STRATEGY OF SPENT NUCLEAR FUEL MANAGEMENT TO NPP IN THE REPUBLIC OF BELARUS

V. PALIUKHOVICH
Ministry of Energy
Minsk, Belarus
Email: v.paliukhovich@rambler.ru

Abstract

The poster report presents the structure of the Strategy of spent fuel management to NPP in the Republic of Belarus. A brief overview of the documents required for the development of the Strategy is presented, as well as relevant intergovernmental agreements.

The presentation provides the different approaches are being considered for spent fuel management, including longtime storage of spent fuel in the Republic of Belarus (the construction of a "dry" store) and sending of the spent fuel to the Russian Federation for temporary technological storage with further reprocessing and the final disposal of radioactive waste in the Republic of Belarus.

The creation of necessary infrastructure of spent fuel management, the design and construction of a temporary spent nuclear fuel storage and final disposal of radioactive waste, define supply chain for the export of the spent fuel and return of conditioned radioactive waste for final disposal in Belarus is presented.

The presentation also provides the information on the cooperation with the IAEA. The progress of the construction of the first NPP in the Republic of Belarus is presented in the report.

1. INTRODUCTION

The Republic of Belarus is building a nuclear power plant under the Russian NPP-2006 project consisting of two power units with a total capacity of about 2400 MW with WWER-1200 reactors. Installation of the main technological equipment of the first power unit is mainly completed and commissioning works are carried out. At the second power unit the installation of the main technological equipment is started.

The Republic of Belarus closely cooperates with International Atomic Energy Agency. A number of missions assessed the national nuclear power infrastructure and noted that the work to establish the necessary infrastructure for the construction of the first nuclear power plant is carried out in accordance with IAEA norms and standards.

In accordance with the IAEA document SSG-16 "Establishing the safety infrastructure for a nuclear power program" the Strategy of spent fuel management to the Belarusian NPP has been developed.

The strategy includes key organizational points for the implementation of the national policy of the Republic of Belarus in the field of spent fuel (hereinafter SF) management, the main directions of scientific, technical and practical activities of the participants in the circulation process; describes a step-by-step, adaptive approach to the final stage of the nuclear fuel cycle based on the consent of the parties involved in the appeal process.

The strategy is developed taking into account:

- International scientific and practical experience in SF management within the declared national strategies;
- Modern tactics of SF problem solving taking into account the prospects of technical progress;
- Services provided on a commercial basis in the international market of proposals for the treatment of spent fuel, and the conditions for their provision, the availability of these services for the Republic of Belarus;
- Economic and technological complexity of implementation of programs for direct geological disposal of spent fuel;
- The possibility of periodic review of the national policy of the Republic of Belarus on the management of SF or amendments and changes to it as a more in-depth study of the problem, the accumulation of practical experience, changes in the political, economic, environmental, social situation, technology development.

SF management should be carried out within the framework of the policy of openness and transparency regarding intentions and plans. The population should be informed about the proposed plans for the management

of SF and the resulting high-level radioactive waste (hereinafter HLW), consultations should be held on relevant issues before making significant decisions.

A draft Environmental report on the strategic environmental assessment of the draft Strategy of spent nuclear fuel management to the Belarusian NPP was developed for public discussions. Public discussions were held in January 2019. As a result of the discussions, the draft Strategy was finalized and sent to the public administration for consideration.

2. THE LEGAL BASIS FOR THE POLICY OF THE REPUBLIC OF BELARUS IN THE FIELD OF SPENT NUCLEAR FUEL

The purpose of the national policy of the Republic of Belarus in the field of SF management is to ensure the protection of individuals, society as a whole and the environment from the harmful effects of ionizing radiation when handling SF of the Belarusian NPP and the resulting radioactive waste; to ensure national security now and in the future, without imposing an excessive burden on the next generation; to achieve optimum economic feasibility and environmental acceptability; fulfillment of obligations to the world community through the creation of the state SF management system, including legislative, organizational and financial mechanisms, human resources, infrastructure.

The legal basis of the policy of the Republic of Belarus in the field of SF management is the Constitution of the Republic of Belarus, international treaties, conventions, agreements of the Republic of Belarus and national legislation in the field of nuclear energy, radiation, environmental and industrial safety, which corresponds to the generally accepted norms of international law.

