SAFETY EVALUATION REPORT

Docket No. 71-9255
Model No. NUHOMS®-MP187 Transportation Package
Certificate of Compliance No. 9255
Revision No. 7

TABLE OF CONTENTS

SAFETY EVALUATION REPORT

Docket No. 71-9255
Model No. NUHOMS®-MP187 Transportation Package
Certificate of Compliance No. 9255
Revision No. 7

SUMMARY

By application dated October 3, 2001, as supplemented on November 29, 2001, and April 16, 2002, Transnuclear, Inc., requested a revision of Certificate of Compliance (CoC) No. 9255, to provide alternate design options for various NUHOMS®-MP187 Cask components, pertaining mainly to the Dry Shielded Canister (DSC) components. Most of the proposed changes were initiated to improve fabrication of the DSCs. The most significant proposed change is the addition of an alternate basket material for the failed fuel DSC. The staff used NUREG-1617 "Standard Review Plan for Transportation Packages for Spent Nuclear Fuel" to conduct its review. The submission was primarily reviewed to ensure that the changes requested for approval did not adversely affect any findings and conclusions previously reached by the staff. This amendment satisfies 10 CFR Part 71 and is therefore approved.

References

Transnuclear West Inc., application dated October 3, 2001.

Transnuclear, Inc., supplement dated November 29, 2001.

Transnuclear, Inc., response to NRC Request for Additional Information dated April 16, 2002.

1.0 GENERAL INFORMATION

1.1 Design

The NUHOMS®-MP187 Packaging was developed by Transuclear West Inc., to provide a means of transporting DSCs with fuel off-site directly from the spent fuel pool, from storage in NUHOMS® storage modules, or from the metal cask storage mode. The cask portion of the packaging functions as a transfer cask for moving DSCs with fuel from the pool to NUHOMS® storage modules and for retrieving DSCs from the modules. The NUHOMS®-MP187 Packaging is composed of the Cask, one of four types of DSCs, and the impact limiters.

The purpose of the cask is to provide containment and shielding of the radioactive materials contained within the DSC during shipment. The cask is composed of an inner shell assembly which is part of the containment boundary, an outer structural shell which acts as an environmental barrier, lead gamma shielding between the inner and outer shells, neutron shielding outside the structural shell, and a stainless steel jacket around the neutron shielding material.

Containment is provided by a stainless steel closure lid bolted to the stainless steel cask. The containment system of the NUHOMS®-MP187 transportation cask consists of (1) the inner shell, (2) the bottom end closure plate, (3) the top closure plate, (4) the top closure inner O-ring seal, (5) the ram closure plate, (6) the ram closure inner O-ring seal, (7) the vent port screw, (8) the vent port O-ring seal, (9) the drain port screw, and (10) the drain port O-ring seal. No credit was given to the DSC as a containment boundary in the transportation safety analysis.

Shielding is provided by 4-inches of stainless steel, 4 inches of lead, and approximately 4.3 inches of neutron shielding. The overall length of the cask is approximately 200 inches; the outer diameter is approximately 93 inches. The maximum gross weight of the package, with impact limiters, is approximately 282,000 lbs. The total length of the package with the impact limiters attached is approximately 308 inches. Four removable trunnions (two upper and two lower) are provided for handling and lifting.

The purpose of the DSC, which is placed within the transport cask, is to permit the transfer of spent fuel assemblies, into or out of a storage module, a dry transfer facility, or a pool as a unit. The DSC also provides additional axial biological shielding during handling and transport. The DSC consists of a stainless steel shell and a basket assembly. The DSC basket assembly provides criticality control and contains a storage position for each fuel assembly. The basket is composed of circular spacer discs machined from thick carbon steel plates. Axial support for the DSC basket is provided by four high strength steel support rod assemblies. Carbon steel components of each DSC basket assembly are electrolytically coated with a thin layer of nickel to inhibit corrosion.

Because of the nature of the fuel that is to be transported, four different types of DSCs are designed for the package; the Fuel Only (FO)-DSC, the Fuel/Control Components (FC)-DSC, the Failed Fuel (FF)-DSC and the 24PT1-DSC. For the FO/FC/24PT1 DSCs, the basket assembly consists of 26 carbon steel spacer discs with 24 openings each, supported by 4 high strength stainless steel support rods.

The Fuel-Only Dry Shielded Canister (FO-DSC) is designed to contain up to 24 intact pressurized water reactor (PWR) spent fuel assemblies. The Fuel/Control Components Dry Shielded Canister (FC-DSC) is designed to contain 24 intact PWR spent fuel assemblies with B&W control components installed. The FC basket is similar to the FO-DSC except that the support rod assemblies and guide sleeves are approximately 6-inches longer. The Failed Fuel Dry Shielded Canister (FF-DSC) is designed to hold 13 PWR damaged fuel assemblies (without control components), each contained within a Failed Fuel Can. The 24PT1 DSC is designed to contain 24 intact pressurized water reactor (PWR) WE 14x14 fuel assemblies with or without rod cluster control assemblies (RCCAs), neutron source assemblies (NSAs), or thimble plug assemblies (TPAs). Westinghouse 14x14 fuel assemblies mixed oxide fuel may also be stored with or without inserts. The 24PT1-DSC is also designed to store up to 20 intact and 4 damaged fuel assemblies in failed fuel cans. In addition, two slots in the 24PT1-DSC may be filled with stainless steel model assemblies which do not contain fuel. The FO/FC/FF/24PT1 DSCs have been previously reviewed and approved by staff.

