

ON PREPARATION OF THE FIFTH NATIONAL REPORT OF THE RUSSIAN FEDERATION ON IMPLEMENTATION OF OBLIGATIONS ARISING FROM THE JOINT CONVENTION ON THE SAFETY OF SPENT FUEL MANAGEMENT AND ON THE SAFETY OF RADIOACTIVE WASTE MANAGEMENT

V. I. Dorogov

Nuclear Safety Institute of RAS, Moscow, Russian Federation

A. V. Ponizov

FBU Scientific Engineering Centre of Nuclear and Radiation Safety, Moscow, Russian Federation

A. V. Khaperkaya

State Corporation "Rosatom", Moscow, Russian Federation

Received 16 August 2017

The paper provides a brief analysis of the process of preparing the Fifth National report of the Russian Federation on implementation of the obligations arising from the Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management to be presented at the Sixth review meeting of the Contracting Parties in May 2018.

Keywords: *Joint Convention, safety, radioactive waste, spent nuclear fuel, review meeting of the Contracting Parties, National report*

The Russian Federation is finalizing the Fifth National Report on implementation of obligations arising from the Joint Convention on the Safety of Spent Fuel (hereafter referred to as SNF) Management and the Safety of Radioactive Waste (hereafter referred to as RW) Management.

The Joint Convention on the Safety of SNF Management and on the Safety of RW Management (hereafter referred to as the Joint Convention) was signed in 1997. By that time, the conditions for a broad international consensus on the need and possibility to consolidate international efforts on application of generally accepted fundamental principles and advanced mechanisms for assurance of safety in these fields were in place. The Joint Convention was ratified by the Russian Federation in 2006.

The goals formulated in the Joint Convention are as follows:

i) to achieve and maintain a high level of safety worldwide in spent fuel and radioactive waste management, through the enhancement of national measures and international cooperation, including where appropriate, safety-related technical cooperation;

ii) to ensure that during all stages of spent fuel and radioactive waste management there are effective defenses against potential hazards so that individuals, society and the environment are protected from harmful effects of ionizing radiation, now and in the future, in such a way that the needs and aspirations of the present generation are met without compromising the ability of future generations to meet their needs and aspirations;

iii) to prevent accidents with radiological consequences and to mitigate their consequences should they occur during any stage of spent fuel or radioactive waste management.

The Joint Convention is applicable to all SNF and RW generated in civilian activities. The field of its application covers all the facility life cycle stages including siting, design, construction, operation, and closure.

According to Article 32 of the Joint Convention, the Contracting Parties shall submit national reports to review meetings of Contracting Parties. These reports shall address the measures taken to implement each of the obligations of the Convention.

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The Joint Convention has adopted the guidelines [1] regulating the application of international cooperation mechanism for efforts taken by each of the Contracting Parties at the national level. This mechanism is implemented by holding regular Review Meetings of the Contracting Parties. The preparation for the Review Meeting includes such major stages as preparation and publication of a National Report, preparation of questions to National Reports of other countries, preparation of answers to the questions received for the National Report, preparation of presentation of the National report, presenting the National Report at the group session, participation in the plenary session of the Review Meeting on preparation of the report summarizing the decisions on all National Reports of all Contracting Parties, participation in the plenary session on preparation of final summary documents of the Review Meeting.

Structure of National Reports is defined by the Joint Convention document "Guidelines regarding the Form and Structure of National Reports" [2]. The National Report includes 11 sections and Annexes. The sections, in particular, include:

- policies and Practices (paragraph 1 of Article 32);
- scope of Application (Article 3);
- inventories and lists of SNF, RW, including description of management facilities (paragraph 2 of Article 32);
- description of Legislative and Regulatory system (Articles 18–20), including information about the regulatory body;
- other General Safety Provisions, including responsibility of the license holder (Article 21), human and financial resources (Article 22), quality

assurance (Article 23), operational radiation protection (Article 24), emergency preparedness (Article 25), decommissioning (Article 26);

- chapters of sections "Safety of SNF management" (Articles 4–10) and "Safety of RW management" (Articles 11–17) including obligations arising from the indicated articles on safety assurance at all the life cycle stages for the facilities in relevant fields (siting, design, construction, operation and decommissioning);
- transboundary Movement (Article 27);
- disused Sealed Sources (Article 28);
- general Efforts to Improve Safety, including summary of safety issues of concern identified earlier and of planned future actions to address those issues, including, where appropriate, measures of international cooperation;
- annexes, including inventories of SNF and RW and lists of relevant management facilities, references to laws, regulations, requirements, guides, etc.

