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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 02/04/06 to 07/25/08, 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 02/04/06 to 07/25/08, 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 10, submitted in February 2008.

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 02/04/06 TO 07/25/08

7135 Minstrel Way, Suite 300, Columbia, MD 21045
Phone: 410-910-6900 • Fax: 410-910-6902

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REPORT OF 72.48 EVALUATIONS PERFORMED FOR THE STANDARDIZED NUHOMS® SYSTEM FOR THE PERIOD 02/04/06 TO 07/25/08

Enclosure 1 Part 1 - DESIGN CHANGES

Licensing Review (LR) 721004-321, Rev. 2 – ***(incorporated into UFSAR Revision 10, but not authorized for use (see Note: below))***

Change Description

In an effort to expand the capability of the NUHOMS® system to plants with reduced crane capacity, a light weight configuration of the OS197 Transfer Cask (TC) was developed, referred to as the OS197L TC. The design intent of this cask is to allow for loading/unloading and transfer of licensed DSCs 24P, 52B, 61BT, 24PT2, 32PT and 24PHB and maintain the bounding crane load to less than 75 tons.

There are four basic design changes associated with the OS197L TC and its operation:

Change 1: Reduced TC weight, through: elimination of the TC lead shielding, the TC liquid neutron shield made in two sections with an inner shell, and a provision for supplemental shielding, including the decon area shield sleeve, shield bell and trailer/skid shielding.

Change 2: The use of an optional flexible plastic/fabric cask protective cover to keep the cask surface from being contaminated in the fuel pool.

Change 3: A reduced weight interim cask top cover used during the downending process and inside the fuel building to provide assurance that events beyond the design basis would not result in the DSC shifting within the cask. The cover, which is installed with a gasket, will allow for maintaining water in the DSC/cask annulus during transfer from the decon area to the trailer.

Change 4: Simplified OS197L TC trunnion configuration. The trunnion change is the replacement of the multiple piece trunnion assembly with a single SA-182 F XM-19 forging for the upper trunnion and an F304 forging for the bottom trunnion. The upper trunnion connects to the yoke and is welded directly to the cask structural shell. The lower trunnion is the rotation point for downending and is only loaded during transfer operations. In both trunnions, the structural load path is simplified, and there is only one weld (trunnion-to-shell). The material for the one-piece trunnion is a high strength austenitic stainless steel, a P8 material per the ASME Code. This material is very ductile, has excellent weldability, and as it is austenitic, has no notch toughness concerns. The ASME Code exempts this material from impact testing. Another benefit is that unlike the previous SA-564 Type 630 precipitation hardened ferritic steel material, the XM-19 material can be weld-repaired without post-weld heat treatment (PWHT). This allows for surface (cosmetic) repairs of the trunnion bearing surface resulting from scratching of the trunnion by the yoke.

Note: Specific portions of Change 1 (related to the OS197L shielding configuration, supporting thermal analysis and a change in the FSAR described procedure of pumping down the DSC water prior to lifting the DSC out of the spent fuel pool) which either result in an alteration to the CoC 1004 Technical Specifications or do not meet 10 CFR 72.48 (c)(2) criteria, have been distinctly marked in the details of this LR. Amendment 11 to CoC 1004 has been submitted to the NRC for those distinctly marked changes. Accordingly, the LR makes it clear that changes as described and evaluated in this LR shall NOT be implemented by any general licensee until CoC 1004 Amendment 11 has been approved by the NRC.

Evaluations

Change 1 Evaluation:

Principal Design Criteria: The principal design criteria for the OS197L are the same as those specified for the OS197 in the NUHOMS® UFSAR Chapter 3. These include the various DSCs that can be transferred in the OS197L together with the overall structural features, shielding, and the decay heat removal requirements. In particular, the OS197L TC is qualified to transfer the 24P, 52B, 61BT, 24PT2, 32PT and 24PHB DSCs, up to a DSC heat limit of 24 kW.

Structural Evaluation: The OS197 cask missile analysis documented in the UFSAR only takes credit for the steel shells of the OS197 cask (0.5" inner shell and 1.5" structural shell). The OS197L TC uses one 2.68" shell. The missile protection capacity of the OS197L TC is therefore greater than that of the OS197 cask. The OS197 cask missile analysis is therefore bounding for the OS197L.

The 75 g analysis for the side and end drops and the 25 g analysis for the corner drop for the OS197 are also bounding for the OS197L TC and are conservative with respect to shell stresses since the thicker OS197L TC single shell has a higher load capacity than the multi shell OS197 TC configuration.

The OS197L TC cg is slightly lower than that of the OS197 TC. The cask bottom forging dimensions are the same for the two casks. Therefore, the OS197L TC will be slightly more stable under the design basis earthquake conditions than the OS197 TC.

Thermal Evaluation: A thermal analysis of the OS197L system is performed to address the use of additional shielding in the decontamination area and on the trailer/skid.

During other modes (in the fuel pool, during transit from the fuel pool to the decontamination area, and from the decontamination area to the trailer) the OS197L TC has heat transfer capability comparable to the OS197 TC. The difference in thermal conductivity of the 0.5" inner shell, 1.5" outer shell and the nominal 3.5" lead shielding in the OS197 is not significantly different from the 3" steel shell used for the OS197L TC analysis. The difference in thermal conductivity between these two configurations is small relative to the other thermal resistances between the ambient environment and the fuel.

The thermal analysis performed in support of the addition of OS197L TC to the NUHOMS® System represents a change in method of evaluation as described in the UFSAR. Accordingly, an updated thermal analysis of this portion of Change 1 has been included in Amendment 11 to CoC 1004 for NRC approval.

