

**REPORT OF 72.48 EVALUATIONS PERFORMED FOR THE NUHOMS® HD SYSTEM FOR THE
PERIOD 09/29/17 to 09/30/19**

LR 721030-452 Rev. 0 – (no associated UFSAR change)

Change Description

This change involves a client request to perform an evaluation for foreign material that may exist in the fuel assemblies (FAs) that have been selected for loading into a NUHOMS® 32PTH Type 1 DSC in a near term fuel loading campaign.

Evaluation

The client provided an inspection data report that identified potential foreign material within the FAs at their nuclear generating station that required an evaluation of their effect on the dry shielded canisters (DSCs). These materials included steel metal chips in various geometries, paint chips, as well as plastic and fiber pieces in various geometries.

Structural

There are two concerns with regard to the introduction of a small amount of foreign materials from a structural point of view. The first is the impact of the material on the DSC pressure boundary. The second is the impact, if any, of the foreign material on the internal DSC environment, or atmosphere, including internal pressure.

Impact of Foreign Material on DSC Pressure Boundary and FAs

1. The structural evaluation with respect to the pressure boundary concluded the following:
 - a. If this material is in contact with the pressure boundary, other DSC components, or the FAs (304 stainless steel, aluminum or zirconium), there is no concern of degradation due to corrosion, given the dry inert helium atmosphere within the DSC.
 - b. Considering the extremely small quantity of foreign material and the inert dry helium atmosphere, a cladding breach would not occur. Even if a non-mechanistic, conservative assumption is made that the pin gas inventory is released, the release of fill gas is already an analyzed event, and this foreign material does not increase the severity of the event.
 - c. Considering the extremely small quantity of foreign material, specifically the paint chips, the plastic, and the fiber in the inert 32PTH Type 1 DSC environment, there is no impact on the performance of the DSC or fuel cladding.

2. Impact of Foreign Material on DSC Internal Pressure

The structural evaluation with respect to the DSC internal pressure concluded that the increase in the calculated pressure does not exceed the previously specified DSC design pressure.

The thermal, criticality, shielding, and confinement capabilities of the DSC are unaffected by the small volume of foreign materials.

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The evaluation of the safety functions resulting from this nonconformance demonstrate that the eight 72.48 evaluation criteria are met.

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Evaluation

The client provided an inspection data report that identified potential foreign material within the FAs at their nuclear generating station that required an evaluation of their effect on the DSCs. These materials included paint chips, plastic and fiber pieces, and concrete.

At high temperatures, polymers deteriorate by off-gassing and (in air) by oxidizing. In a radiation environment, they deteriorate by cross-linking. The net result is some loss of weight due to off-gassing of volatiles, and decreased ductility (increased brittleness). For the purpose of the effect of organic foreign material on design functions, outgassing is the main interest.

The outgassing products may include low-molecular-weight species of antioxidants and UV stabilizers, unreacted polymer residues and degradation products, low-molecular-weight plasticizers, water vapor, and carbon dioxide. These products are unlikely to be corrosive, considering polymers with these components are frequently used in contact with metals. The concrete piece will release primarily water.

Outgassing of 4% by mass is an upper limit for outgassing of silicones that are not post-cured. This can be used as a limiting value, since silicones outgas more than most elastomers. The same amount is considered for the concrete, given the conservatism with consideration that all this material is in one DSC and given the 1.5 conservatism factor applied to estimated weights. The limiting mass of outgassing for 20 g of foreign material and concrete is then $0.04 \times 20 = 0.80$ g.

The limiting mass of outgassing, 0.80 g, is 4.4% of the 18 g (1 mole) cavity gas impurity limit based on water vapor that is evaluated as the residue after vacuum drying. This considered that the outgassing has the same molecular weight as water, a conservative assumption since the organic products of outgassing are expected to have a larger molecular weight.

Considering the low mass of outgassing products, even when all foreign organic material and concrete is considered to be located in one DSC, the incremental effect on the purity of the helium backfill, on long term corrosion of the DSC or the fuel cladding, on the internal pressure, and on thermal conductivity of the backfill helium is negligible. Therefore, it is concluded that there is no measurable impact.

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