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Aging Management of Dry Storage Systems in Centralized Interim Storage Facilities

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In the United States, used fuel assemblies discharged from nuclear power plants (NPPs) have historically been stored on-site using licensed dry storage systems. The duration of storage at the NPP sites was intended to be short term (20 to 40 years) with subsequent transportation to a geological repository. Due to shutdown/decommissioning of several NPPs and delays in the implementation of the geological repository, there is a need to develop solutions to manage the storage of dry storage systems in interim storage facilities.
The centralized interim storage facility (CISF) functions as an intermediate repository/staging area for dry storage systems for an extended duration of time prior to eventual transportation to a geological repository. The operation of a CISF will lead to a significant reduction in the number of independent spent fuel storage installations (ISFSIs) nationally and enable release of space in those decommissioned reactor sites that currently only maintain their respective ISFSIs.
The licensed dry storage systems are categorized as 1) metal cask systems with fuel assemblies directly loaded into the cask which is then stored on site or 2) canister systems where the fuel is housed within a thin-walled canister which is then stored in an overpack. Regardless of type, these systems need to be designed and licensed to ensure that the necessary safety functions are maintained during long term periods of storage and subsequent transportation after storage. In addition, consideration needs to be given to potential aging deterioration of component materials that may occur during operation of the storage system at the ISFSI or in a CISF.
Managing the effects of aging of the structures, systems, and components associated with dry storage is therefore, an important aspect of the extended interim storage of used fuel. Effective aging management programs require a technical understanding of the aging degradation mechanism, inspection and assessment techniques, prevention and mitigation measures (to retard the effects of aging) and, as needed, guidance on repairs or replacements for each component. Significant research is being carried to develop expertise on the various aspects of aging management including material behavior, inspection methods, criteria and long term durability.
The CISF approach to dry storage offers a significant advantage wherein an aging management program can be effectively and uniformly implemented for a wide variety of currently licensed dry storage systems. For example, the appropriate siting of the CISF location can be made to significantly minimize the potential for environmental degradation or natural phenomena.
The paper provides additional insights into design and operation of CISF with an objective to managing effects on dry storage systems for long-term interim storage. The paper also discusses innovative solutions being developed for comprehensive aging management within interim storage facilities.

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United States of America

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