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In addition, prior to lifting the OS197L TC out of the spent fuel pool, up to 13,600 lbs of water is pumped out from the DSC cavity and helium is added around the fuel assemblies to eliminate exposure of the fuel assemblies to air. This change in sequence of operations from those described in the UFSAR results in an initial fuel cladding temperature prior to the start of DSC vacuum drying operation that may be higher than the 215 °F assumed in the UFSAR. This may result in a shorter vacuum drying time than that specified in TS 1.2.17, 1.2.17a and 1.2.17b. It also constitutes a change to an element of methodology described in the UFSAR. Accordingly, this change in sequence of operations and its affect on the TSs has been addressed in the Amendment 11 to CoC 1004 submittal.

For the cask in the decontamination area and for transfer from the decontamination area to the trailer with a drained neutron shield, the effect of the decontamination shield and drained neutron shield on the thermal analysis is negligible. In this configuration, the DSC/cask annulus is maintained full of water and is vented, thus maintaining the DSC surface temperature at a bounding temperature of 215 °F, which corresponds to the boiling temperature of water at atmospheric pressure with a small allowance for hydrostatic head. In addition, the DSC cavity is refilled with water after the loaded OS197L TC is placed within the shielding sleeve on the decon pad. This is identical to the analyzed condition of the DSC for DSC welding, vacuum drying, helium backfilling and downending operations. Therefore, the addition of the decontamination area shield and draining of the neutron shield does not impact the canister analysis boundary conditions. The decontamination shield also contains vents at the bottom and top of the shield to allow for air flow around the cask outer surface.

The response of the OS197L transfer cask for a transient fire accident is bounded by the steady state loss of sun shade and liquid neutron shield accident. This is consistent with the results of the fire accident analysis for the OS197 cask. If crane limits allow, the OS197L TC can be moved from the decon area to the transfer trailer with the neutron shield full and the cask/DSC annulus empty.

The neutron shield configuration of two half-shells does not impact this analysis. This modification slightly enhances the thermal conductivity of the neutron shield (at the seam between the neutron shield halves). Therefore, the above results are bounding for the OS197L cask configuration. The two piece neutron shield provides the same level of shielding as the OS197 TC neutron shield. The water annulus thickness is unchanged. The outer shell of the OS197L TC neutron shield is slightly thicker than that used in the OS197 (.25" versus .18"). The addition of the seam between the two halves would reduce gamma dose in the vicinity of the seam but would increase neutron dose due to less water in the vicinity. As discussed for the trunnion modification above, since the total dose is primarily gamma, the increase in steel will result in a net decrease in total dose in the vicinity of the seams. The use of the two piece neutron shield has negligible impact on the structural analysis, criticality analysis and mechanical interfaces.

Shielding Evaluation: The OS197L TC shielding analysis determined that the dose rates (measured at the surface of the supplemental shielding) for the OS197L TC (122 mrem/hr surface dose), are approximately one-third of the dose rates for the OS197 TC (346 mrem/hr surface dose), since credit is taken for the supplemental shielding for the

OS197L TC. Relative to the precision of the shielding analysis, the two casks can be considered to have similar shielding.

CoC 1004 TS 1.2.11 and 1.2.11a require TC dose rates to be measured at a distance of 3 feet from the cask surface and do not make any provision for the use of supplemental or temporary shielding around the TC. This change in the shielding configuration of the TC results in an alteration of the limits specified in TS 1.2.11 and 1.2.11a. Accordingly, this change in shielding configuration of the TC has been addressed in Amendment 11 to CoC 1004.

The OS197L TC shielding analysis calculates dose rates for accident analyses that assume a loss of both the inner and outer neutron shield shells of the OS197L TC (with a 32PT DSC payload) in the event of a cask drop accident. The methodology used is similar to that described in UFSAR Section M.11.2.5.3.

In the event of a cask drop accident, the OS197L TC shielding analysis assumes a loss of both the inner and outer neutron shield shells of the OS197L TC (with a 32PT DSC payload). The methodology used is similar to that described in UFSAR Section M.11.2.5.3.

Criticality Evaluation: The modifications associated with the OS197L cask (reduced weight of transfer cask and two-piece neutron shield) will not adversely impact the criticality analyses performed for the OS197 cask. The changes are in an area of relatively insignificant importance to criticality – no change in the fuel geometry / poison loading / or borated water concentration. The changes only affect the outer surface of the cask. The UFSAR shows that a reflective boundary, simulating an infinite cask array, was employed, further reducing the sensitivity of the analysis to TC design changes. In addition the OD of the OS197 and OS197L are basically the same. Therefore, these changes will have a negligible impact on the criticality analyses.

Mechanical Evaluation: The modifications associated with the OS197L cask and the two-piece neutron shield will not adversely impact the mechanical interface of the cask with other NUHOMS® and plant structures. The interfacing trunnion dimensions of trunnion shelf diameter and width are unchanged from the OS197. The connections of the neutron shield, although slightly altered to accommodate the two-part fabrication, are very similar and utilize the same fittings (self-sealing Swageloks) for draining and filling.

Placement and support of the cask on the trailer is unchanged and the alignment of the cask to the HSM will still utilize cask targets affixed to the trunnions and the top and bottom of the cask. Some adjustment of the target construction has been made to account for the trailer shielding above the cask, but the process of alignment (optical/laser alignment to the targets on the HSM face) is unchanged. The connection of the cask to the HSM is altered slightly, to account for the side shielding on the trailer.

Change 2 Evaluation:

Structural Evaluation: The use of the flexible plastic/fabric cask protective cover has no impact on the structural analysis due to its minimal weight.

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Shielding Evaluation: The use of the flexible plastic/fabric cask protective cover has no impact on the shielding analysis.

Thermal Evaluation: The use of the flexible plastic/fabric cask protective cover has no impact on the thermal analysis since it is only used in the pool. During this time the DSC/cask annulus is filled with water and this defines the DSC shell temperature.

