TRANSNUCLEAR
AN AREVA COMPANY

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U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852

Subject: Submittal of Biennial Report of 72.48 Evaluations Performed for the Standardized NUHOMS® System, CoC 1004, for the Period 07/26/08 to 07/23/10, Docket 72-1004

Pursuant to the requirements of 10 CFR 72.48(d)(2), Transnuclear, Inc. herewith submits the subject 72.48 summary report. Enclosure 1 provides a brief description of changes, tests, and experiments, including a summary of the 72.48 evaluation of each change implemented from 07/26/08 to 07/23/10, including indication as to whether the evaluations had associated Updated Final Safety Analysis Report (UFSAR) changes that were incorporated into the UFSAR for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel, NUH003.0103, Revision 11, submitted on February 1, 2010.

Should you or your staff require additional information, please do not hesitate to contact me at 410-910-6878 or Dr. Jayant Bondre at 410-910-6881.

Sincerely,

Donis Shaw

Donis Shaw
Licensing Manager

cc: B. Jennifer Davis (NRC SFST), provided in a separate mailing

Enclosures:

1. REPORT OF 72.48 EVALUATIONS PERFORMED FOR THE STANDARDIZED NUHOMS® SYSTEM FOR THE PERIOD 07/26/08 to 07/23/10

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REPORT OF 72.48 EVALUATIONS PERFORMED FOR THE STANDARDIZED NUHOMS® SYSTEM FOR THE PERIOD 07/26/08 to 07/23/10

Enclosure 1 Part 1 - DESIGN CHANGES

Licensing Review (LR) 721004-558, Rev. 0 – *(incorporated into UFSAR Revision 11)*

Change Description

The proposed activity addressed the effects of partial zero gaps between the dry shielded canister (DSC) shell and basket. The zero gap scenario was analyzed in TN calculations for the 24PTH, 61BT, 32PT, 24PHB, 61BTH, and 32PTH1 DSCs. These calculations evaluated the effect on the DSC ASME Code stress analysis for a fabrication condition where the gap between the DSC basket and shell is reduced below the minimum specified in the design drawings due to local distortion in the shell (typical at shell weld joints), thereby constituting partial interference and higher stresses. The effects of a zero basket to shell gap were evaluated in the design basis analytical model and demonstrated to satisfy ASME Code stress allowable values such that design basis compliance for the DSC confinement boundary is maintained.

Evaluation

Structural and Confinement Design Functions

The DSC shell confinement boundary is designed, fabricated, examined, and tested to the requirements of the ASME B&PV Code, Section III, Subsection NB. TN calculations evaluated the effect on the DSC stress analysis based on the ASME Code for a reduced basket to shell gap due to local fabrication anomalies. The local basket to shell cold gap of zero results in the potential for thermal interference between the basket and shell imposing loads on the shell due to differential thermal expansion. The calculations demonstrate that although the stresses of a DSC with a controlling local basket to shell gap potentially reduced to a minimum of zero increase, they remain within the ASME Code design allowable values.

Balance of Design Functions

The balance of DSC design functions related to shielding, thermal, and criticality functions as well as loading, field closure, transfer, and storage operations are not adversely affected.

The eight 72.48 evaluation criteria were met.

LR 721004-614 Rev. 0 – *(incorporated into UFSAR Revision 11)*

Change Description

The proposed activity initiated fabrication changes to the horizontal storage module (HSM) Model 202 procurement documentation for a specific client procurement situation. Most of the specified changes were identical to changes previously evaluated for other client situations and did not require 72.48 Screening or Evaluation. The following change required an Evaluation:

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The client project will use the new Type B HSM door

- The existing HSM Model 202 door has a minimum of 18-1/2" thick reinforced concrete attached to a 7-7/8" thick steel plate.
- The new Type B HSM Model 202 door has a minimum of 25 3/8" thick reinforced concrete attached to a 3" thick steel plate.

Evaluation

The structural evaluation of the standard HSM Model 202 door, as stated in UFSAR Section V.3.7.8.5, is based on the HSM-H. The HSM-H was added to the Standardized NUHOMS® System by CoC 1004 Amendment 8. UFSAR Section V.3.7.8.5 refers to Section P.3.7.11.6.5 which states in part that the door is only evaluated for missile impact load. The thermal load, dead weight, tornado wind, differential pressure, flood load and seismic load cause insignificant stresses in the door. The conclusion that the missile impact load is bounding is still valid for the new HSM Model 202 Type B door design.

The structural evaluation of the Type B door was documented in TN calculations. The Type B door is evaluated using the same methodology and missile spectrum as the standard door, for local effects due to missile impact loads. The required calculated thicknesses for these local impacts were each much less than 3 inches (the steel thickness in the Type B door). The overall structural response of the Type B door was evaluated due to the following missile impact loads:

- Wood plank missile
- Wooden utility pole
- Armor piercing artillery shell
- Steel pipe 3" diameter, Sch. 40
- Steel pipe 6" diameter, Sch. 40
- Steel pipe 12" diameter, Sch. 40
- Steel rod, 1" diameter
- Automobile missile

For these missile impact loads:

- All computed ductility ratios were either less than 1 or less than 2, which are < 20 (allowable ductility).
- Maximum computed displacements were either 0.00442" or 0.009", which are < 0.5" (gap between the door and the DSC).

The ductility of the door subject to maximum blast pressure was computed to be less than 1.3. The door connection was evaluated as follows:

The pull-out load on the door is controlled by the tornado wind load. The maximum calculated tensile force per bolt is 8.56 kips which is less that the allowable load per bolt of 44.3 kips (ASTM A325 steel properties are used). The concrete pull-out strength is calculated to be 24 kips. Half of the concrete pull-out strength (12 kips) is greater than the tension load (8.56 kips) per bolt, thus satisfying the ductility requirements of the ACI code.

In conclusion, the optional Type B door design for the HSM Model 202 is adequate to prevent any local damage due to missile impact and qualified for the overall structural response due to missile impact load. Therefore, the addition of the new door will have no impact on the structural design functions of the HSM Model 202 as described in the UFSAR.

The eight 72.48 evaluation criteria were met.

