

AMERICA'S NUCLEAR SOLUTION

August 31, 2016

Mr. Mark Lombard, Director
U.S. Nuclear Regulatory Commission
Division of Spent Fuel Management
Attention: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738

References: (1) Letter from J. Scott Kirk (WCS) to Mark Lombard (NRC), License Application to Construct and Operate a Consolidated Interim Storage Facility for Spent Nuclear Fuel in Andrews County, Texas, Docket 72-1050, dated April 28, 2016

(2) Letter from Mark Lombard (NRC) to Scott Kirk (WCS), Acceptance Review of Specific License Application Requesting Authorization to Construct and Operate a Consolidated Interim Storage Facility for Spent Nuclear Fuel – Supplemental Information Needed, dated June 22, 2016

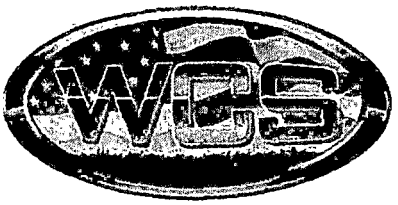
(3) Letter from J. Scott Kirk (WCS) to Mark Lombard (NRC), Supplemental Information to Support the License Application for an Interim Storage Facility for Spent Nuclear Fuel in Andrews County, Texas, Docket 72-1050, dated July 6, 2016

Subject: Supplemental Information to Support a License Application for a Consolidated Interim Storage Facility for Spent Nuclear Fuel in Andrews, Texas, Docket 72-1050

Dear Mr. Lombard:

Waste Control Specialists LLC (WCS) hereby files supplemental information requested by the NRC staff on June 22, 2016 (Reference 2) to support its continued review of WCS's April 28, 2016 license application requesting authorization to construct and operate a Consolidated Interim Storage Facility for Spent Nuclear Fuel in Andrews County, Texas (Reference 1). WCS is providing responses to 21 of the Request for Supplemental Information (RSI) items in accordance with the RSI Response Schedule attached to our letter to you dated July 6, 2016 (Reference 3) and the enclosed updated schedule.

NMSS26



AMERICA'S NUCLEAR SOLUTION

For clarification, WCS is requesting authorization to use only previously approved storage canister designs, and the application does not include future certificate of compliance (CoC) amendments that have not yet been approved by the NRC. We are revising our Safety Analysis Report (SAR), proposed Technical Specifications, and proposed License Conditions to ensure consistency and clarity in this regard.

WCS is providing responses and replacement pages for affected parts of the SAR, the proposed License, and proposed Technical Specifications to address each of the RSIs that were scheduled for completion on August 31, 2016. The replacement pages marked proprietary should be withheld from public disclosure in accordance with 10 CFR 2.390. Supporting affidavits declaring the basis for withholding such information from public disclosure are enclosed.

WCS anticipates that it will prepare a consolidated updated revision to the SAR, proposed License, proposed Technical Specifications, and Environmental Report containing all of these pages once the RSI responses are completed.

WCS will continue to submit responses to the RSIs pertaining to the Physical Security Plan under separate cover, as those responses contain Safeguards Information and must be controlled in accordance with the requirements specified in 10 CFR 73.22.

WCS requests that a copy of all correspondence regarding this matter be emailed to my attention (rbaltzer@valhi.net) as soon as possible after issuance. If you have any questions or need additional information, please call me at972-450-4235.

I certify under penalty of perjury that the foregoing is true and correct.

Executed on August 31, 2016

Rodney Baltzer
President



AMERICA'S NUCLEAR SOLUTION

Cc:

John-Chau Nguyen, NRC
Elicia Sanchez, WCS
Jay Britten, WCS
Jay Cartwright, WCS
Jeremy Vesely, WCS
Mike Lynch, AREVA
Kent Cole, NAC International
WCS Regulatory Compliance
WCS Records Management

Enclosures:

Schedule
RSI Responses
Affidavit of [WCS]
Affidavit of [AREVA]
Affidavit of [NAC]

WASTE CONTROL SPECIALISTS LLC

LICENSE APPLICATION

WASTE CONTROL SPECIALISTS LLC

AMERICA'S NUCLEAR SOLUTION

DOCKET 72-1050

Response to Requests for Supplemental Information

August 31, 2016

August 31, 2016

Request for Supplement Information Submittal Schedule

Safety Analysis Report Non-Proprietary				
	20-Jul-16	31-Aug-16	30-Sep-16	31-Oct-16
Multi-Discipline			1.1***	1.2 1.2.a 1.2.b
General	1.1.a 1.1.b 1.1.c 1.1.d 1.1.e 2.1 2.2 2.3.a 2.3.b 2.3.c 2.3.d 7.2 8.2 8.3 9.1 9.1.a 9.1.b 9.1.c 9.1.d 9.1.e 9.1.f 9.1.g 9.5 9.6 9.8 10.2 10.4 12.1 12.2 12.3 12.4 12.5 12.6	4.3 4.5 4.6 4.7 4.8 5.1 5.2 5.3 5.5 5.6 6.1 6.2* 6.3 8.1 9.2 9.4 10.1** 10.3 11.1 11.2 17.1	1.2 4.2*** 15.1 16.1	4.1 4.4 5.4 5.7 7.1 9.3 9.7
Total	**33**	**21**	**5**	**10**
Percent Complete	**48%**	**30%**	**7%**	**14%**

* RSI was scheduled for the July 20, 2016 submittal, but required additional calculations, therefore it was moved to August 31, 2016 submittal.

** RSI was moved from September 30, 2016 to be included in the August 31, 2016 submittal.

*** RSI's were scheduled for the August 31, 2016 submittal, but moved to September 30, 2016 submittal, due to more time needed to create the drawings and gather references.

August 31, 2016

Request for Supplement Information Submittal Schedule

Environmental Report				
	20-Jul-16	31-Aug-16	30-Sep-16	31-Oct-16
	18.1 18.2			
Total	2	0	0	0
Percent Complete	100%	0%	0%	0%

Safety Analysis Report Proprietary				
	20-Jul-16	31-Aug-16	30-Sep-16	31-Oct-16
	2.1 2.2 9.2		10.1	9.1
Total	3	0	1	1
Percent Complete	60%	0%	20%	20%

Physical Security Plan				
	20-Jul-16	31-Aug-16	30-Sep-16	31-Oct-16
General	1			
Specific	1 2 9 10* 11 12 13 14* 15** 16 18** 22 23 24 25	3 4*** 5 6 7 8 17 19*** 20 21 26	27	
Total	16	11	1	0
Percent Complete	57%	39%	4%	0%

* RSI's were moved from August 31, 2016 to be included in the July 20, 2016 submittal

** RSI's were moved from September 30, 2016 submittal to be included in the July 20, 2016 submittal

*** RSI's were moved from September 30, 2016 to be included in the August submittal

Overall Totals				
	20-Jul-16	31-Aug-16	30-Sep-16	31-Oct-16
Total Number of RSIs	54	32	7	11
Percent Complete	52%	31%	7%	11%

WASTE CONTROL SPECIALISTS LLC

AFFIDAVIT

I, Rodney Baltzer, President of Waste Control Specialists LLC (WCS), am making the following representations that to the best of my knowledge and beliefs:

1. The following document which WCS wishes to have withheld from public disclosure is:

   a) **WCS Safety Analysis Report (SAR) pages marked "PROPRIETARY INFORMATION"**
   b) **AREVA's Drawings listed in their Affidavit**
   c) **NAC references listed in their Affidavit**

2. The information contained in the document cited in 1 above is considered confidential information pursuant to Title 10 of the Code of Federal Regulations (CFR), Part 2.390(a)(4) and is thereby protected from public disclosure by regulation.

3. Pursuant to 10 CFR 2.390, the information contained in the document cited in 1 above is protected from public disclosure by regulation because it includes correspondences and reports to the NRC which contain trade secrets or commercial information pursuant to 10 CFR 2.390(a)(4).

4. The information contained in the document cited in 1 above has not been made available to public sources by WCS, nor has WCS authorized that it be made available.

8/29/16

Rodney Baltzer
President

Date

SONDRA R. MURDOCK
Notary Public, State of Texas
My Commission Expires
June 18, 2018

I certify the above named person appeared before me and executed this document on this the 29 day of August, 2016

Sondra R. Murdock
Notary Public

My commission expires: June 18, 2018

AFFIDAVIT PURSUANT
TO 10 CFR 2.390

AREVA Inc.)
State of Maryland) SS.
County of Howard)

I, Jayant Bondre, depose and say that I am a Vice President of AREVA Inc., duly authorized to execute this affidavit, and have reviewed or caused to have reviewed the information that is identified as proprietary and referenced in the paragraph immediately below. I am submitting this affidavit in conformance with the provisions of 10 CFR 2.390 of the Commission's regulations for withholding this information.

The information for which proprietary treatment is sought is listed below:

Drawing Number	Revision No.	Title
13302-1007	0	NUHOMS® SYSTEM GTCC CANISTER CLOSURE INSTALLATION
13302-1005	0	NUHOMS® SYSTEM GTCC CANISTER MAIN ASSEMBLY

I have personal knowledge of the criteria and procedures utilized by AREVA Inc. in designating information as a trade secret, privileged, or as confidential commercial or financial information.

Pursuant to the provisions of paragraph (b) (4) of Section 2.390 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure, included in the above referenced document, should be withheld.

1) The information sought to be withheld from public disclosure involves drawings which are owned and held in confidence by AREVA Inc.

2) The information is of a type customarily held in confidence by AREVA Inc. and not customarily disclosed to the public. AREVA Inc. has a rational basis for determining the types of information customarily held in confidence by it.

3) Public disclosure of the information is likely to cause substantial harm to the competitive position of AREVA Inc. because the information consists of descriptions of the design of radioactive waste storage systems, the application of which provides a competitive economic advantage. The availability of such information to competitors would enable them to modify their product to better compete with AREVA Inc., take marketing or other actions to improve their product's position or impair the position of AREVA Inc.' s product, and avoid developing similar data and analyses in support of their processes, methods or apparatus.

Further the deponent sayeth not.

