Transactions of the Korean Nuclear Society Autumn Meeting
Changwon, Korea, October 30-31, 2025

International Joint Project for Spent Fuel and Back-End Cycle Strategies OECD Nuclear Energy Agency, WISARD

Minho Song*, Sunghwan Chung, Kyungho Roh, Kiyoung Kim
Korea Hydro & Nuclear Power Co., Ltd., Central Research Institute
1312 beongil 70, Yuseong daero, Yuseong gu, Daejeon, Korea
**Corresponding author : songalsgh@khnp.co.kr*

**** Keywords : WISARD, Spent Fuel, SMR, Advanced Reactors, Back-End Cycle***

1. Introduction

The increasing deployment of Small Modular Reactors (SMRs) and Advanced Reactors (ARs) presents new challenges for the nuclear the back-end cycle. Unlike conventional light water reactors (LWRs), these advanced systems are expected to use a variety of fuel types, including metallic and oxide fuels for sodium-cooled fast reactors (SFRs) and low-enriched uranium (LEU) fuels for SMRs. The spent fuel generated from these systems exhibits different physical, chemical and radiological properties, which require a re-evaluation of existing storage, transport, and disposal strategies.

The OECD/NEA initiated the WISARD (Waste Integration for SMRs and Advanced Reactor Development) project. This international collaboration seeks to establish a knowledge base and methodologies to ensure that spent fuel from SMRs and ARs can be managed in a safe, technically robust, and economically feasible manner.

2. Research Direction and Plan

Fig 1. WISARD project development

The research strategy of the WISARD project is guided by six core principles that ensure a comprehensive and forward-looking approach to spent fuel management of SMRs and ARs.

First, early consideration of logistics and constraints allows the project to anticipate technical and infrastructural challenges in storage, transport and disposal design before large-scale deployment of new reactor systems. This proactive approach minimizes risks and avoids costly retrofitting at later stages.

Second, technology deployment decisions and fuel cycle options are systematically evaluated. Different SMR and AR designs may require unique back-end solutions depending on each fuel cycle (once-through, partial recycling, or closed cycle). The project thus seeks to align fuel cycle strategies with long-term spent fuel management solutions.

Third, the project emphasizes identifying opportunities to 'design away' problems at the early development stage. By integrating spent fuel management considerations into the designs of SMR and AR, it is possible to reduce the long-term challenges of spent fuel handling, packaging and final disposal.

Fourth, the improved preparation for future disposal is in accordance with generating data on the behavior of new fuel types under disposal conditions, including thermal output, radiotoxicity, and radionuclide migration. This ensures that repository concepts remain robust and adaptable to emerging fuel technologies.

Fifth, stakeholder coordination to minimize disconnects is promoted through close engagement with the regulatory bodies, industry partners and technical organizations. This prevents fragmentation of knowledge and helps establish internationally harmonized safety standards.

Finally, collaboration with global experts strengthens the project by incorporating multidisciplinary expertise. This global partnership, facilitated by the OECD/NEA, ensures that knowledge is shared across borders and solutions are internationally credible.

By integrating these six principles, the WISARD project aims to provide actionable frameworks for governments and industry to address the challenges of SMR and AR spent fuel management in a sustainable and coordinated manner.

3. Conclusions

The OECD/NEA WISARD project represents a timely and critical initiative to address the challenges associated with managing spent fuel from SMRs and ARs.

By systematically evaluating treatment/recycling, storage, transport and disposal of innovative fuel types, WISARD provides both technical insights and policy-relevant guidance. The outcomes are expected to support the safe and sustainable deployment of SMRs and ARs, ensuring that their advantages in flexibility and low-carbon energy production are accompanied by equally robust waste management solutions. The project will also contribute to regulatory harmonization and public acceptance, strengthening the credibility of nuclear energy as a sustainable option for the future.

REFERENCES

IAEA, Regulations for the Safe Transport of Radioactive Material, IAEA Safety Standards, No. SSR-6 (Rev. 1), 2018

IAEA, Specific Safety Guide SSG-15: Storage of Spent Nuclear Fuel, International Atomic Energy Agency, Vienna, 2020.

OECD NEA, WISARD Kick-Off Workshop, 25 March 2024

OECD NEA, WISARD Launch Meeting, 12 May 2025