**Integration Group for the Safety Case (IGSC) Symposium 2024***MOVING TOWARDS THE CONSTRUCTION OF A SAFE DGR – GETTING REAL*

|  |  |
| --- | --- |
| **Abstract Number: 33** | **Session 7.2.1** |
| **Author: Edward Matteo**  **SANDIA NATIONAL LABORATORIES**  **Department of Nuclear Waste Disposal Research and Analysis**  **USA**  **enmatte@sandia.gov** | |
| **Abstract Title: Overview of Advanced Reactor Spent Nuclear Fuel Types** | |
| **Abstract (300-500 words):**  There is considerable international interest to develop and deploy advanced nuclear reactor technologies, both as part of a strategy to meet zero emissions climate goals, and for applications to generate heat and energy in remote areas away from industrial infrastructure. While there are many design concepts being proposed for Advanced Reactors (ARs), there are essentially three main categories of AR Spent Nuclear Fuel (SNF) that currently need to be considered for Back-end Nuclear Fuel Cycle (BENFC) management – TRi-structural ISOtopic (TRISO), metallic, and Molten Salt Reactor (MSR) SNF.  This presentation will provide an overview of the characteristics and attributes of these AR SNF types, with particular emphasis on aspects relevant to BENFC considerations. This will include preliminary analysis of potential AR SNF types, and a discussion of previously analysed fuels from the US DOE-managed SNF inventory that have similar characteristics to AR SNF.  TRSIO fuel is utilized in high temperature gas reactors (HGTRs) or MSRs, where the fuel may be arrayed either in prismatic block or pebble bed configurations in an HGTR, or as pebbles in an MSR. Metallic fuel is used in Sodium Fast Reactors (SFRs), and sometimes has a sodium bond between the fuel and cladding that can accommodate fuel swelling during SFR reactor operation. MSRs typically use a fluoride or chloride based molten salt coolant with uranium or thorium fuel, which is typically interspersed within the molten salt coolant during reactor operation.  TRISO SNF was included in the disposal plan for Yucca Mountain (DOE, 2008), as were of some types of metallic fuels. TRISO SNF is suitable for disposal, although there are several ways in which it differs from typical LWR SNF (e.g., potential gas generation from radiolysis of graphite and graphite impurities). Metallic fuel without sodium was included for disposal, while metallic fuel that included a sodium bond between the fuel and the cladding was not considered for disposal.  Salt waste generated by a molten salt reactor was not included in the disposal plan for Yucca Mountain (DOE, 2008). Disposal in other types of repositories could present challenges because the salt waste form will dissolve easily in water and has the potential for gas generation.  DOE (2008). “Yucca Mountain Repository License Application, Safety Analysis Report,*”* DOE/RW-0573, Update No. 1, November 2008, U.S. Department of Energy, Office of Civilian Radioactive Waste Management, Las Vegas, NV.  SNL is managed and operated by NTESS under DOE NNSA contract DE-NA0003525. SAND2024-02303A. | |