

Nationwide environment-oriented program of radioactive waste management in Ukraine – 10398

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ABSTRACT

RW management until 2017 shall be governed by the Law of Ukraine “On Nationwide environment-oriented program of radioactive waste management in Ukraine” (hereafter – State program) dated September 17, 2008. State program is not valid for management of spent nuclear fuel and residues of Uranium mining and processing since these radioactive materials are not classified as RW. The tentative funding from state budget and state fund of RW management is 5247.5 millions hryvnia. The principal result of State program implementation will be safeguarding of present and future generation, increase of the environment protection against the RW impact, improvement of RW management system, decrease of social risks connected with mitigation of Chornobyl NPP accident, prevention of terroristic acts and establishment of favorable conditions for nuclear energy use on behalf of rise in the standard of living. State program will continue after 2017 in form of operation of legacy facilities and construction of new ones including the geological repository. It will give additional possibilities for implementation of the Energy strategy until 2030 and will support the sustainable development of Ukraine.

INTRODUCTION

Nationwide Environment-Oriented Program of Radioactive Waste Management in Ukraine (hereinafter – the Program) has been worked out by interdepartmental work group after a commission of the government of Ukraine and was put in force by the Law of Ukraine of September 17, 2008. The goal of the Program was implementation of basic principles of state policy in field of radioactive waste management. These basic principles include:

- priority of protection of life and health of staff, population and environment from the influence of radioactive waste in accordance with state norms for radiation safety;
- ensuring minimum practically achievable level of generation of radioactive waste;
- non-admission of uncontrolled accumulation of radioactive waste;
- ensuring state supervision of radioactive waste management;
- ensuring safe isolation of radioactive waste from the environment during substantiation of safety of radioactive waste storages;
- storage of radioactive waste at suppliers for a limited period with further transfer of radioactive waste to specialized enterprises for radioactive waste management;
- responsibility of radioactive waste generators for safety during radioactive waste management up to their transfer to specialized enterprises for radioactive waste management;
- prohibition to legal and natural persons, as a result of whose activities radioactive waste are generated and which are supplying and operating nuclear materials and nuclear facilities, to carry out activities on disposal of radioactive waste;
- international cooperation in field of radioactive waste management;
- active scientific and research activities in field of radioactive waste management.

Program takes into consideration basic provisions of Power Engineering Strategy of Ukraine for the period of up to 2030 and is aimed at implementation of a set of measures for ensuring safety during collection, treatment, transportation, storage and disposal of radioactive waste, both already accumulated and to be accumulated in future. The program is developed taking into account legislation of the European Union concerning radioactive waste management.

In the program, there are not considered issues of management of spent nuclear fuel and waste of uranium treatment industry, because these waste are not declared by Ukraine as radioactive waste until their transfer to specialized enterprises for disposal.

CURRENT STATUS OF RW MANAGEMENT IN UKRAINE

Ukraine has well-developed nuclear power engineering and widely use radioactive substances and radioisotope production in various fields of industry. Therefore, management of radioactive waste, especially their treatment, storage and disposal, population and environmental protection from negative influence of radioactive waste is one of the most important issues. As a whole, current system of legislative and normative documents of Ukraine

in field of radioactive waste management complies with international practices, but does not satisfy practical needs to the full extent. In Ukraine, there are accumulated significant amounts of radioactive waste due to:

- power production at nuclear power plants;
- use of ionizing radiation sources and radioactive substances in industry, medical and scientific institutions (including operation of research reactors);
- accidents and Unit 4 of the Chernobyl NPP.

Status of storage of radioactive waste in Ukraine is characterized as described below.

To date, in Ukrainian NPP's there are 15 reactors in operation, including 13 VVER-1000 and 2 VVER-440. On sites of Ukrainian NPP's (except for Chernobyl NPP), there are stored about 29,300 m³ of low-level, 1,160 m³ of intermediate-level and 140 m³ of high-level solid RW. Level of filling of storages is more than 33 percents. In storages of the NPP's, there are accumulated more than 35,000 m³ of liquid RW. Degree of filling of storages for liquid RW is from 20 to 80 per cent. Conditions for storage of radioactive waste at the NPP's comply with radiation safety requirements. However, above-mentioned storages are the temporary ones, and their capacities are not designed for possible extension of operating life of reactors. Radioactive waste, located in storages of the NPP's, require treatment and conditioning for their further disposal. There are no techniques for conditioning of certain types of liquid RW ("salt cake").