***LR 721004-632 Rev. 0* – (approved after the UFSAR Revision 11 update submittal)**

Change Description

The proposed activity evaluated the effects of the Design Basis Tornado (DBT) on the Standardized and OS197 type transfer casks (TCs) using the DBT and missile spectrum for which the horizontal storage modules (HSMs) are evaluated. The DBT and missile spectrum for HSMs are higher than those used previously for the evaluation of the TCs. Using the same DBT and missile spectrum for HSMs and TCs ensures consistency in the design of the Standardized NUHOMS® System.

Evaluation

The TCs used in the Standardized NUHOMS® System are utilized to move the dry shielded canisters (DSCs) from the plant's fuel/reactor building, where they are loaded with spent fuel assemblies, to the HSMs, where the DSCs are stored. The TCs provide shielding and protection from potential hazards during DSC closure operations and transfer to the HSM. The TC is designed to provide sufficient shielding to ensure that dose rates are ALARA. Two lifting trunnions are provided for handling the TC in the plant's fuel/reactor building using a lifting yoke and an overhead crane. Lower support trunnions are provided on the TC for pivoting the TC from/to the vertical and horizontal positions on the support skid/transport trailer. A cover plate is provided to seal the bottom hydraulic ram access penetration of the TC during fuel loading.

DBT and missiles could potentially reduce the shielding of the TC by damaging the neutron shield shell. The consequence of reduced shielding for the TCs is bounded by the accident case of "Loss of Neutron Shield," which assumes that no neutron shield is available for this accident condition, which bounds any possible damages to the neutron shield. Therefore, the increase of DBT and missile spectrum has no adverse effect on the shielding evaluations described in the UFSAR.

TCs do not provide any criticality or confinement functions.

The thermal evaluation of the DSC while within the TC remains unaffected since the effects of increasing the DBT and missiles spectrum are bounded by the accident case of "Loss of Neutron Shield" described in the UFSAR.

Increasing the DBT and missile spectrum has no adverse impact on the operation of the TCs. The procedures for loading, unloading, or any other DSC handling operations remain the same as those described in the UFSAR.

Increasing the DBT and missile spectrum affects only the structural integrity of the TCs. The structural integrity of the TC is crucial to provide protection from potential hazards during DSC closure operations and transfer to the HSM.

The structural integrity of the TC due to the increased DBT and missile spectrum were evaluated in a TN calculation. The calculation demonstrates that the TCs remain stable, the missiles do not penetrate the TC shell or end plates, and the stresses due to the impact of DBT and missiles remain well within the allowable limits. Therefore, the structural integrity of the TC remains unaffected by the increase of DBT and missiles.

The eight 72.48 evaluation criteria were met.

LR 721004-649 Rev. 1 ***– (incorporated into UFSAR Revision 11)***

Change Description

The proposed activity involved the following design modifications to the OS197FC series transfer cask (TC), in order to render its configuration the same as the OS197FC-B TC. The OS197FC series TC was added to UFSAR Appendix P for use with the 24PTH dry shielded canister (DSC) by CoC 1004 Amendment 8. The OS197FC-B TC was added to UFSAR Appendix T by CoC 1004 Amendment 10 for use with the 61BTH Type 2 DSC.

1. Attach ½" thick plate wedge segments arranged around the circumference of the cask bottom plate. The size and distribution of the wedge segments is the same as those in the OS197FC-B TC.

2. To maintain the same cask cavity length, remove ½" thick material from the underside of the top cover lid and add it to the outer side of the lid (to maintain the same 3" nominal thickness of the top cover). The net effect of this change is a lid that protrudes ½" instead of 1" into the cask cavity, and an overall increase in cask length of ½".

3. Because of Change 2 increase the length of the top lid bolts by ½" and adjust the length of the taper pins.

The listed changes effectively render the OS197FC TC the same as the OS197FC-B TC with the exception that the intermittent lip (at the bolt locations) around the underside of the lid is removed. In addition, the proposed activity included a change to replace the single 1" hoist ring with two ¾" hoist rings.

Evaluation

The proposed changes are consistent with those made by Amendment 10 for the OS197FC-B in Appendix T, except that the entire underside of the lid is shaved off 1/2" instead of a

1/2" thick recess equal the diameter of the DSC, which results in an intermittent lip at the bolt locations around the circumference (in the OS197FC-B). This in effect results in a reduction of the underside of the lid protruding inside the cask cavity from 1" at the intermittent bolt locations to 1/2" all around (in the OS197FC). The other difference is the change to replace the single hoist ring with two hoist rings. The changes were evaluated as follows.

Structural:

Addition of wedge segments at the cask bottom

The size and distribution of the wedges are identical to the OS197FC-B. The wedges installed on the bottom of the cask are loaded strictly in compression by the weight of the DSC and there are no significant applied loads.

TC Lid Modifications

The intermittent lip in the OS197FC-B is located at the lid bolt locations and spans between airflow cut outs; it has a height (depth) of 1/2" and a thickness of 0.53". Because of its small size it has a minimal contribution to the structural response of the lid and thus its removal has no impact on the reported lid stresses with the exception of a possible increase in bearing stresses due to the side drop accident loads. Under side drop accident loads the modified lid has a reduced bearing area against the TC flange (based on the 1/2" portion of the lid protruding inside the TC cavity, instead of the intermittent 1"). A TN calculation evaluated the bearing stresses due to the accident side drop in a similar TC lid (1/2" contact with the TC flange) and determined bearing stresses on the order of 63.5 ksi. Although bearing stresses are not required to be evaluated for Level 0 service loads, this evaluation shows that these stresses are well below the minimum published ultimate strength of the material (75 ksi).

Effect of Cask Overall Length Increase of 1/2"

The interference evaluation of the TC during uprighting and down-ending was performed in a TN calculation to ensure that a clearance of at least 3" was provided. The 1/2" increase in length of the TC reduces this clearance slightly but does not impact the uprighting or down-ending of the cask.

