Accelerated Aging of Used Nuclear Fuel in Storage ($1.5 million/year for 3 years)

With the recent decision not to pursue Yucca Mountain as a geologic repository, used nuclear fuel (UNF) will be required to remain in storage for longer periods of time than had previously been envisioned. The present regulatory basis for dry cask storage is 60 years, but the Nuclear Regulatory Commission (NRC) is considering extending that period; NRC Commissioners and other authorities are discussing 100 year and longer storage schemes. The regulatory requirements address key safety-significant aspects of UNF storage systems such as structural, thermal, containment, radiation shielding, and criticality safety performance, as well as related operational requirements pertaining to UNF handling and retrievability. In addition, transportation will eventually be necessary, so the UNF must meet the regulatory requirements for transportation at the end of the storage period.

This IRP is focused on the resolving issues associated with extended storage of UNF, with specific concern being the long-term behavior of high burnup UNF (>45 gigawatt-days/metric ton). Issues that need to be addressed include long-term integrity of the fuel cladding, maintaining the fuel assembly configuration, and canister integrity. The fuel cladding must be protected against degradation that leads to gross ruptures; the fuel assembly support brackets, spacers, etc. must function to prevent significant fuel deformation, such as bowing; and the canister must not leak. Examples of the issues to be addressed include the following long-term degradation mechanisms:

- Hydride diffusion and embrittlement
- Creep
- Corrosion
- Stress corrosion cracking
- Accelerated degradation due to marine environment (e.g., salty air)
- Degradation of Concrete

Funding will support one project focused on the R&D of accelerated aging techniques to better understand these long-term degradation mechanisms from a significantly shortened testing timeframe. Proposed accelerated aging techniques must be novel, but developed enough to allow initial operations in a laboratory by the end of the three-year period of performance. The product of this research could eventually inform the technical basis that provides the technical justification for extended storage. Proposals should be for a period of three years and a total cost not to exceed $4.5 million.