Criticality Evaluation: The use of a protective cover with the OS197L cask will not adversely impact the criticality analyses performed for the OS197 cask. The changes are in an area of relatively insignificant importance to criticality which does not involve any change in the fuel geometry, poison loading, or borated water concentration.

Mechanical Evaluation: The use of a protective cover with the OS197L cask will not adversely impact the mechanical interfaces. The cover will be used only in the fuel pool, and thus will have no interface with the trailer or HSM. The cover may be installed in the decontamination area, but only for a cask with no fuel assemblies. It is anticipated that the cover will have a thickness less than 1/16" and will be compatible with fuel pool chemistry.

Change 3 Evaluation:

The interim cask cover is bolted to the cask with 16 bolts and sees minimal stresses due to the hydraulic pressure of the cask/DSC annulus water. The stress levels for a conservative 3 psi annulus hydraulic head are 6 ksi, well below the yield value. The interim cover is designed with lifting points that meet ANSI N14.6.

The effect on personnel doses will be minimal since the timeframe for use of this cover is short and significant shielding is provided at the top of the canisters.

The use of this cover will not impact the criticality analysis and will provide a slight improvement in thermal performance (heat rejection from the DSC).

Change 4 Evaluation:

Structural Evaluation: The structural analysis performed for the OS197L TC determined that for the upper trunnion the maximum stress ratio is 0.74 and therefore the trunnion configuration has significant margin with respect to ASME/ANSI N14.6 code allowables, and meets the N14.6 requirements for 6/10 on yield/ultimate stress. The upper trunnions are load tested during fabrication, just as the multiple piece trunnions have been tested. The lower trunnions have a maximum stress ratio of 0.16 to ASME Code allowables. The trunnion-to-shell weldment will be a multiple-pass weld, using multiple-level PT, the same as for the multiple piece trunnion.

Shielding Evaluation: The shielding analysis performed for the OS197L TC compared the effect of the solid steel trunnion design to the original trunnion design (multiple pieces) which used NS-3 neutron absorber to reduce neutron dose. The result of this analysis indicates that this change does result in an increase in neutron dose; however, since the majority of the dose contribution is gamma; the overall dose is reduced by more than a factor of 10 in the solid steel trunnion configuration, thus providing a positive impact on occupational dose rates.

Thermal Evaluation: The use of a solid trunnion has minimal impact on the thermal analysis since the transfer of heat through the small cross sectional area of the trunnions is a small fraction of the total heat transfer area. The use of a solid trunnion will enhance heat transfer through the trunnion with respect to that of an NS-3 filled trunnion because the thermal conductivity of steel is higher than NS-3.

Criticality Evaluation: The trunnion modification will have a negligible impact on the criticality analysis as they are outside the cask OD and cover only a small percentage of the cask OD surface.

Mechanical Evaluation: The solid one piece trunnion does not adversely impact the mechanical interface of the cask with other NUHOMS® and plant structures. The interfacing trunnion dimensions of the trunnion shelf diameter and width are unchanged from the OS197. As a result there is no change to the landing of the trunnions on the transfer trailer, or the upending/downending operations. The material of the trunnions, an austenitic stainless steel, is compatible with all the interfacing equipment, yoke, and trailer trunnion towers.

Alignment of the cask to the HSM will still utilize cask targets affixed to the trunnions, the same as for the OS197.

***LR 721004-338 Rev. 1* – (incorporated into UFSAR Revision 10)**

Change Description

This LR addresses the addition of the HSM Model 202 into the UFSAR as an alternative to the existing Standardized HSM Model 80 and Model 102 described in the UFSAR. The HSM Model 202 is qualified to store the 24P, 52B, 61BT, 24PT2, 32PT, 24PHB, and 24PTH-S-LC DSCs, which are currently licensed under CoC 1004. These DSCs store spent fuel with a maximum heat load of 24.0 kW.

The geometry and configuration of the HSM Model 202 is based on the HSM-H, which is currently qualified to store only 24PTH DSCs. The HSM Model 202 offers greater biological shielding and heat rejection capabilities compared to Models 80 and 102.

The significant changes made to the HSM Model 80 and 102 to generate the Model 202 HSM are a general increase in overall height of the module to minimize air flow resistance, selected differences in the wall and roof thicknesses, elimination of the gap between adjacent modules, and a change in the vent, heat shield, and DSC support structure configuration to facilitate decay heat removal.

The HSM Model 202 can store both PWR and BWR Dry Shielded Canisters (DSCs) of varying lengths. The varying lengths of the DSCs are accommodated through the use of rail spacers. Similar to the design basis, function, and operation of the HSM Model 80 and Model 102, the Model 202 provides a passive cooling system involving air circulation by natural convection to ensure that peak cladding temperatures during long term storage of spent fuel assemblies remain below acceptable limits to assure fuel cladding integrity.

Evaluation

The effect of qualifying the HSM Model 202 for inclusion in the UFSAR for storage of the 24P, 52B, 61BT, 24PT2, 32PT, 24PHB, and 24PTH-S-LC DSCs is summarized below:

Principal Design Criteria: The HSM Model 202 is evaluated to ensure it meets or envelopes the design criteria in the UFSAR for the Standardized HSM Model 80 and Model 102 as described in UFSAR Table 3.2-1. These include the various DSCs that can be stored in the HSM Model 80 and Model 102 together with the overall structural features and the decay heat removal requirements. There is no change in the design criteria.

Structural Evaluation: The HSM Model 202 is based on the HSM-H. Thus, the structural evaluation of the HSM-H is applicable to the HSM Model 202. Additional evaluations reconcile any differences in the design criteria applicable to the HSM Model 202, as described in UFSAR Chapter 3 and evaluated in Chapter 8, and the design criteria applicable to the HSM-H, as described in UFSAR Appendix P.