The Republic of Belarus is a state party to the Joint Convention on the safety of spent fuel management and on the safety of radioactive waste management.

With the IAEA recommendations, international practice and national legislation the direct responsibility for the management of SF rests with the operating organization. According to the law "On the use of nuclear energy" the activities on the management of spent nuclear materials, including SF, are carried out by the operating organization (state enterprise "Belarusian nuclear power plant") on its own or with the involvement of other structures.

2. SCENARIOS OF POSSIBLE OPTIONS FOR THE TREATMENT OF SPENT NUCLEAR FUEL OF THE BELARUSIAN NPP

National priorities for the long-term management of spent nuclear fuel can be adjusted as decisions are taken at previous stages, taking into account technological advances, technological developments, political, environmental, economic, social and other factors.

In accordance with paragraph 2 of Article 9 of the Agreement between the Government of the Republic of Belarus and the Government of the Russian Federation "On cooperation in the construction of a nuclear power plant in the territory of the Republic of Belarus" the spent nuclear fuel of the Belarusian NPP, purchased from Russian performing organizations, shall be returned to the Russian Federation for processing on the terms determined by the Parties in a separate Intergovernmental agreement.

The Russian Federation is considered as the main country supplier of services and technologies for SF management of the Belarusian NPP.

The scientific institution "Joint Institute for Energy and Nuclear Research-SOSNY" of the National Academy of Sciences of Belarus with the involvement of the profile Russian organization JSC "Techsnabexport" (authorized by the Government of Russia for this type of activity) carried out a feasibility study of three possible options for management SF of the Belarusian NPP:

- Option 1 - sending SF for processing to the Russian Federation, taking into account the long-term storage of SF on the territory of the Russian Federation, followed by the return of high-level radioactive waste and their disposal on the territory of the Republic of Belarus;
- Option 2 - sending SF for processing to the Russian Federation, taking into account the long-term "dry" storage of SF on the territory of the Republic of Belarus, followed by the return and disposal of high-level waste in the Republic of Belarus;

— Option 3 - long-term storage of SF with their subsequent burial on the territory of the Republic of Belarus in deep geological formation.

The difference between option 1 and option 2 is the timing of sending SF for processing to the Russian Federation. According to the first version of SF after aging in the pool of spent fuel for 10 years is sent for processing in batches, starting from 2030. Under the second option, SF is sent for processing to Russia after long-term storage in Belarus for up to 50 years on a specially created SF container storage site.

In accordance with the Joint Convention on the safety of spent fuel management and on the safety of radioactive waste management, the Republic of Belarus needs to establish the necessary infrastructure for the reception of HLW resulting from the processing of irradiated assemblies.

The third option provides for the organization of long-term storage of SF in containers ("dry storage") on the territory of the Republic of Belarus without sending irradiated assemblies for processing to the Russian Federation. This option refers to a "deferred solution".

According to the results of the analysis, option 1 is considered as a priority option for SF management of the Belarusian NPP.

3. THE STRATEGIC DIRECTION OF THE REPUBLIC OF BELARUS IN THE FIELD OF SPENT NUCLEAR FUEL MANAGEMENT

The priority option for SF management of the Belarusian NPP is currently SF processing in the Russian Federation with the return to the Republic of Belarus of high-level radioactive waste included in the glass-like matrix containing radionuclides of cesium-strontium (short-lived) fraction, with the exception of long-lived radionuclides.

Processing of SF should be carried out, after intermediate storage in the territories of the Republic of Belarus and/or the Russian Federation, in volumes and in terms which are defined proceeding from the principles of ecological acceptability and economic expediency, after confirmation of ensuring technical readiness of the relevant production capacities on the conditions approved by the authorized organizations of the Republic of Belarus and the Russian Federation, including agreements on use of the allocated useful products of processing.