Polyurethane foam and aluminum honeycomb filled energy absorbers (impact limiters) are attached to each end of the cask to limit the consequences of normal, hypothetical accident, and design conditions specified by 10 CFR Part 71. The impact limiter shells are fabricated from stainless steel. Within that shell are closed-cell polyurethane foam and aluminum honeycomb material. The impact limiter is attached to the cask by carbon steel impact limiter attachment bolts. Each impact limiter is bolted to the cask body through the neutron shield top and bottom support rings.

1.2 Proposed Changes

By letter dated October 3, 2001, Transnuclear West Inc., submitted an application for amendment of the NUHOMS®-MP187 Multi-Purpose Cask, 10 CFR Part 71, Certificate of Compliance No. 9255, amendment 7. The proposed changes includes the following:

1) Section 5a(2), Failed Fuel Dry Shielded Canister (FF-DSC) revised to indicate that the FF-DSC basket may be fabricated from austenitic stainless steel as an alternate option,

2) Section 5a(3) Drawings revised to reference the new revision level of the drawings listed in Attachment D to the October 3, 2001, letter, and

3) Revisions to address other editorial corrections and minor modification changes to the NUHOMS®-MP187 Safety Analysis Report (SAR), Revision 13.

By letter dated November 29, 2001, Transnuclear, Inc., submitted a Supplement to the amendment. This Supplement requested that Certificate of Compliance No. 9255 be amended to include the following:

1) Elimination of hydrogen monitoring for the NUHOMS®-MP187 design that uses carbon steel plated with electroless nickel,

2) Suggested changes to NUHOMS® Certificate of Compliance 71-9255, Revision 6 (Draft),

3) Section 5a(3) drawings revised to reference the new revision level of the drawings listed in Attachment D to the November 29, 2001, letter, and

4) Revisions to address other editorial corrections and minor modification changes to the NUHOMS®-MP187 SAR, Revision 13.

2.0 STRUCTURAL

The objective of this review is to verify that the structural performance of the package has been adequately evaluated for the tests specified under normal conditions of transport and hypothetical accident conditions and that the package design has adequate structural integrity to meet the requirement of 10 CFR Part 71.

2.1 Description of Structural Changes

The basket assembly of the FF-DSC consists of 15 carbon steel or austenitic stainless steel (SA-240, Type XM-19) spacer discs, four carbon steel or austenitic stainless steel (SA-240, Type XM-19) support plates, and 13 stainless steel failed fuel cans. The spacer discs maintain the cross-sectional spacing of the fuel assemblies and provide lateral support for the fuel assemblies and failed fuel cans. The support plates provide the same function as the support rods in the FO-DSC and FC-DSC designs. The FF-DSC spacer discs are two inches thick (FC/FO spacer discs are 1.25 inches thick), and has longitudinal pitch of 11.25 inches in the interior spans (FC/FO longitudinal pitch is 6.75 inches).

The FF-DSC support plates and spacer discs are fabricated from two-inch thick ASME SA-537, Class 2 or SA-543, Class B, Type 1 carbon steel, or from two-inch thick (spacer discs) and four-inch thick (support plates) SA-240, Type XM-19 austenitic stainless steel plate material. In order to demonstrate compliance with the brittle fracture criteria specified in NUREG/CR-1815, Notes 4 and 19 of Drawing NUH-05-4005 require the spacer disc and support plate materials to be tested to meet the above brittle fracture criteria (not applicable to XM-19 material).

In the structural analysis, the applicant:

1) considered the structural impact on spacer discs, the support plates, fuel cans etc., due to top spacer disc relocation;
2) analyzed and presented options for the welds of the spacer disc to the support plates;
3) provided detailed analyses and calculations of FF-DSC anti-rotation key to prevent rotation of the basket assembly within the DSC; and
4) performed 75g end drop stress analyses for the support plates, etc..

The FF-DSC basket design was shown to have acceptable margins of safety under normal conditions of transport and hypothetical accident conditions.

Minor modifications and corrections to the drawings to improve fit or fabricability of the components, and other changes including the revision level update and editorial and inconsistency corrections, were reviewed and found to be insignificant to the structural integrity of the package.

2.2 Evaluation Findings

The staff reviewed the proposed package design changes and concludes that the requirements of 10 CFR Part 71 remain satisfied.

3.0 THERMAL

The objective of this review is to verify that the proposed changes to the NUHOMS®-MP187 packaging satisfy the thermal acceptance criteria and requirements of 10 CFR Part 71 under normal conditions of transport and hypothetical accident conditions.