The reconciliation showed that the only difference in criteria is in the applied pressures due to the design basis tornado wind load. Even though the tornado wind speed criteria are the same (maximum wind speed of 360 mph and pressure drop of 3 psi for both Model 202 and HSM-H), the resulting applied pressures are different due to use of conservative pressure coefficients for the Model 202 relative to those used for the HSM-H. The HSM-H pressure coefficients are based on the criteria of ASCE Standard 07-95.

As a result of the reconciliation, the HSM Model 202 is evaluated for the higher tornado-generated wind pressures. These evaluations included stability evaluations and recalculation of stresses due to the higher tornado generated wind pressures.

Thermal Evaluation: A new thermal evaluation was generated to qualify the HSM Model 202 for all applicable normal, off-normal and accident thermal loading conditions for storing the 24P, 52B, 61BT, 24PT2, 32PT, and 24PHB DSCs. The 24PTH-S-LC DSC is qualified separately for storage in the HSM Model 202 since the HSM Model 202 and the HSM-H are similar designs.

This thermal evaluation determined both the HSM (concrete) temperatures and the resulting fuel cladding temperatures for the various DSCs. The calculation showed that the concrete temperatures were less than previous allowables, except for blocked vent conditions ("accident"). Since the "accident" temperatures exceed 177 °C (350 °F), elevated temperature testing of the exact concrete mix (cement type, additives, water-cement ratio, aggregates, proportions) was performed for the HSM Model 202. The use of high temperature concrete testing is explicitly accepted by the NRC, as documented in referenced NRC SER [Reference 1], Section 3.0, Page 3-5. The testing acceptably demonstrated that the level of strength reduction is less than that which was applied (10% in the calculation), and shows that the increased temperatures do not cause deterioration of the concrete.

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The thermal evaluation of the HSM Model 202 and the DSCs to be loaded demonstrated that the DSC shell temperatures for DSCs placed within the HSM Model 202 are bounded by the temperatures used in the previous DSC analysis (HSM Model 80 and Model 102). In turn, fuel cladding temperatures are bounded and remain below allowables.

Shielding Evaluation: The dose rates on the surface and vents of the HSM Model 202 are bounded by the dose rates on the surface and vents of either the HSM Model 80 or Model 102 as specified in the UFSAR, Chapter 7, because the HSM Model 202 provides considerably more shielding than either the HSM Model 80 or Model 102. In particular, the front wall, roof, rear shield wall and end shield wall of the HSM Model 202 are considerably thicker. The vents of the HSM Model 202 have been reconfigured such that the cross-sectional areas of the air inlet and outlet openings, and the interior flow paths are designed to optimize ventilation air flow in the module for decay heat removal. Additionally, an outlet vent cover was added to the HSM Model 202 and the gap between adjacent modules was eliminated in order to improve shielding and minimize radiation streaming.

Criticality Evaluation: The addition of the HSM Model 202 to the UFSAR does not require any criticality reanalysis because the criticality safety analyses performed for the HSM Model 80/102 are not adversely affected by the different configuration of the Model 202. The criticality evaluations presented in the UFSAR for storage of the currently licensed DSCs in the HSM Model 80 and Model 102 demonstrate that the DSCs are maintained in a subcritical configuration and prevent a nuclear criticality accident. Only dry DSCs are placed in the HSM; therefore the criticality safety calculations only model the canister and the transfer cask and do not include the modeling and evaluation of the HSM since it is not warranted (has no significant impact on the results). Consequently, the criticality analyses are not adversely affected by the addition of the Model 202.

Operations/Maintenance Evaluation: The addition of the HSM Model 202 has no adverse impact on the operations/maintenance of the standardized NUHOMS® system. The external interfaces with the HSM Model 202 such as the docking of the transfer cask to the HSM Model 202 are unchanged and still involve the use of a cask restraint system. The Model 202 design allows for transfer cask alignment without changes to the basic steps and their sequence. In particular, the alignment of the transfer cask to targets on the HSM docking ring is unchanged. In addition, the Temperature Monitoring System (TMS) is controlled using the same type and configuration of roof thermowells as the HSM Model 80 and Model 102. Furthermore, there is no adverse impact on the insertion/withdrawal operations of the DSC into/from the HSM Model 202. The Inlet/Outlet vent inspections are unchanged in scope and frequency.

Reference 1: U.S. Nuclear Regulatory Commission, Safety Evaluation Report of the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel, December 1994

***LR 721004-352 Rev. 0* – (incorporated into UFSAR Revision 10)**

Change Description

This LR addresses three design changes to the HSM-H configuration: (1) Provide an option to eliminate the 2" x 1/2" slots on the DSC Support Structure Extension Plate (2) Provide for optional (flat) anodized aluminum side heat shield with (flat) stainless steel side heat shields, which includes connections, and (3) Provide for optional louvered aluminum roof heat shield with flat stainless steel heat shield, which includes connections.

Evaluation

Structural Evaluation: The above changes are made to simplify fabrication and installation of the HSM-H. The changes have been evaluated in a structural analysis and have been shown to meet the structural design criteria for the HSM-H as described in the UFSAR. Therefore, the changes do not affect the structural performance of the HSM-H as described in the UFSAR.

Thermal Evaluation: The primary purpose of the DSC support structure extension plate slots is to provide additional air flow around the DSC. The modified HSM-H configuration of flat stainless steel heat shields and no slots on the DSC support structure extension plate has been evaluated in the revised thermal analysis and has been shown to meet the thermal design criteria for the HSM-H as described in the UFSAR.

Shielding Evaluation: The DSC support structure is not relied on for any shielding. The shielding analysis of the HSM-H includes the side heat shield modeled as flat plate. However, the change from aluminum to stainless was found to have no adverse bearing on the shielding performance of the HSM-H. Therefore, the changes do not affect the shielding performance of the HSM-H as described in the UFSAR.

Criticality and Confinement Evaluation: The changes do not affect the DSC and therefore are not relevant to the criticality analysis. There is no effect on confinement.

