ATTACHMENT 2

ADVANCED NUHOMS® SAR REVISED PAGES (REVISION 4)

NON-PROPRIETARY VERSION

SEE LIST OF EFFECTED PAGES FOR A COMPLETE LISTING OF PAGES TO BE REPLACED/ADDED

ANUH-01.0150
Revision 4

SAFETY ANALYSIS REPORT
FOR THE
STANDARDIZED ADVANCED NUHOMS®
HORIZONTAL MODULAR STORAGE SYSTEM
FOR IRRADIATED NUCLEAR FUEL

NON-PROPRIETARY REPORT

By
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Fremont, CA

Revision 4
July 2001

Executive Summary

Revisions 1, 2, 3 *and 4* of this Safety Analysis Report incorporate changes based on the initial and supplemental responses to NRC Request for Information.

This Safety Analysis Report provides the generic safety analysis for the standardized Advanced NUHOMS®[1] System for dry storage of light water reactor spent nuclear fuel assemblies. This system provides for the safe dry storage of spent fuel in a passive Independent Spent Fuel Storage Installation (ISFSI) which fully complies with the requirements of 10CFR72 and ANSI 57.9.

This Safety Analysis Report describes the design and forms the basis for generic NRC certification of the standardized Advanced NUHOMS® System and will be used by 10CFR50/10CFR72 general license holders in accordance with 10CFR72 Subparts K and L. It is also suitable for reference in 10CFR72 site specific license applications.

The principal features of the standardized Advanced NUHOMS® System which differ from the previously approved NUHOMS® Systems are:

1. Modification to the C of C No. 1004 HSM (development of Advanced HSM, AHSM) to support qualification for sites with high seismic spectra and/or requirements for a significant reduction in ISFSI dose (e.g., due to congested reactor sites).

2. The AHSM configuration requires a minimum of three AHSMs tied together to limit sliding and uplift during a seismic event.

3. The Dry Shielded Canister used in this application, the 24PT1-DSC, is a modification to the FO-DSC associated with C of C No. 9255 (also used as a transfer cask under Rancho Seco Materials License SNM-2510, Docket No. 72-11) with additional provisions allowing storage of intact and damaged fuel assemblies, along with control components in a single DSC.

The NUHOMS® System provides long-term interim storage for spent fuel assemblies which have been out of the reactor for a sufficient period of time and which comply with the criteria set forth in this Safety Analysis Report. The fuel assemblies are confined in a helium atmosphere by a dry shielded canister. The canister is protected and shielded by a massive reinforced concrete module. Decay heat is removed from the canister and the concrete module by a passive natural draft convection ventilation system.

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[1] NUHOMS® is a registered trademark of Transnuclear West Inc.

NUHOMS® System is a totally passive installation that is designed to provide shielding and safe confinement of spent fuel for a range of postulated accident conditions and natural phenomena.

The NUHOMS® System OS197 Cask (C of C No. 1004) is used for transfer operations for the Advanced NUHOMS® System. Evaluations of this cask in this application is limited to those areas where existing analysis (in the aforementioned C of C) is not bounding.

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Table 12.2-1 Fuel Specifications

Fuel Type	Maximum Initial Enrichment	Cladding Material	Minimum Cooling Time	Minimum Initial Enrichment	Maximum Burnup
UO_2 WE 14x14 (with or without IFBA fuel rods)	4.05 weight % U-235	Type 304 Stainless Steel	10 years	See Table 12.2-4 for Enrichment, Burnup, and Cooling Time Limits.	
WE 14x14 MOX	2.84 weight % Fissile Pu - 64 rods 3.10 weight % Fissile Pu - 92 rods 3.31 weight % Fissile Pu - 24 rods	Zircalloy-4	20 years	2.78 weight % Fissile Pu –64 rods 3.05 weight % Fissile Pu –92 rods 3.25 weight % Fissile Pu – 24 rods	25,000 MWd/MTU
Integral Control Components	N/A	N/A	10 years	N/A	N/A

Table 12.2-2 Fuel Dimension and Weights

Parameter	WE 14x14 SC[1]	WE 14x14 MOX[1]
Number of Rods	180	180
Number of Guide Tubes/Instrument Tubes	*16*	*16*
Cross Section (in)	7.763	7.763
Unirradiated Length (in)	138.5	138.5
Fuel Rod Pitch (in)	0.556	0.556
Fuel Rod O.D. (in)	0.422	0.422
Clad Material	Type 304 SS	Zircaloy-4
Clad Thickness (in)	0.0165	0.0243
Pellet O.D. (in)	0.3835	0.3659
Max. initial ^{235}U Enrichment (%wt)	4.05	Note 2
Theoretical Density (%)	93-95	91
Active Fuel Length (in)	120	119.4
Max. U Content (kg)	375	Note 3
Ave. U Content (kg)	366.3	Note 3
Assembly Weight (lbs)	1210	1150
Max. Assembly Weight incl. NFAH[4] (lbs)	1320	1320