The applicant defined a lower thermal conductivity for the SA-240, Type XM-19 austenitic stainless steel. The applicant, using the HEATING thermal analysis code, recalculated the

bounding spacer disk radial temperature distribution. The applicant used a lower decay heat load because the FF-DSC is designed to transport only 13 damaged fuel assemblies verses the 24 intact fuel assemblies in the FO/FC-DSC's. The loaded FF-DSC has a decay heat load of 9.93kW (13.5kW for the FO/FC-DSC). Given the lower thermal conductivity of the Type XM-19 austenitic stainless steel and the lower decay heat load the applicant calculated a maximum temperature increase in the spacer disk of less than 100°F and a maximum temperature of 464°F. This increased temperature, however, remains well below the bounding maximum temperature calculated for the FO/FC-DSC's.

The temperature is well below the previously accepted maximum calculated temperature and is therefore acceptable. The original analyses remain bounding and the previous findings and conclusions of the staff, therefore, stand. The staff determined that proposed changes listed in Section 1.2 of this Safety Evaluation Report (SER) will not impact the thermal performance of the NUHOMS®-MP187 packaging.

4.0 CONTAINMENT

The objective of this review is to verify that the proposed changes to the NUHOMS®-MP187 packaging satisfy the containment requirements of 10 CFR Part 71 under normal conditions of transport and hypothetical accident conditions.

The staff determined that the containment evaluation is not impacted by the proposed changes listed in Section 1.2 of this SER. Therefore the original analyses remain bounding and the previous findings and conclusions of the staff stand.

5.0 SHIELDING

The objective of this review is to verify that the proposed changes to the NUHOMS®-MP187 packaging satisfy the external radiation requirements of 10 CFR Part 71 under normal conditions of transport and hypothetical accident conditions.

The staff determined that the shielding evaluation is not impacted by the proposed changes listed in Section 1.2 of this SER. Therefore the original analyses remain bounding and the previous findings and conclusions of the staff stand.

6.0 CRITICALITY

The objective of this review is to verify that the proposed changes to the NUHOMS®-MP187 packaging satisfy the criticality safety requirements of 10 CFR Part 71 under normal conditions of transport and hypothetical accident conditions.

The staff determined that the criticality evaluation is not impacted by the proposed changes listed in Section 1.2 of this SER. Therefore the original analyses demonstrating that the fuel assembly payloads previously approved will remain subcritical such that the k_{eff}, including bias and uncertainty, is less than 0.95, and that the previous findings and conclusions of the staff stand.

7.0 OPERATING PROCEDURES

The objective of this review is to verify that the proposed changes to the NUHOMS®-MP187 packaging satisfy the operating procedures requirements of 10 CFR Part 71 and that the package will be operated in a manner consistent with the conditions assumed in the evaluation for approval.

7.1 Proposed Changes

The applicant requested to eliminate hydrogen monitoring for the NUHOMS®-MP187 design that uses carbon steel plated with electroless nickel. The applicant provided a support letter from Sacramento Municipal Utility District (SMUD) dated October 18, 2001. The letter presented monitoring data recorded for the first canister showing the maximum hydrogen concentration results during inner cover plate welding operations at Rancho Seco. The data was monitored at five-minute intervals (from 16:40 to 19:45, April 11, 2000) and showed consistent results of 1.0 Lower Explosive Limit (LEL). The LEL maximum is 60.0.

Two additional SMUD Office Memos, dated 7/12/01 and 9/05/01 from Michael Hieronimus, Operations Superintendent to Jim Fields, Manager of Dry Fuel Storage respectively, provided monitoring data for canister #2 and #3 tack weld and root passes, which are consistently lower than 1.0 LEL.

7.2 Evaluation Findings

Based on the presented data, i.e., LEL levels below 1.0, the staff agrees that the hydrogen monitoring for the NUHOMS®-MP187 that uses carbon steel plated with electroless nickel is not necessary, and concludes that it may be eliminated.

8.0 ACCEPTANCE TESTS AND MAINTENANCE PROGRAM

The objective of this review is to verify that the proposed changes to the NUHOMS®-MP187 packaging satisfy the acceptance test requirements of 10 CFR Part 71 and that a maintenance program will ensure acceptable packaging performance throughout it's service life.

The staff has reviewed the identification of the codes, standards, and provisions of the QA program, as noted in the revised documentation submitted by the applicant, applicable to testing and maintenance of the packaging and found reasonable assurance that the requirements specified in 10 CFR 71.31(c), 10 CFR 71.37 (b), 10 CFR 71.87(b), and 10 CFR 71.87(g) will be met.

CONCLUSION

The staff concludes that the requested changes will not affect the ability of the package to meet the requirements of 10 CFR Part 71. Pursuant to 10 CFR Part 71, Certificate of Compliance No. 9255 for the NUHOMS®-MP187 transportation package is revised.

Issued with Certificate of Compliance No. 9255, Revision No. 7,
on July 10, 2002 , 2002.