Mechanical Evaluation: The changes do not affect the design function of the HSM-H which is to store the DSC and provide environmental protection, shielding and heat decay capability to the DSC during storage. The change does not affect DSC insertion, DSC storage or DSC retrieval operations.

***LR 721004-401 Rev. 0* – (incorporated into UFSAR Revision 10)**

Change Description

This LR addresses qualification of B&W 15x15 BPRAs with a different material composition (Mark-B BPRAs) for storage in the NUHOMS®-24PHB System.

Evaluation

Structural Evaluation: The total weight of the design basis B&W 15x15 BPRAs (30.24 Kg) exceeds that of the Mark-B BPRA (28.17 Kg). Therefore all structural evaluations requiring payload weights remain bounding for the Mark-B BPRAs. Although the maximum calculated internal pressure increases slightly due to the pressure of Mark-B BPRAs (63.7 psig) as compared to B&W 15x15 BPRAs (63.1 psig) it is still well below the design pressure of 68.0 psig. All other structural evaluations remain bounding for the Mark-B BPRAs since the calculated DSC internal pressures are bounded by the associated design pressures for the NUHOMS® 24PHB System.

Thermal Evaluation: All thermal evaluations remain bounding for the Mark-B BPRAs since there is no change in the decay heat.

Shielding Evaluation: Radiological evaluations dominated by the "in-core" region remain bounding for the Mark-B BPRAs since the calculated Co59 masses for the Mark-B BPRA for the fuel zone are bounded by those utilized in the design basis B&W 15x15 BPRAs for the NUHOMS® 24PHB System. The Co59 masses in the plenum and top zones of the Mark-B BPRAs, however, are twice as much as the design basis BPRAs. The design basis evaluations established that all the HSM and ISFSI site dose rates are unaffected by the increase in the top and plenum source terms. Further, it was established that the conservatisms in the wet welding dose calculations are sufficient to offset the effect of the increased plenum and top zone source terms for the Mark-B BPRAs. The dry welding and top end transfer gamma dose rates are expected to increase by up to 7% due to the increase in the top and plenum zone source terms.

The effect of a 7% increase in the axial dose rates during dry welding and transfer operations is an inconsequential increase in the occupational dose rates for the NUHOMS® 24PHB system. This increase is expected to be offset by the decrease in the dose rates in other operations due to the 400% decrease in the source term in the fuel region. All other normal and accident dose rates for the Mark-B BPRAs are bounded by the design basis BPRA dose rates.

All Other Evaluations: All other evaluations (criticality, confinement, operating systems, test and maintenance programs, radiation protection, accident and decommissioning evaluations) remain bounding for the Mark-B BPRAs since potential impacts on these evaluations from the structural, thermal and shielding evaluations are shown to be bounded by the design basis analyses for the NUHOMS® 24PHB System.

***LR 721004-406 Rev. 0* – (incorporated into UFSAR Revision 10)**

Change Description

This 72.48 clarifies the transfer cask external contamination criteria during cask handling operations outside the spent fuel pool for existing NUHOMS® transfer casks. The UFSAR is revised to state that the limits are those imposed by the specific plant Radiation Protection (RP) program.

The reason for this change is to reflect that the ability to perform surface decontamination of the TC may be limited, such as in the case of the OS197L transfer cask, and that the contamination levels during the cask handling operations have no adverse impact on the NUHOMS® system, and are only a plant RP concern. The previous reference to 49 CFR 173.443(d) was intended only as a guideline. Plants may wish to impose either more stringent or more liberal criteria for movement of the TC outside the fuel/auxiliary building to the ISFSI and back.

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Note that the DSC external surface contamination limits of TS 1.2.12 are not altered or changed by this 72.48.

Evaluation

Principal Design Criteria: The principal design criteria for the NUHOMS® TCs are not altered by this change. In particular, there is no reduction in the weight, heat load, or allowable DSC capabilities of any of the NUHOMS® TCs resulting from this change.

Structural Evaluation: There is no change to the TC configuration or TC design loadings resulting from this change. Therefore there is no adverse impact.

Shielding and Criticality Evaluation: The external TC surface contamination levels have no adverse impact on the shielding or criticality disciplines. External surface contamination, of even the most extreme levels, creates no significant dose increase on the cask surface. In any case this would be included in any measurement of dose rates. Any surface contamination has no adverse impact on criticality as it is outside the cask neutron shield.

Thermal Evaluation: The levels of TC surface contamination have no adverse impact on the heat rejection capability of the TC.

LR 721004-410 Rev. 0* – *(incorporated into UFSAR Revision 10)

Change Description

This 72.48 evaluation evaluates the use of solid upper and lower trunnions as an alternate configuration to the multi-piece trunnion design for the OS197 and OS197H onsite transfer casks. This alternate design enhances structural strength of the cask, simplifies fabricability and results in reduced maintenance costs during the life of the cask.

Evaluation

Structural Evaluation: The alternate configuration replaces the multiple piece upper and lower trunnion assembly with a single piece ASME SA-182 FXM-19 forging for the upper trunnion and an F304 forging for the bottom trunnion. The upper trunnions are the cask's interface with the yoke and are welded directly to the cask structural shell. The lower trunnions are the rotation point for downending and are only loaded during transfer operations. In both trunnions, the structural load path is simplified, and there is only one weld (trunnion-to-shell). The critical trunnion sleeve to trunnion weld is eliminated for the solid trunnions.

The material for the one-piece trunnion is a high strength austenitic stainless steel, a P8 material per the ASME Code. This material is very ductile, has excellent weldability, and as it is austenitic has no notch toughness concerns. The ASME Code exempts this material from impact testing. Another benefit is that unlike the previous SA-564, Type 630 precipitation hardened ferritic steel material, the XM-19 material can be weld repaired without PWHT. This allows for surface (cosmetic) repairs of the trunnion bearing surface resulting from scratching of the trunnion by the yoke.

