MP197HB Transport Cask

Criticality Analysis

MP197HB Criticality Analysis

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Safety Analysis Overview

- **Criticality Analysis is based on two types of Analysis Methodologies**
- **Fresh Fuel–The spent fuel assemblies are modeled as fresh fuel (un-irradiated) in the criticality analysis**
- **Burnup Credit–Credit for the negative reactivity due to fuel assembly irradiation (or burnup credit) is employed in the criticality analysis**

DSCs and Methods

DSCs with BWR Fuel Assemblies

DSC	Criticality Analysis Methodology	New Evaluation
▶61BT ▶61BTH	Criticality Analysis for Storage documented in Appendices K.6 (61BT) and T.6 (61BTH) for the Standardized NUHOMS® System (CoC-1004) Amendment 10 utilized the "fresh fuel" methodology and can directly be utilized herein	NO
▶69BTH ▶61BTH (with failed fuel)	Criticality Analysis utilizing the "fresh fuel" model to be performed for the new 69BTH DSC and 61BTH (with failed fuel contents)	YES

DSCs and Methods

DSCs with PWR Fuel Assemblies

DSC	Criticality Analysis Methodology	New Evaluation
24PT4	Criticality Analysis for Storage documented in Appendix A.6 (24PT4) for the Advanced NUHOMS® System (CoC-1029) utilized the "fresh fuel" methodology and can directly be utilized herein	NO

DSCs and Methods

DSCs with PWR Fuel Assemblies

DSC	Criticality Analysis Methodology	New Evaluation
▶32PT ▶24PTH ▶32PTH ▶32PTH1 ▶37PTH	▶Criticality Analysis utilizing burnup credit methodology to be performed	Yes

TRANSNUCLEAR

Computer Codes and Models
(For 69BTH, 61BTH with Failed Fuel DSCs without Burnup Credit)

Parameter / Methodology Description	Implementation in MP197HB Analysis	References Reviewed by the NRC
Computer Code / Cross Section Library for Criticality Analysis	CSAS25 module of SCALE 4.4 with the 44 Group ENDF/B-V Library	Identical to modeling approach described for 61BTH DSC, in Appendix T.6 in Amendment 10 for the Standardized NUHOMS® System (CoC-1004)
Analysis Models	3D model of the DSC, Basket with fuel in Cask	Identical to modeling approach described for 61BTH DSC, in Appendix T.6 in Amendment 10 for the Standardized NUHOMS® System (CoC-1004)

Criticality Analysis–Intact Fuel

(For 69BTH, 61BTH with Failed Fuel DSCs without Burnup Credit)

Parameter / Methodology Description	References Reviewed by the NRC
▶Most reactive fuel design ▶Most reactive geometry / material configuration ▶Initial Enrichment as a function of fixed poison loading	Identical Approach as described for 61BTH DSC, in Appendix T.6 in Amendment 10 for the Standardized NUHOMS® System (CoC-1004)

Criticality Analysis – Damaged/Failed Fuel
(For 69BTH, 61BTH with Failed Fuel DSCs without Burnup Credit)

Parameter / Methodology Description	References Reviewed by the NRC
▶Evaluate the various damaged/failed assembly configurations and determine most reactive damaged/failed configuration ▶Initial Enrichment as a function of poison loading	Identical Approach for damaged fuel as described for 61BTH DSC, in Appendix T.6 in Amendment 10 for the Standardized NUHOMS® System (CoC-1004)
The damaged fuel and failed fuel from a criticality analysis standpoint are identical except that the active fuel portion of the failed fuel is allowed to slide axially–since it is modeled as an array of rods and not as a fuel assembly	

Criticality Benchmarks and USL
(For 69BTH, 61BTH with Failed Fuel DSCs without Burnup Credit)

Parameter / Methodology Description	References Reviewed by the NRC
▶Criticality Benchmarks ▶Upper Subcritical Limit (USL-1) with USLSTATS Code	Identical Experiments (125), Benchmark Parameters and USL-1 methodology utilized in the 61BTH DSC, in Appendix T.6 in Amendment 10 for the Standardized NUHOMS® System (CoC-1004)

MP197HB Burnup Credit Criticality Analysis

- Burnup Credit Methodology Overview
  - Depletion Calculation Methodology
    - Computer codes
    - Benchmarks
    - Models
  - Criticality Calculation Methodology
    - Computer codes
    - Benchmarks
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- Criticality Results
- Criticality Analysis Summary