Jayant Bondre
Vice President, AREVA Inc.

Subscribed and sworn before me this 29th day of August, 2016.

Notary Public
My Commission Expires 10/16/19

RONDA JONES
NOTARY PUBLIC STATE OF MARYLAND
My Commission Expires October 16, 2019

NAC INTERNATIONAL

NAC INTERNATIONAL
AFFIDAVIT PURSUANT TO 10 CFR 2.390

George Carver (Affiant), VP Engineering and Licensing, of NAC International, hereinafter referred to as NAC, at 3930 East Jones Bridge Road, Norcross, Georgia 30092, being duly sworn, deposes and says that:

1. Affiant has reviewed the information described in Item 2 and is personally familiar with the trade secrets and privileged information contained therein, and is authorized to request its withholding.

2. The information to be withheld includes the following NAC Proprietary Information that is being provided in support of the Waste Control Specialists (WCS) centralized interim storage facility (CISF) site-specific license application. Specifically, WCS's response to NRC's request for supplemental information.

    - WCS Safety Analysis Report (SAR) pages marked "PROPRIETARY INFORMATION"
        - Chapter 7, "Installation Design and Structural Evaluation"
    - Requests for Supplemental Information (RSI) responses to NP-5.5 and NP-5.6
    - RSI Multi-discipline 1.1NP and 5.6NP supporting documentation:
        - 630075-R-06, Rev. 3
        - ESS-032, Rev. 1
        - LSI-ZS-VCT-2012, Rev. 1
        - 630075-2004, Rev. 13
        - 630075-2006, Rev. 4
        - 630075-2015, Rev. 7
        - 630078-2016, Rev. 3
        - NAC004-C-001, Rev. 0
        - NAC004-C-002, Rev. 0
        - NAC004-CALC-02, Rev. 0
        - NAC004-CALC-04, Rev. 1

    NAC is the owner of this information that is considered to be NAC Proprietary Information.

3. NAC makes this application for withholding of proprietary information based upon the exemption from disclosure set forth in: the Freedom of Information Act ("FOIA"); 5 USC Sec. 552(b)(4) and the Trade Secrets Act; 18 USC Sec. 1905; and NRC Regulations 10 CFR Part 9.17(a)(4), 2.390(a)(4), and 2.390(b)(1) for "trade secrets and commercial financial information obtained from a person, and privileged or confidential" (Exemption 4). The information for which exemption from disclosure is herein sought is all "confidential commercial information," and some portions may also qualify under the narrower definition of "trade secret," within the meanings assigned to those terms for purposes of FOIA Exemption 4.

4. Examples of categories of information that fit into the definition of proprietary information are:

    a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by competitors of NAC, without license from NAC, constitutes a competitive economic advantage over other companies.

    b. Information that, if used by a competitor, would reduce their expenditure of resources or improve their competitive position in the design, manufacture, shipment, installation, assurance of quality or licensing of a similar product.

c. Information that reveals cost or price information, production capacities, budget levels or commercial strategies of NAC, its customers, or its suppliers.

d. Information that reveals aspects of past, present or future NAC customer-funded development plans and programs of potential commercial value to NAC.

e. Information that discloses patentable subject matter for which it may be desirable to obtain patent protection.

The information that is sought to be withheld is considered to be proprietary for the reasons set forth in Items 4.a, 4.b, and 4.d.

5. The information to be withheld is being transmitted to the NRC in confidence.

6. The information sought to be withheld, including that compiled from many sources, is of a sort customarily held in confidence by NAC, and is, in fact, so held. This information has, to the best of my knowledge and belief, consistently been held in confidence by NAC. No public disclosure has been made, and it is not available in public sources. All disclosures to third parties, including any required transmittals to the NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary agreements, which provide for maintenance of the information in confidence. Its initial designation as proprietary information and the subsequent steps taken to prevent its unauthorized disclosure are as set forth in Items 7 and 8 following.

7. Initial approval of proprietary treatment of a document/information is made by the Vice President, Engineering, the Project Manager, the Licensing Specialist, or the Director, Licensing – the persons most likely to know the value and sensitivity of the information in relation to industry knowledge. Access to proprietary documents within NAC is limited via "controlled distribution" to individuals on a "need to know" basis. The procedure for external release of NAC proprietary documents typically requires the approval of the Project Manager based on a review of the documents for technical content, competitive effect and accuracy of the proprietary designation. Disclosures of proprietary documents outside of NAC are limited to regulatory agencies, customers and potential customers and their agents, suppliers, licensees and contractors with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary agreements.

8. NAC has invested a significant amount of time and money in the research, development, engineering and analytical costs to develop the information that is sought to be withheld as proprietary. This information is considered to be proprietary because it contains detailed descriptions of analytical approaches, methodologies, technical data and/or evaluation results not available elsewhere. The precise value of the expertise required to develop the proprietary information is difficult to quantify, but it is clearly substantial.

   Public disclosure of the information to be withheld is likely to cause substantial harm to the competitive position of NAC, as the owner of the information, and reduce or eliminate the availability of profit-making opportunities. The proprietary information is part of NAC's comprehensive spent fuel storage and transport technology base, and its commercial value extends beyond the original development cost to include the development of the expertise to determine and apply the appropriate evaluation process. The value of this proprietary information and the competitive advantage that it provides to NAC would be lost if the information were disclosed to the public. Making such information available to other parties, including competitors, without their having to make similar investments of time, labor and money would provide competitors with an unfair advantage and deprive NAC of the opportunity to seek an adequate return on its large investment.

NAC INTERNATIONAL

NAC INTERNATIONAL
AFFIDAVIT PURSUANT TO 10 CFR 2.390 (continued)

STATE OF GEORGIA, COUNTY OF GWINNETT

Mr. George Carver, being duly sworn, deposes and says:

That he has read the foregoing affidavit and the matters stated herein are true and correct to the best of his knowledge, information and belief.

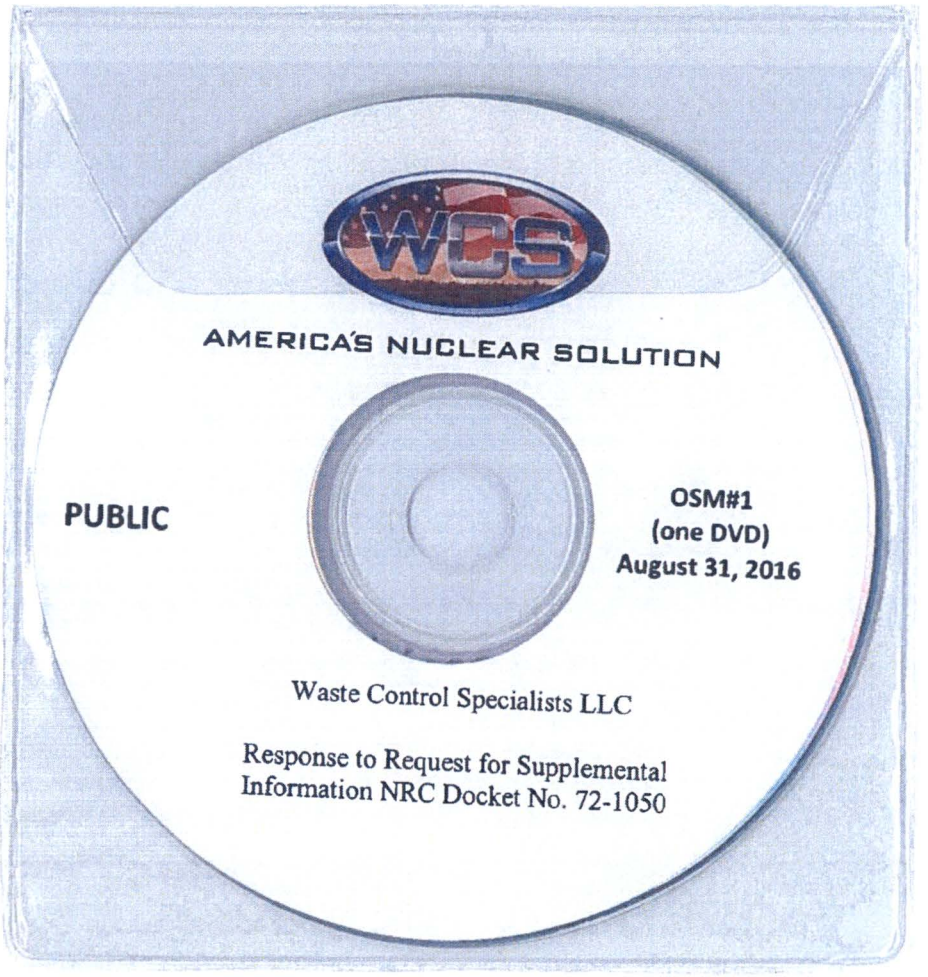
Executed at Norcross, Georgia, this 26th day of August 2016.