Processing the spent fuel from the Belarusian nuclear power plant with appropriate technical, environmental and economic points of view, after resolution of all issues, ensuring the disposal of high-level radioactive waste containing cesium-strontium fraction, the buried near-surface structures ("medium depth") is the "delayed burial". In the case of implementation of this embodiment, the object for a certain time, to reduce the amplitude of the heat dissipation limit, is operated in the mode "controlled storage" and then, after a final preservation, becomes the object of disposal of radioactive waste. This would eliminate the need for a full-scale SF or HLW disposal site in deep geological formations.

Optimization of transport and technological operations associated with the preparation and subsequent shipment of SF of the Belarusian NPP for processing requires a storage area at the NPP with a capacity of 8-16 dual-purpose (transportation and storage) containers that are technologically compatible with the SF management system in accordance with the NPP project. It is required to provide for the possibility of expanding the storage area for the construction of an intermediate storage of SF.

Construction in the Republic of Belarus of the object long-term storage of SF and HLW, based on container solutions, will cost-effectively to form a shipping party for delivery of SF to the Russian Federation, and also to plan the program of the SF removal in conjunction with the volume of regenerated nuclear materials in case of their involvement in the nuclear fuel cycle the Belarusian nuclear power plant, and a return to the Republic of Belarus vitrified HLW. The capacity of the intermediate storage should be optimal to ensure the flexibility of the SF and HLW management system.

Construction of a SF storage site at the Belarusian NPP with the possibility of its expansion to a dry SF container storage will preserve sufficient freedom in decision-making, minimize the risks and the impact of existing uncertainties.

The development of a joint decision with the Russian side on the conditions of processing of SF of the Belarusian NPP in the Russian Federation also requires technical and economic study by authorized organizations of the prospects for the use of fissile products in the fuel cycle of the Belarusian NPP.

Technical possibility, economic feasibility of re-use of nuclear materials extracted from SF in the fuel cycle of reactors on thermal neutrons of the Belarusian NPP require study and justification.

When handling SF products of the Belarusian NPP (regenerated nuclear materials and radionuclides not subject to further use), it is recommended to be guided by the principle of radiation equivalence of SF imported into the Russian Federation for the purpose of processing and the products of processing returned to the Republic of Belarus. The method of determining this radiation equivalence should be determined within the framework of the negotiation process between the authorized organizations of the Republic of Belarus and the Russian Federation.

By the time of return to the Republic of Belarus of waste of processing of SF it is required to confirm existence in the territory of the country of installations for the address with them.

If an agreement to return spent nuclear fuel to the Russian Federation cannot be executed, as an alternative option for the treatment of spent nuclear fuel of the Belarusian NPP on the modern stage it is a long-term interim storage of the spent fuel followed by disposal in a deep geological formation.

4. THE MECHANISM FOR IMPLEMENTING THE STRATEGY

The implementation of the state policy in the field of SF management is carried out through the interaction of the republican bodies of state administration and regulation of the safe use of nuclear energy, scientific institutions and other organizations and departments involved, as well as a clear delineation of their powers and responsibilities.

The Ministry of Energy of the Republic of Belarus is responsible for overall coordination and control of the implementation of the Strategy of spent nuclear fuel management to the Belarusian NPP.

Scientific and technical support of SF management is carried out with the involvement of organizations of the National Academy of Sciences of Belarus, relevant ministries and departments.

The priority measures for the implementation of the SF management strategy to the Belarusian NPP are:

— Development and conclusion of an intergovernmental agreement between the Russian Federation and the Republic of Belarus on cooperation in the management of SF of the Belarusian NPP and appointment of Belarusian and Russian authorized organizations on the management of SF of the Belarusian NPP, waste and useful products of its processing;
— The signing of a long-term framework contract for the management of spent nuclear fuel of the Belarusian NPP between the Belarusian and Russian authorities;
— Development of long-term financing mechanisms for the management of SF of the Belarusian NPP and products thereof;
— The construction at the territory of the Belarusian nuclear power plant the accumulation area with the possibility of extension for the construction of the intermediate (long-term) storage of spent nuclear fuel.
— The Ministry of Energy of the Republic of Belarus periodically reviews the provisions of the Strategy and, in case of significant changes in the conditions of practical activities on the management of SF or the requirements of the legal framework in this area, as well as new scientific and technical achievements or other factors, makes appropriate proposals to the Government of the Republic of Belarus.