In addition to the presentation of the National report, the Contracting Party is also required to participate in preparation of written questions to the National Reports of other countries and in preparation of the answers to the questions and comments of other countries received with regards to its own National Report.

Open presentation and discussion of the National Report with Contracting Parties at regular Review Meetings is of special significance.

The Russian Federation took part in the Review Meetings in 2006, 2009, 2012 and 2015. Four National Reports were prepared; the Fifth is at the finalizing stage. The Fifth National Report shall be prepared and presented by the Russian Federation at the Sixth Review Meeting to be held from 21 May to 1 June 2018.

A joint decision of Rostekhnadzor and the State Corporation "Rosatom" "On the procedure for drafting and submission to IAEA of the Fifth National Report of the Russian Federation on implementation of obligations arising from the Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management for the period of 2016–2018" (hereafter referred to as Decision) has been approved to assure timely and high-quality preparation of the Fifth National Report. The Decision is supplemented by the "Procedure for drafting and submission to IAEA of the Fifth National Report of the Russian Federation On implementation of obligations arising from the Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management", which guides the actions on preparation of the Fifth National Report by Rostekhnadzor and the State Corporation "Rosatom".

In accordance with the Decision, the responsibility for preparation of the Fifth National Report was assigned to the State Corporation "Rosatom" (state nuclear management body) and to Rostekhnadzor (state nuclear regulatory body). With account for

the positive experience of preparation of the four previous National Reports [3], IBRAE RAN and SEC NRS were engaged in preparation of the Fifth National Report.

The Fifth National Report of the Russian Federation reflects information on implementation of obligations arising from the Joint Convention on the Safety of SNF and RW, including description of policies and practices in the field of SNF and RW management, legislative and regulatory structure, measures for protection of personnel, population and environment at all stages of SNF and RW management, measures on safety assurance of transboundary movement of SNF, RW and sealed sources. The National Report of the Russian Federation also indicates that the state policy in the field of SNF management is based on the principle of reprocessing and recycling of regenerated nuclear materials in the nuclear fuel cycle. The policy in the field of RW management is aimed at the further development of regulatory and organizational framework for RW management and establishment of RW disposal sites.

The Fifth National Report of the Russian Federation reflects the major changes in the legislative and regulatory systems. There were considerable changes introduced into the federal codes and standards in the field of use of nuclear energy over the reviewed period.

The following safety requirements on RW management prior to disposal and in process of disposal were updated and entered into force:

- "Safety rules in management of radioactive waste of nuclear power plants" (NP-002-15);
- "Collection, reprocessing, storage and conditioning of liquid radioactive waste. Safety Requirements" (NP-019-15);
- "Collection, reprocessing, storage and conditioning of solid radioactive waste. Safety Requirements" (NP-020-15);
- "Management of gaseous radioactive waste. Safety Requirements" (NP-021-15);
- "Disposal of radioactive waste. Principles, criteria and main safety requirements" (NP-055-14);
- "Safety in management of radioactive waste. General provisions" (NP-058-14);
- "Near-surface disposal of radioactive waste. Safety Requirements" (NP-069-14).

The regulations were revised to incorporate the requirements of the Federal law of 11 July 2011 No.190-FZ "On the management of radioactive waste and on amending separate legal acts of the Russian Federation". In particular, the safety requirements for management of non-retrievable and retrievable RW were introduced.

The introduced "Criteria for acceptance of radioactive waste for disposal" (NP-093-14) set general acceptance criteria for RW to be disposed, requirements for setting of RW acceptance criteria for disposal at a specific disposal facility, requirements to confirmation of RW compliance to acceptance

criteria, requirements to the passport of RW transferred for disposal.

"Requirements to the structure and content of the safety case for radioactive waste storage facilities" (NP-099-17), and "Requirements to the structure and content of the safety case for radioactive waste disposal facilities" (NP-100-17) were introduced in 2017. The documents regulate development of safety case reports for RW storage and disposal facilities.

The draft federal codes and standards in the field of use of atomic energy "Safety requirements to non-retrievable radioactive waste storage and conservation facilities" setting the requirements to the management of non-retrievable RW have been developed in accordance with Article 8 of the Federal Law of 11 July 2011 No. 190-FZ "On the management of radioactive waste and on amending separate legal acts of the Russian Federation". The approval of the document is planned for 2017. The proposals have been developed to change the following federal codes and standards in the field of use of atomic energy "Safety of radioactive waste management. General provisions" (NP-058-14), "Disposal of radioactive waste. Principles, criteria and general safety requirements" (NP-055-14), "Near-surface disposal of radioactive waste. Safety requirements" (NP-069-14), "Criteria for acceptance of radioactive waste for disposal" (NP-093-14) with regards to introduction of safety requirements in management of sealed ionizing radiation sources, including their disposal. Their approval is planned for 2017.

