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An Integrated Approach to Closing the Technical Data Gap for High Burnup Spent Fuel Performance during Normal Conditions of Transport (NCT)

The United States Department of Energy (DOE), Office of Nuclear Energy (NE) initiated a program in 2009 to develop the technical basis to support the licensing for long term storage and subsequent transportation of high burnup spent fuel. An initial focus of this program was development of a technical data gap analysis that identified the data gaps that needed to be addressed to support licensing. Given the number of gaps that were identified, a prioritization of gaps was developed in order to identify the high priority gaps where a focus would result in high impact in terms licensing support.

From the gap analysis and prioritization work, performance of high burnup fuel during transport was identified as high priority. This paper summarizes the work that has subsequently been done to address the issue and to understand performance characteristics of high burnup fuel during NCT operations. The work that has been done includes laboratory and field testing, as well as modeling and simulation. Further, this work addresses material property issues associated with cladding strength and ductility, cladding and fuel interaction related to the fuel rod response to cyclic loadings, and loading functions on the fuel generated from shock and vibration conditions that are representative of Normal Conditions of Transport. This integrated approach builds confidence in our overall understanding of high burnup spent fuel system response to transportation loadings.

This paper will cover the technical issues associated with addressing the technical gap of high burnup spent fuel performance when subjected to Normal Conditions of Transport. The theme of the paper will show how integration of engineering tools (e.g., testing and analysis), coupled with understanding of the basic science phenomena germane to this problem, is used to demonstrate understanding of how high burnup fuel will perform during Normal Conditions of Transport.

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