to the radionuclide characteristics, radioactive waste can be attributed to different categories, such waste shall be attributed to the highest possible category.

Table D1. Classification of Solid and Liquid Radioactive Waste

Wastes category	Specific activity, Bq/kg (Bq/l)			
	tritium	β-and γ-emitters (excluding tritium)	α-emitters (excluding transuranic)	transuranic elements
Solid Waste				
Very low-level	less than 10^7	less than 10^3	less than 10^2	less than 10^1
Low-level	from 10^7 to 10^8	from 10^3 to 10^4	from 10^2 to 10^3	from 10^1 to 10^2
Intermediate-level	from 10^8 to 10^{11}	from 10^4 to 10^7	from 10^3 to 10^6	from 10^2 to 10^5
High-level	more than 10^{11}	more than 10^7	more than 10^6	more than 10^5
Liquid Waste				
Low-level	less than 10^4	less than 10^3	less than 10^2	less than 10^1
Intermediate-level	from 10^4 to 10^8	from 10^3 to 10^7	from 10^2 to 10^6	from 10^1 to 10^5
High-level	more than 10^8	more than 10^7	more than 10^6	more than 10^5

D.2 Inventory

D.2.1 SNF inventory

The launched program for transportation of RBMK and RR SNF slowed down the growth rates of SNF accumulation in reactor storage facilities.

SNF inventory at Russian enterprises

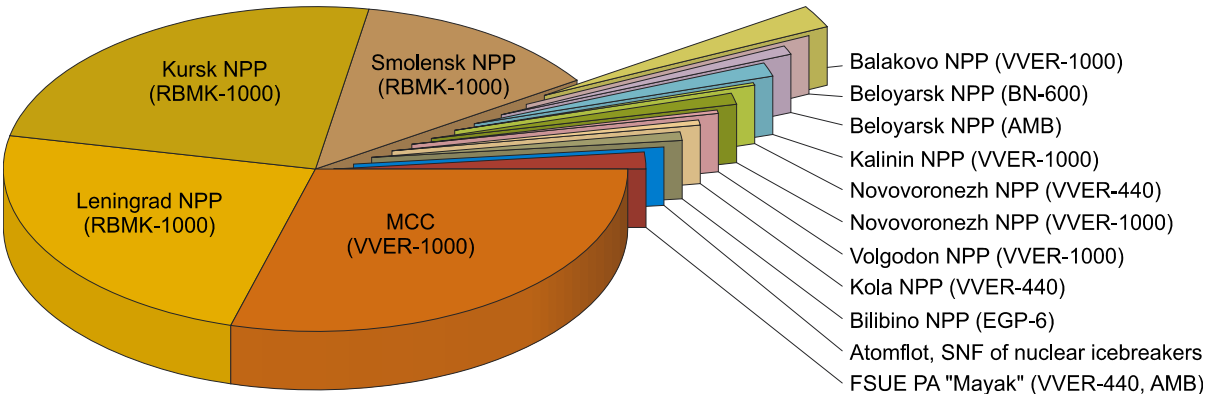


Table D.2. SNF inventory from different reactor units, as of January1, 2014

Operating organization and its branches	Fuel type	SNF quantity, metric tons
Kola NPP	WWER-440	84.554
Novovoronezh NPP	WWER-440	2.919
	WWER-1000	154.342
Balakovo NPP	WWER-1000	349.714
Rostov NPP	WWER-1000	149.122
Kalinin NPP	WWER-1000	308.159
Kursk NPP	RBMK-1000	4733.883
Leningrad NPP	RBMK-1000	4776.363
Smolensk NPP	RBMK-1000	2960.06
Beloyarsk NPP	BN-600	30.704
	AMB	190.9
Bilibino NPP	EGP-6	159.361
PA Mayak	WWER-440, AMB	453
MCC	WWER-1000	6582
	RBMK	344
IPPE	AM-1	10.57
RIAR	MIR, SM, VK-50, BOR-60	63.613
NRC «Kurchatov Institute»	MR, IR-8	
Atomflot, FMB «Lepse»		2.52*
Atomflot, FMB «Lotta»		3.58*
Atomflot, FMB «Imandra»		1.01*
Atomflot, NI SNF container-type SF		1.34*