Substitution of 2 – 3/4" Swivel Hoist Rings for the 1" Hoist Ring

The Substitution of 2 – 3/4" Swivel Hoist Rings for the 1" hoist ring described in the UFSAR is acceptable, as follows: The only time that these hoist rings are used is when the cask is horizontal and being docked with an HSM at an ISFSI. At no time in the NUHOMS® ISFSI operations is the lid lifted over a loaded DSC or inside the building using these hoist rings so there are no heavy loads issues with the use of these rings. As such they need to meet normal factors of safety of 3 on yield and 5 on ultimate. The as-built weight of the OS197H lid for the OS197H-3 is 5160 lb. This lid does not have the cutouts for the airflow but is otherwise similar in geometry to the lid of the OS197FC cask. Assuming a weight of 5200 lb., the load on each host ring is 2600 lb. With a published allowable working load of 5000 (American 23009) lb. at a rating of 5: 1 on ultimate, the factor of safety at working load approaches 10 on ultimate and provides a clear margin for the use of the 3/4" swivel hoist rings.

Thermal:

The airflow passages formed by the wedges and the revised top lid have been evaluated in UFSAR Appendix T for the OS197FC-B lid. The cut outs in the lid are not changed; thus the thermal performance is not affected by the removal of the lip in the underside of the lid.

Shielding:

The introduction of the wedges, reduced lid overlap and the changes in hoist rings do not affect the shielding performance of the OS197FC.

Criticality:

The changes to the top lid and the introduction of the wedges do not affect the DSC and therefore are not relevant to the criticality analysis.

Operations:

The proposed changes do not adversely affect the general handling of the OS197FC TC for fuel loading, DSC transfer to the ISFSI, DSC insertion, DSC storage and DSC retrieval operations.

The eight 72.48 evaluation criteria were met.

***LR 721004-664 Rev. 0* – (incorporated into UFSAR Revision 11)**

Change Description

The proposed activity included the following five design changes that improve fabricability of the 32PTH1 dry shielded canister (DSC):

1. Change to the weld preparations of the outer top cover plate
2. Change to the weld preparations of the inner top cover plate
3. Permit chamfers to the middle basket plate
4. Change from a chamfer to a notch at the bottom corners of eight comer fuel compartments
5. Permit blending of the subsections of the transition rails.

Based on a TN calculation which determined the increase in the compressive stress in the fuel compartments during vertical loadings, Item 4 above required an Evaluation. None of the other items have an adverse affect on any design functions.

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Evaluation

The fuel compartments provide the structural rigidity of the 32PTH1 DSC basket, maintain fuel geometry used in the criticality analysis, and conduct heat from the spent fuel.

The structural design function is the only adversely effected function of the 32PTH1 DSC fuel compartments. The table below reports the original maximum stress, new maximum stress and the maximum allowed by the ASME Code, during the 75g vertical end drop.

Basket Type	Original Max Compressive Stress	New Max Compressive Stress	ASME Code Allowable
1	7.70 ksi	7.73 ksi	44.4 ksi
2	7.67 ksi	7.73 ksi	44.4 ksi

With the design change, the fuel compartments continue to perform their design function

The eight 72.48 evaluation criteria were met.

LR 721004-665 Rev. 0 – (approved after the UFSAR Revision 11 update submittal)

Change Description

The proposed activity involved changes associated with the 61BTH Type 2 dry shielded canister (DSC) for editorial and clarification reasons, to make the DSC easier to fabricate, and to allow use of an alternate top grid assembly. The changes are described below:

A. Allow use of alternate design for the top grid assembly (TGA Alternate 3) with associated configuration changes necessary for its assembly.
B. Allow use of an alternate configuration for the inner bottom cover plate to shell connection.
C. Allow chamfering the bottom of the aluminum plates to accommodate weld shrinkage and potential distortion of the shell near the weld with the inner bottom cover plate.
D. Allow chamfering the bottom outside corner of the four 4-compartment assemblies to accommodate weld shrinkage and potential distortion of the shell near the weld with the inner bottom cover plate.
E. Allow chamfering the aluminum plate on the R90 rail to accommodate weld shrinkage and potential distortion of the shell near the weld with the inner bottom cover plate.
F. Allow the aluminum plates to be made from multiple pieces and using them as shims to meet basket to shell gap requirements.
G. Editorial changes to drawings to improve the section views and make them clearer.
H. Allow the use of nuts to fasten screws to the R45 rails in lieu of threading the R45 rails.

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Only activities A and F required an Evaluation.

Evaluation

Activity A

TGA Alternate 3 is the same, with some minor exceptions discussed below, to the holddown ring used with the 61BT and 61BTH Type 1 DSCs

- TGA Alternate 3 has a longer spacer pad, 6.0 versus 2.0 inches, at the 0, 90, 180 and 270 degree locations.
- TGA Alternate 3 has 2 alignment pins versus 4 alignment legs for the holddown ring.

To accommodate TGA Alternate 3 additional changes need to be made to the DSC. These are discussed below:

1. TGA Alternates 1 and 2 have plates on the bottom side that slide between the fuel tubes, at the top, in lieu of having insert plates, Since TGA Alternate 3 does not have these bottom plates, insert plates are installed between the fuel tubes at the top. Inserts are also installed between the fuel tubes at the bottom which match the top.

2. The R90 rails at the 0 and 180 degree locations need a hole to fit with the alignment pin. A drain hole is also required.

3. On the 61BTH Type 2 DSC design, the support ring is recessed into the top shield plug and the TGA Alternate 3 spacer pads need something to rest upon when the DSC is horizontal. Therefore, four 0.75 inch thick shell spacer pads are welded to the shell to match the four spacer pads on TGA Alternate 3.

TN calculations were performed to assure that the DSC is structurally adequate. The results show that the compressive stress in TGA Alternate 3 is 7.52 ksi which is higher than the 5.2 ksi stress in TGA Alternates 1 and 2. However, all of these values are significantly below the allowable stress of 39.96 ksi.

Activity F

This activity pertains to making aluminum plates from multiple pieces and using them as shims to meet basket to shell gap requirements.

This change allows fabricators to meet the basket to shell gap requirement by adjusting both the thicknesses of and number of aluminum plates. These plates are bolted with the R45 rails to the compartment wraps. Therefore, fabricators may achieve the gap requirements by shimming the R45 rails with the aluminum plates.

The purpose of these aluminum plates is to provide enhanced heat transfer from the basket to the shell. Using several plates/sheets to make up the required thickness of each item, rather than using a single thick plate, introduces gaps and adds thermal resistance. A TN calculation shows that the design function of the aluminum plates is adversely affected by allowing each to consist of up to six plates/sheets.

