SAFETY EVALUATION REPORT
TO INCLUDE A NEW FUEL SPECIFICATION

DOCKET NO. 72-1004
STANDARDIZED NUHOMS® HORIZONTAL MODULAR STORAGE SYSTEM
TRANSNUCLEAR WEST, INC.
CERTIFICATE OF COMPLIANCE NO. 1004

1.0 INTRODUCTION

This Safety Evaluation Report (SER) documents the review and evaluation of a request by Transnuclear West, Inc. (TN West) dated February 16, 1996, as supplemented, to revise Certificate of Compliance (CoC) No. 1004 to include a new fuel specification for the Standardized NUHOMS® Horizontal Modular Storage System for irradiated nuclear fuel known as the NUHOMS®-24P and/or NUHOMS®-52B designs. The proposed new fuel specification provides a simplified method for determining acceptable spent fuel to be stored in the NUHOMS®-24P and/or NUHOMS®-52B systems. In the initial application, TN West included the storage of control components in Table 1-1a of Attachment D. Subsequently, TN West withdrew the reference to storage of control components from Table 1-1a. This SER documents the staff's review and evaluation without the inclusion of the storage of control components.

2.0 BACKGROUND

This SER is issued in response to a TN West request for amendment to the Certificate of Compliance 1004 to use a simplified method for determining acceptable spent fuel from both pressurized water reactors (PWRs) and boiling water reactors (BWRs) for dry cask irradiated fuel storage in the standardized NUHOMS® cask design. The amendment request was reviewed in concert with Revision 4A of the NUHOMS® safety analysis report (SAR).

3.0 EVALUATION

The staff evaluated the new fuel specification by reviewing the amendment request and performing confirmatory analyses. The scope of this SER is limited to those areas of the NUHOMS® system which have been changed from the version currently certified and documented in the NUHOMS® SAR.

The staff reviewed the TN West analyses and determined that the NUHOMS® storage system remains below all regulatory limits with the new fuel specification. Criticality safety has not been affected by the revised fuel specification because the maximum fuel enrichment and fuel

designs have not changed from the previously approved NUHOMS® system. The staff's review concludes that the information presented in this request satisfies the requirements for the general description as described in Title 10, Code of Federal Regulations, Part 72 (10 CFR Part 72), NRC Regulatory Guide 3.61, and acceptable dry cask storage safety analysis methodology presented in NUREG-1536. However, the staff does not accept the inclusion of burnups above 45,000 MWD/MTU due to inadequate supporting data, analyses, or justifications.

3.1 Design Criteria

The general design criteria for a dry cask storage system must adequately (1) define the spent fuel specifications; (2) classify the structures, systems and components important to safety; and (3) ensure that the dry cask storage system complies with the relevant design criteria of 10 CFR Part 72. The staff's review concludes that this amendment request complies with the design criteria requirements and provides adequate assurance that spent fuel will be characterized and stored in compliance with the requirements of 10 CFR Part 72.

3.2 Structural

The structural analysis for the amendment of the dry shielded canister (DSC) confinement vessel is identical to the original version of the Standardized NUHOMS®-24P and NUHOMS®-52B designs with the exception of the evaluation for the accident pressure condition that may occur because of the higher burnup fuel.

The SAR for the initial CoC used an accident internal pressure of 65 psia (50.3 psig) for the DSC. The proposed new fuel specification calculated the maximum internal pressure of 73.4 psia (58.7 psig). For the purpose of analysis, this value was rounded to 60 psig. This higher pressure was used in a stress analysis of the DSC inside the horizontal storage module (HSM) with all vents blocked and a side drop. The results of the stress analysis were evaluated against the ASME Boiler & Pressure Vessel (B&PV) Code for Service Level D. All stresses were determined to be below the ASME Code allowable stresses for Service Level D. The staff reviewed the TN West calculations and finds the structural analysis to be satisfactory.

3.3 Thermal

The spent fuel cladding long-term storage temperature thermal design criteria has been revised. The currently approved NUHOMS® SAR includes a maximum allowable fuel burnup of up to 40,000 MWD/MTU for PWR fuel and 35,000 MWD/MTU for BWR fuel. This amendment requests a maximum allowable PWR fuel burnup of 50,000 MWD/MTU and a maximum allowable BWR fuel burnup of 45,000 MWD/MTU. However, there is limited data to show that the cladding of spent fuel with burnups greater than 45,000 MWD/MTU will remain undamaged during a 20-year licensed period. The staff's review of the limited information available on higher burnup fuels suggests that the following characteristic changes will occur in the fuel: (1) increased cladding oxidation, (2) increased hoop stresses, and (3) changes to fuel pellet integrity (i.e., increased fuel pellet cracking with burnup). These burnup dependent effects could potentially lead to failure of the cladding that could result in the dispersal of fuel during transportation and handling events. Therefore, the staff only accepts a maximum burnup of 45,000 MWD/MTU for both the PWR and BWR fuels.