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For the upper trunnion the maximum stress ratio for critical lift is 0.68 and, therefore, the solid trunnion configuration has significant additional margin over the multi-piece trunnion configurations with respect to ASME/ANSI N14.6 code allowables, and meets N14.6 requirements for 6/10 on yield/ultimate stress. The upper trunnions are load tested during fabrication, just as the multiple piece trunnions have been tested. The lower trunnions have a maximum stress ratio of 0.23 to ASME Code allowables. The trunnion to shell weldment is a multi-pass weld, using multi-level PT, the same as for the multiple piece trunnion.

Shielding Evaluation: The shielding analysis evaluated the change in shielding resulting from the deletion of the multi-piece trunnion design and replacement with solid trunnions. The result of this analysis indicates that this change results in an increase in neutron dose; however, since the majority of the dose contribution is gamma, the overall dose is reduced in the solid steel trunnion configuration by a factor greater than 10, thus providing a positive impact on occupational dose rates.

Thermal Evaluation: The use of a solid trunnion has minimal impact on the thermal analysis since the transfer of heat through the small cross sectional area of the trunnions is a small fraction of the total heat transfer area. The use of a solid trunnion will enhance heat transfer through the trunnion with respect to that of an NS-3 filled trunnion because the thermal conductivity of steel is higher than NS-3.

Criticality Evaluation: The trunnion modification will have a negligible impact on the criticality analysis as they are outside the cask OD and cover only a small percentage of the cask OD surface.

Confinement and Mechanical Evaluation: The change does not impact the confinement boundary. The solid one piece trunnion will not adversely impact the mechanical interface of the cask with other NUHOMS® and plant structures. The interfacing trunnion dimensions of the trunnion shelf diameter and width are unchanged. As a result there is no change to the landing of the trunnions on the transfer trailer, or the upending/downending operations. The material of the trunnions, an austenitic stainless steel, is compatible with all the interfacing equipment, yoke, and trailer trunnion towers. There are no changes in loading/unloading procedures.

***LR 721004-445, Rev.0* – (incorporated into UFSAR Revision 10)**

Change Description

This LR addresses the creation of a project-specific configuration drawing for the fabrication and installation of HSM Model 202 for storage of the NUHOMS®-61BT DSC at the Limerick station. It identifies two changes to the HSM-H procurement documents as requiring a 72.48 evaluation: (1) Provision of a new flat, stainless steel configuration for the top heat shield (THS) and side heat shields (SHS) and, (2) The elimination of the need for 2" x 1/2" slots on the DSC Support Structure extension plate.

Evaluation

Structural Evaluation: The geometry, dimensions, properties of concrete, steel components, the embedments and all other components of the HSM model 202 are identical to the

HSM-H. These changes have been evaluated in a structural calculation and have been shown to meet the structural design criteria for the HSM-H as described in the UFSAR.

Thermal Evaluation: The geometry and configuration of the HSM Model 202 is based on the HSM-H. The effects of eliminating the need for slots with the use of the flat stainless steel heat shields in the Model 202 have been evaluated using a methodology which is identical to the methodology used for HSM-H as described in Chapter P.4 of the UFSAR. The thermal calculation concluded that the concrete temperatures for the HSM model 202 loaded with various DSCs are bounded by the values reported in the UFSAR for the normal, off-normal and accident conditions. The thermal analysis also demonstrated that the maximum shell temperatures of the various DSCs (24P, 24PT2S/L, 52B, 61BT, 32PT, 24PHB and 24PTH-S-LC) when stored inside this HSM Model 202 configuration remain bounded by the corresponding values reported in the UFSAR for these same payloads. Therefore, the maximum basket component and fuel cladding temperatures of all the DSCs stored in HSM Model 202 with this modified THS/SHS configuration are also bounded.

Shielding Evaluation: The DSC support structure is not relied upon for any shielding. The shielding analysis of the HSM model 202 does not credit the heat shields for any shielding. The change from aluminum to stainless has no adverse bearing on the shielding performance of the HSM model 202.

Criticality and Confinement Evaluation: The changes do not affect the DSC and, therefore are not relevant to the criticality analysis. There is no effect on confinement.

Mechanical Evaluation: The changes do not affect the design function of the HSM model 202 which is to store the DSC and provide environmental protection, shielding and decay heat removal capability to the DSC during storage. The change does not affect DSC insertion, DSC storage or DSC retrieval operations.

LR 721004-498, Rev.0 – (incorporated into UFSAR Revision 10)

Change Description

This LR addresses the modifications to the HSM door handling fixture for use with a forklift instead of a crane for sites with overhead obstructions that limit crane use. In the UFSAR's current post-canister-insertion sequence, the cask is pulled back using the skid positioning system, the DSC drop-in restraint is installed, the HSM door is installed, and then the trailer is pulled way. The use of a forklift requires modifying these operations to allow pulling the transfer trailer away from the HSM after installing the DSC drop-in restraint, as required for access to install the door.

A similar situation occurs for operations to remove the DSC from the HSM.

Evaluation

The modification in operations described above results in the HSM providing reduced shielding and tornado missile protection for the DSCs bottom end for a short period immediately after DSC insertion and immediately before DSC removal. The time from

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pulling the trailer away to driving the forklift with the door up to the HSM is expected to be less than five minutes.

The installation or removal of the drop-in DSC restraint is unchanged, that is, it still occurs with the trailer backed close to the HSM. Therefore, there is no effect on the seismic protection for the DSC, as described in UFSAR Section 8.2.3.2.C(iii).

The temporarily reduced shielding is to be addressed by licensee ALARA procedures.

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Enclosure 1 Part 2 - NONCONFORMANCES

***LR 721004-399 Rev. 0* – (no associated UFSAR change)**

Change Description

This 72.48 evaluation addresses the evaluation of potential foreign material that may be present in the fuel assemblies to be stored by OPPD at the Fort Calhoun Station (FCS) in the 32PT-S100 DSCs.