The National Report gives general information on the amount of RW and SNF in the Russian Federation. The inventories provided demonstrate that the total volume of accumulated RW at the facilities of the Russian Federation by the end of 2016 was 556.36 mln m³ with a total activity of 1.14·10²⁰ Bq. The waste was located at 174 facilities at 897 RW storage sites, including the sites used for accumulation and/or temporary storage of RW.

Over 96% of LRW is low-level waste with total activity of 8.79 10¹⁵ Bq (about 1% of the total LRW activity), and 88.7% of this waste is stored at storage facilities (special ponds and accumulation reservoirs) of PA "Mayak". Part of intermediate-level LRW is isolated from the environment in deep geological formations. High-level LRW totals less than 0.01% of the overall LRW volume; its activity reaches 61% of the total LRW activity and is isolated from the environment.

Processing of high-level LRW at FSUE "PA Mayak" resulted in accumulation of 2481.6 m³ of vitrified SRW with total activity of 1.43·10¹⁹ Bq (about 80% of the total activity of accumulated RW). Very low-level SRW represents 98% of the total amount. The majority of such waste is located at the Priargunsky Industrial Mining and Chemical Union (PJSC PIM-CU), a uranium mining facility.

The SNF inventory lists presented in the Fifth National Report inform that about 22.5 thous. tons of SNF was accumulated in the Russian Federation by the end of 2016.

A major part of SNF from RBMK-1000 is kept at Kursk, Leningrad, Smolensk NPPs and at the Mining Chemical Combine (MCC, Krasnoyarsk).

A major part of SNF from VVER-1000 is kept at MCC.

The Fifth National Report includes information on major advances related to safety assurance in the fields considered by the Joint Convention:

- on SNF management:
 - construction of a dry SNF storage facility at MCC has been completed. Relocation of VVER-1000 SNF from "wet" to "dry" storage has started; 13234 RBMK-1000 spent fuel assemblies (SFA) from Kursk and Leningrad NPPs, 1359 SFA of VVER-1000 have been placed for dry storage; 2211 SFA from FSUE "Atomflot" and 3754 SFA of research reactors have been reprocessed; 555 t of SNF have been reprocessed.
 - construction of the first startup complex of the pilot demonstration centre for SNF reprocessing at MCC (with capacity up to 5 t of SNF per year) has been completed and the relevant license for operation has been received; the second startup complex of the pilot demonstration centre for SNF reprocessing (capacity up to 250 t of SNF per year) is under construction;
- on RW management:
 - RW processing systems have been commissioned or modified at Leningrad, Smolensk, Kola and Novovoronezh NPPs in 2015–2016;
 - electric furnace EP-500/5 for HLW vitrification has been commissioned at FSUE "PA "Mayak";
 - the vitrified waste storage facility has been enlarged;
 - activities on landfilling have been completed for the following LRW storage pools: B-2 at Siberian Chemical Combine (SCC, Seversk), No. 354 at MCC, V-9 at "PA "Mayak"; activities related to safety of storage pools B-1 and B-25 at SCC, V-17 at "PA "Mayak", No. 365 at MCC are continued in the framework of the Federal targeted program "Nuclear and radiation safety for 2016–2020 and for the period up to 2030" (hereafter referred to as FTP NRS-2);
 - a program of experimental and computational work for a long-term safety case of LRW deep geological disposal facility has been developed in response to recommendations of IAEA peer review;
- on decommissioning:
 - industrial uranium-graphite nuclear reactor EI-2 at SCC was decommissioned in 2015;
 - works on decommissioning of the floating maintenance base "Volodarsky" have been completed; decommissioning of floating maintenance base "Lepse" (to be completed in 2019), icebreakers

"Sibir" (to be completed in 2017) and "Arktika" (to be completed in 2019) is underway;

- building "B" of JSC "All-Russian Research Institute of Inorganic Materials" was decommissioned in 2016 in Moscow in the urban area.

