WCS CISF NRC Pre-Application Meeting

Safety Analysis Report (SAR) Incorporation by Reference

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Presentation Overview

- Introductions
- Topics for Discussion with Staff
  - Regulatory basis for incorporation of previously approved SARs
  - Walk through an Example Draft SAR Chapter referencing previously approved SAR information
  - Discuss what tools WCS can provide to help NRC reviewers review WCS SAR
  - List of sections of the WCS SAR that expect to include information to be incorporated by reference
- Questions

INTRODUCTIONS

Topics for Discussion with Staff

- **Regulatory basis for incorporation of previously approved SARs**

10 CFR 72.18 Elimination of Repetition

- **Regulatory Basis is found in 10 CFR 72.18**
  - **“In any application under this part, the applicant may incorporate by reference information contained in previous applications, statements, or reports filed with the Commission: Provided, That such references are clear and specific.”**

Regulatory Guide 3.48 Addresses "Material Incorporated by Reference"

- **Section 1.5**
  - **Definition of "Topical Reports" covers previously approved NRC SARs**

    ". . . **"topical reports" are defined as reports that have been prepared by** architect-engineers or **other organizations and filed separately with the NRC in support of** this application or **of other applications** or of product lines."
  - **SAR needs to tabulate reference documents**

    "This section should include a tabulation of any documents submitted to the Commission in other applications that are incorporated in whole or in part in this application by reference."
  - **SAR Sections need to point to applicable sections of reference documents**

    "If any information submitted in connection with other applications is incorporated by reference in this SAR, summaries of such information should be included in appropriate sections of this SAR."

Regulatory Guide 3.61

- **Introduction includes:**

  "This regulatory guide provides guidance on the format and content of a topical safety analysis report (TSAR) for a spent fuel storage cask. There is no regulation that requires the submittal of a TSAR for spent fuel storage casks. However, if a TSAR on a specific spent fuel storage cask is evaluated by the NRC staff and accepted for referencing in licensing actions, appropriate sections of the TSAR could be referenced in other submittals. **Applicants for a specific license under Part 72 could reference the appropriate information in their SAR, thus significantly reducing their time, effort, and costs."**

NUREG-1567 Addresses Incorporation by Reference

- **Section 1.5.5 Material Incorporated by Reference**

  "The reviewer should verify that a tabulation of all topical reports incorporated by reference has been provided. The reviewer should verify that any documents submitted to the Commission in other applications and incorporated in whole or in part have been tabulated and a summary included in the appropriate section of the SAR."

Topics for Discussion with Staff

- **Walk through an Example Draft SAR Chapter referencing previously approved SAR information**

Chapter 10 Criticality

- **Site Specific Parameters have no impact on Criticality Analysis**
  - **Proviso: Structural, Thermal and Confinement evaluations demonstrate that for all normal, off-normal and accident conditions for Original Design and Licensing Basis for the Canister are Bounding for WCS site.**
- **Therefore, no new criticality analysis is required to demonstrate criticality safety for the canister designs**
- **All criticality analysis is therefore incorporated by reference to previously approved general and site specific licenses**

Chapter 10 Criticality

10. Criticality Evaluation

Storage and transportation cask systems received at the WCS CISF are designed to ensure that the stored materials remain subcritical under normal, off-normal and accident conditions during all site operations, transfers and storage. This chapter presents criticality safety criteria and summarizes design features which ensure criticality safety at the WCS CISF. The design of the canisters is such that, under all credible conditions, the highest effective neutron multiplication factor (k_{eff}) remains less than 0.95.

Chapter 10 Criticality

10.1 Criticality Design Criteria and Features

This section presents the criticality design criteria for the WCS CISF and summarizes criticality safety design and licensing bases applicable to the authorized storage cask systems.

10.1.1 Criteria

As specified in the Technical Specification [10-1] **only canisters that were loaded and stored in accordance with the listed Site Specific or General Licenses are acceptable for storage at the WCS CISF**. **Criticality safety is demonstrated for all authorized storage systems in the original Site Specific and General License licensing documents**. The criticality safety criterion is satisfied for all systems. Criticality safety evaluations further assume limiting fuel characteristics, which are stipulated in the Technical Specifications associated with the applicable Site Specific or General License.

