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Fabrication Thermal Test. Methodology for a Safe Cask Thermal Performance

One of the safety-related functions in a DPC is the thermal performance. Regulations only address a thermal test to assure the cask thermal performance under accident conditions (fire test). As a DPC is also to be used for storage, the thermal passive behavior of the cask under normal condition of storage shall be demonstrated. Although this thermal test is not included in storage regulations, some of the regulators required to perform this test as a confirmatory test for the normal condition of storage. In most of the cases, the result of this test will provide with an acceptable resolution or not of the cask design licensing application.

It is a standard procedure in Spain to perform a fabrication thermal test to the first cask manufactured. Two aims are intended to be confirmed: a) validation of the analytical model and b) to assure the correct thermal performance of the cask.

Thermal test FEM simulation uses almost the same model used for the licensing evaluation with minor changes. The FE model considers the same heat load per fuel assembly, and therefore the same total cask heat load as used in the licensing calculations. Modifications are on account of the difficulties to represent the normal condition of storage in the shop.

Thermal test uses the first cask manufactured. The cask is in final condition and the only part of the cask different from the final storage cask configuration is the cask lid system. A special lid is used for the test to be able to take the instrumentation wires out of the cask cavity. The thermal test lid should represent the same thermal behavior of the final storage cask lid configuration. The fuel assembly heat load is simulated by using electrical heaters. FA thermal axial profile is quite difficult to simulate using electrical heaters as these provide a uniform heat along the length. For this reason, both ends of the simulated fuel assembly will provide higher temperatures than those obtained in the licensing evaluation.

Temperature measurements shall be made once the cask reaches the thermal equilibrium. A successful thermal test is considered when the test temperatures are lower than those obtained in the FE model. Additionally, test temperatures shall be lower than those obtained in the licensing calculations, except for those thermocouples inside the cavity close to the ends of the simulated fuel assemblies.

Country/ int. organization

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