The National Report describes the organizational and technical measures on enhancing the safety of SNF management (centralized storage and reprocessing), RW management (reprocessing and disposal of RW, including the accumulated waste), and decommissioning of nuclear and radiation-hazardous facilities (NRHF). There are two levels of planning and funding of measures on SNF and RW management and NRHF decommissioning in the Russian Federation:

- Federal Targeted Programs with assigned activities and funds allocated for intermediate and long-term periods. The Government of the Russian Federation has approved and is funding FTP NRS-2 until 2030, subprogram "Industrial dismantlement of nuclear submarines, surface ships with nuclear propulsion unit, nuclear maintenance ships and remediation of radiation-hazardous facilities for 2011–2015 and for the period up to 2020";
- Three-year plans for implementation of measures in accordance with the documents approved by the President and the Government (Fundamentals of the State Policy in the Field of nuclear and radiation safety, plans for deployment of the second stage of the Unified state system of RW management).

The programs and planned measures on both levels are coordinated with each other.

The terms "Good Practice" and "Area of Good Performance" introduced at the Third extraordinary meeting of the Contracting Parties have been used for preparation of the Fifth National Report. The terms are defined as follows:

A Good Practice is a new or revised practice, policy or program that makes a significant contribution to the safety of radioactive waste and spent fuel management. A Good Practice is one that has been tried and proven by at least one Contracting Party, but has not been widely implemented by other Contracting Parties; and is applicable to other Contracting Parties with similar programs. An Area of Good Performance is a new or enhanced practice, policy or program for a Contracting Party that is commendable and is being implemented. An Area of Good Performance is a significant accomplishment for the Contracting Party, although it may have been undertaken by other Contracting Parties. An Area of Good Performance could be demonstrated, for example, through achievement of milestones or improvements from the previous review.

The Fifth National Report of the Russian Federation reviews the activities complying with the introduced terms.

“Good Practice”:

- Establishment at the site of MCC of an integrated centralized complex for SNF management. The complex includes centralized facilities for “wet” and “dry” storage, reprocessing and fabrication of uranium-plutonium fuel. The centralized facility contributes to the following strategic goals:
 - safe long term (at least 50 years) storage of SNF;
 - enhanced environmental safety due to application of reprocessing processes eliminating LRW generation and transition of radionuclides into a safe form suitable for long-term storage and subsequent reliable isolation;
 - closure of nuclear fuel cycle.
 - Priority principle for arranging decommissioning activities, based on characterization of the facility condition and its location. The prioritized sites were the most hazardous facilities located in cities. For example, the building “B” of JSC “All-Russian Research Institute for Inorganic Materials” has been decommissioned. The building “B” was used for research, including radiochemical ones, starting in 1940-s. Radiation safety was assured at all stages of decommissioning operations, there was no excess exposure of personnel or change of radiation situation on the perimeter of the facility. These efforts resulted in closure of the NRHF and remediation of the territory.
 - Typical principle for organization of operations. Out of more than 12 closed industrial uranium-graphite reactors (IUGR), one was selected (EI-2 of at SCC) to test the overall procedure of operations. IUGR was constructed in 1958–1990 for plutonium production. IUGR is a structure, whose volume is approximately 150 thous. m³, with surface and underground parts. The underground part of the facility with a reactor vault is 40–50 m deep. Dry filling was selected for conservation of IUGR structures. Change of adsorption properties of milled clay rocks with inorganic viscous additives was studied experimentally. The optimum content of barrier material for filling of IUGR vault and near-reactor rooms as well as the method of filling were selected. The practical experience obtained in the process of IUGR EI-2 decommissioning by the only organization in Russia specializing in this kind of operations, JSC “Pilot and Demonstration Center for Decommissioning of Uranium-Graphite Nuclear Reactors” (JSC “PDC UGR”), will be used for decommissioning of similar nuclear facilities.
- ### “Areas of Good Performance”
- Deployment of the Unified state system for radioactive waste management.
 - Initial inventory of RW and conditions of their storage were large-scale and important activities completed in 2013–2014 in order to confirm the data on the accumulated RW and its locations and make decisions on further measures on assurance of RW safety.
 - Development and enactment of key regulatory and organizational arrangements and start of operations on construction of RW disposal facilities.
 - Establishment of criteria for waste designation as RW and RW categorization in accordance with the preferred disposal method.
 - Commissioning of the 1st section of the near-surface RW disposal facility of FSUE NO RW in Novouralsk in the territory of JSC UECC.
 - Conservation of open LRW storage pools.
 - completion of works on landfilling of the following LRW storage pools: B-2 at SCC, No. 354 at MCC, V-9 at “PA “Mayak”.
 - Establishment of SNF management system.
 - Completion of construction of a dry SNF storage facility at MCC (KhOT-2). The storage facility has been constructed and commissioned. KhOT-2 will accept over 20 thous. tons of SNF from RBMK-1000 and 10 thous. tons of SNF from VVER-1000 for safe long-term storage.
 - Construction of a startup complex of the pilot demonstration centre for SNF reprocessing based on innovation techniques. The startup complex of the pilot demonstration centre for SNF reprocessing will be used to work out the process modes for innovative SNF reprocessing technologies in a half-industrial scope. Further development of the facility shall include commissioning and operation of the next generation SNF reprocessing facility (second complex of the pilot demonstration centre) with a capacity of 250 t of SNF per year, with potential further modular expansion.
 - Establishment of SNF dismantlement facilities at NPPs with SNF from RBMK-1000 reactors. A unique technology of container storage of SNF from RBMK-1000 and its dispatch to MCC was developed.
 - Transportation of accumulated SNF for centralized storage and reprocessing. In 2014–2016 the following activities were implemented: over 13 thous. SFA of RBMK-1000 from Leningrad and Kursk NPP were placed at KhOT-2 (MCC), 1359 SFA of VVER-1000 placed at KhOT-1 (MCC). 3754 SFA of research reactors and 2211 SFA from FSUE “Atomflot” were transported to FSUE “PA “Mayak”.
 - TUK-141 container and railroad transporter TK-U-141 were developed for transportation of SFA of VVER-1000 with increased enrichment and burnup. The similar systems (TUK-140 and TK-E-140) were developed for VVER-440 SNF.
- The National Report of the Russian Federation in Russian and English is available at IAEA website since October 2017.
- “Absentee” consideration phase results in written questions and answers of the Contracting Parties to the National Reports. In the process of review of the Fourth National Report, 126 questions concerning SNF and RW management were formulated. The Russian Federation, in turn, has prepared over