Chapter 10 Criticality

10.1.2 Features

The storage systems are designed to ensure that the stored materials remain subcritical under normal, off-normal and accident-level conditions during all site operations, transfers and storage. The primary cask criticality control design features are basket geometry and supplemental neutron absorber materials. Neutron reflector effects on cask and/or canister walls are also evaluated in the design and licensing basis calculations of final k_{eff}. Continued reliance on these design features is used following receipt of transportation casks at the WCS CISF, in order to ensure that the stored materials remain subcritical under normal, off-normal and accident-level conditions. These features will also remain functional for subsequent off-site transportation and SNF retrieval operations.

WCS CISF design and operational control features preclude events or conditions which may degrade canister/cask systems, including fuel, basket geometry and neutron absorber materials. The criticality control design feature integrity has been demonstrated for all systems received at the WCS CISF site under all normal, off-normal and accident-level conditions. Therefore, criticality monitoring is not required.

Chapter 10 Criticality

10.1.2 Features (continued)

Package confinement systems are likewise protected from damage. Canister cavity confinement features provide a defense-in-depth criticality control function by precluding the risk that any hydrogenous neutron moderator will be introduced into the SNF basket cavity of any package received for storage. Canister confinement features are summarized in Chapter 11.

Chapter 10 Criticality

10.2 Stored Material Specifications

Spent nuclear fuel characteristics are addressed in the individual canister/cask system criticality safety evaluations which are provided in **Appendices A.10, B.10, C.10, D.10, E.10, F.10 and G.10**, depending on the canister/cask system. Packages received at the CISF are loaded in accordance with SAR and regulatory requirements applicable at the site where the fuel was originally loaded and stored. Objective evidence is provided through records review for each canister prior to transport, verifying that the canister was fabricated, loaded, stored and maintained in accordance with the Site Specific or General License requirements prior to shipment.

Chapter 10 Criticality

10.3 Criticality Assessment

No criticality safety analyses are performed beyond those presented in the applicable SARs for the canisters that are authorized for storage at the WCS CISF by the Technical Specification [10-1] that were loaded and stored in accordance with the listed Site Specific or General Licenses.

Section 10.4 points to the appropriate Appendix for each authorized canister/cask system listed in the Technical Specification [10-1] as acceptable for storage at the WCS CISF. Each Appendix then points to the applicable design/licensing basis criticality analysis bounding the conditions of operations and storage at the WCS CISF.

Chapter 10 Criticality

10.4 Criticality Analysis

Section 2.1 of the Technical Specifications [10-1] lists the canisters authorized for storage at the WCS CISF. The following table provides the cross reference to the applicable appendix and section for each canister/storage overpack where the criticality safety is discussed.

(See Next Slide for Table)

Cross Reference Table from Chapter 10

Cask System	Canister	Overpack	Appendix
NUHOMS® MP187 Cask System	FO-DSC	HSM (Model 80)	**Appendix A.10**
	FC-DSC		
	FF-DSC		
Advanced Standardized NUHOMS® System	NUHOMS® 24PT1	AHSM	Appendix B.10
Standardized NUHOMS® System	NUHOMS® 61BT	HSM Model 102	Appendix C.10
	NUHOMS® 61BTH Type 1		Appendix D.10
NAC-MPC	Yankee Class	VCC	Appendix E.10
	Connecticut Yankee	VCC	
	LACBWR	VCC	
NAC-UMS	Classes 1 through 5	VCC	Appendix F.10
MAGNASTOR	TSC1 through TSC4	CC1 through CC4	Appendix G.10

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Appendix A.10 Criticality
Applies to NUHOMS® MP187 Cask System

- **A.10. Criticality Evaluation**

  The design criteria for the NUHOMS® MP187 Cask System requires that the DSCs be designed to remain subcritical under normal, off-normal, and accident conditions. The design of the DSC is such that, under all credible conditions, the highest effective neutron multiplication factor (k_{eff}) remains less than 0.95 including uncertainties and bias.

Appendix A.10 Criticality

A.10.1 Discussion and Results

The NUHOMS®-MP187 Cask System criticality analysis is documented in **Section 3.3.4 of the "Rancho Seco Independent Spent Fuel Storage Installation Safety Analysis Report" [A.10-1]** and in **Chapter 6 of the "Safety Analysis Report for the NUHOMS®-MP187 Multi-purpose Cask" [A.10-2]**. This **criticality analysis bounds the conditions for transfer and onsite storage at the WCS CISF** because there is no credible event which would result in the flooding of a DSC in HSM storage which would result in k_{eff} exceeding the worst case 10 CFR 71 transportation conditions evaluated in references [A.10-1] and [A.10-2]. Specific information on the criticality safety analysis which bounds the WCS CISF is discussed in this section.

