**SAND2024-02396A**

**Integration Group for the Safety Case (IGSC) Symposium 2024**

*MOVING TOWARDS THE CONSTRUCTION OF A SAFE DGR – GETTING REAL*

|  |  |
| --- | --- |
| **Abstract Number: 60** | **Session 7.2.2** |
| **Author: David Sassani**  **SANDIA NATIONAL LABORATORIES, Department of Applied Systems Analysis &Research, USA**  [**dsassan@sandia.gov**](mailto:dsassan@sandia.gov) | |
| **Abstract Title: Analysing Advanced Reactor Spent Fuel for the Back End of the Fuel Cycle** | |
| **Abstract (300-500 words):** All options for generating power from nuclear energy generate radioactive waste that will require permanent isolation from the biosphere (this includes reprocessing fuel cycles). Choices made regarding advanced reactor (AR) fuel cycles can affect waste characteristics such as mass, volume, radioactivity, physical form, and thermal power, but do not eliminate the need for waste isolation. Deep geological disposal, the preferred method for permanent isolation, includes mined geologic repositories in multiple lithologies in saturated/unsaturated environments, as well as deep borehole concepts [1,2]. In addition, AR fuel cycles are also evaluated for potential issues on storage/transportation of various AR spent nuclear fuel (SNF)[2]. Some AR SNF would benefit from chemical/physical treatments to facilitate storage/transportation and disposal.  Mined repositories are in operation for some categories of transuranic and intermediate-level waste [1], a repository for spent nuclear fuels (SNF) is on the verge of operation in Finland, and many countries have active geologic repository programs. Published safety assessments for geologic repositories proposed in the United States, Finland, France, Sweden, Switzerland, and other nations, provide insight into the waste form characteristics that most affect the repository system long-term performance. This work leverages past experience with nuclear waste disposal safety assessments to assess potential AR SNF preliminary pathways and strategies for storage/transportation, and disposal options, and to illuminate potential issues for further research and development (R&D). Features, events, and processes (FEP) are assessed at a high-level and preliminary models are being evaluated for lifetimes of SNF in safety assessments. Initial work focuses on AR SNF with substantial post-closure lifetime and delineating waste form pathways for others. Some AR SNF differ from DSNF [2], there are potential issues (gaps) that remain to be constrained. For example, use of high-assay low-enriched uranium (HALEU), to allow for more efficient reactors that are run to higher burn-up (longer core duration). Such HALEU SNF can differ in criticality potential, fission product inventories, and thermal density.   1. Sandia National Laboratories 2014. *Evaluation of Options for Permanent Geologic Disposal of Used Nuclear Fuel and High-Level Radioactive Waste Inventory in Support of a Comprehensive National Nuclear Fuel Cycle Strategy*. FCRD-UFD-2013-000371, Revision 1; SAND-2014-0187P; SAND-2014-0189P. Albuquerque, NM: Sandia National Laboratories. 2. Matteo, E., L. Price, R. Pulido, P. Weck, A. Taconi, P. Mariner, T. Hadgu, H. Park, J. Greathouse, D. Sassani, and A. Alsaed, 2023. *Advanced Reactors Fuel and Waste Streams Disposition Strategies*, SAND2023-08602R, Sandia National Laboratories, Albuquerque, NM.   *SNL is managed and operated by NTESS under DOE NNSA contract DE-NA0003525. SAND2024-02396A.* | |