(1) Nominal values shown unless stated otherwise
(2) Mixed-Oxide assemblies with 0.71 weight % U-235 and *maximum* fissile Pu weight of 2.84 weight % (64 rods), 3.10 weight % (92 rods), and 3.31 weight % (24 rods)
(3) Total weight of Pu is 11.24 kg and the total weight of U is 311.225 kg
(4) Weights of TPAs and NSAs are enveloped by RCCAs

12.4.0 Design Features

The specifications in this section include the design characteristics of special importance to each of the physical barriers and to maintenance of safety margins in the Advanced NUHOMS® System design. The principal objective of this section is to describe the design envelope that may constrain any physical changes to essential equipment. Included in this section are the site environmental parameters that provide the bases for design, but are not inherently suited for description as LCOs.

12.4.1 Site

12.4.1.1 Site Location

Because this SAR is prepared for a general license, a discussion of a site-specific ISFSI location is not applicable.

12.4.2 Storage System Features

12.4.2.1 Storage Capacity

The total storage capacity of the ISFSI is governed by the plant-specific license conditions.

12.4.2.2 Storage Pad

For sites for which soil-structure interaction is considered important, the licensee is to perform site-specific analysis considering the effects of soil-structure interaction. Amplified seismic spectra at the location of the AHSM center of gravity (CG) is to be developed based on the SSI responses. The AHSM center of gravity is shown in Table 3.2-1. The site-specific spectra at the AHSM CG must be bounded by the spectra presented in Chapter 2.

The storage pad location shall have no potential for liquefaction at the site-specific SSE level earthquake.

Additional requirements for the pad configuration are provided in Section 12.4.4.2.

12.4.2.3 Canister Neutron Absorber

Neutron absorber with a minimum ^{10}B loading of 0.025 grams/square centimeter is provided for criticality control.

12.4.2.4 Canister Flux Trap Configuration

The canister flux trap configuration is defined by the spacer disc ligament width dimensions. Figure 12.4-1 shows the location and dimensions of the ligaments (the dimensions shown in the one quadrant are applicable to all four quadrants).

12.4.2.5 Fuel Spacers

Bottom fuel spacers are required to be located at the bottom of the DSC below each fuel assembly stored in the 24PT1-DSC. Top fuel spacers are required to be located above each intact fuel assembly stored in the 24PT1-DSC (the failed fuel can design includes an integral top fuel spacer and therefore does not require a top fuel spacer).