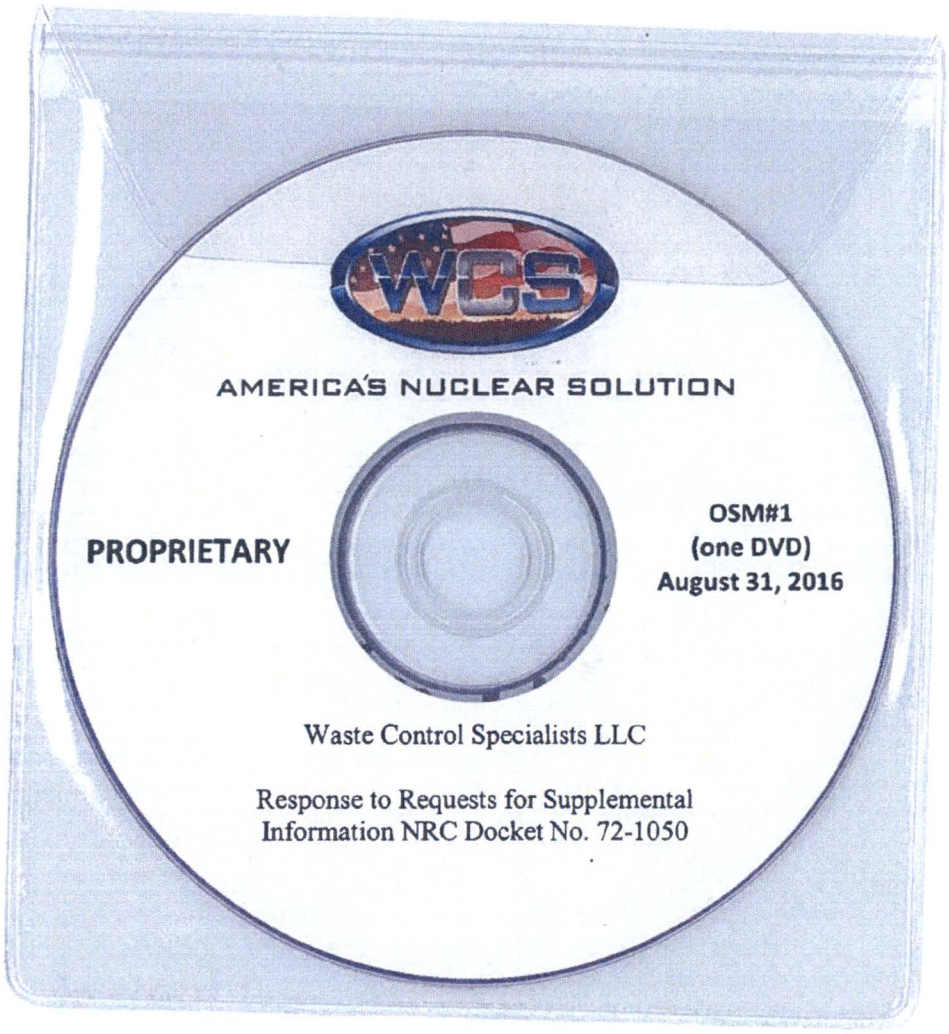
George Carver
VP Engineering and Licensing
NAC International

Subscribed and sworn before me this 26th day of August, 2016.

Jeannie Klinetob
Notary Public




WCS
AMERICA'S NUCLEAR SOLUTION
PUBLIC
OSM#1
(one DVD)
August 31, 2016
Waste Control Specialists LLC
Response to Request for Supplemental
Information NRC Docket No. 72-1050


WCS
AMERICA'S NUCLEAR SOLUTION
PROPRIETARY
OSM#1
(one DVD)
August 31, 2016
Waste Control Specialists LLC
Response to Requests for Supplemental
Information NRC Docket No. 72-1050

RSI NP-4.3

Provide drawings for the facility and facility SSCs relied on for facility operations.
The application provides a description of the proposed CISF that includes a few high-level overview sketches of the facility and artist renderings of facility SSCs such as the cask transfer system (CTS). However, details regarding the facility and facility SSCs (including buildings) remain unclear. Adequately detailed drawings for the facility and facility SSCs are needed to enable staff's review of the proposed CISF, including these facility and facility SSC details. NUREG-1567 Sections 5.4.1.1, 5.4.3.1, 5.4.4.1, 5.4.5.1, 5.5.1.1, 5.5.3.1, 5.5.4.1, and 5.5.5.1 provide guidance regarding details of the facility and facility SSCs for which drawings are needed. These details include items such as the confinement structures; reinforced concrete structures and other SSCs both important to safety and not important to safety that perform functions including confinement, radiation shielding, structural support, floors, protection against natural phenomena and accidents, and other functions and features as identified in the cited SRP sections. The drawings help to define the facility and facility SSC configurations. Drawings should also provide information regarding the site layout and layout of the facility structures where spent fuel and GTCC waste containers are handled, transferred, or stored (e.g., cask handling building). This layout information should include items such as transfer routes (e.g., cask handling building to pad and/or off-normal holding area), barriers, identification of the 10 CFR Part 72 controlled area boundary and distances from facility features and structures to the 10 CFR Part 72 controlled area boundary and the restricted area boundary, identification of health physics facilities, area radiation monitoring around the facility and in facility structures/areas where spent fuel and GTCC waste containers are handled, transferred or stored. See Sections 11.4.2.2, 11.4.2.5, and 11.4.4.2 of NUREG-1567 for additional guidance.

This information is needed to determine compliance with 10 CFR 72.24(a-c), 10 CFR 72.104, 10 CFR 72.106, 10 CFR 72.126, and relevant requirements in 10 CFR Part 20.

WCS Response to RSI 4.3:

Figures have been updated and added to the WCS CISF SAR Chapters 1 and 9.

Application Impacts:

WCS SAR Chapter 1, List of Figures has been updated to add new figures and to update figures. Sections 1.2 and 1.2.3 also have been revised to address the figures (see attached).

WCS SAR Chapter 4, Sections 4.1.2.2, 4.1.2.3, 4.1.2.4, 4.1.2.5, and 4.1.2.8 have been updated to address these new and updated figures that have been added to WCS SAR Chapters 1 and 4 (see attached).

WCS SAR Chapter 9, Section 9.4, Figure 9-1, Figure 9-2, and Figure 9-3 have been updated (see attached).

Updated Figures:

WCS SAR Chapter 1 Figure 1-2, WCS CISF Site Boundary Layout has been updated (see attached).

WCS SAR Chapter 1 Figure 1-3, WCS CISF Site Layout has been updated (see attached).

WCS SAR Chapter 9 Figure 9-1, WCS CISF Conceptual Plan, Phases 1 though 8 has been updated (see attached).

WCS SAR Chapter 9 Figure 9-2, WCS CISF Plan, Phase 1 has been updated (see attached).

WCS SAR Chapter 9 Figure 9-3, WCS CISF Storage Area Layout (Phase 1) has been updated (see attached).

New Figures:

WCS SAR Chapter 1 New Figure 1-6 "WCS CISF Storage Pad Layout" has been added (see attached).

WCS SAR Chapter 1 New Figure 1-7 "Cask Handling Building Plan" has been added (see attached).

WCS SAR Chapter 1 New Figure 1-8 "Cask Handling Building Section View" has been added (see attached).

WCS SAR Chapter 1 New Figure 1-9 "Security and Administration Building Plan" has been added (see attached).

List of Figures

Figure 1-1 WCS CISF Location 1-26
Figure 1-2 WCS CISF ~~Site Layout~~ Boundary Layout 1-27
Figure 1-3 WCS CISF Site ~~Overview~~ Site Layout 1-28
Figure 1-4 Site Location Map 1-29
Figure 1-5 10,000-Year Return Period Response Spectra (5% Damped) 1-30
Figure 1-6 WCS CISF Storage Pad Layout
Figure 1-7 Cask Handling Building Plan
Figure 1-8 Cask Handling Building Section View
Figure 1-9 Security and Administration Building Plan

1.2 General Description of Installation

The WCS CISF is designed as a stand-alone facility and consists of a ~~Cask Handling Building,~~ storage area, and support facilities. ~~A site layout is provided in Figure 1-2, and a site overview is provided in Figure 1-3.~~

The facility boundary is established at the outer limits by the Part 73 Owner Controlled Area (OCA). The Protected Area (PA) boundary is approximately 660 feet inside of the OCA boundary. The storage area is approximately 330 feet inside of the PA boundary. These areas are shown in Figure 1-2, "WCS CISF Site Boundary Layout."
Figure 1-3 is a blow-up view of the facility showing the storage area and the support facilities inside the Protected Area. Support facilities include the Cask Handling Building, the Security and Administration Building, Transport Haul Route, and Rail Access.

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Likewise, heat removal is totally passive in the overpacks and no active cooling system is required. Therefore, there are no required Instrumentation and Control Systems for the WCS CISF.

1.2.1 Location and Site Characteristics

The WCS CISF facility is located approximately 32 miles west of the city of Andrews, Texas, and five miles east of the city of Eunice, New Mexico. The WCS CISF facility is located approximately one-half mile east of the Texas-New Mexico state boundary and one mile north of Texas Highway 176. It occupies parts of Section 16 and 17, Block A-29, Public School Land, Andrews County, Texas included in approximately 25 square miles of property (primarily in Texas with nominal acreage in New Mexico) owned by WCS LLC in northwestern Andrews County, Texas.

The WCS facility is situated in an arid, isolated part of the state. Figure 1-4 shows the location of the facility with respect to known or easily identifiable landmarks. Figure 1-4, as supplemented by Figure 1-1, illustrates county boundaries, rail access, highways, and major roads.

The approximate coordinates of the site are 32° 27' 08" north latitude and 103° 03' 35" west longitude.

1.2.2 Principal Design Criteria

The WCS CISF principal design criteria are based on the site characteristics, the design criteria associated with the cask systems listed in Table 1-1 that have been previously certified by the NRC, and specific criteria required for the WCS CISF design.

The cask systems listed in Table 1-1 meet the WCS CISF design criteria. Table 1-2 provides a summary of the WCS CISF principal design criteria.

1.2.3 Facility Descriptions

The major facilities at the WCS CISF are the Cask Handling Building and the storage area. The Cask Handling Building is ~~a steel building~~ approximately 140 feet long by 150 feet wide by 65 feet high. The purpose of the Cask Handling Building is to receive and prepare for storage shipments of dual-purpose canister systems. It will also receive GTCC waste canisters for storage at the site. It is also designed to process canisters stored at the site for off-site shipment. The Cask Handling Building is designed to handle canisterized fuel only and does not have the capability to handle bare fuel. ~~The Cask Handling Building is designed to withstand all normal operating loads and off-normal loads created by natural phenomena.~~

The building is a two bay commercially designed and fabricated steel frame structure with metal siding and reinforced concrete foundations and floors. The steel structure is designed to support two commercial overhead cranes used to move transportation casks from the rail car to the transport vehicle. One bay of the building will house the Canister Transfer System described in Section 1.3.1.2 and the other bay will be available for direct transfer of transportation casks from the rail car to the transport vehicle. A 2,400 square foot area of the building is set aside for cask storage and maintenance. The building plan view is shown in Figure 1-7. Figure 1-8 is a section through the building showing the overhead crane location. Air monitors and dosimeters are located in the building for monitoring purposes. The building is not designed or intended to provide confinement or shielding for SNF or GTCC materials. The building structure, including crane supports, are classified as ITS to prevent massive building collapse or the dropping of heavy objects on to spent fuel cask systems and related ITS SSCs. The remainder of the building components will be NITS. For design specifics, see Section 7.5.3.