In Ukraine, more than 5 thousand enterprises and organizations are carrying out activities, that lead to RW generation. Management of radioactive waste, being generated at industrial enterprises, medical, scientific, research and other institutions, is carried out by the state interregional specialized enterprises of Ukrainian State Corporation Radon. In Ukraine, there are six state interregional specialized enterprises Radon (Kyiv, Kharkiv, Dnipropetrovs'k, Donetsk, Odessa and Lviv). In storages of specialized enterprises, there are about 5,500 m³ of liquid and solid RW. In general, conditions of their storage comply with the radiation safety requirements; however part of the storages is under accident conditions. At the moment, the interregional specialized enterprises accept waste only for temporary container storage.

As a result of accident at Chernobyl NPP, significant amounts of radioactive waste of various types were generated. Accident RW are represented by a wide spectrum of materials (damaged nuclear fuel, fragments of reactor structures, natural objects, etc.). Nuclide composition of RW is determined by the composition of irradiated nuclear fuel RVPK-1000. Their total amount of RW in the exclusion zone (without Shelter Object) is about 2,800,000 m³. At RW disposal sites and at RW temporary localization sites, there are more than 2,000,000 m³ of waste with total activity of about $7,4 \times 10^{15}$ Bq. The majority of these waste is short-level low- and intermediate-level waste. There are about 12,500 m³ of long-living waste. Approximately the same amount of RW is located in natural objects (plants, soil, bottom sediments, ground water) of radioactively contaminated landscapes of the exclusion zone. At Shelter Object, according to various expert assessments, there are from 530,000 m³ to 1,700,000 m³ of RW with total activity of 3.7×10^{17} Bq. About 40,000 m³ of these waste are long-living waste. In the storages of Chernobyl NPP, there are about 19,100 m³ of liquid RW and 2,500 m³ of solid RW. Outside the exclusion zone, in Kyiv, Zhytomyr and Chernihiv Region, there are a series of RW storages, resulted from decontamination activities at contaminated territories and settlements. Significant part of RW, generated as a result of Chernobyl accident, is stored under conditions that do not comply with existing radiation safety requirements. For disposal of short-living low- and intermediate-level waste of Chernobyl origin, taking into account requirements of existing normative documents, industrial complex for decontamination, transportation, treatment and disposal of radioactive waste from the territories, contaminated as a result of Chernobyl accident – Vector (hereinafter – the Vector Complex) is being constructed. There are almost no activities on creation of infrastructure and facilities for storage and disposal of long-living and high-level waste (except for creation of temporary storage facility for high-level waste and storage facility for low- and intermediate-level long-living RW of limited capacity on site of Chernobyl NPP).

In storages of research reactors of the Institute for Nuclear Research of NAS of Ukraine (Kyiv) and Institute for Nuclear Power and Industry of the Ministry of Fuel and Energy of Ukraine (Sevastopol), that are to be decommissioned in the nearest future, there is comparatively low amount of radioactive waste (about 12 t of solid RW and 460 m³ of liquid low- and intermediate-level RW), which are stored in compliance with radiation safety requirements. All these waste require conditioning with further transportation to locations of long-term storage and further disposal.

In future, amount of radioactive waste in Ukraine will increase as a result of:

- operation of existing power units of NPP's and putting into operation of new ones;
- decommissioning of power units of NPP's and research reactors: for future decommissioning of power units of Zaporizhya NPP, Rivne NPP, Khmelnytsky NPP and Yuzhnoukrainska NPP, generation of about 145,600 m³ of RW can be expected, among which 13,000 m³ belong to intermediate and high-level waste with long-living radionuclides;
- decommissioning of Chernobyl NPP: construction of industrial complex for treatment of solid RW and facility for treatment of liquid RW is close to completion. As a result of operation of the industrial complex for treatment of solid RW, about 90,000 m³ of short-living RW will be treated. In general,

operation of the facility for treatment of liquid RW will lead to production of from 70,000 to 100,000 200 l drums with solidified RW;

- transformation of the Shelter Object into ecologically safe system;
- rehabilitation of territories, contaminated as a result of Chornobyl catastrophe;
- return to Ukraine of radioactive waste after treatment of spent nuclear fuel of Ukrainian NPP's in Russian Federation;
- rehabilitation of territories, contaminated as a result of military activities.