Based on the review of TN West's temperature and pressure calculations for normal, off-normal, and accident conditions, all calculated values were found to be within the design basis, except for the accident pressure for the NUHOMS®-24P DSC. The higher pressure was used in the structural evaluation discussed in Section 3.2 above. As stated in Section 3.2, the staff determined that the stress calculations for the structural integrity of the DSC are within acceptable ASME Code design limits.

3.4 Shielding

The proposed fuel specifications will result in higher maximum dose rates for the HSM door, transfer cask (TC) top end, and TC bottom end. These higher dose rates do not affect off-site doses because the associated HSM wall and roof dose rates are lower than the original SAR values. The occupational dose to load each HSM was calculated to increase by approximately 20 percent from 1.00 person-rem to 1.20 person-rem. The NRC staff reviewed the submitted calculations and performed confirmatory calculations and concluded that there is reasonable assurance that individual worker exposures will not exceed the regulatory limit specified in 10 CFR 20.1201.

3.5 Criticality

This SAR section was not changed as a result of the amendment request.

3.6 Confinement

The proposed fuel specifications allow a broader range of spent fuel that, when coupled with the inclusion of additional radioisotopes, increases the radiological consequences of a postulated leakage of a DSC. The calculated maximum whole body dose resulting from a postulated failure of the confinement of one DSC was determined to be 516.4 mrem, which is much less than the regulatory limit of 5,000 mrem as stated in 10 CFR 72.106(b). The staff's review of the proposed new fuel qualifications results in a maximum of a 17 percent increase in the off-site dose (direct and scattered) when compared to the dose rates currently stated in the NUHOMS® SAR. The staff has determined that this increase in off-site dose rate will not exceed the regulatory public dose limit specified in 10 CFR 72.104.

3.7 Operating Procedures

This SAR section was not changed as a result of this amendment.

3.8 Acceptance Tests and Maintenance Program

This SAR section was not changed as a result of this amendment.

3.9 Radiation Protection

In this amendment request, TN West calculated doses to the public that would result from the release of radionuclides in postulated design basis events. In its calculation, TN West assumed a 100 percent failure of the fuel inside the DSC. Using the same 300 meter atmospheric dispersion factor assumed in the NUHOMS® SAR, the staff found that the maximum whole body dose is 516.4 mrem, which is significantly less than the 10 CFR 72.106(b) regulatory limit of

5,000 mrem.

3.10 Accident Analysis

The proposed fuel specification resulted in the reanalysis of two accident scenarios: (1) failure of all pins with subsequent ground level breach of the DSC and (2) DSC pressurization. In the case of the fuel pin failure with DSC confinement breach, the staff's confirmatory analysis resulted in a 300 meter maximum whole body dose of 516.4 mrem, which is well below the regulatory limit in 10 CFR 72.106(b).

The DSC pressurization accident scenario was calculated to result in a peak DSC pressure of 58.7 psig, which exceeds the previous NUHOMS® SAR value of 50 psig. This higher pressure was rounded to 60 psig and used in the structural analysis of the DSC. The structural analysis showed that all calculated stresses were below the ASME B&PV Service Level D allowable values.

3.11 Technical Specifications

The amendment requested that the technical specifications (Attachment A) be changed to incorporate new fuel qualification tables for PWR and BWR fuels. These tables present the minimum required cooling time for fuel as a function of the initial fuel enrichment and fuel burnup. The use of these tables provides a simplified approach for users of the NUHOMS® storage system to select acceptable fuel for storage without calculating specific fuel assembly decay heat and radiation source terms. Staff review of the structural, thermal, criticality, dose, and shielding basis for these tables confirmed that their use ensures that the design basis for the NUHOMS® system is not exceeded. However, the staff does not accept the inclusion of burnups above 45,000 MWD/MTU due to inadequate supporting data, analyses, or justifications.

3.12 Quality Assurance

This SAR section was not changed as a result of this amendment request.

3.13 Decommissioning

This SAR section was not changed as a result of this amendment request.

4.0 EVALUATION FINDINGS

The conditions for use and, by reference, Revision 4A of the NUHOMS® SAR, satisfy the requirements of 10 CFR Part 72. The proposed technical specifications provided reasonable assurance that the cask will allow safe storage of spent fuel.