This change also allows the fabricator to make the R90 rails out of multiple plates/ sheets. These plates/ sheets are bolted to the compartment wrap.

The main purpose of making the R90 rail of aluminum material is to provide enhanced heat transfer from the basket to the shell. Using several plates/sheets to make up the required thickness of each rail, rather than using a single thick plate, introduces gaps and adds thermal resistance. A TN calculation shows that the design function of the R90 rails is adversely affected by allowing each to consist of up to five plates/sheets.

The calculation shows that the fuel cladding, fuel compartment and neutron absorber temperatures increase a maximum 6 °F. The R45/R90 rail temperatures increase by 10 °F and the TGA temperature increases by 4 °F. A reconciliation calculation of the basket structural analysis was performed due to these changes to the rails and shim plates to verify the structural adequacy. It was determined that previous stress evaluations were based on bounding temperature distributions which have a margin of 10 °F.

The eight 72.48 evaluation criteria were met.

LR 721004-688, Rev. 2* – *(incorporated into UFSAR Revision 11)

Change Description

The proposed activity involves the use of a low density grout material to perform specified repairs (limited to smaller surface areas) on the concrete surfaces of the horizontal storage modules (HSMs). The proposed activity also involves the use of the low density grout to perform cosmetic rework on the entire surface of the HSM (no limit on the surface area) provided the rework is not performed over surfaces with exposed rebar.

Evaluation

The design function of the concrete surfaces of the HSM is to provide structural protection to the DSC and its contents and to maintain dose rates ALARA. The concrete also serves to maintain the appropriate geometry for air circulation within the HSM to provide for effective heat removal from the dry shielded canister (DSC) and its contents. Since the thermo-physical properties of the grout (except for density) are similar to those of the concrete, the structural and thermal design functions of the HSM remain unchanged. The HSM has no criticality or confinement functions.

Regarding the shielding function, a calculation was performed to determine the surface dose rate increase on the HSM when grout is used to repair concrete surface defects. The calculation uses Monte Carlo N-Particle Transport Code system (MCNP) and replaces sections of concrete (with partial depths and limited areas) at the highest dose rate locations on the HSM with grout. The replacement grout is of exact dimensions and at 70% of the HSM concrete density.

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The results show an increase in the surface average dose rates by approximately 6%. Applying a 6% increase due to the presence of grout, the accident dose will be below 47 mrem which is still less than 1% of the accident dose limit of 5000 mrem. This results in a reduction in the available margin to the accident dose limits by no more than 0.1%.

The eight 72.48 evaluation criteria were met.

LR 721004-707, Rev.0 – (incorporated into UFSAR Revision 11)

Change Description

UFSAR drawing NUH-61B-1064-SAR, sheet 1, Revision 3, view F-F shows the centerline of the web on the dry shielded canister (DSC) R45 rail coincident with the poison/insert plate centerlines. The two webs on the R90 rails are also shown coincident with the poison/insert plate centerlines. The two end plate centerlines on the R90 rails are shown coincident with the 9 compartment wrap thickness centerlines. These are only shown pictorially on the UFSAR drawing. UFSAR drawing NUH-61B-1064-SAR, sheet 2, Revision 3 shows the location of the webs as 5.79 inches and 6.43 inches from the edge for the R45 and R90 rails, respectively.

This change explicitly requires that the rail centerlines be coincident with the neutron absorber/insert centerlines and deletes the web locating dimensions. It also requires that the end plate centerlines on the R90 rails be coincident with the 9 compartment wrap plate centerlines.

Evaluation

The R45 and R90 transition rails maintain the structural geometry of the basket and provide a heat conduction path from the fuel compartments to the DSC shell. The R45 and R90 transition rails are credited in shielding and criticality analysis, but these are not considered primary design functions.

The proposed activity has no impact on the thermal, shielding, confinement and criticality design functions. A TN calculation was performed to analyze stresses. The table below shows the increased stresses in the fuel compartment and the DSC, the original maximum stresses, and the ASME code allowable stresses.

Location	Stress Category	Sensitivity Analysis Stress Intensity [ksi]	Original Stress Intensity [ksi]	Allowable Stress Intensity [ksi]
Fuel Compartment	P_m	16.06	13.47	44.45
	$P_m + P_b$	26.89	25.76	57.15
DSC	P_m	3.32	3.27	44.45

The maximum stresses stay below the ASME code allowables.

The eight 72.48 evaluation criteria were met.

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LR 721004-715, Rev.0 – (incorporated into UFSAR Revision 11)

Change Description

The change involved reducing the open area of the bird screens located at the inlet/outlet vents of the horizontal storage module (HSM) Model 80/102 from 83% considered in the thermal evaluation analysis to 70.5% as shown on UFSAR drawing NUH-03-6024-SAR, Rev. 4 and the corresponding design drawing. The effects of the proposed change were addressed in a TN calculation. This calculation considered the effect of reducing the bird screen open area from 83% to 70% instead of 70.5% to remain conservative in the evaluation.

Evaluation

The HSM Model 80/102 provides a self-contained modular structure for storage of spent fuel canisterized in a DSC. The HSM is constructed from reinforced concrete and structural steel. The HSM also provides a means of removing spent fuel decay heat by a combination of radiation, conduction and convection. Ambient air enters the HSM through ventilation inlet openings in the lower side walls of the HSM and circulates around the DSC and the heat shield. Air exits the HSM through outlet openings in the upper side walls of the HSM.

The reduction of the bird screen open area increases the air flow resistance through the HSM and adversely affects the cooling performance of the HSM. The adverse effect on the HSM bulk air temperature (in absolute temperature) evaluated in the calculation was found to be less than 0.5%. It was concluded that this small amount of air temperature change has a negligible effect on the DSC shell, HSM concrete, and fuel cladding temperatures. Therefore, the thermal performance of the HSM Model 80/102 due to reduction of bird screen open area as described in the UFSAR remains unchanged. The maximum component temperatures reported in UFSAR remain valid.

The eight 72.48 evaluation criteria were met.