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~~equipment used to make the transfer to the storage overpacks is substantially identical~~ to that used to transfer the canister into dry storage at the reactor facilities where the fuel was initially stored.

The storage area is a large area comprised of concrete storage pads and storage overpacks. The purpose of the storage area is to provide safe storage for the canisterized spent nuclear fuel in cask systems that were previously approved by the NRC. The pads and approach aprons are designed to meet the applicable requirements of these previously approved cask systems. The storage area will be constructed in phases, as necessary. Phase 1 is designed to accommodate approximately 5,000 MTHM of spent nuclear fuel and GTCC waste in approximately 470 storage overpacks.

The remainder of the WCS CISF facilities provide support functions such as ~~administrative activities,~~ fuel receipt, security and fire protection. Table 1-3 provides a list of the WCS CISF facilities and their functions. ~~The facility locations are provided in Figure 1-2.~~

Figure 1-6 shows the Phase 1 storage area. The individual storage pads are constructed of reinforced concrete at approximately ground level. Horizontal storage module pads will have concrete approach aprons. Vertical storage module pads will surrounded by gravel approach roads.

The Security and Administration Building is a commercially designed and fabricated steel building with a reinforced concrete floor and foundation. The building primarily functions as the location for the Central Alarm Station and for Health Physics spaces. Additionally, the building provides additional security and administration spaces and is the main personnel entrance and exit for the facility. Figure 1-9 shows the Security and Administration Building Layout.

received at the WCS CISF. The controls for limiting the types and forms of spent nuclear fuel received at the WCS CISF are the same as those placed on the cask systems by the NRC-issued site licenses or certificates of compliance for the included transportation and storage systems. The approved systems are listed in Section 2.1 of the Technical Specifications [1-4]. The type, form and sources authorized for storage include:

- Canisterized spent nuclear fuel elements from commercial nuclear utilities licensed pursuant to 10 CFR Part 50 and associated radioactive materials related to the receipt, transfer, and storage of that spent nuclear fuel.
- Uranium or Mixed-Oxide (MOX) in the form of intact spent fuel assemblies, damaged fuel assemblies, and fuel debris, as allowed by Materials License SNM-2510, any amendment; Table 1-1c or Table 1-1j or Table 1-1t of Certificate of Compliance No. 1004, any amendment; Section 2.1 of Certificate of Compliance No. 1029, any amendment; Section B 2.1 of Certificate of Compliance No. 1025, and amendment; Section B 2.1 of Certificate of Compliance No. 1015, and amendment; Sections 1.0 and 2.0 of Certificate of Compliance No. 1031, any amendment, modified as described in paragraph 9 below.
- Canisterized GTCC Waste, non-fuel related material generated as a result of plant operations and decommissioning where radionuclide concentration limits of Class C waste in 10 CFR 61.55 are exceeded.
- GTCC waste, as activated metals comprised of miscellaneous solid waste resulting from segmentation and decommissioning processes.

Aging Management considerations for the canisters and storage overpacks are discussed in Section 11.5.

1.2.5 Waste Products Generated During Operations

As described in Chapter 6, there are minimal radioactive wastes generated at the WCS CISF. Gaseous and liquid wastes are not generated at the WCS CISF. Small volumes of solid radioactive waste may be produced from routine operations involving contamination surveys and decontamination activities involving incoming and outgoing transportation casks and equipment. Potential solid waste streams are collected and temporarily stored on site for processing and disposal at the WCS Federal Waste Disposal Facility (FWF).

4.1 Installation Design

This section provides a description of the WCS CISF layout and the major buildings, structures and canister Storage Area. It also identifies the major operating functions performed at the WCS CISF and the appropriate references providing detailed information for each operating function.

4.1.1 Location and Layout of Facility

The WCS CISF is located in Andrews County, Texas near the Texas and New Mexico state line. The WCS CISF will be to the north and adjacent to the existing WCS facilities. The entrance for the WCS CISF is located approximately 1.5 miles north of the existing entrance to WCS on Texas State Highway 176. Figures 1-1 through 1-4 show the location and layout of the WCS CISF.

4.1.2 Principle Features

The WCS CISF is a SNF and GTCC waste dry storage system facility with a capacity of 5,000 MTHM. Only canisterized SNF and GTCC waste will be received at the WCS CISF. The storage overpacks used at the WCS CISF are a combination of those designed by AREVA TN and NAC International. Waste shipments arrive at the WCS CISF by rail car and the transportation cask will be unloaded from the rail car to either a Canister Transfer System, for vertical systems; or directly to a transfer vehicle, for the horizontal systems. For the vertical systems, the Canister Transfer System is used to transfer the loaded canisters from the transportation cask to a storage overpack which is then moved to the Storage Pad via the vertical cask transporter (VCT). For the horizontal systems, the transportation cask is used as the transfer cask to move the loaded canister out to the Storage Pad where the canister is transferred directly to its storage overpack. Figure 1-2 shows the WCS CISF layout.

4.1.2.1 Site Boundary

The WCS property is approximately 14,000 acres in Texas and New Mexico. The WCS CISF will be located in Texas on approximately 155 acres of land. Adjacent to the WCS CISF will be the WCS low-level radioactive waste (LLRW) and Hazardous Waste Treatment, Storage, and Disposal Facility (TSDF) operations.

4.1.2.2 Owner Controlled Area

The Owner Controlled Area (OCA) is the outer controlled boundary of the WCS CISF. This fenced in area encloses approximately 155 acres within the 14,000 acres of WCS property. Special authorization is required for access to this area.

The location of the OCA in relation to the CISF is shown on Figure 1-2

4.1.2.3 Protected Area

The Protected Area (PA) is approximately 36 acres within the OCA which includes the concrete storage pads, storage overpacks, Cask Handling Building, and the Security and Administration Building. The PA is surrounded by a double fence with a minimu terior fence acts as a "nuisance" fence and ruder barrier and detection. Personnel Administration Building. There is a minim the OCA fence.

Figure 1-2 shows the fence boundaries in relation to the components of the CISF.

4.1.2.4 Storage Area and Concrete Storage pads

SNF is placed in storage overpacks located on concrete pads in the Storage Area. The Storage Area is 350 feet wide by 800 feet long and consists of concrete storage pads, concrete access aprons, and access roadways. There is a minimum of 100 meters between the Storage Area and the PA fence.

Storage overpack design details and criteria for confinement, shielding, structural, and protection from natural phenomena are provided in Appendices A-G.

hickness and steel reinforcing depend is used on each pad. Concrete aprons necessary to facilitate VCT and trans rage placement of canisters.

Storage Pad design details and criteria for natural phenomena and accidents are located in Section 7.6.1.

4.1.2.5 Cask Handling Building

contains two

cranes

Transfer of each canister from the rail car to the transfer vehicle or VCT occurs inside the Cask Handling Building. The Cask Handling Building ~~is a 22,500 square foot building with an~~ overhead ~~crane~~ capable of lifting and manipulating the transportation cask and canister. ~~A back-up crane may be installed in the Cask Handling Building to provide operational redundancy.~~ For canisters stored in horizontal storage overpacks, the overhead bridge crane is used to transfer the transportation cask from the rail car to a transfer vehicle that will move the canister to the concrete pad. For canisters stored in Vertical Concrete Casks (VCCs), the Cask Transfer System and VCT are used to transfer the canister from the transportation cask a VCC that is then moved to the Storage Area.

4.1.2.6 Transportation Cask Que

Figures 1-7 and 1-8 show the Cask Handling Building layout and elevation section. The Cask Handling Building does not provide confinement or radiation shielding other than a concrete masonry unit wall between the main building section and the office area. Section 7.5.3 describes building design criteria for protection from natural phenomena and accidents.

The rail side track that br s queuing length of approximately 8 mmodate five primary rail cars and five Once a rail car has been unloaded, it will be released through the east end of the Cask Handling Building and outside of the PA.

4.1.2.7 Rail Side Track

The rail side track will depart from the existing WCS rail loop and extend north and to the east into the PA and the Cask Handling Building. There is sufficient rail length for 10 rail cars to be inside the PA before ~~indexing~~ through the Cask Handling Building. Unloaded rail cars will exit the Cask Handling Building and continue east on the rail sidetrack which will connect back into the existing WCS rail loop.

4.1.2.8 Security and Administration Building

Proceeding

The Security and Administration Building will coordinate several functions for the WCS CISF. Security personnel will monitor sensors and intrusion alarms, control employee access, and process visitors into the WCS CISF. Health physics will operate and store equipment in this building and an administration staff will use this building for processing shipments and storing records. The building will contain the Central Alarm Station (CAS), Armory, locker rooms, break room, offices, health physics spaces, and records storage. The backup electrical generator system for the WCS CISF is located at this building.

4.1.2.9 Receiving Area

When the shipping cask arrives a
visually inspected for damage pr

See Figure 1-9 for the building layout. The building is a commercially designed and fabricated steel structure with reinforced concrete floors and foundations. The building is not important to safety and does not provide any confinement or radiation shielding functions. The building will be designed for protection against natural phenomena as required by standard local building codes.

4.1.2.10 Concrete Cask Staging Area

There is an area inside the Cask
awaiting loading via the Canister Transfer System. Additional staging areas are available outside the security boundaries of the WCS CISF.

4.1.2.11 Off-Normal Holding Area

Any casks arriving on-site via rail car are visually inspected for any damage prior to entry into the Cask Handling Building. If damage is noted, the transportation cask will be assessed and the transportation cask will be held in the Cask Handling Building or on the rail spur within the OCA until a recovery plan is implemented.

4.1.2.12 Water Utilities and Fire Protection

Potable water will be supplied to the WCS CISF from the existing WCS potable water system. The WCS CISF porable water system will tie-in to the existing potable water system at WCS. Fire protection will be maintained by WCS in accordance with National Fire Protection Association (NFPA) standards.

