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Sustainability Aspects in Radioactive Waste Management in Lithuania

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Background

Ignalina NPP has been permanently shut down and is currently in the decommissioning phase. Decommissioning activities, besides dismantling projects, also include construction and operation of treatment, storage and disposal facilities for radioactive waste. Before commencing any activity (construction, operation or decommissioning), licenses and permits for the implementation of such activity shall be obtained from national regulatory bodies and public administrations. Licenses and permits are granted based on the submitted studies, reports and other documentation that justify compliance with all applicable regulations and requirements are met.

Safety and Sustainability

According to the IAEA Nuclear Safety and Security Glossary, 2022 (Interim) Edition, "**safety**" means "***…the protection of people and the environment against radiation risks, and the safety of facilities and activities that give rise to radiation risks. …Safety is concerned with both radiation risks under normal operating conditions and radiation risks as a consequence of accidents***". Safety measures include actions and arrangements to prevent accidents and to mitigate their consequences. The safety analysis is a consistent and systematic assessment of the radiological impacts of the radioactive waste management, decommissioning or any other activities carried out at the site and a comparison of obtained results with established safety criteria (e.g. maximum permissible doses to workers and population, the limit value for the release of radionuclides into the environment). If the safety analysis determines that the established safety criteria are not exceeded during normal operation and in the case of postulated accidents, then the safety is justified. Otherwise, administrative and/or technical measures must be taken to improve the safety.

Numerous safety analysis reports were prepared at the Ignalina NPP for different activities: construction and operation of radioactive waste handling, storage and disposal facilities, and implementation of various decommissioning projects. The format and content of the safety analysis reports presented either in the national regulations or IAEA safety guides do not set direct requirements to consider sustainability issues. However, it should be considered that safety analysis is only an integral part of the entire radioactive waste management, decommissioning or other activity licensing process, during which an environmental impact assessment is performed, the financial resources are assessed, permits for radioactive and non-radioactive releases into the environment are obtained, the public (in some cases, foreign society and institutions) and various governmental and non-governmental organizations are involved. As an example, the licensing scheme of the formerly planned new NPP in Lithuania is presented below, which shows how many stages must be passed before the start of the facility operation. Although the scheme presented is intended for the construction of an NPP, the stages are largely the same for the installation of radioactive waste management facilities or decommissioning activities. Also, in 2017 additional requirements BSR-1.1.5-2017 "Rules of Procedure for Public Participation in Decision-Making in the Area of Nuclear Energy" were issued regarding public involvement in the decision-making process. According to these requirements, the public shall have access to the safety justification documents, and the comments provided by the public shall be considered by authorities.

Sustainability in radioactive waste management includes three key elements:

- **Environmental protection** (against radiation and non-radiation risks). This is ensured by designing and implementing state-of-the-art technologies, performing continuous radiological monitoring, periodical measurements of samples of various environmental components (air, water, soil, plants, etc.), and recording emissions of non-radioactive pollutants into the environment. Ignalina NPP is releasing annual reports on environmental monitoring that contain information on radiological and non-radiological impacts on the environment.
- **Economics**. According to the national requirements, Ignalina NPP shall keep the generation of radioactive waste to the minimum practicable, in terms of both activity and volume, using best available technologies without involving excessive costs. Ignalina NPP has optimized the processes related to waste generation which allowed it to reduce the amount of waste. Since 2014, Ignalina NPP is making a comparative market analysis of its controlled operating costs using the "Make or buy" approach and is taking the decisions regarding the procurement of specific activities.
- **Society**. According to the national Law on Nuclear Safety, the public has a right to participate in the decision making process related to radioactive waste management in Lithuania, such as approval of the site evaluation report, issuance of licences for construction, operation, decommissioning of a radioactive waste management facility, and supervision of a closed radioactive waste repository. Ignalina NPP is obligated to make the application documents for the aforementioned authorization decisions available to the public and consider all comments, suggestions and opinions provided by the public.

Also, these three key elements are comprehensively considered in Environmental Impact Assessment (EIA) Reports that are obligatory for radioactive waste management and decommissioning activities. The EIA covers a wide range of aspects such as potential direct and indirect radiological and non-radiological impacts on public health, air, water, soil, climate, social-economical state, and biodiversity. About twenty radioactive waste management projects in Lithuania have been harmonized with authorities, public and other relevant parties and passed EIA procedures.

Relation between Safety and Sustainability

As mentioned before, "safety" means a set of measures protecting people and the environment from ionizing radiation. The selection of these measures can be more or less sustainable from an economic and environmental point of view. A few examples:

- Rather conservative assumptions on radiation source terms are accepted in safety analysis when assessing the need of biological shielding. Also, it is typically assumed that the storage facility is completely filled with packages containing radioactive waste of maximum activities. This means that the required thickness of the barriers (e.g., reinforced concrete walls) that provide shielding is greater in comparison with the case when more realistic values of the radiation source or package loading schemes would be accepted. The installation of the thicker walls requires more materials as well as financial resources. As radiological monitoring reports show, the doses calculated in safety analysis reports are usually much higher than those actually measured during the monitoring.
- The waste acceptance criteria being conservatively determined in a safety analysis report, can lead to the situation when large amounts of radioactive waste may have to be placed in a deep geological repository (which is extremely expensive) instead of near-surface or landfill repository. This would not be rational from a financial and environmental point of views, and the public would most likely adopt an unfavourable attitude toward the size of the site and irrational usage of resources.