** recalculated to uranium metal*

D.2.2 RW inventory

In general, the total RW inventory is distributed among 120 enterprises located in 44 regions of the Russian Federation owning in total 830 RW storage facilities, including sites for collection and/or temporary storage (RW which volume is greater than 1 thousand tone for SRW and/or 1 thousand m^3 for LRW are held at 45 enterprises in 239 storage facilities) and 3 deep well injection facilities for LRW disposal. Under the initial RW registration project, decisions have been made on consolidation of particular storage facilities into unified complexes. For this reason and due to the start of RW removal from a number of temporary storage facilities, it is projected that in the future the number of storage facilities will continue to decrease.

The major portion of LRW that are held at nuclear enterprises represents low-level RW (98%) with a total activity of $8.4 \cdot 10^{15}$ Bq (which accounts for some 0.03% of the inventory's total activity), 98% of which are held in near-surface water-reservoirs at PA «Mayak».

Most intermediate-level LRW are kept at SCC, MCC and RIAR and are isolated from the environment in deep geological formations.

High-level LRW represent less than 0.02% of the total LRW inventory by volume, whereas its activity accounts for some 63% of the inventory's total activity. All high-level LRW are kept in purpose-designed structures and are isolated from the environment.

About 94% of the total SRW inventory is low-level RW. Most of this waste is kept at PIMCU (uranium mining enterprise). 91% of the SRW activity accounts for high-level SRW.

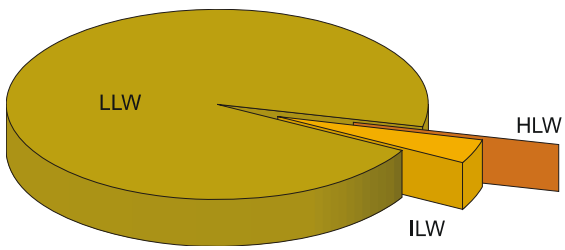
As of the end of 2013, sites of the nuclear sector were holding some 489.6 million m^3 ($4.2 \cdot 10^{19}$ Bq) of LRW and 90.4 million tons ($4.7 \cdot 10^{19}$ Bq) of SRW.

Table D.2 LRW generation in 2013

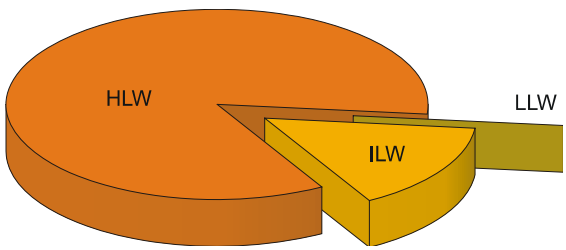
Total LRW	Volume 1.88 mln m^3 — 100%	Activity $1.55 \cdot 10^{18}$ Bq — 100%
LLW	90.43%	Less than 0.01%
ILW	9.36%	2.08%
HLW	0.21%	97.91%

The accumulated LRW inventory breakdown:

by volume

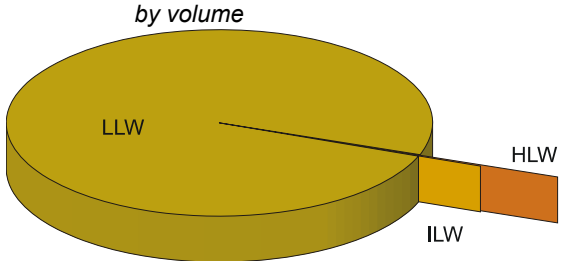
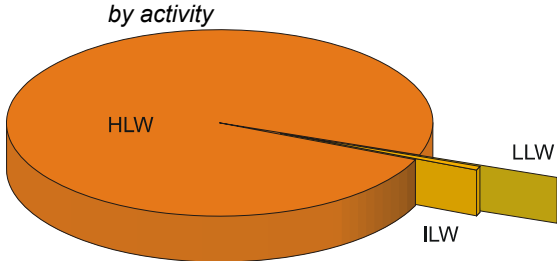


by activity



The accumulated SRW inventory breakdown:

by volume



by activity