4.1.2.13 Site Utility Supplies and Systems

Existing WCS site electrical service exists at the WCS CISF location. This infrastructure will be upgraded to accommodate the WCS CISF needs.

9.4 Estimated On-Site Collective Dose Assessment

On-site dose rates are computed for the proposed storage configuration using the

s due
ing

The WCS CISF will be constructed and loaded in eight phases, as indicated on Figure 9-1. The WCS CISF is enclosed by a protected area fence system, and detector locations D1 through D16 are placed along this fenceline, as indicated in Figure 9-1. The protected area fences lie within the owner controlled area fence.

9.4.1 Radiation Dose Rate Within the Controlled Area

~~The WCS CISF will be loaded in eight phases, as indicated on Figure 9-1. This application is for Phase 1 only. The WCS CISF is enclosed by a protected area fence, and detector locations D1 through D16 are placed on the fence line, as indicated on Figure 9-1. The protected area fence lies within the controlled area fence.~~

~~A close-up view of Phase 1 loading is provided in Figure 9-2 with additional detector locations shown. Detector locations P-001 through P-008 are for various locations around the facility. Detector locations DSB-01 through DSB-10 are located along the security barrier that lies within the protected area fence.~~

~~A detailed loading diagram illustrating both the NUHOMS® and NAC storage overpacks is provided in Figure 9-3.~~

This application is for construction and loading of Phase 1 only. A close-up view of Phase 1 loading is provided in Figure 9-2 with detector locations for this configuration shown. Detectors DSB-01 through DSB-10 are located within the protected area for Phase 1.

The HSMs are loaded back-to-back in a single row. Sacramento Municipal Utility District (SMUD) fuel is modeled in a 2x11 array of HSM Model 80s at the eastern end of the WCS CISF. San Onofre Nuclear Generating Station (SONGS) fuel is modeled

and
, as

A diagram illustrating the Phase 1 storage area and the detectors located within this area is provided in Figure 9-3. Alarming Radiation Monitors (ARM) and dosimeter locations in the Cask Handling Building are shown in Figure 1-7.

On-site dose rate contributions from the NUHOMS® Storage Overpacks are computed for the proposed storage configuration using MCNP5. Average calculated neutron and gamma dose rates on the surfaces of the various HSM modules are obtained from the respective FSARs [9-3, 9-4, 9-5] and are summarized in Table 9-1. Note that the HSM surface dose rates for the HSM Model 102 are conservatively increased from the reference FSAR values.

The arrays of HSMs are modeled as solid concrete boxes resting on a concrete pad 1.5 feet thick, and a surface source is modeled on each of the HSM array surfaces to reproduce the applicable HSM surface dose rates indicated in Table 9-1. Source particles are started using an outward cosine distribution and spectra applicable to each HSM system.

Security-Related Information Figure Withheld Under 10 CFR 2.390.

Figure 1-2
WCS CISF Site Boundary Layout

Security-Related Information Figure
Withheld Under 10 CFR 2.390.

Figure 1-3
WCS CISF Site Layout

Security-Related Information Figure Withheld Under 10 CFR 2.390.

Figure 1-6
WCS CISF Storage Pad Layout

Security-Related Information Figure Withheld Under 10 CFR 2.390.

Figure 1-7, Cask Handling Building Plan

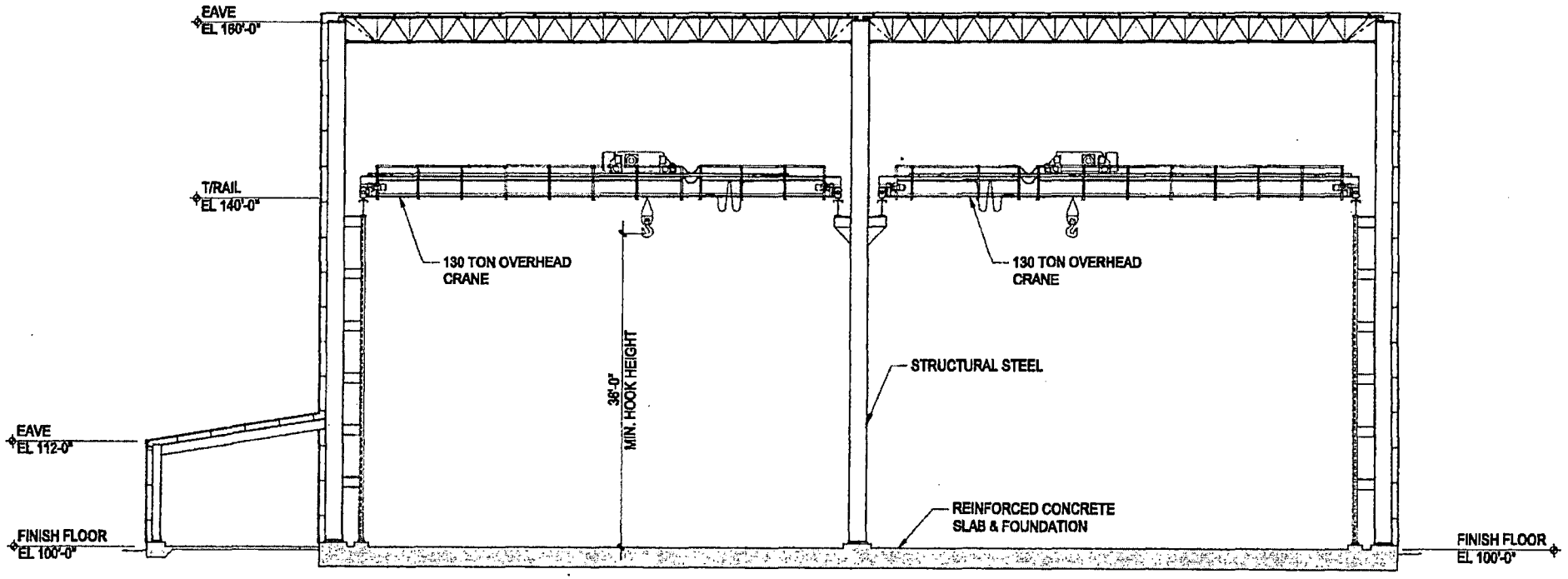


Figure 1-8
Cask Handling Building Section View

Security-Related Information Figure Withheld Under 10 CFR 2.390.

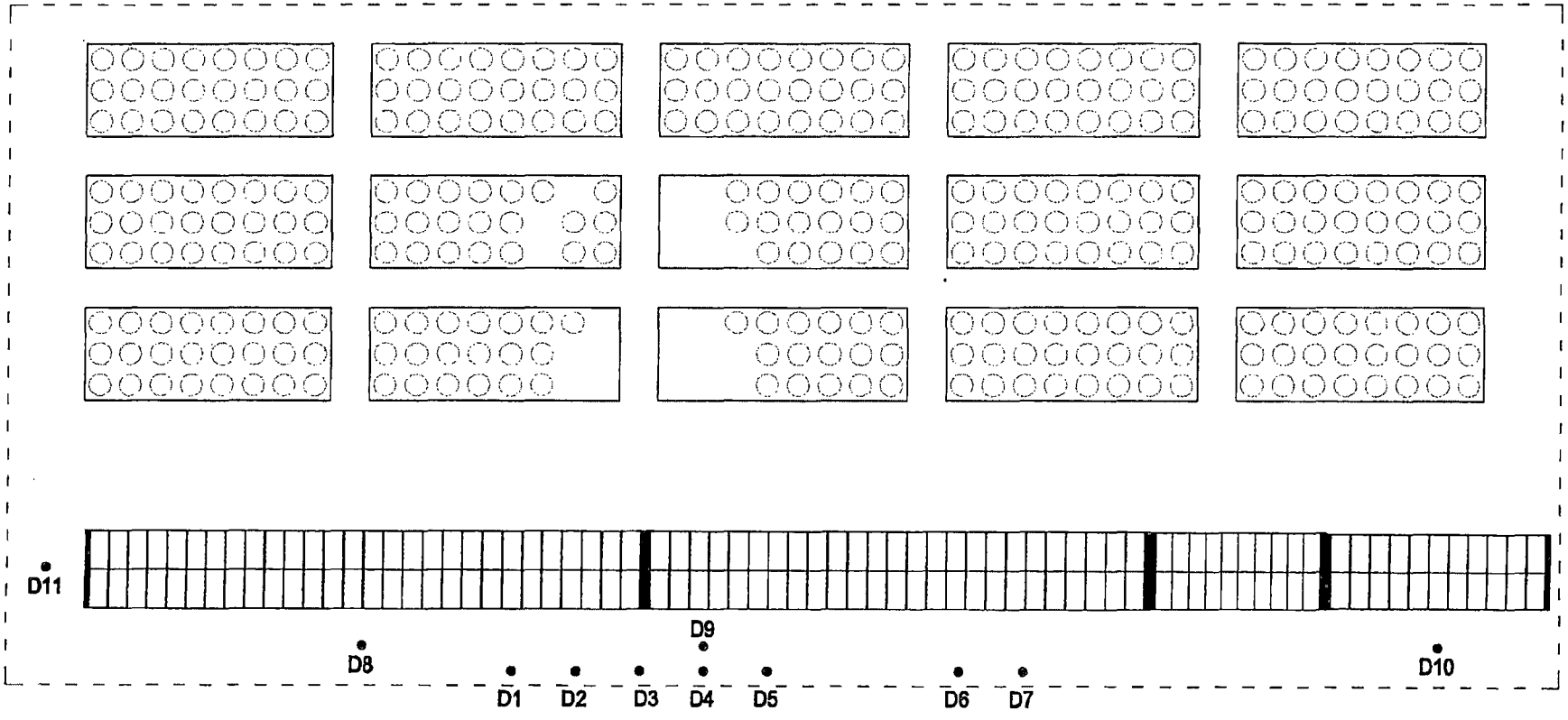
Figure 1-9
Security and Administration Building Plan

Security-Related Information Figure
Withheld Under 10 CFR 2.390.