Appendix A.10 Criticality

A.10.1 Discussion and Results (continued)

The FO- and FC-DSCs consist of a shell assembly and an internal basket assembly. The basket assemblies are composed of four axially oriented support rods and twenty-six spacer discs. This basket assembly provides positive location for twenty-four fuel assemblies under normal operating conditions, off-normal operating conditions and accident conditions. The basket assembly uses fixed neutron absorbers that isolate each fuel assembly. Guide sleeves are designed to permit unrestricted flooding and draining of fuel cells. The FC-DSC is designed with a longer internal cavity length to accommodate fuel assemblies with control components. No credit is taken for the presence of control hardware, thus the FC-DSC is identical to the FO-DSC for the purpose of criticality analysis.

Appendix A.10 Criticality

A.10.1 Discussion and Results (continued)

The FF-DSC is different from the FO-DSC in its capacity, function, and design. The FF-DSC's capacity is thirteen fuel assemblies and is intended to package fuel with cladding defects. Fuel assemblies cladding damage is limited to no more than 15 fuel pins with known or suspected cladding damage greater than hairline cracks and pinhole leaks. Missing cladding and/or crack size in the fuel pins is limited such that a fuel pellet is not able to pass through the gap created by the cladding opening during normal handling. Each assembly is placed in a separate, removable can with a fixed mesh screen on the bottom and similarly screened lid on top. These cans have slightly larger interior dimensions than the FO-DSCs (9.00 in. vs. 8.90 in.) to accommodate bowed or twisted fuel. Due to its smaller payload and the relatively massive nature of the FF-DSC cans, the FF-DSC does not require borated neutron absorbers. The fuel cans are designed to permit unrestricted flooding and draining of fuel cells.

Appendix A.10 Criticality

A.10.1 Discussion and Results (continued)

The design basis criticality analysis performed for the NUHOMS®-MP187 Cask System assumes the most reactive configuration of the canister and contents in an infinite array of casks bounding all conditions of receipt transfer and storage at the WCS CISF where the canisters will remain dry under all conditions of transfer and storage including normal, off-normal and accident conditions as demonstrated in Chapter 12 of this SAR.

The results of the evaluations demonstrate that the maximum calculated k_{eff}, including statistical uncertainty and bias, are less than less than 0.95.

Appendix A.10 Criticality

A.10.2 Package Fuel Loading

Section 2.1 of the Technical Specifications [A.10-3] lists the canisters authorized for storage at the WCS CISF. **Section 3.3.4.2 Spent Fuel Loading of reference [A.10-1] provides the Package Fuel Loading.**

A.10.3 Model Specification

Section 3.3.4.3 Model Specification of reference [A.10-1] provides a discussion of the criticality model cask regional densities used to calculate the bounding k_{eff} for the NUHOMS®-MP187 Cask System.

A.10.4 Criticality Calculation

Section 3.3.4.4 Criticality Calculation and 3.3.4.5 Error Contingency Criteria of reference [A.10-1] provides a discussion of the criticality calculations that demonstrate that the maximum calculated k_{eff} for the NUHOMS®-MP187 Cask System is less then 0.95.

Appendix A.10 Criticality

A.10.5 Critical Benchmark Experiments

Section 3.3.4.6 Verification Analysis of reference [A.10-1] provides a discussion of the benchmark experiments and applicability, details of benchmark calculations, and the results of benchmark calculations.

A.10.6 References

A.10-1 “Rancho Seco Independent Spent Fuel Storage Installation Safety Analysis Report,” NRC Docket No. 72-11, Revision 4.

A.10-2 AREVA TN Americas, “Safety Analysis Report for the NUHOMS®-MP187 Multi-purpose Cask, Revision 1, USNRC Docket Number 71-9255.

A.10-3 Proposed SNM-XXXX Appendix A, System Generic Technical Specifications, Amendment 0.