Based on FCS documents RE-AD-0004, "Fuel Characterization of Spent Fuel For Dry Storage," and RE-AD-0005, "Fuel Selection and DSC Planning for Dry Cask Storage," the following bounding foreign materials/quantities are evaluated:

- 0.05 lbs of plastic (Poly Vinyl Chloride – PVC) per DSC,
- 0.025 lbs of duct tape, per DSC,
- 0.025 lbs of plastic string and wrap material, per DSC and
- 0.10 lbs of either stainless steel or carbon steel, or a mix per DSC.

This 72.48 addressed only the 4 DSCs to be loaded at FCS under an NRC-issued exemption with a maximum decay heat of 11.0 kW.

Evaluation

Structural Evaluation: There are two primary structural concerns with regard to the introduction of a small amount of foreign material. 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.

Corrosion rates for stainless steel were researched and a uniform corrosion rate of 0.001 mm/year, or 0.0004 inch/year for 18 Cr, 8 Ni stainless steel in an industrial atmosphere was determined. The nominal 32PT DSC shell is 0.500" thick. A conservatively assumed rate of 0.0004 inch/year, which assumes a gaseous environment with O_2 and other corrosive gases, would still require over 125 years to reduce the nominal thickness 10%, a value that would still not significantly degrade the pressure boundary. Again it should be noted that the DSC internal atmosphere is not industrial air, but dry helium. The second concern is the effect of the foreign material on the FA's. The effect of the foreign material on corrosion of the fuel cladding is estimated for a very conservative case of liquid hydrochloric acid on zirconium, which reported a corrosion rate of < 0.001 inch/year. The nominal cladding thickness for FCS FA's is 0.028" and full thickness corrosion would require more than 30 years. It again should be noted that the DSC internal atmosphere is not liquid hydrochloric acid, but dry helium. Thus 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.

Given that this material was placed within the DSC, three scenarios are possible for the plastic, tape and nylon materials:

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1. The plastic, tape and nylon material did 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 plastic, tape and nylon material decomposed/melted during VD operations, but did not vaporize. It thus remains as a solid reconfigured piece of material.
3. The plastic, tape and nylon material melted and vaporized during VD operations and all that remains is residue. This is the most likely scenario.

In all three cases, if this material is in contact with the pressure boundary, other DSC components or the fuel assemblies (304 stainless steel, aluminum or zirconium) there is no concern for degradation due to corrosion, given the dry inert atmosphere.

In all three cases, if this material were in contact with the FA, specifically the cladding, the worst case result would be localized cladding corrosion. Given the amount of foreign material (< 0.2 lbs) and the inert dry helium atmosphere, cladding breach would not occur.

To quantify the assessment of the material/residue, an estimate of the concentration of chlorides and fluorides that would be present in the DSC is made, assuming total dissolution of the PVC material, which is found to contain Chlorides and/or Fluorides, into the DSC cavity water. The percentage of chlorides in a reflooded DSC is conservatively estimated to be 4 ppm. Exposure of DSC components to this small chloride concentration for the short period of time associated with reflood, subsequent to which the fuel would be dried or stored in a large water volume spent fuel pool (thus further diluting the chloride content), would have no adverse effect on the DSC or fuel cladding.

There is no adverse impact on canister internal pressure, as the internal pressure, even considering the added gas volume (conservatively calculated), is less than the design limit, and the reduction in allowable heat load will further reduce this pressure. The net effect is a pressure reduction of 1.14 x 0.74 < 0.90 of the calculated values.

Mechanical Evaluation: The weight of the foreign material is less than 0.2 lb. This will not change the DSC CG location or exceed any weight limits. The material is of a small enough volume that no problems are anticipated in successfully vacuum drying. Prior to leaving the Auxiliary 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.

Thermal Evaluation: The limiting source term is unchanged. The NRC-issued exemption limits the DSC heat loads to 11 kW. There are no changes to the acceptance criteria for these fuel types. As noted in the Structural Evaluation discussion, the reduced heat load results in reduced internal pressurization even after considering the added gas generation due to vaporization of the debris.

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Shielding Evaluation: 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.

Criticality Evaluation: 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 the cladding will not be breached and there will be no dispersal or reconfiguration of pellet material. The fuel assembly will not become "damaged." Thus there is no adverse impact on criticality.

Confinement Evaluation: 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.

LR 721004-440 Rev. 0 - (no associated UFSAR change)

Change Description

This LR addresses the "use-as-is" disposition of a nonconforming Inner Top Cover Plate bevel for one DSC (DSC-32PT-11). This specific Inner Top Cover plate exhibited a slight (.007" maximum) local undersized bevel condition (two adjacent measurement locations each representing 5° (or about 3") of circumference).

Evaluation

The condition affects in-process dimensions only. The nonconformance is limited to locally undersized Inner Top Cover Plate bevels. The bevels form the weld prep for the closure weld. The licensing commitment is for the Inner Top Cover to Shell closure weld to be a 3/16" multi-layer groove weld. There are no licensing commitments or design intents regarding bevel size. Bevel size is relevant only in its potential effect on the size of the completed closure weld.

Per the calculation covering the dry shielded canister shell assembly structural analysis, the maximum stress intensity ratio (highest modeled stress intensity divided by the maximum allowable stress intensity) for all modeled conditions is .84. If the analysis were to be re-performed assuming the worst case condition existed around the entire circumference, it can be concluded that a maximum stress intensity ratio of .87 would result. The margin of acceptability would be .15% as opposed to .19%, as originally modeled (again, assuming the worst case condition existed around the entire circumference).

Also, there is no reason to suspect the actual weld size in the two locations is less than 3/16". So long as the closure welds were made by skilled craftsmen following recommended practices, penetration beyond the bottom of the groove well in excess of the .007" needed to achieve a 3/16" closure weld is to be expected.