Figure 9-1
WCS CISF Conceptual Plan, Phases 1 through 8

Security-Related Information Figure Withheld Under 10 CFR 2.390.

Figure 9-2
WCS CISF Plan, Phase 1



LEGEND

● DETECTOR LOCATIONS

Figure 9-3
WCS CISF Storage Area Layout
(Phase 1)

NOTE: SEE FIGURE 1-6 FOR ADDITIONAL INFORMATION

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1.2 General Description of Installation

The WCS CISF is designed as a stand-alone facility and consists of a storage area, and support facilities. The facility boundary is established at the outer limits by the Part 73 Owner Controlled Area (OCA). The Protected Area (PA) boundary is approximately 660 feet inside the OCA boundary. The storage area is approximately 330 feet inside the PA boundary. These areas are shown in Figure 1-2 "WCS CISF Site Boundary Layout."

Figure 1-3 is a blow-up view of the facility showing the storage area and the support facilities inside the Protected Area. Support facilities include the Cask Handling Building, the Security and Administration Building, Transport Haul Route, and Rail Access.

Other than the Canister Transfer System in the Cask Handling Building, storage systems and pads, there are no additional systems required for the safe storage of the canisters. The following ancillary systems are part of the WCS CISF: lighting, security systems including CCTV and intrusion detection, temperature monitoring, and lightning protection.

Because there is no waste generated during the storage phase, there are no gaseous, liquid, or solid radioactive waste treatment systems associated with the storage system. Likewise, heat removal is totally passive in the overpacks and no active cooling system is required. Therefore, there are no required Instrumentation and Control Systems for the WCS CISF.

1.2.1 Location and Site Characteristics

The WCS CISF facility is located approximately 32 miles west of the city of Andrews, Texas, and five miles east of the city of Eunice, New Mexico. The WCS CISF facility is located approximately one-half mile east of the Texas-New Mexico state boundary and one mile north of Texas Highway 176. It occupies parts of Section 16 and 17, Block A-29, Public School Land, Andrews County, Texas included in approximately 25 square miles of property (primarily in Texas with nominal acreage in New Mexico) owned by WCS LLC in northwestern Andrews County, Texas.

The WCS facility is situated in an arid, isolated part of the state. Figure 1-4 shows the location of the facility with respect to known or easily identifiable landmarks. Figure 1-4, as supplemented by Figure 1-1, illustrates county boundaries, rail access, highways, and major roads.

The approximate coordinates of the site are 32° 27' 08" north latitude and 103° 03' 35" west longitude.

1.2.2 Principal Design Criteria

The WCS CISF principal design criteria are based on the site characteristics, the design criteria associated with the cask systems listed in Table 1-1 that have been previously certified by the NRC, and specific criteria required for the WCS CISF design.

The cask systems listed in Table 1-1 meet the WCS CISF design criteria. Table 1-2 provides a summary of the WCS CISF principal design criteria.

1.2.3 Facility Descriptions

The major facilities at the WCS CISF are the Cask Handling Building and the storage area. The Cask Handling Building is approximately 140 feet long by 150 feet wide by 65 feet high. The building is a two bay commercially designed and fabricated steel frame structure with metal siding and reinforced concrete foundations and floors. The steel structure is designed to support two commercial overhead cranes used to move transportation casks from the rail car to the transport vehicle. One bay of the building will house the Canister Transfer System described in Section 1.3.1.2 and the other bay will be available for direct transfer of transportation casks from the rail car to the transport vehicle. A 2,400 square foot area of the building is set aside for cask storage and maintenance. The building plan view is shown in Figure 1-7. Figure 1-8 is a section through the building showing the overhead crane location. Air monitors and dosimeters are located in the building for monitoring purposes. The building is not designed or intended to provided confinement or shielding for SNF or GTCC materials. The building structure, including crane supports, are classified as ITS to prevent massive building collapse or the dropping of heavy objects onto spent fuel cask systems and related to ITS SSCs. The remainder of the building component will NITS. For design specifics, see Section 7.5.3. The purpose -of the Cask Handling Building is to receive and prepare for storage shipments of dual-purpose canister systems. It will also receive GTCC waste canisters for storage at the site. It is also designed to process canisters stored at the site for off-site shipment. The Cask Handling Building is designed to handle canisterized fuel only and does not have the capability to handle bare fuel. The Cask Handling Building is designed to withstand all normal operating loads and off-normal loads created by natural phenomena.

As Low As Reasonably Achievable (ALARA) principles are incorporated, to the maximum extent practical, throughout the facility design to reduce radiation exposure to facility personnel. Cranes/lifting devices for transferring the NUHOMS® transportation/transfer casks from the transportation skid to the transfer trailer/skid are designed to minimize the need for facility personnel to be near the loaded cask. This equipment is NITS as the lift heights of the loaded casks are maintained below 80 inches at all times after removal of the impact limiters. The analysis of bounding drop scenarios shows that a NUHOMS® transportation/transfer cask will maintain structural integrity of the DSC confinement boundary and maintain basket geometry from an 80 inch (from the bottom of the cask to the "ground") drop. The ITS canister transfer system for the vertical transfer of canisters is remotely operated and the transfer equipment used to make the transfer to the storage overpacks is substantially identical to that used to transfer the canister into dry storage at the reactor facilities where the fuel was initially stored.

The storage area is a large area comprised of concrete storage pads and storage overpacks. The purpose of the storage area is to provide safe storage for the canisterized spent nuclear fuel in cask systems that were previously approved by the NRC. The pads and approach aprons are designed to meet the applicable requirements of these previously approved cask systems. The storage area will be constructed in phases, as necessary. Phase 1 is designed to accommodate approximately 5,000 MTHM of spent nuclear fuel and GTCC waste in approximately 470 storage overpacks. Figure 1-6 shows the Phase 1 storage area, The individual storage pads are constructed of reinforced concrete at approximately ground level. Horizontal storage module pad will have concrete approach aprons. Vertical storage module pads will be surrounded by gravel approach roads.

The Security and Administration Building is a commercially designed and fabricated steel building with a reinforced concrete floor and foundation. The building primarily functions as the location for the Central Alarm Station and for Health Physics spaces. Additionally, the building provides security and administration spaces and is the main personnel entrance and exit for the facility. Figure 1-9 shows the Security and Administration Building Layout.

The remainder of the WCS CISF facilities provide support functions such as fuel receipt, security and fire protection. Table 1-3 provides a list of the WCS CISF facilities and their functions.

Security-Related Information Figure Withheld Under 10 CFR 2.390.

Figure 1-2
WCS CISF Site Boundary Layout

Security-Related Information Figure Withheld Under 10 CFR 2.390.

Figure 1-3
WCS CISF Site Layout

Security-Related Information Figure Withheld Under 10 CFR 2.390.

Figure 1-6 WCS CISF Storage Pad Layout

4.1 Installation Design

This section provides a description of the WCS CISF layout and the major buildings, structures and canister Storage Area. It also identifies the major operating functions performed at the WCS CISF and the appropriate references providing detailed information for each operating function.

4.1.1 Location and Layout of Facility

The WCS CISF is located in Andrews County, Texas near the Texas and New Mexico state line. The WCS CISF will be to the north and adjacent to the existing WCS facilities. The entrance for the WCS CISF is located approximately 1.5 miles north of the existing entrance to WCS on Texas State Highway 176. Figures 1-1 through 1-4 show the location and layout of the WCS CISF.

4.1.2 Principle Features

The WCS CISF is a SNF and GTCC waste dry storage system facility with a capacity of 5,000 MTHM. Only canisterized SNF and GTCC waste will be received at the WCS CISF. The storage overpacks used at the WCS CISF are a combination of those designed by AREVA TN and NAC International. Waste shipments arrive at the WCS CISF by rail car and the transportation cask will be unloaded from the rail car to either a Canister Transfer System, for vertical systems; or directly to a transfer vehicle, for the horizontal systems. For the vertical systems, the Canister Transfer System is used to transfer the loaded canisters from the transportation cask to a storage overpack which is then moved to the Storage Pad via the vertical cask transporter (VCT). For the horizontal systems, the transportation cask is used as the transfer cask to move the loaded canister out to the Storage Pad where the canister is transferred directly to its storage overpack. Figure 1-2 shows the WCS CISF layout.

4.1.2.1 Site Boundary

The WCS property is approximately 14,000 acres in Texas and New Mexico. The WCS CISF will be located in Texas on approximately 155 acres of land. Adjacent to the WCS CISF will be the WCS low-level radioactive waste (LLRW) and Hazardous Waste Treatment, Storage, and Disposal Facility (TSDF) operations.

4.1.2.2 Owner Controlled Area

The Owner Controlled Area (OCA) is the outer controlled boundary of the WCS CISF. This fenced in area encloses approximately 155 acres within the 14,000 acres of WCS property. Special authorization is required for access to this area. The location of the OCA in realtion to the CISf is shown on Figure 1-2.

4.1.2.3 Protected Area

The Protected Area (PA) is approximately 36 acres within the OCA which includes the concrete storage pads, storage overpacks, Cask Handling Building, and the Security and Administration Building. The PA is surrounded by a double fence with a minimum 20-foot space between each fence. The exterior fence acts as a "nuisance" fence and the interior fence is the primary fence for intruder barrier and detection. Personnel will access the PA through the Security and Administration Building. There is a minimum of 200 meters between the PA fence and the OCA fence.

4.1.2.4 Storage Area and Concrete Storage pads

SNF is placed in storage overpacks located on concrete pads in the Storage Area. The Storage Area is 350 feet wide by 800 feet long and consists of concrete storage pads, concrete access aprons, and access roadways. There is a minimum of 100 meters between the Storage Area and the PA fence. Storage overpack design details and criteria for confinement, shieldnig, structural, and protection from natural phenomena are provided in Appendices A-G.

Concrete pad thickness and steel reinforcing depends of which type of storage overpack that is used on each pad. Concrete aprons and access roadways are constructed as necessary to facilitate VCT and transfer vehicle access and final storage placement of canisters. Storage Pad design details and criteria for natural phenomena and accidents are located in Section 7.6.1.