Topics for Discussion with Staff

- **Discuss what tools WCS can provide to help NRC reviewers review WCS SAR**

Consistent with NUREG-1567 and RG 3.48
A Tabulation of Reference SARs Provided

1.6 Material Incorporated by Reference

- **This section provides a tabulation of the safety analysis reports incorporated by reference as part of the WCS SAR**
  - Title of Reference SAR
  - Report Number
  - Revision
  - USNRC Docket Number
  - List of sections of the WCS SAR in which the Reference SAR is referenced
- **Non-Proprietary versions of the reference SARs will also be provided**
  - A list of sections in the WCS SAR in which the Reference SAR is referenced is not required for the non-proprietary versions of the SARs

Topics for Discussion with Staff

- **List of sections of the WCS SAR that expect to include information to be incorporated by reference**

WCS SAR Chapters that Incorporate a "Topical Report"

Chapter	Description	SARs Referenced (Docket Number)
01	INTRODUCTION AND GENERAL DESCRIPTION OF INSTALLATION	Section 1.6 (1.6 Material Incorporated by Reference)
02	SITE CHARACTERISTICS	None Expected
03	PRINCIPAL DESIGN CRITERIA	None Expected
03A	Appendix 3A - Design Criteria for NUHOMS® MP187 System	72-11 71-9255
03B	Appendix 3B - Design Criteria for Advanced Standardized NUHOMS® System	72-1029 72-11 71-9255
03C	Appendix 3C - Design Criteria for Standardized NUHOMS® System 61BT	72-1004 71-9302
03D	Appendix 3D - Design Criteria for Standardized NUHOMS® System 61BTH	72-1004 71-9302
03E	Appendix 3E - Design Criteria for NAC-MPC	72-1025
03F	Appendix 3F - Design Criteria for NAC-UMS	72-1015
03G	Appendix 3G - Design Criteria for NAC-MAGNATOR	72-1031

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WCS SAR Chapters that Incorporate a "Topical Report"

Chapter	Description	SARs Referenced (Docket Number)
04	OPERATING SYSTEMS	None Expected
04A	Appendix 4A - Operating Systems for NUHOMS® MP187 System	72-11
04B	Appendix 4B - Operating Systems for Advanced Standardized NUHOMS® System	72-1029
04C	Appendix 4C - Operating Systems for Standardized NUHOMS® System 61BT	72-1004
04D	Appendix 4D - Operating Systems for Standardized NUHOMS® System 61BTH	72-1004
04E	Appendix 4E - Operating Systems for NAC-MPC	72-1025
04F	Appendix 4F - Operating Systems for NAC-UMS	72-1015
04G	Appendix 4G - Operating Systems for NAC-MAGNASTOR	72-1031
05	OPERATING PROCEDURES	None Expected
05A	Appendix 5A - Operating Procedures for NUHOMS® MP187 System	None Expected
05B	Appendix 5B - Operating Procedures for Advanced Standardized NUHOMS® System	None Expected
05C	Appendix 5C - Operating Procedures for Standardized NUHOMS® System 61BT	None Expected
05D	Appendix 5D - Operating Procedures for Standardized NUHOMS® System 61BTH	None Expected
05E	Appendix 5E - Operating Procedures for NAC-MPC	None Expected
05F	Appendix 5F - Operating Procedures for NAC-UMS	None Expected
05G	Appendix 5G - Operating Procedures for NAC-MAGNASTOR	None Expected

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WCS SAR Chapters that Incorporate a "Topical Report"

Chapter	Description	SARs Referenced (Docket Number)
06	WASTE CONFINEMENT AND MANAGEMENT	None Expected
07	INSTALLATION DESIGN AND STRUCTURAL EVALUATION	None Expected
07A	Appendix 7A - Structural Evaluation for NUHOMS® MP187 System	72-11 71-9255
07B	Appendix 7B - Structural Evaluation for Advanced Standardized NUHOMS® System	72-1029 72-11 71-9255
07C	Appendix 7C - Structural Evaluation for Standardized NUHOMS® System 61BT	72-1004 71-9302
07D	Appendix 7D - Structural Evaluation for Standardized NUHOMS® System 61BTH	72-1004 71-9302
07E	Appendix 7E - Structural Evaluation for NAC-MPC	72-1025
07F	Appendix 7F - Structural Evaluation for NAC-UMS	72-1015
07G	Appendix 7G - Structural Evaluation for NAC-MAGNASTOR	72-1031

WCS SAR Chapters that Incorporate a "Topical Report"

