



Back End strategy in Ukraine: interface- related issues and potential solutions

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Competence and responsibilities of the Parliament and the Government of Ukraine

The Parliament of Ukraine (Verkhovna Rada) is the legislative body in the country

- The competence of the parliament includes the development, adoption and monitoring of the implementation of laws, approval of the state budget, ratification of international agreements

The Government of Ukraine - the Cabinet of Ministers

- coordinates the work of ministries, other executive bodies



Competence and responsibilities of the Ministry of Energy and Coal Industry of Ukraine

Competence and responsibilities of the **Ministry of Energy and Coal Industry of Ukraine**

- Power engineering
- Oil and gas industry
- Coal industry
- Nuclear power industry

Competence of the **Department of Nuclear Energy and Atomic Industry Complex** includes

- development of the nuclear industry complex
- provision of international security procedures and legislative initiatives
- **handling of spent nuclear fuel and radioactive waste**



Competence and responsibilities of the State Enterprise National Nuclear Energy Generating Company Energoatom

According to the Law of Ukraine "On the use of nuclear energy and radiation safety" Energoatom is the operating organization responsible for the **safe operation of nuclear power plants in Ukraine:**

- Zaporizhzhya NPP – 6 units WWER-1000, SFDS (Spent fuel dry storage)
- Rivne NPP - 2 units WWER-440, 2 units WWER-1000
- Khmelnytsky NPP - 2 units WWER-1000
- South-Ukraine NPP - 3 units WWER-1000

Nuclear facilities planned to be created by Energoatom

- Power Unit 3 of Khmelnytsky NPP
- Power Unit 4 of Khmelnytsky NPP
- Centralized Spent Nuclear Fuel Storage Facility



Competence and responsibilities of the State Enterprise National Nuclear Energy Generating Company Energoatom

The main tasks of Energoatom

- Power generation at operating NPPs, provided that the safety level of the power units is constantly improved;
- construction of new and life extension of existing power units, creation of infrastructure for handling of irradiated nuclear fuel before its transferring to the state administration.

Safety Policy

Energoatom implements the NPP safety policy in accordance with the "Basic principles of the NPP. INSAG-12 »



Competence and responsibilities of State regulatory body on nuclear and radiation safety of Ukraine (the state nuclear regulatory inspectorate of Ukraine)

- Development of norms, rules and standards on nuclear and radiation safety;
- Carrying out of nuclear facility safety inspection;
- Issue of appropriate licenses, permits;
- State supervision over compliance to norms, rules and standards on nuclear and radiation safety;
- Preparation of reports and reviews on the condition of nuclear and radiation safety within the territory of Ukraine and their submission to the Verkhovna Rada and the President of Ukraine, other bodies of state power and self-government, public organizations, in accordance with the procedure established by the legislation of Ukraine;
- Organization and performing of researches aimed at improving the safety of nuclear facilities, sources of ionizing radiation and solving the problems of radiation protection of personnel, public and environment



Competence and responsibilities of State regulatory body on nuclear and radiation safety of Ukraine

BASIC PRINCIPLE

- Nuclear energy in Ukraine is used exclusively for peaceful purposes.
- Based on current technology, only uranium enrichment and reprocessing of spent nuclear fuel are deemed susceptible to proliferation.
- Hence, these stages will not be performed in Ukraine.
- Ukraine uses enrichment and reprocessing services of the international producers



State policy and strategy for radioactive waste (RW) and spent fuel (SF) management

- Energy Strategy of Ukraine (up to 2035)
- Strategy for Radioactive Waste Management in Ukraine (up to 2060)
- National Special Ecological Programme on Radioactive Waste Management
- Programme on Chornobyl NPP Decommissioning and Transformation of Shelter Object into Ecologically Safe System

At present, there is no unambiguous decision on the best option for SNF handling in the world nuclear power industry.

Each country that operates nuclear power plants independently defines national approaches to SNF handling, which depend on specific technical, economic and political conditions.

Now there are three options for SNF handling in the world nuclear power industry: reprocessing, disposal and long term interim storage (so-called "deferred decision").



State policy and strategy for radioactive waste (RW) and spent fuel (SF) management

- Ukraine as many other countries have selected the option of "deferred decision".
- The main activity of the final stage of the fuel cycle is focused on SNF storage technologies.