LR 721004-786, Rev.0 – (approved after the UFSAR Revision 11 update submittal)

Change Description

Based on NRC Information Notice 2009-23, "Nuclear Fuel Thermal Conductivity Degradation," this proposed activity evaluated the impact of irradiated UO_2 pellet conductivity and thermal performance on the Standardized NUHOMS® System.

Evaluation

The utilized methodologies for evaluation of the effective fuel conductivities (K_{eff}) in the Standardized NUHOMS® System dry shielded canisters (DSCs) are listed in the table below.

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DSC	Methodology
24P	K_{eff} is based on test data considering effect of irradiation.
24PHB	K_{eff} is based on test data considering effect of irradiation.
24PTH	ANSYS model based on un-irradiated UO_2 conductivity.
32PT	ANSYS model based on un-irradiated UO_2 conductivity.
32PTH1	K_{eff} is the bounding value calculated for 24PTH, 32PTH (CoC 1030).
52B	K_{eff} is based on test data considering effect of irradiation.
61BT	ANSYS model based on un-irradiated UO_2 conductivity.
61BTH	K_{eff} is the bounding value calculated for TN-68 and 61BT.

As seen in the table, the methodologies used for the 24P, 24PHB, and 52B DSCs are based on test data, which includes the effect of irradiation. Therefore, the performance of the 24P, 24PHB, and 52B DSCs are unaffected by the change and no further evaluation was required for these DSC types.

Calculations of effective fuel conductivities in the remaining DSC designs in the table were based on un-irradiated UO_2 conductivity. Using the irradiated UO_2 conductivity will reduce the fuel effective conductivity and potentially increases the maximum fuel cladding temperature. The evaluation considered therefore the design of 24PTH, 32PT, 32PTH1, 61BT, and 61BTH DSCs.

DSC types 24PTH, 32PT, and 32PTH1 are designed for PWR fuel assemblies. The effective fuel conductivities in these DSC types are calculated based on ANSYS models using un-irradiated UO_2 conductivity. Based on a sensitivity study documented in a TN calculation, the effective fuel assembly conductivity with irradiated UO_2 conductivity is approximately 3% lower than that with un-irradiated UO_2 conductivity at an operating temperature of 700 °F. This difference is smaller at lower operating temperatures. This sensitivity analysis demonstrated that the effect of fuel conductivity degradation due to irradiation on the maximum fuel cladding temperature is limited to 1 °F. This amount of impact is considered as insignificant.

DSC types 61BT and 61BTH are designed for BWR fuel assemblies. The effective fuel conductivities in these DSC types are also calculated based on ANSYS models using un-irradiated UO_2 conductivity. Similar to the PWR effective fuel conductivities discussed above, a sensitivity analysis was performed for BWR fuel assemblies in a TN calculation using the same methodologies. This sensitivity analysis demonstrated also that the effect of fuel conductivity degradation due to irradiation on the maximum fuel cladding temperature is less than 1 °F and is therefore insignificant.

The internal pressure of the cask cavity is proportional to the average cavity gas temperature. An increase of 1 °F for the cavity gas temperature increases the internal pressure by only 0.1 % for operating temperatures from 300 °F to 800 °F. Therefore, the effect of considering irradiated UO_2 on the DSC internal pressure is insignificant.

The irradiated UO_2 conductivity does not affect the cask structure directly. The impact of the irradiated UO_2 on the thermal stresses of DSC shells, and therefore on the structural function is insignificant.

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There is no adverse impact on the confinement capabilities of the cask as there are no new leak paths introduced and the effect of irradiated UO_2 on the cavity internal pressures is insignificant, as discussed above.

There is no adverse impact on shielding, as the irradiated UO_2 conductivity does not change the source term limits of the fuel assemblies nor impact the shielding properties of the materials.

There is no adverse impact on criticality. There will be no dispersal or reconfiguration of pellet material. The structure, the geometry, and the neutron absorbing capability of the basket materials remain unaffected by the irradiated UO_2 conductivity.

There is no adverse impact on operations. The temperature limits for operations, such as vacuum drying, remain unaffected. The increase of the maximum fuel cladding temperature for these operations is insignificant. Therefore, there are no required changes to the procedures for loading, unloading, or any other cask handling operations.

These results demonstrated that considering the effects of irradiated UO_2 conductivity does not adversely affect the system design functions.

All eight 72.48 evaluation criteria are met.

LR 721004-828, Rev.0 – (approved after the UFSAR Revision 11 update submittal)

Change Description

The proposed activity involved the use of shims to make the adjustment of the inserts possible to meet the specified basket to shell gap requirement during fabrication of the 24PTH dry shielded canister (DSC), based on fabricator feedback.

Evaluation

The affected components of the 24PTH Type 1 DSC are the basket aluminum plates, poison plates, and fuel compartments. The fuel cladding is not a DSC component, but it is also affected.

The basket aluminum plates provide a heat transfer path to remove heat generated by the fuel. They are considered non-structural and no credit is taken for their strength. However, they are considered to also carry compressive/bearing loads such that the thickness of these materials will not be reduced by pressure from the fuel and fuel tubes under normal and accident (drop) loads.

The poison plates provide criticality control. They also provide a heat transfer path to remove heat generated by the fuel.

The fuel compartments provide structural strength and rigidity to the basket. The fuel compartments hold the fuel and provide the required fuel geometry in order to maintain criticality control.

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The only effect on the affected DSC components and the fuel cladding is an increase in temperature by 1, 2, 2, and 1 °F, for the basket aluminum plates, poison plates, fuel compartments, and fuel cladding, respectively. This is an adverse impact to the fuel cladding and thermal design function of the basket components. However, the fuel cladding temperature is still well below the temperature limit of 752 °F.

As a result of the temperature increases, the structural and the criticality design functions of the fuel compartments were also evaluated. The maximum temperatures exhibited by the sensitivity analysis were compared with the temperature input used in the structural analysis of the 24PTH basket assembly for the accident and normal conditions. The maximum temperature input used in the structural analysis was 750 °F, for the basket center. Therefore, it is acceptable to state that there is no adverse impact to the structural design function of the stainless steel fuel compartments, because the temperatures exhibited by the sensitivity analysis are bounded by the higher temperature used in the structural analysis.