In Ukraine, temporary storage of RW is carried out for RW of all types and levels of activity; however, disposal is possible for a very limited part of these RW. The only storage in Ukraine, where disposal is carried out, is Buryakivka disposal site, where low-level short-living RW of Chornobyl origin are disposed of. Conditioning of RW aimed at their long-term storage or disposal is almost not applied.

STAGES OF THE PROGRAM

The Program envisages development and carrying out organizational, scientific, methodological, technical, financial and economical measures, aimed at creation of unified system for radioactive waste management on base of maximum use of existing facilities and construction of the centralized storage for disposal of short-living radioactive waste and obligatory construction of geological repository for disposal of long-living radioactive waste. To solve the problem of management of radioactive waste, it is envisaged to implement 12 tasks of the Program in 2008-2017.

Such division is based on step-by-step creation of integral infrastructure of RW management and advance creation of centralized facilities for long-term storage and disposal of any types of waste, including geological repository, unified techniques and technical means for their retrieval and transportation, as well as on progress of activities for transformation of the Shelter Object into an ecologically safe system, decommissioning of power units of Chornobyl NPP and other NPP's. Activities, related to creation of geological repository for RW, will last for several decades.

Task 1. Construction, commissioning and operation of Vector Complex.

There will be constructed and put into operation 25 facilities for disposal of short-living RW, 3 facilities for storage of long-living RW and 6 facilities for RW treatment. Significant amount of scientific, research and design activities is planned, including activities on creation of facility for treatment of high-level RW using gas-fluoride techniques. After reaching the designed capacity, Vector Complex will be able to receive about 50,000 m³ of RW of various types and categories per year for treatment, storage and disposals.

Task 2. Ensuring further development of management system for RW, generated as a result of operation of Ukrainian NPP's, minimization of volumes of their generation.

There will be created facilities for removal of solid RW from temporary storages and their treatment, facilities for treatment of "salt cake" to the condition, suitable for long-term storage, as well as upgraded decontamination sections. All NPP's of Ukraine will be supplied with containers for storage of various types of radioactive waste. At Zaporizhya NPP and Yuzhnoukrainska NPP, facilities for treatment of liquid RW will be created.

Task 3. Designing, construction and operation of facility for interim storage of high-level radioactive waste that will be returned from Russian Federation after treatment of spent nuclear fuel from Ukrainian NPP's. It is planned to put storage into operation until year 2017.

Task 4. Ensuring further development of management system for RW, generated as a result of Chornobyl catastrophe.

It is planned to carry out reassessment of safety of sites for RW temporary localization sites and RW disposal sites aimed at improvement of systems and means for monitoring their conditions, improvement of level of their radiation safety and physical protection. Data on amount of RW will be adjusted, feasibility studies will be developed, and designs for minimization of ecological hazard from RW temporary localization sites and RW disposal sites will be implemented. Disposal facilities at Buryakivka disposal site will be reconstructed. Radiation monitoring and control of conditions of decontamination waste storage sites and sites for sanitary treatment of vehicles, located outside the exclusion zone and zone of unconditional (obligatory) resettlement, will be continued.

Task 5. Re-equipment and restructuring of specialized enterprises of the Ukrainian State Corporation Radon, aimed at creation of conditions for collection and temporary storage of radioactive waste.

There will be developed the designs and carried out activities on retrieval of radioactive waste from suspended storages of state interregional specialized enterprises and their transportation to the storages of Vector Complex, liquidation of sites for special treatment of technique and vehicles in Kyiv, Zhytomyr and Chernigiv regions. It is planned to develop and implement the technique for retrieval and conditioning of radioactive waste in form of disused sealed radiation sources (SRS) from the well-type storages. To carry out these activities, containers for storage of solid RW and disused SRS, specialized vehicles and equipment will be purchased. It is envisaged to work out and implement automated monitoring systems at the specialized enterprises.

Task 6. Ensuring further development of state system for accounting of RW.

It is envisaged to improve the existing Ukrainian state register of RW and state cadastre of storages and sites for temporary localization of RW by upgrading local automated subsystems for accounting of RW, as well as creation and putting into operation of automated state RW accounting system. It is planned to carry out state inventory of radioactive waste every three years.

Task 7. Ensuring radiation safety and carrying out radiation protection measures during radioactive waste management, reduction of radiation doses for the staff of specialized enterprises and population.