hundred questions to National Reports of other Contracting Parties concerning issues of RW management and predisposal, use of reserve funds, and regulatory activities.

Specialists working in the nuclear industry and representatives of regulatory bodies currently have a possibility to ask questions to the National Reports posted at IAEA website and receive answers (contacts: AVKhaperskaya@rosatom.ru). Foreign National Reports of interest may be received from the State Corporation "Rosatom" liaison officer A. A. Erastov (AAErastov@rosatom.ru).

The final stage represents a direct review of National Reports at the Review Meeting of the Contracting Parties. Direct discussion of fulfillment of obligations arising from the Joint Convention is carried out in country groups. Each of the groups includes countries with developed nuclear industry and countries with relatively small inventories of nuclear materials.

General provisions of the Fourth National Report of the Russian Federation were reflected in presentations made by the deputy Head of Rostekhnadzor

A. V. Ferapontov (regulation of safety in management of SNF and RW), Director for State policy in the field of SNF and RW management and nuclear facilities decommissioning of the State Corporation "Rosatom" O. V. Krukov (management of nuclear energy use), and Head of Department of Rostekhnadzor E. G. Kudryavtsev (answers to some questions to the National Report of the Russian Federation).

At the upcoming sixth Review Meeting of the Contracting Parties, Russia is included in the fifth group of countries together with Spain, Argentina, Kazakhstan, Tajikistan, Australia, Estonia, Indonesia, Mauritania and Cuba.

A presentation about the preparation of the Fifth National Report is planned in the framework of the International forum-dialogue to be held on 21–22 November 2017. Relevant information will also be published in the "Radioactive waste" journal.

The Fifth National Report of the Russian Federation was developed in accordance with the guidelines and clearly reflects the fulfillment of obligations arising from the Joint Convention by the Russian Federation. It reflects major changes in the legislative and regulatory framework, and provides detailed information on all implemented and planned activities related to SNF and RW safety.

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Information about the authors

Dorogov Viktor Ilyich, PhD, Head of Office, Nuclear Safety Institute, 115191, Moscow, Bolshaya Tuskaya St., 52, e-mail: vid@ibrae.ac.ru

Ponizov Anton Vladimirovich, Head of Office, Federal State-Funded Institution Scientific and Engineering Center of Nuclear and Radiation Safety, 107140, Moscow, Malaya Krasnoselskaya St., 2/8, 5, e-mail: ponizov@secnrs.ru

Haperskaya Anzhelika Viktorovna, PhD, Senior Manager of the Project Office on the Development of Spent Nuclear Fuel Management System, State Corporation Rosatom, 119017, Moscow, Bolshaya Ordynka St., 24, e-mail: AVKhaperskaya@rosatom.ru

Bibliographic description

Dorogov V. I., Ponizov A. V., Haperskaya A. V. On the preparation of the fifth national report of the Russian Federation on the implementation of the obligations arising out of the Joint Convention on the safety of spent fuel management and on the safety of radioactive waste management // *Radioactive waste.* — 2017. — № 1. — pp. 66–71. (In Russian).