One important factor in maintaining criticality control is proper geometry of the fuel compartments. Since the temperatures exhibited by the sensitivity analysis are bounded by the higher input temperatures used in the structural analysis, it can be concluded that the fuel compartments are able to maintain their structural integrity and geometry in the normal and accident loading conditions. Therefore, there is no adverse impact to the criticality design function of the fuel compartment as a result of this change.

The eight 72.48 evaluation criteria were met.

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Enclosure 1 Part 2 - NONCONFORMANCES

***LR 721004-718 Rev. 0* – (no associated UFSAR change)**

Change Description

The proposed activity is to evaluate the effect of potential foreign materials (debris) that may be present in the fuel assemblies to be stored in 24PHB DSCs.

The following bounding material type and weight limits are considered for this evaluation.

- Inorganic foreign material (combined weight) Metallic (Stainless steel, Carbon steel, Aluminum, Zirconium Alloy, Inconel, or a combination) Non-Metallic (Glass)	0.1 lbs
- Organic / organic based foreign material (combined weight) PVC, Tie wrap, Plastic string, Duct Tape, Paint Chip, or a combination	0.1 lbs
Total Debris Weight	0.2 lbs

Evaluation

The effect of the potential introduction of foreign materials (debris) into the 24PHB DSC is evaluated below.

There are three structural concerns with regard to the introduction of a small amount of foreign material.

a) The impact on the internal DSC environment
b) The impact on the internal DSC pressure
c) The impact on the weight

Impact of Foreign Material on Internal DSC Environment

The inorganic metallic foreign materials are stainless steel, carbon steel, aluminum, zirconium alloy (zircaloy), and inconel or a combination. Stainless steel, zircaloy, and inconel are used to fabricate either the basket and DSC or the fuel assembly and do not have any adverse effect on the DSC internal environment. Aluminum is commonly used in fabrication of other baskets such as 32PT and does not have any corrosive effect on the DSC internal environment. Carbon steel could induce corrosion of the DSC components and/or fuel assemblies in an environment that is conducive to corrosion (an environment with water, air or other electrolyte present). However, the vacuum drying of the DSC reduces the quantity of water, air or other oxidizing agents to 0.25 volume % or less. This level of concentration of oxidizing agent with the balance of the DSC free volume filled with inert helium gas and the small amount of carbon steel will not support any significant corrosion in the DSC.

The inorganic, non-metallic foreign material is glass. For the purpose of this analysis, the glass is assumed to be a piece of lighting glass with the bounding composition of Borosilicate. The softening temperature of the Borosilicate glasses is 700 °C (1292 °F). The softening point is the temperature at which the glass will deform under its own weight. The maximum temperature in the 24PHB DSC is 762 °F based on Table N.4-1 of the UFSAR during accident blocked vent conditions and is significantly below the softening point of the glass. Therefore, there is no deformation of the glass due to heat load in the 24PHB DSC and its presence does not impact the internal environment of the 24PHB DSC.

Three scenarios are possible for the organic or organic based foreign materials:

1. The organic material does not melt/vaporize during vacuum drying (VD) operations and remains present at the start of HSM storage. This material is then present in an inert dry atmosphere (helium).
2. The organic material decomposes/melts during VD operations, but does not vaporize. It thus remains as a solid reconfigured piece of material.
3. The organic material melts and vaporizes during VD operations and all that remains is residue. This is the most likely scenario since the temperature in the DSC is likely to exceed the melting/decomposition temperatures of the organic foreign materials.

The organic/organic based foreign materials could induce corrosion of the DSC components and/or fuel assemblies in an environment that is conducive to corrosion (an environment with water, air or other electrolyte present). However, the vacuum drying of the DSC reduces the quantity of water, air or other oxidizing agents to 0.25 volume % or less. This level of concentration of oxidizing agent with the balance of the DSC free volume filled with inert helium gas will not support any significant corrosion in the DSC. Therefore, although the debris in the DSC (plastic, tape, nylon, etc.) could potentially cause some corrosion in an air/water environment, the lack of an oxidizing agent in the DSC and the inert helium gas fill of 99.75% of the free volume of the DSC, will preclude any corrosion of the pressure boundary, basket (or other DSC components) or fuel assemblies.

To quantify any impact of the foreign material on corrosion of the pressure boundary, corrosion rates for stainless steel were researched. To quantify any impact of the foreign material on corrosion of the fuel cladding, corrosion rates for Zirconium were researched. The conclusion from both of these searches is that both the stainless steel pressure boundary and the zirconium cladding are resistant to corrosion and it would take many years, even assuming unrealistic environments, to reduce thickness to a level of concern. Therefore, corrosion from a very small amount of foreign material in a dry helium (inert gas) atmosphere is not a concern for the pressure boundary or the fuel cladding.

Impact of Foreign Material on DSC Internal Pressure

The impact of the foreign materials on the internal DSC pressure is evaluated and documented in a TN calculation. This calculation assumes conservatively that all the organic foreign material (0.1 lbs) converts to hydrogen gas after sealing of the DSC. Since hydrogen gas has the lowest molecular weight, this assumption maximizes the amount of gas moles within the DSC cavity and thus maximizes the internal pressure. The calculation shows that the internal DSC pressure with foreign material remains below the design limits. Thus the stresses in the DSC shell assembly remain bounded by those reported in the UFSAR.

Impact of Foreign Material on DSC Weight and Center of Gravity

The weight of the foreign material is limited to 0.2 lbs. Based on Table N.3.2-1 of the UFSAR, the dry weight of the 24PHB DSC is between 75,646 and 78,129 lbs and any weight fluctuations below 50 lbs is considered negligible. The small amount of foreign material weight will not change the DSC weight or its center of gravity location by any significant amount or exceed any weight limits. Therefore, the foreign materials have no adverse impact on the DSC weight evaluation.

Effects on the Additional Design Functions

There is no adverse impact on the thermal function. The limiting source term is unchanged. There are no changes to the acceptance criteria for these fuel types. The volume of the foreign material is not sufficient to alter the DSC internal atmosphere and thus alter gaseous heat transfer. Any gas generated from breakdown of the foreign material will add only a very small amount to the internal DSC atmosphere, i.e., the assumed helium for gaseous heat transfer is not reduced.