4.1.2.5 Cask Handling Building

Transfer of each canister from the rail car to the transfer vehicle or VCT occurs inside the Cask Handling Building. The Cask Handling Building contains two overhead cranes capable of lifting and manipulating the transportation cask and canister. For canisters stored in horizontal storage overpacks, the overhead bridge crane is used to transfer the transportation cask from the rail car to a transfer vehicle that will move the canister to the concrete pad. For canisters stored in Vertical Concrete Casks (VCCs), the Cask Transfer System and VCT are used to transfer the canister from the transportation cask a VCC that is then moved to the Storage Area. Figures 1-7 and 1-8 show the Cask Handling Building Layout and elevation section. The cask Handling Building does not provide confinement or radiation sheilding other than a concrete masonry unit wall between the main building section and the office area. Section 7.5.3 describes building design criteria for protection from natural phenomena and accidents.

4.1.2.6 Transportation Cask Queuing Areas

The rail side track that brings rail cars to the Cask Handling Building has queuing length of approximately 800 feet inside of the PA. This length will accommodate five primary rail cars and five accompanying buffer cars, all within the PA. Once a rail car has been unloaded, it will be released through the east end of the Cask Handling Building and outside of the PA.

4.1.2.7 Rail Side Track

The rail side track will depart from the existing WCS rail loop and extend north and to the east into the PA and the Cask Handling Building. There is sufficient rail length for 10 rail cars to be inside the PA before proceeding through the Cask Handling Building. Unloaded rail cars will exit the Cask Handling Building and continue east on the rail sidetrack which will connect back into the existing WCS rail loop.

4.1.2.8 Security and Administration Building

The Security and Administration Building will coordinate several functions for the WCS CISF. Security personnel will monitor sensors and intrusion alarms, control employee access, and process visitors into the WCS CISF. Health physics will operate and store equipment in this building and an administration staff will use this building for processing shipments and storing records. The building will contain the Central Alarm Station (CAS), Armory, locker rooms, break room, offices, health physics spaces, and records storage. The backup electrical generator system for the WCS CISF is located at this building. See Figure 1-9 for the building layout. The building is a commercially designed and fabricated steel structure with reineforced concrete floors and foundations. The building is not important-to-safety and does not provide any confinement or radiation shielding functions. The building will be designed for protection against natural phenomena as required by standard local building codes.

4.1.2.9 Receiving Area

When the shipping cask arrives at the WCS CISF, the shipping cask and cradle are visually inspected for damage prior to entry into the OCA.

4.1.2.10 Concrete Cask Staging Area

There is an area inside the Cask Handling Building for VCC staging for VCCs awaiting loading via the Canister Transfer System. Additional staging areas are available outside the security boundaries of the WCS CISF.

4.1.2.11 Off-Normal Holding Area

Transport casks arriving at the CISF via rail spur will be visually inspected and radiation dose rate and contamination surveys will be performed.

If initial radiological surveys preclude completion of the other steps of receipt instruction, WCS will isolate the rail car or move the rail car to the Cask Handling Building and establish appropriate radiological controls. WCS will document the damage, notify the NRC of the condition and develop a corrective action plan. WCS will evaluation the use of movable shielding to protect personnel from radiation exposure while the damaged cask is on site.

9.4 Estimated On-Site Collective Dose Assessment

On-site dose rates are computed for the proposed storage configuration using the MCNP5 v1.40 and MCNP6 version 1.0 computer programs. The dose to workers due to a loading operation is also estimated based upon dose rate information in existing storage FSARs and transportation SARs. The dose to workers due to loading is provided in the Appendices for each system as listed in Table 9-4.

9.4.1 Radiation Dose Rate Within the Controlled Area

The WCS CISF will be constructed and loaded in eight phases, as indicated on Figure 9-1. The WCS CISF is enclosed by a protected area fence system, and detector locations D1 through D16 are placed along this fence-line, as indicated in Figure 9-1. The protected area fences lie within the owner controlled area fence.

This application is for construction and loading of Phase 1 only. A close-up view of Phase 1 loading is provided in Figure 9-2 with detector locations for this configuration shown. Detectors DSB-01 through DSB-10 are located within the protected area for Phase 1.

A diagram illustrating the Phase 1 storage area and the detectors located within this area is provided in Figure 9-3. Alarming Radiation Monitoring (ARM) and dosimeter locations in the Cask Handling Building are shown in Figure 1-7.

NUHOMS® Systems

The HSMs are loaded back-to-back in a single row. Sacramento Municipal Utility District (SMUD) fuel is modeled in a 2x11 array of HSM Model 80s at the eastern end of the WCS CISF. San Onofre Nuclear Generating Station (SONGS) fuel is modeled in a 2x10 array of AHSMs, and Millstone fuel is modeled in two arrays (2x25 and 2x28) of HSM Model 102s. Detectors are located at positions D1 through D11, as illustrated on Figure 9-3.

On-site dose rate contributions from the NUHOMS® Storage Overpacks are computed for the proposed storage configuration using MCNP5. Average calculated neutron and gamma dose rates on the surfaces of the various HSM modules are obtained from the respective FSARs [9-3, 9-4, 9-5] and are summarized in Table 9-1. Note that the HSM surface dose rates for the HSM Model 102 are conservatively increased from the reference FSAR values.

The arrays of HSMs are modeled as solid concrete boxes resting on a concrete pad 1.5 feet thick, and a surface source is modeled on each of the HSM array surfaces to reproduce the applicable HSM surface dose rates indicated in Table 9-1. Source particles are started using an outward cosine distribution and spectra applicable to each HSM system.

Security-Related Information Figure Withheld Under 10 CFR 2.390.

Figure 9-1
WCS CISF Conceptual Plan, Phases 1 through 8

Security-Related Information Figure Withheld Under 10 CFR 2.390.

Figure 9-2
WCS CISF Plan, Phase 1

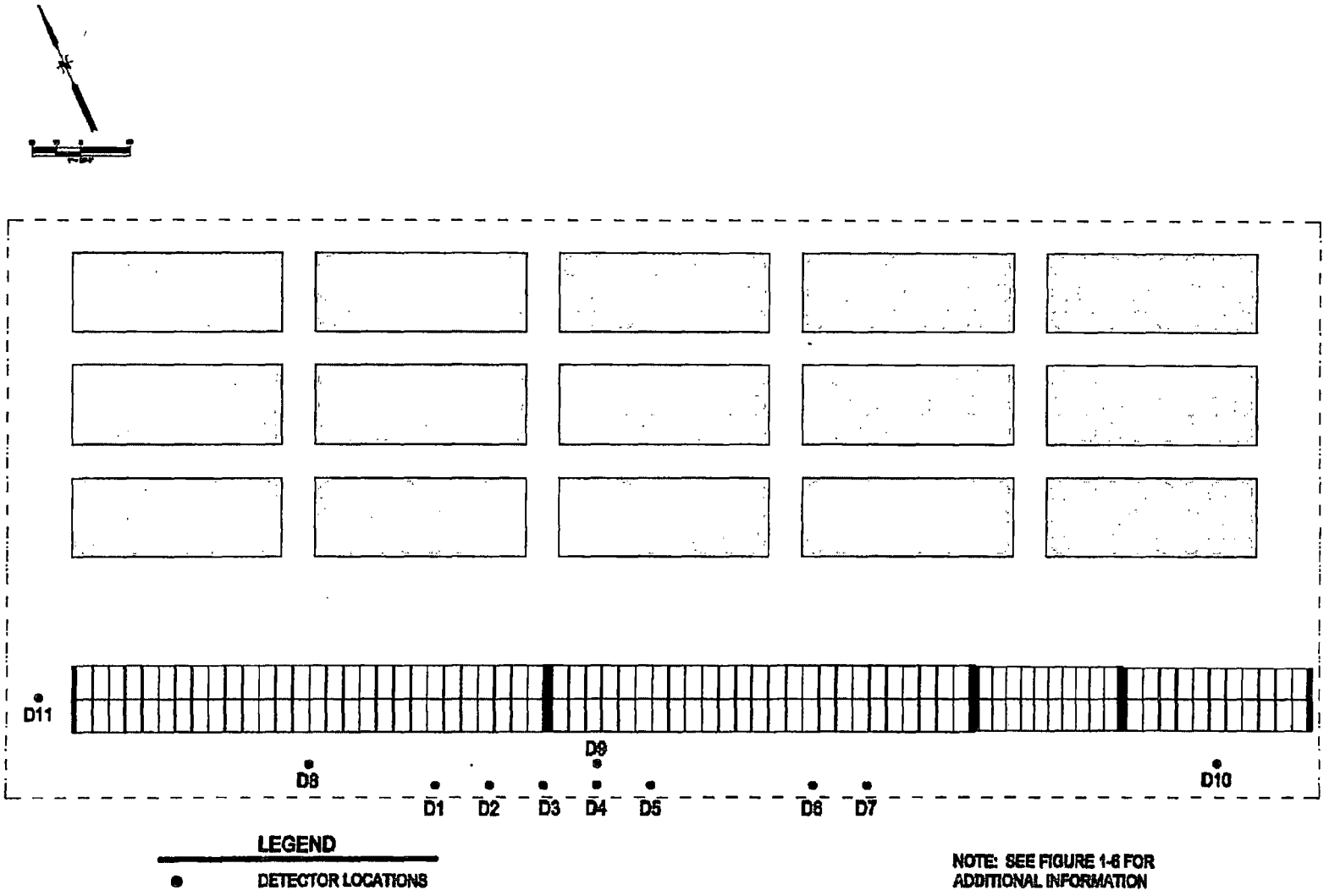


Figure 9-3
WCS CISF Storage Area Layout

RSI NP-4.5

Provide clear and specific references to design drawings and descriptions, including description of the shielding design of the overpacks, storage modules, and canisters to be used at the CISF.