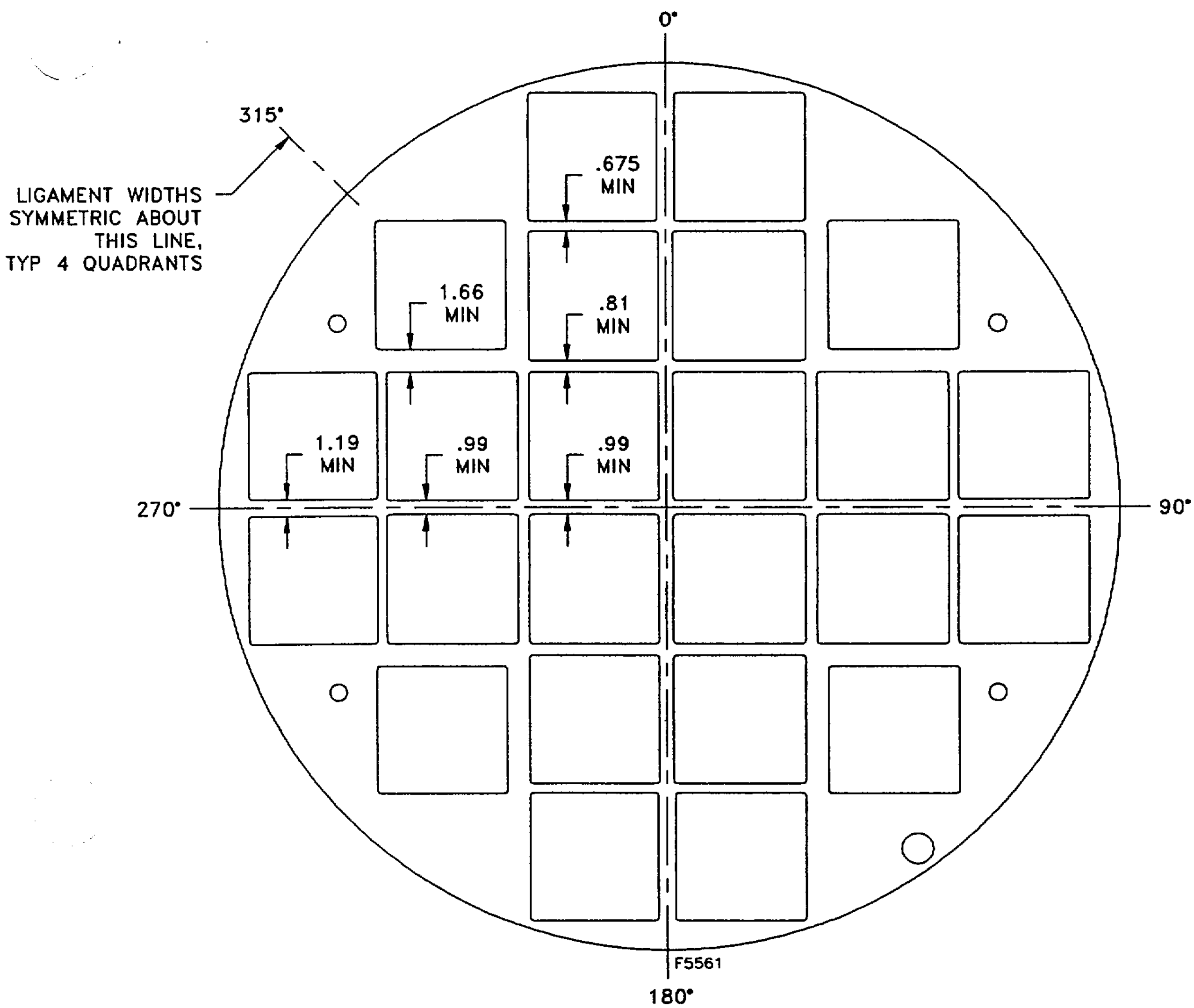

***Figure* 12.4-1**
Minimum Spacer Disc Ligament Widths

12.4.3 Codes and Standards

12.4.3.1 Advanced Horizontal Storage Module (AHSM)

The reinforced concrete AHSM is designed to meet the requirements of ACI 349-97. Load combinations specified in ANSI 57.9-1984, Section 6.17.3.1 are used for combining normal operating, off-normal, and accident loads for the AHSM.

12.4.3.2 Dry Shielded Canister (24PT1-DSC)

The 24PT1-DSC is designed fabricated and inspected to the maximum practical extent in accordance with ASME Boiler and Pressure Vessel Code Section III, Division 1, 1992 Edition with Addenda through 1994, including exceptions allowed by Code Case N-595-1, Subsections NB, NF, and NG for Class 1 components and supports. Code exceptions are discussed in 12.4.3.4.

12.4.3.3 Transfer Cask

The Transfer Cask shall meet the codes and standards that are applicable to its design under Certificate of Compliance C of C *72-1004, OS-197 Transfer Cask.*

A solar shield is required for cask transfer operations at temperatures exceeding 100°F.

12.4.3.4 Exceptions to Codes and Standards

ASME Code exceptions for the 24PT1-DSC are listed below:

DSC Shell Assembly ASME Code Exceptions, Subsection NB

Reference ASME Code Section/Article	Code Requirement	Exception, Justification & Compensatory Measures
NCA	All	Not compliant with NCA
NB-1100	Requirements for Code Stamping of Components	The 24PT1-DSC shell is designed & fabricated in accordance with the ASME Code, Section III, Subsection NB to the maximum extent practical. However, Code Stamping is not required. As Code Stamping is not required, the fabricator is not required to hold an ASME "N" or "NPT" stamp, or to be ASME Certified.
NB-2130 NB-4121	Material must be supplied by ASME approved material suppliers Material Certification by Certificate Holder	All materials designated as ASME on the SAR drawings are obtained from ASME approved MM or MS supplier(s) with ASME CMTR's. Material is certified to meet all ASME Code criteria but is not eligible for certification or Code Stamping if a non-ASME fabricator is used. As the fabricator is not required to be ASME certified, material certification to NB-2130 is not possible. Material traceability & certification are maintained in accordance with TNW's NRC approved QA program