Chapter	Description	SARs Referenced (Docket Number)
08	THERMAL EVALUATION	None Expected
08A	Appendix 8A - Thermal Evaluation for NUHOMS® MP187 System	72-11 71-9255
08B	Appendix 8B - Thermal Evaluation for Advanced Standardized NUHOMS® System	72-1029 72-11 71-9255
08C	Appendix 8C - Thermal Evaluation for Standardized NUHOMS® System 61BT	72-1004 71-9302
08D	Appendix 8D - Thermal Evaluation for Standardized NUHOMS® System 61BTH	72-1004 71-9302
08E	Appendix 8E - Thermal Evaluation for NAC-MPC	72-1025
08F	Appendix 8F - Thermal Evaluation for NAC-UMS	72-1015
08G	Appendix 8G - Thermal Evaluation for NAC-MAGNASTOR	72-1031

WCS SAR Chapters that Incorporate a "Topical Report"

Chapter	Description	SARs Referenced (Docket Number)
09	RADIATION PROTECTION	None Expected
09A	Appendix 9A - Radiation Protection for NUHOMS® MP187 System	72-11 71-9255
09B	Appendix 9B - Radiation Protection for Advanced Standardized NUHOMS® System	72-1029 71-9255
09C	Appendix 9C - Radiation Protection for Standardized NUHOMS® System 61BT	72-1004 71-9302
09D	Appendix 9D - Radiation Protection for Standardized NUHOMS® System 61BTH	72-1004 71-9302
09E	Appendix 9E - Radiation Protection for NAC-MPC	72-1025
09F	Appendix 9F - Radiation Protection for NAC-UMS	72-1015
09G	Appendix 9G - Radiation Protection for NAC-MAGNASTOR	72-1031

WCS SAR Chapters that Incorporate a "Topical Report"

Chapter	Description	SARs Referenced (Docket Number)
10	CRITICALITY EVALUATION	None Expected
10A	Appendix 10A - Criticality Evaluation for NUHOMS® MP187 System	72-11
10B	Appendix 10B - Criticality Evaluation for Advanced Standardized NUHOMS® System	72-1029
10C	Appendix 10C - Criticality Evaluation for Standardized NUHOMS® System 61BT	72-1004
10D	Appendix 10D - Criticality Evaluation for Standardized NUHOMS® System 61BTH	72-1004
10E	Appendix 10E - Criticality Evaluation for NAC-MPC	72-1025
10F	Appendix 10F - Criticality Evaluation for NAC-UMS	72-1015
10G	Appendix 10G - Criticality Evaluation for NAC-MAGNASTOR	72-1031
11	CONFINEMENT EVALUATION	None Expected
11A	Appendix 11A - Confinement Evaluation for NUHOMS® MP187 System	72-11
11B	Appendix 11B - Confinement Evaluation for Advanced Standardized NUHOMS® System	72-1029
11C	Appendix 11C - Confinement Evaluation for Standardized NUHOMS® System 61BT	72-1004
11D	Appendix 11D - Confinement Evaluation for Standardized NUHOMS® System 61BTH	72-1004
11E	Appendix 11E - Confinement Evaluation for NAC-MPC	72-1025
11F	Appendix 11F - Confinement Evaluation for NAC-UMS	72-1015
11G	Appendix 11G - Confinement Evaluation for NAC-MAGNASTOR	72-1031

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WCS SAR Chapters that Incorporate a "Topical Report"

Chapter	Description	SARs Referenced (Docket Number)
12	ACCIDENT ANALYSES	None Expected
12A	Appendix 12A - Accident Analyses for NUHOMS® MP187 System	72-11 71-9255
12B	Appendix 12B - Accident Analyses for Advanced Standardized NUHOMS® System	72-1029 72-11 71-9255
12C	Appendix 12C - Accident Analyses for Standardized NUHOMS® System 61BT	72-1004 71-9302
12D	Appendix 12D - Accident Analyses for Standardized NUHOMS® System 61BTH	72-1004 71-9302
12E	Appendix 12E - Accident Analyses for NAC-MPC	72-1025
12F	Appendix 12F - Accident Analyses for NAC-UMS	72-1015
12G	Appendix 12G - Accident Analyses for NAC-MAGNASTOR	72-1031
13	CONDUCT OF OPERATIONS	None Expected
14	OPERATING CONTROLS AND LIMITS	None Expected
14A	APPENDIX 14A TECHNICAL SPECIFICATION BASES FOR SITE	None Expected
14B	APPENDIX 14B TECHNICAL SPECIFICATION BASES FOR NUHOMS®	None Expected
14C	APPENDIX 14C TECHNICAL SPECIFICATION BASES FOR VCCs	None Expected

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QUESTIONS