There is no impact on the confinement capabilities of the DSCs as there are no new leak paths introduced. As stated previously, the foreign material will not adversely impact the stainless steel DSC pressure boundary.

There is no adverse impact on shielding. The introduction of foreign material into the DSC does not change the source term limits of the Fuel Qualification table. The shielding analysis does not explicitly rely on the DSC internal gas environment. The volume of the foreign material is very small, contains no significant material susceptible to activation (no cobalt), and thus will not significantly alter the long term source term.

There is no adverse impact on criticality. The DSC will be drained, successfully vacuum dried, and sealed. The very small amount of foreign material will not create a concern during future reflooding. As shown previously, the concentration of dissolved materials (conservatively assuming that it all goes into solution following reflood) is very low and thus will not adversely change k_{eff}. The fuel cladding will not be breached by this small amount of material within a dry helium atmosphere. Thus, there will be no dispersal or reconfiguration of pellet material. The fuel assembly will not become "damaged". In conclusion, there is no adverse impact on criticality of including the small amount of foreign material.

There is no adverse impact on operations. The material is of a small enough volume (0.2 lb per canister), that no problems are anticipated in successfully vacuum drying. Prior to leaving the Fuel Handling Building for storage, the vacuum drying and sealing operations will have been performed successfully. It can be inferred that any reflooding operations would be similarly unaffected. Assuming that the debris is still intact, it would either be retained as it was before or it would have become dislodged during horizontal transfer and is now "loose" in the DSC. In either case, this debris is not large enough to block reflooding through the siphon tube, nor would it interfere with subsequent gas venting. During fuel unloading, there are no required changes to the procedures for opening the DSC, testing the atmosphere within the DSC, and removing the closure plates. The change addressed by this evaluation does not affect system loading and unloading operations, nor does it alter any canister handling operations.

The eight 72.48 evaluation criteria were met.

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LR 721004-735 Rev. 0 - (no associated UFSAR change)

Change Description

The proposed activity was to evaluate the effect of damaged and slipped fuel assembly grids on the performance of the 24PHB dry shielded canister (DSC). During client operations within their reactor, some of the fuel assembly grids were slipped or damaged. The extent of the grid slip and damage considered in this evaluation was limited to:

- The slip length for a single slipped grid was limited to:
  - 5 inches for B&W 15x15 Mark B2 to B9. The maximum unsupported span between two slipped grids in this case is limited to 25.63 inches.
  - 4.5 inches for B&W 15x15 Mark B10. The maximum unsupported span between two slipped grids in this case is limited to 25.13 inches.
- At least one upper or lower part of a damaged grid strap remains undamaged.
- Damaged grid does not protrude outside the envelope of the fuel assembly guide sleeve.
- The fuel rods in the fuel assembly with slipped/damaged grids remain intact without any known or suspected gross cladding breaches.

Evaluation

The effect of the slipped/damaged fuel assembly grids on the functions of the 24PHB DSC is evaluated below.

Effects on the Structural Design Function

The slipped/damaged fuel assembly grids have no effect on the design, form, or fit of any component of the DSC shell and basket assemblies. The fuel cladding of the fuel assemblies with slipped/damaged grids remains intact. Therefore, the potential for release of the fill and fission gases from the fuel rods remains the same as described in the UFSAR. Hence, the internal pressures of the DSC for the conditions considered in the UFSAR remain unchanged. Since no additional load condition is introduced by the slipped/damaged fuel grids, the structural evaluations for the DSC shell and basket assembly for normal, off-normal, and accident conditions as described in the UFSAR remain unaffected. The structural concerns with regard to the slipped/damaged fuel assembly grids are then focused only on the following items.

a) The fuel assembly structural integrity
b) The fuel assembly retrievability

The structural integrity and retrievability of the fuel assemblies with slipped/damaged grids for normal, off-normal, and accident conditions are evaluated below.

Fuel Assembly Structural Integrity and Retrievability for Normal/Off-normal Conditions

The fuel assemblies are supported laterally by the guide sleeves and are exposed only to their own dead weight load for normal and off-normal transfer and storage conditions.

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The grid damages are limited to one part of the grid. Therefore, adequate grid force is maintained on the fuel rod at the location of the grid damage. Due to this condition, the limited vibration during the short period of transfer operations will not affect the fuel assembly integrity.

As described in UFSAR Section 3.3.7.1.2, deflection of the fuel rods between the spacer grids is the only significant structural condition affecting the retrievability of the fuel assembly for normal and off-normal conditions. The deflection of a fuel assembly with intact grids is evaluated to be 0.015 inches. This deflection is calculated based on the standard beam theory for a uniformly loaded tubular beam (UFSAR, Section 3.3.7.1.2). Based on this theory, the maximum deflection of a fuel rod between slipped/damaged grids for a B&W 15x15 fuel assembly (longest distance) is calculated to be 0.036 in.

The nominal envelope of the fuel assembly is 8.536 inches as shown in UFSAR Table N.2-1 and Technical Specifications Table 1-1i. With the maximum deflection calculated above, the envelope of the fuel assembly between the two slipped/damaged grids increases to (8.536+0.036) 8.572 inches. This value remains well within the minimum inner width of the guide sleeve, which is 8.750 inches as defined in TN specification records. Therefore, the slipped/damaged grids do not impede the retrievability of the fuel assemblies.

Fuel Assembly Structural Integrity and Retrievability for Accident Conditions

The accident condition which can potentially affect the structural integrity of the fuel cladding is the transfer cask (TC) drop. The drop scenarios evaluated in UFSAR Section N.3.7.5 for the TC with a 24PHB DSC are:

1. A horizontal side drop or slapdown from a height of 80 inches.
2. An oblique corner drop from a height of 80 inches at an angle of 30° to the horizontal, onto the top or bottom corner of the TC.

In the UFSAR, 24PHB DSCs are evaluated for a 75g horizontal side drop. The vertical end drop is not a credible event for the NUHOMS® System. However, to envelop the results of the oblique corner drop, analysis is performed for a 60g top and bottom end drop load.

The impact of the TC accident drops is not evaluated explicitly in the UFSAR for the 24PHB DSC. The methodology described in UFSAR Appendices T and U was used to evaluate the effects of the TC drops on the structural integrity of the fuel assemblies. This evaluation is documented in TN calculations.