Therefore, there is no effect on the structural integrity of the unit or on the structural and confinement design functions.

LR 721004-446 Rev. 0 - ***(as a result of the evaluation of this nonconformance, a design change was made to drawing NUH-03-8002-SAR, which was incorporated into UFSAR Revision 10)***

Change Description

During annual inspection of transfer cask OS197-2 conducted by PP&L on 7/19/2006 to support engineering trending of scratches and other damage incurred during transfer operations, a new scratch exceeding minimum wall thickness was discovered. The inspection concluded that a total of 9 scratches were unchanged from previous surveys with 3 new scratches identified. Two of the new scratches meet the minimum wall thickness of 0.38", while the third scratch is ¾" in length, approximately 0.10" wide with a resulting liner thickness of 0.365". This is 0.015" below the allowable minimum wall thickness shown in Note 3 on UFSAR drawing NUH-03-8002-SAR, Rev. 7.

Evaluation

This 72.48 evaluation addresses the reduction in the inner liner thickness resulting from the scratch. Analysis results demonstrate that the scratch does not adversely affect the system design and all eight 72.48 evaluation criteria are met. In addition, the thermal and radiological characteristics of the fuel and the mechanical performance of the onsite transfer cask system remain unchanged. A discussion of design functions follows:

Structural Evaluation: The inner liner has been evaluated and documented in calculation NUH-06-200, Rev. 5, Appendix B for a min. wall thickness of 0.349" which is less than the min. wall at the scratch of 0.365". The NCR does not affect the structural performance of OS197-2 as described in the UFSAR.

Thermal Evaluation: There is no change to the method of analysis or the analytical results caused by accepting the minor scratch at the top end of OS197-2. Therefore, the change has no adverse affect on OS197-2 thermal analysis results for normal, off-normal operating, or accident conditions presented in the UFSAR.

Shielding Evaluation: The NCR does not affect the shielding performance of OS197-2, as described in the UFSAR. The insignificant loss of material from the scratch will have an undetectable change in the total measured cask dose.

Criticality Evaluation: The NCR does not affect the DSC and, therefore, is not relevant to the criticality analysis.

Mechanical Evaluation: The NCR does not affect the design function of OS197-2 since the minimum wall thickness at the scratch exceeds the minimum value already evaluated in the calculations. The NCR does not affect handling of OS197-2 for fuel loading, DSC transfer to the ISFSI, DSC insertion, DSC storage or DSC retrieval operations.

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LR 721004-460 Rev. 0 - (no associated UFSAR change)

Change Description

This LR addresses the "use-as-is" disposition of five new scratches discovered on the liner of OS197-3 during loading operations. Four of these scratches are small in depth and do not violate the liner minimum wall thickness of 0.45" required by TN design documents. The fifth scratch is 1" long in the axial direction, 1" wide and 0.12" deep at an azimuth of approximately 120°. This gouge is partially in the tapered transition of the liner-to-top-forging weld and partially in the actual liner material.

Evaluation

Structural Evaluation: For the 125 ton capacity OS197-3 TC, the minimum measured thickness at the scratches (0.339") does not meet the UFSAR drawing requirement of 0.440". The gouge meets the calculated minimum wall thickness (0.249" required vs. 0.339" measured) for the normal and off-normal loads without any allowance for local stresses as permitted by NC-3217(c). For Service Level D calculated stress intensities associated with the postulated drop accident loads the ASME Code only requires evaluation of the primary and primary plus bending stresses. The stresses associated with the gouge in the lip are classified as secondary, or Q stresses and do not require evaluation. Therefore, the gouge will have no affect on the structural strength of the inner liner and may be accepted without needing a repair.

Thermal Evaluation: There is no change to the thermal analysis results reported in the UFSAR as a result of this gouge at the top end of OS197-3.

Shielding Evaluation: The NCR does not affect the shielding performance of OS197-3, as described in the UFSAR. The insignificant loss of material from the gouge will have an undetectable change in the total measured cask dose.

Criticality Evaluation: The NCR does not affect the DSC and, therefore, is not relevant to the criticality analysis.

Mechanical Evaluation: The NCR does not affect the design function of OS197-3 since the minimum wall thickness at the gouge is adequate to support the structural requirements of the shell. The NCR does not affect handling of OS197-3 for fuel loading, DSC transfer to the ISFSI, DSC insertion, DSC storage or DSC retrieval operations.

LR 721004-593 Rev. 0 - (no associated UFSAR change)

Change Description

This LR addresses the use of a commercial grade Helicoil in place of a Category B Helicoil (Note: this is applicable to the OS197 and OS197 FC cask configurations).

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Evaluation

Use of a commercial grade Helicoil in place of a Category B Helicoil is evaluated as if the Helicoil and cask bolt were missing. Removing 1 out of 16 cask closure bolts increases the stresses on the remaining 15 bolts during normal, off-normal and accident conditions.

The existing structural analysis of the transfer cask evaluates the corner drop as the critical bolt case. This analysis determines that the calculated load per bolt is 66,400 lbs which is 40% of the 166,000 lb capacity of each bolt. The loss of a single bolt would result in an increase in the load per bolt from 66,400 to (66,400 x 16/15) = 70,800 lbs/ bolt resulting in a margin of (1 – 70,800/166,000) = 0.57. This large margin ensures that the remaining cask lid bolts continue to serve their design function for all postulated load cases. The maximum tensile stress in the bolt for this configuration would increase from 35 ksi to less than 38 ksi (bolt area is 1.898 in^2). The allowable tensile stress in the bolts is the lesser of 0.7 S_u or 1.0 S_y, which is 87.5 ksi. Therefore, the remaining 15 closure bolts remain adequate to withstand the controlling drop loads with more than a factor of two margin.