

Engineering

High burnup fuel Demonstration cask project

Purpose

Sponsored by the U.S. Department of Energy (DOE) and including the Electric Power Research Institute (EPRI), this project focuses on obtaining data that will confirm the technical justifications for the licensing of the extended storage of high burn-up (HBU) fuel. This data will help inform future dry storage system designs, support ISFSI and dry storage system license renewals, and support future transportation of HBU used nuclear fuel.

Technology

The cask utilized for the demonstration program is a TN-32B bolted-lid cask that was modified with innovative features to allow for thermocouples to be installed through the cask lid into seven fuel assemblies. The demonstration program was designed such that the HBU fuel in the cask would closely mimic typical conditions experienced during all stages of dry storage: loading,

drying, helium backfilling, and transfer to and storage at the ISFSI.

Problem

Due to the anticipated extended storage of spent nuclear fuel (SNF) of greater than 50 years, there is a need for confirmatory thermal data to benchmark the thermal modeling performed by the U.S. Nuclear Regulatory Commission (NRC), national laboratories, and cask vendors. This is used to establish specific material properties of

Award winning

RECIPIENT OF THE 2019 U.S. DEPARTMENT OF ENERGY SECRETARY'S ACHIEVEMENT AWARD

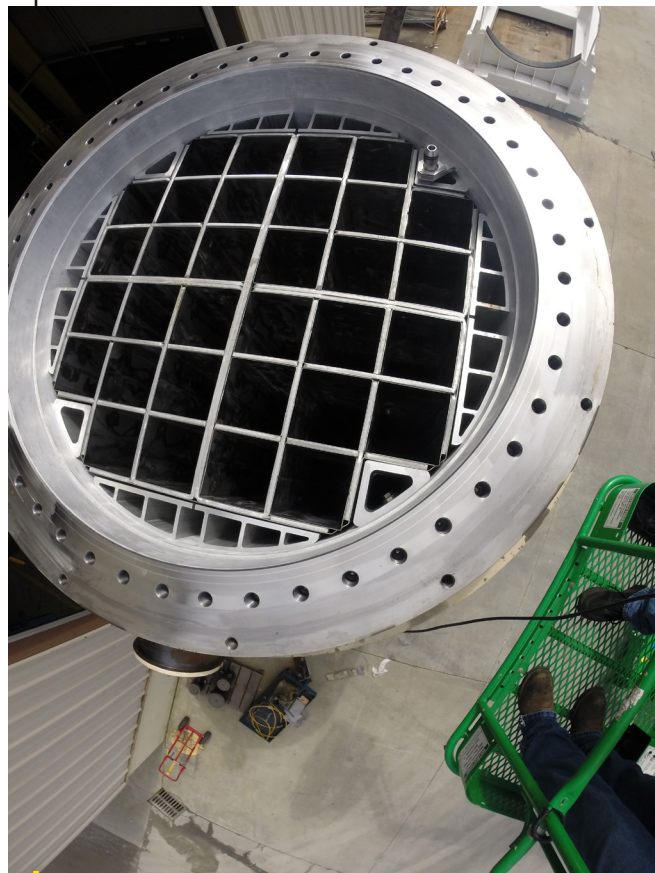
This award was presented to the HBU Demonstration Cask R&D project team for its efforts in providing data needed by the nuclear industry to support extended storage of HBU used nuclear fuel.

This information has far-reaching impacts across the industry because it means that the more than 3,000 loaded high and low burn-up spent fuel casks that have been loaded into dry storage can be safely stored and transported, thereby saving hundreds of millions of dollars.

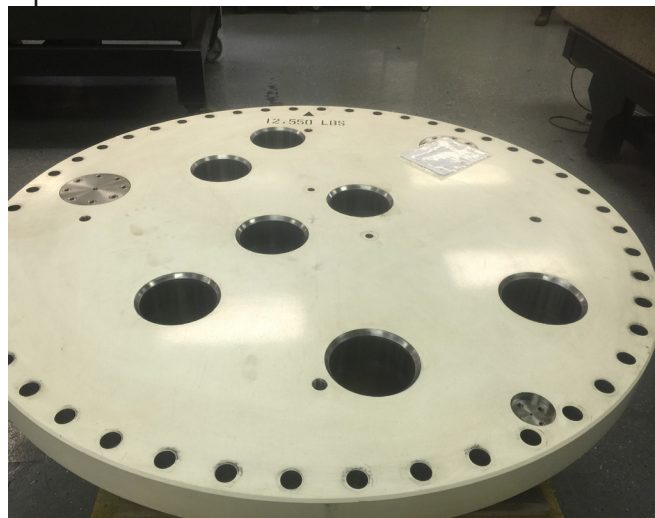


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The TN-32B cask



Modified cask lid

Orano High burnup fuel

the SNF and the canister/cask containing the SNF that might impact functions credited for structural confinement or maintaining sub-criticality.



The Orano team examining the TN-32B cask

Solution

An industry team was formed that includes EPRI, Orano, Orano TN, Framatome, and most importantly, a utility partner, Dominion Energy, to research HBU fuel storage.

The HBU demonstration cask is a TN-32B bolted metal cask. This cask was modified to accommodate the DOE HBU demonstration project goals. The design of this modified cask included thermocouple lances, funnel fuel assembly guide funnels, and modifications to the cask's over pressure system, neutron shield, lid, and protective cover. Sixty-three (63) thermocouples are incorporated in seven lances, inserted into fuel assembly guide tubes through the HBU cask lid. The design of the lances are based on an in-core instrumentation design currently utilized in a U.S. pressurized water reactor. Each lance contains nine thermocouples at varied axial heights.

The TN-32B modified cask was loaded and instrumented at Dominion Energy's North Anna Power Station after four and a half years of detailed planning, design, fabrication and testing. Serving as the host of the research, Dominion Energy provided the HBU fuel, submitted the license amendment to the NRC, loaded the cask, and installed the instrumentation. The cask will remain on the ISFSI pad at the North Anna Power Station collecting thermal data for approximately ten years.

Data used from 63 thermocouples will be used to confirm the thermal models used to predict the behavior of HBU fuel in dry storage casks through the loading, drying and long term storage phases.