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Thermal Modeling Round Robin of the High-Burnup Demonstration Cask

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Thermal analyses of dry storage systems use margins in their design basis input assumptions to ensure the peak cladding temperature does not exceed an established regulatory limit. Due to these margins, a best-estimate understanding of the thermal behavior of the dry storage system is generally not available from these design licensing basis models. The development of accurate best-estimate thermal models with uncertainty quantification can lead to a more efficient use of storage, transportation, and ultimate disposal systems. A thermal modeling benchmarking project included the Electric Power Research Institute (EPRI), U.S. Nuclear Regulatory Commission, U.S. Department of Energy (DOE), U.S. National Laboratories, vendors, and utilities to assess the accuracy of best-estimate models through experimental and validation efforts. This paper describes the joint round robin aimed at further assessing the accuracy of best-estimate simulations. A total of four model submissions to this double-blind benchmark are compared with temperature measurement data acquired by the DOE/EPRI High Burnup (HBU) project. For this project, actual HBU pressurized water reactor spent fuel assemblies were stored in a bolted conductive dry storage system with thermocouples placed inside the guide tubes. The thermal analysis results were collected, and comparisons made to the benchmark measurement data. Results highlight the importance of developing a refined assessment of key uncertainty terms in modeling solutions, including decay heat calculations and internal gaps impacting the conduction of heat.

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