State policy and strategy for radioactive waste (RW) and spent fuel (SF) management

The following steps are used in Ukraine for implementation of this strategy:

- unloading of spent fuel from reactors to pools at the NPP
- temporary storage of fuel in the pools of NPPs to allow radioactive decay
- shipment of spent nuclear fuel (SNF) for reprocessing to Russia
- SNF reprocessing (in Russia) for subsequent returning of reprocessed products to Ukraine
- returning of reprocessed products to Ukraine has been scheduled since 2022
- SNF storage (for 50 years) in the spent fuel dry storage at the Site of ZNPP
- construction of the spent fuel storage of a dry-type (for 100 years) in Exclusion Zone (commissioning is scheduled since 2020)
- construction of the storage for reprocessed SNF products in Exclusion Zone is scheduled for 2022
- Long-term storage of long-lived and high-level radioactive wastes after reprocessed SNF since 2022
- Life extension of the spent fuel dry storage at the ZNPP's site for the period of more than 50 years



Radioactive waste (RW) and spent fuel (SF) management infrastructure

Spent fuel (SF) interim storage facilities (ISF):

- **ISF (dry-type) at Zaporizhzhya NPP** (only for SF generated on ZNPP's site) – in operation;
- **Arrangements with Russian Federation** concerning spent nuclear fuel from Khmelnytsky, Rovno and South Ukraine NPPs;
- **Centralized ISF (dry-type)** for the SF from Khmelnytsky, Rovno and South Ukraine NPPs in Exclusion Zone - under construction.
- **ISF-1** (wet-type) at Chornobyl NPP – in operation;
- **ISF-2** (dry-type) at Chornobyl NPP – under construction.

RW and SF management infrastructure

Vektor site in Exclusion Zone:

- Industrial Complex Vektor for decontamination, transportation, reprocessing and disposal of radioactive wastes (centralized near-surface disposal facilities for solid RW are under construction and infrastructure is established);
- Centralized facility for a long-term storage of disused radioactive sources is under construction;
- Special storage facility for a long-term storage of vitrified high-level wastes to be returned after reprocessing of SF from Russia is being designed;
- Facilities for a long-term storage of the RW from Shelter Object are being designed



Key unsolved problems

Key unsolved problems:

- storage at NPPs and sending of leaking SFA for reprocessing
- Life extension of interim SNF storage facilities
- long-term storage of SNF and SNF reprocessed products
- disposal

Causes of unresolved problems:

- complexity of safety justification of life extension of SNF interim storage facilities
- lack of technical solutions on SNF disposal
- technological complexity of this process
- high cost



Solution of problems

Solution of financial problems

- According to the legal documents of Ukraine, the creation of a storage facility for SNF reprocessed products should be financed through the Special State Fund for Radioactive Waste Management.
- The «polluter pays» principle requires that those who benefit from the production of waste should pay for its subsequent management.
- In the case of nuclear power production, the ultimate beneficiary of this practice is the electricity consumer.
- The management of NPP's nuclear waste should be financed from the proceeds from the sale of electricity.

Solution of organizational and technical problems

- International cooperation in the field of safety justification of life extension of SNF interim storage facilities
- Joining together the efforts of politicians, scientists, designers, operators and others in the process of decision making
- Usage of international experience in SNF disposal
- Joint financing of international projects on studying of SNF behavior during interim and long-term storage of SNF



Mechanisms for communication between reactor operators, associated vendors, regulators, waste management organization

- **Studying and implementation of the international experience in interface managing in the back end of the fuel cycle.**
- **Sharing of responsibility between entities at the legislative level**
- **Development of strategies at the level of government and ministries**
- **Development and approval of detailed plans for the implementation of strategies**
- **Development and coordination with the regulatory body of conceptual technical solutions, technical specifications, requirements, mechanisms of interaction between participants during the process**
- **Legislative definition of the funding sources of projects**
- **Development and support of databases (SNF and SNF reprocessed products located in the storage facilities) at the operators and state level**



Conclusions

Only the combination of the efforts of international organizations, politicians, scientists, designers, operators can help make the right decision on the back end of the fuel cycle

Thank you very much for your attention