Based on these calculations, the maximum stress and strain of the fuel cladding due to drop conditions remain below the maximum allowable limits. Therefore, the integrity of the fuel cladding for fuel assemblies with slipped/damaged grids is assured.

Effects on the Additional Design Functions

There is no impact on the thermal evaluation. The source term and the maximum decay heat loads for fuel assemblies with slipped/damaged grids are unchanged. There are no changes to the thermal acceptance criteria due to loading of these fuel assemblies. The thermal design features of the 24PHB system remain unchanged.

There is no impact on the confinement capabilities of the 24PHB DSCs as there are no new leak paths introduced. As stated previously, the fuel rods within the fuel assemblies with slipped/damaged grids are intact and their impact on DSC pressure boundaries remains unchanged.

There is no adverse impact on shielding. The slipped/damaged fuel assembly grids do not change the source term limits of the Fuel Qualification table. The shielding evaluation as described in the UFSAR remains unchanged.

There is no adverse impact on criticality. The dimensions and the geometry of the fuel assembly with slipped/damaged grids remain unchanged. The initial enrichment and the other fuel characteristics as described in UFSAR Table N.6-1 remain unchanged. The fuel rods are intact. Thus, there will be no dispersal or reconfiguration of pellet material. The fuel assembly will not become "damaged" subsequent to accident drops. In conclusion, there is no adverse impact on criticality of the fuel assemblies with slipped/damaged fuel assembly grids.

There is no adverse impact on operations. The fuel assemblies with slipped and/or damaged grids maintain their fuel-specific and system-related functions described in the UFSAR. Therefore, the lifting, loading, vacuum drying and other operations can be followed using the same procedures described in the UFSAR. Retrievability of the fuel assemblies is assured for the normal, off-normal, and accident conditions as described above. Therefore, the unloading operations remain unaffected. The change addressed by this evaluation does not affect system loading and unloading operations, nor does it alter any canister handling operations.

The eight 72.48 evaluation criteria were met.

***LR 721004-755 Rev. 1* - (no associated UFSAR change)**

Change Description

The proposed activity involved 25PHBL dry shielded canister (DSC) baskets and acceptance of carbon steel spacer discs which were welded to stainless steel support rods without preheat. The associated TN specification states "Preheat temperatures recommended or required by ASME III, Subsection NB and NF, as applicable, are mandatory. In addition to governing ASME BPVC, all carbon spacer disk welds shall have preheat temperature of 200 ºF." The condition is also contrary to ASME Section III, Article NF-4610.

Evaluation

The welds between the carbon steel spacer discs and the stainless steel support rods secure the spacer disc in place along the vertical axis of the DSC. The spacer discs structural function is to keep the geometry of the fuel tubes as required for criticality safety and heat transfer.

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Fabrication of these welds without the minimum preheat required by the specification and by the ASME Code has the potential to cause hydrogen embrittlement in the heat affected zone (HAZ) of the carbon steel disc, which in turn could lead to cracking in the HAZ. If cracking were to occur on the disc side of the weld, the weld to the support rod would be unaffected. The welds would then act like collars to capture the spacer disc in its axial position under normal conditions, but the structural function under end drop accident conditions could be adversely affected.

1) Impact testing of the HAZ performed for the weld procedure qualification record showed minimum Charpy results of 87 ft lb and 55 mil lateral expansion at -20 °F, well in excess of the ASME NF-2330 minimum of 30 ft lb (≥ 1inch, ≥ 70 ksi, least of three tests) and 25 mil (≥ 1inch) as well as the 25 mil requirement of the TN specification.
2) PT examination records for 32 DSCs show all welds at joint BA-1-8, A-D to be acceptable. This represents a total of 2048 welds without evidence of cracking at the surface.
3) Weld mockup testing at 41 °F preheat by Hitachi-Zosen found no subsurface cracking upon sectioning the weld.

Furthermore, the stresses in the weld under normal handling loads are only 22% of allowable, and under end drop accident loads, 60% of allowable.

Many of the subject baskets were no longer accessible for post weld heat treatment (PWHT), which would bring the welds into conformance with the ASME code. PWHT would in any case not be a practical option because of its effect on the dimensional conformance of the basket.

The evidence above confirms that the non-conforming welds will perform as intended under all design conditions for this storage-only DSC.

The eight 72.48 evaluation criteria were met.

The proposed activities for the three evaluations listed below were identical, except for the measured values, which are provided in the Change Description section. Therefore, a single summary is provided here which covers all three items.

***LR 721004-808 Rev. 0* - (no associated UFSAR change)**

***LR 721004-816 Rev. 0* - (no associated UFSAR change)**

***LR 721004-819 Rev. 0* - (no associated UFSAR change)**

Change Description

The proposed activities involved 61BTH Type 2 dry shielded canister (DSC) baskets and accepting as use-as-is gaps between the R45 aluminum plates which were larger than the gaps specified. The specified gap requirements are .06" to .14". The nonconforming gaps were as follows:

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	Range of Gaps	Average Gap
LR 721004-808 Rev. 0	.14" to .28"	.20"
LR 721004-816 Rev. 0	.14" to .24"	.17"
LR 721004-819 Rev. 0	.14" to .26"	.18"

Evaluation

The affected components of the 61BTH Type 2 DSC basket were the fuel compartments, neutron absorbing plates, and basket rails. The effect on the fuel cladding was also evaluated.

The fuel compartments provide structural strength and rigidity to the basket. The fuel compartments hold the fuel and provide the required fuel geometry in order to maintain criticality control.

The neutron absorbing plates provide criticality control by absorbing neutrons and keeping neutrons from transferring to adjacent compartments. They also provide a heat transfer path to remove heat generated by the fuel.

The basket rails provide structural strength and geometry for the basket while providing a heat transfer path from the basket to the shell. The rails are credited in the shielding and criticality analyses.

A sensitivity analysis was performed and documented in a TN calculation. The analysis determined that the proposed activity would cause a temperature increase in the fuel compartments, neutron absorbing plates, and basket rails, of 1 °F. The proposed activity resulted in an adverse impact; however, the fuel cladding temperature is well below the temperature limit of 752 °F.

The eight 72.48 evaluation criteria were met.