

Development of SMR technology in Poland – management of radioactive waste and spent nuclear fuel



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Introduction

Poland is considering nuclear energy as a component of its energy mix to achieve sustainability goals, to reduce coal consumption, and enhance the security of energy. In particular, small modular reactors (SMRs) have emerged as a promising solution. A large number of energy businesses have indicated that they are ready to construct and use SMRs. According to preliminary estimates, Poland may have 22 SMRs with a combined capacity of roughly 4 GW by 2030, producing both heat and electricity. This may be a response to the challenge presented by the ambitious objective of considerably cutting CO₂ emissions into the environment by decarbonizing the Polish energy sector.

Management of the Radioactive Waste and the Spent Nuclear Fuel – international cooperation and projects

Before new reactors are put into service, a number of issues pertaining to their operational safety must be resolved. Finding the appropriate techniques for spent nuclear fuel (SNF) and radioactive waste (RW) management will be one of the many required tasks to complete. The INCT group has participated in a number of national and international research projects concerning the management of radioactive waste and spent nuclear fuel. Among others, they were:

- IPPA „Implementing Public Participation Approaches in Radioactive Waste Disposal”
- SACSESS “Safety of ACtinide SEparation proceSSes”
- GENIORS “GEN IV Integrated Oxides fuels Recycling Strategies”
- EURAD „European Joint Programme on Radioactive Waste Management”.

The team is currently involved in two international projects related to the management of radioactive waste and spent nuclear fuel including SMRs: EURAD-2 and IAEA CRP.

Description of the studies to be done in Poland

Operating SMRs generate nuclear waste that must be managed for thousands of years, even though they are designed to produce less radioactive waste than bigger reactors. Therefore one of the main problems in Poland will be the elaboration of an effective waste management system that will guarantee safety and a public confidence in it. Operating small nuclear reactors, particularly of the next generation, will necessitate resolving several issues, despite the numerous apparent benefits of SMR technology.

Handling of spent fuel and radioactive waste generated by the future operation of the SMRs in Poland, as well as the waste produced after their decommissioning, will be one of the greatest challenges. In combination with their disposal, this difficulty involves pre-storage and potential recycling of used fuel.

Water-cooled SMR reactors, which are technically very comparable to the standard light water reactors, are now planned for implementation in Poland. However a growing number of companies are discussing about using High-Assay Low-Enriched Uranium fuel (HALEU), which is enriched between 5% and less than 20%, in these reactors. Consequently, various procedures for managing nuclear material at every stage, from cooling and storing the fuel to transporting and disposing must be adapted to the Polish conditions. This indicates modifications of the procedures that take into account the composition and properties of the spent nuclear fuel produced.

Since the storage systems are optimized for existing spent fuel, significant adjustments and research on this topic will be necessary for new spent fuel. It will be essential to establish, e.g. the packaging criteria for new waste streams.

Among the most important problems awaiting Poland will be the construction of a novel radioactive waste disposal and solving many problems concerning the transport of radioactive waste to this place. This work must take into account the waste generated by the operation of the SMRs and the fuel type intended for use.

Final remarks concerning the management of Spent Nuclear Fuel and Radioactive Waste

Management of the radioactive waste and spent nuclear fuel from the SMRs has to be followed by the Government Documents regulating the management policy of RW and SNF resulting from the Polish Nuclear Energy Program and National Plan for the Management of Radioactive Waste and Spent Nuclear Fuel.

The further work undertaken with a view to the waste from SMRs and management of radioactive waste from all reactors to be built in Poland, as well as handling the spent nuclear fuel should not only ensure their safety for the environment but also help in social acceptance for waste disposal.

The next steps of this procedure should concern:

- Designing and building of a new near surface repository for radioactive waste;
- Preparation for the closing process of closing the National Radioactive Waste Repository in Rozan and ensuring safe operation of the repository until its closure;
- Actions related to the expected plans of construction of the Underground Research Laboratory (URL) and Deep Geological Repository (DGR) for high-level radioactive waste and spent nuclear fuel.

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The Important Issues of the Management of Radioactive Waste and Spent Nuclear Fuel – Research Facilities at the INCT used in the Project