To avoid or minimize contamination of the environment and irradiation of staff of the specialized enterprises and population during radioactive waste management, it is envisaged to upgrade radiation monitoring systems of sanitary protection zones and observation zones of sites for RW disposal of the state interregional specialized enterprises, implement state-of-the-art methods for measurement of parameters of radiation and dosimetry monitoring, upgrade and renew radiation monitoring, spectrometry and other equipment of laboratories of radiation safety service of the state interregional specialized enterprises, provide the staff of state interregional specialized enterprises with personal protection equipment, upgrade guarding and physical security systems at RW storage sites.

Task 8. Staff training and carrying out information and educational activities.

There will be developed and implemented long-term program for training and advanced training of specialists in field of radioactive waste management, based on organizational support of activities of training and methodological centers for retraining and advanced training of staff of specialized enterprises on base of leading enterprises and educational institutions. There will be continued information of population about radioecological situations in regions, where there are locate enterprises, carrying out activities in field of RW management, and about status of solving problems, related to management of RW of Chernobyl origin. Studying of public opinion, and support of participation of the public in implementation of state policy in field of radioactive waste management are envisaged.

Task 9. Creation and support of functioning of infrastructure of radioactive waste management at Chernobyl NPP and at the Shelter Object.

It is envisaged to complete tests and put into operation facility for treatment of liquid RW and put into operation objects of industrial complex for management of solid RW of Chernobyl NPP. It is planned to create sections for solid RW treatment, complex for treatment of radioactively contaminated metal, facilities for cleaning (treatment) of cable goods, facility for preliminary treatment of liquid RW with removal of transuranium elements and organic substances, as well as to construct temporary storages for solid radioactive waste. It is planned to design, construct and put into operation sections for fabrication of packages for RW, supply of container carriers and specialized vehicles for RW transportation.

Task 10. Development of normative and legislative basis in field of radioactive waste management, carrying out scientific, research and construction activities, preparation of the national report on observance of the Unified Convention for Safety of Spent Fuel Management and Safety of Radioactive Waste Management.

There will developed new normative and legal document; changes in existing legislative acts in field of use of nuclear power and RW management will be made.

Task 11. Carrying out set of exploration, assessment, scientific, methodological, research and design activities on site selection for arrangement of geological repository for disposal of long-living and high-level radioactive waste.

It is envisaged to carry out set of scientific and methodological measures for studying of natural, economical, social and demographic characteristics of sites for construction of geological repository, develop of techniques for site investigation, including drilling of big-diameter deep boreholes, carry out geophysical, hydrogeological, analytical and experimental researches. It is planned to carry out set of exploration activities in the territories of interest, detailed prospecting activities and preliminary assessment of three sites, potentially suitable for construction of geological repository. There will be worked out the program for scientific support of site selection activities and carrying out preliminary designing activities, and database for storage of information on the results of exploration, prospecting, design and assessment activities in the framework of the program for creation of geological repository.

Task 12. Solution of issues, related to management of RW, generated as a result of military activities of the USSR.

Activities on ensuring ecologically safe state of RW, accumulated in storages that are managed by the Ministry of Defense of Ukraine will be carried out.

BASIC RESULTS OF PROGRAM IMPLEMENTATION

Basic results of execution of the Program will consist in ensuring safety and level of protection of current and future generations and environment from hazardous impact of radioactive waste, improvement of RW management system, mitigation of social and psychological stress, related to liquidation of consequences of accident at Chernobyl NPP, prevention of acts of terrorism, as well as creation of favourable conditions for

further use of nuclear power aimed at improvement of living standards of population of Ukraine. Therefore, timely and efficient completion of tasks, envisaged by the Program, will ensure essential positive ecological, economical and social results.

CONCLUSION

The Cabinet of Ukraine is responsible for execution of Program, the Ministry of Emergency of Ukraine is an official client and Minister Deputy of Ministry of Emergency of Ukraine is a Program Director. The tentative funding from state budget and state fund of radioactive waste management is 5247.5 millions hryvnia in total for period 2008-2017. The annual funding of the Program is corrected by Cabinet of Ukraine in accordance with state budget for relevant year and established priorities. Program activities executors are enterprises, institutions and organizations irrespective of the form of ownership. Cabinet of Ukraine established that all radioactive waste accumulated by waste generators before April 1, 2009, must be handed over for disposal or long-term storage not later than 2019.