A review of the SAR indicates that the CISF SAR does not include all of the necessary information to describe all of the SSCs for the storage systems used at the proposed facility. For example, Section D.9.1 of the WCS SAR references Section 7.3.2.1 of the NUHOMS FSAR for information on the 61 BTH Type 1 canister and the HSM Model 102 storage module. That section of the NUHOMS FSAR describes the radiation shielding features of these items and references details and drawings for the HSM and canister that exist in Chapter 4 and Appendix E of the FSAR. However, the references do not include details, drawings and descriptions of radiation shielding features specific to the 61 BTH Type 1 canister (which exist in specific sections of Appendix T of the NUHOMS FSAR). The applicant should ensure the CISF SAR includes clear and specific references to information for all of the SSCs for each storage system to be used at the CISF.

This information is needed to determine compliance with 10 CFR 72.18, 10 CFR 72.24(b), (c), and (e).

WCS Response to RSI 4.5:

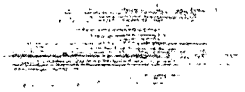
WCS has modified Section 4.2.2.2 and Table 4-1 of the CISF SAR to point to where the canister, transfer cask and storage overpacks drawings are either provided or incorporated by reference with specific pointers to where the drawings can be found in the reference FSARs and SARs. WCS has added specific references to design drawings and descriptions of the shielding design features for the applicable canisters (DSCs), transfer casks and storage overpacks as requested in each of the appendices. WCS also has added new sections to the end of each of the Chapter 4, Appendices to list the applicable drawings for the storage systems. These new sections either include a copy of the required drawings or provide specific reference to the sections in the FSARs and SARs where the drawings reside.

WCS SAR Impact:

WCS has revised CISF SAR Chapter 4, Section 4.2.2.2 and Table 4-1 as discussed in the response above (see attached).

WCS has revised the following sections in Appendix A to the WCS CISF SAR: A.4 TOC, A.4.2, A.4.2.1, A.4.2.2, A.4.2.3, A.4.5 and A.9.1, and added Section A.4.6 and associated GTCC waste canister drawings 13302-1005 Revision 0 and 13302-1007 Revision 0 as discussed in the response (see attached).

WCS has revised the following sections in Appendix B to the WCS CISF SAR: B.4 TOC, B.4.2, B.4.2.1, B.4.2.2, B.4.2.3, and B.9.1 and added Section B.4.6 as discussed in the response (see attached).



WCS has revised the following sections in Appendix C to the SAR: C.4 TOC, C.4.2, C.4.2.1, C.4.2.2, C.4.2.3, C.4.5 and C.9.1 and added Section C.4.6 as discussed in the response (see attached).

WCS has revised the following sections in Appendix D to the SAR: D.4 TOC, D.4.2, D.4.2.1, D.4.2.2, D.4.2.3, and D.9.1 and added Section D.4.6 as discussed in the response (see attached).

WCS has revised the following sections in Appendix E to the SAR, as discussed in the response:

WCS SAR Appendix E changes, below:

E.4 TOC

Addition to the end of the Table of Contents:

E.4.4 Supplemental Data .....page number (to be added)

E.4

Addition to the end of the section:

Section E.4.4 provides a listing of all applicable license drawings (i.e., only Yankee-MPC, CY-MPC, and MPC-LACBWR fuel storage systems) from Reference [E.4-1].

E.9.1

Change to the third paragraph:

The NAC-MPC storage system is comprised of a transportable storage canister, a transfer cask, and a vertical concrete storage cask. License drawings for these items are provided in Section E.4.4~~1.7 of Reference E.9.3-1.~~

E.9.2.1

Change to the second paragraph:

The MPC-LACBWR storage system is comprised of a transportable storage canister, a transfer cask, and a vertical concrete storage cask. License drawings for these items are provided in Section E.4.4~~1.A.7 of Reference E.9.3-1.~~

Section E.4.4 has been added:

E.4.4 Supplemental Data

The licensing drawings for the NAC-MPC system are listed in Section 1.7, *Drawings*, and Section 1.A.7, *MPC-LACBWR Licensing Drawings*, in volume 1 of the *NAC-MPC Final Safety Analysis Report*, Revision 10 [E.4-1].

Section 1.7.1 lists the Yankee-MPC license drawings; Section 1.7.2 lists the Yankee Class Reconfigured Fuel Assembly License drawings; and Section 1.7.3 lists the CY-MPC license drawings. These drawings appear in the FSAR immediately after the drawing lists in Section 1.7.

Section 1.A.7 lists the MPC-LACBWR licensing drawings. These drawings appear in the FSAR immediately after the drawing list in Section 1.A.7.

WCS has revised the following sections in Appendix F to the SAR, as discussed in the response:

WCS SAR Appendix E changes, below:

F.4 TOC

Addition to the end of the Table of Contents:

F.4.3 Supplemental Data .....Page number (to be added)

F.4

Addition to the end of the section:

Section F.4.3 provides a listing of all applicable license drawings (i.e., NAC-UMS drawings associated with the storage PWR fuel and site-specific Maine Yankee fuel drawings) from Reference [F.4.2-1].

F.9.1

Change to the second paragraph:

The NAC-UMS storage system is comprised of a transportable storage canister, a transfer cask (standard or advanced configuration), and a vertical concrete storage cask. Canister handling, fuel loading, and canister closing are operationally identical for both transfer cask configurations. License drawings for these components are provided in Section F.4.3~~1.8 of the NAC-UMS FSAR, Reference F.9.2-1.~~

F.9.1.1

Change to the last paragraph:

An optional carbon steel supplemental shielding fixture, shown in ~~NAC-UMS FSAR (Reference F.9.2-1)~~ Drawing 790-613, may be installed to reduce the radiation dose rates at the air inlets.

Section F.4.3 has been added:

F.4.3 Supplemental Data

The licensing drawings for the NAC-UMS Universal Storage System are listed in Section 1.8.1, *License Drawings* of the *NAC-UMS® Universal Storage System Final Safety Analysis Report*,

Revision 10 [F.4.2-1]. These drawings appear in the FSAR immediately after the drawing list in Section 1.8.1.

WCS has revised the following sections in Appendix G to the SAR, as discussed in the response:

WCS SAR Appendix G changes, below:

G.4 TOC

Addition to the end of the Table of Contents:

G.4.3 Supplemental Data .....Page number (to be added)

G.4

Addition to the end of the section:

Section G.4.3 provides reference to applicable license drawings (i.e., only undamaged and damaged PWR fuel storage systems) from Reference [G.4-1].

G.9.1.1

Addition to the first paragraph:

The transfer cask radial shield is comprised of steel inner and outer shells connected by solid steel top and bottom forgings. License drawings for these components are provided in Section G.4.3.The shell encloses a lead gamma shield and a solid borated polymer (NS-4-FR) neutron shield.

G.9.1.2

Addition to first paragraph:

The concrete cask is composed of body and lid components. License drawings for these components are provided in Section G.4.3. The body contains the air inlets, air outlets, and the cavity for TSC placement.

Section G.4.3 has been added:

G.4.3 Supplemental Data

The licensing drawings for the MAGNASTOR® System are listed in Section 1.8, *License Drawings* of the *MAGNASTOR® System Final Safety Analysis Report*, Revision 7 [G.4-1]. These drawings appear in the FSAR immediately after the drawing list in Section 1.8.1.

4.2.2 Storage Area

Storage Area systems and operations are described in this section. The main function of the Storage Area is to provide a location to place the storage overpacks containing the canisters received at the WCS CISF. The Storage Area is designed for the transfer, storage and retrieval of canisterized SNF and GTCC waste. The Storage Area is constructed in stages, as needed, to support WCS CISF operational throughput requirements, and is contained within the double fence of the OCA. (Figures 1-2 and 1-3).

The Storage Area is designed to accommodate both horizontal and vertical systems. There are NUHOMS® pads with space for up to 148 horizontal storage systems (22 HSM Model 80s, 20 AHSMs and 106 HSM Model 102s) There are thirteen separate pads for the vertical systems that hold up to 319 storage overpacks (169 UMS, 59 MPC and 91 MAGNASTOR VCCs).

4.2.2.1 Concrete Pad Structures

Six storage systems were evaluated for storage in the WCS CISF Storage Area. These cask systems each have their own unique storage pad requirements. Table 4-1 provides a cross reference to the applicable appendix and section for each canister/storage overpack where the concrete pad structures are discussed.

4.2.2.2 Cask Storage Systems

and drawings are provided or incorporated by reference

Six storage systems were evaluated for storage in the WCS CISF Storage Area. These cask systems contain SNF or GTCC waste in sealed canisters. Table 4-1 provides a cross reference to the applicable appendix and section for each canister/storage overpack where the individual cask storage systems are discussed.

4.2.2.3 Cask Transfer Systems

Six storage systems were evaluated for storage in the WCS CISF Storage Area. These cask systems use various cask transfer systems. Table 4-1 provides a cross reference to the applicable appendix and section for each canister/storage overpack where the individual cask transfer systems are discussed.

Table 4-1
Operating Systems Associated with the Storage Systems at the WCS CISF

Cask System	Canister	Overpack	Appendix
NUHOMS®-MP187 Cask System	FO-DSC	HSM (Model 80)	Appendix A.4
	FC-DSC		
	FF-DSC		
Standardized Advanced NUHOMS® System	(Drawings listed in Section B.4.6)	AHSM	Appendix B.4
Standardized NUHOMS® System	(Drawings listed in Section C.4.6)	HSM Model 102	Appendix C.4
	NUHOMS® (Drawings listed in Section D.4.6)		Appendix D.4
NAC-MPC	Yankee Class	VCC	Appendix E.4
	Connecticut Yankee	VCC	
	LACBWR	VCC	
NAC-UMS	Classes 1 thru 5	VCC	Appendix F.4
MAGNASTOR	TSC1 thru TSC4	CC1 thru CC4	Appendix G.4

(Drawings listed in Section A.4.6)

Drawings listed in Section E.4.4

Drawings listed in Section F.4.3

Drawings listed in Section G.4.3

APPENDIX A.4
OPERATING SYSTEMS
NUHOMS®-MP187 Cask System

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A.4. OPERATING SYSTEMS A.4-1

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A.4.1.3 Safety Considerations A.4-4

A.4.2 Cask Storage System A.4-5

A.4.2.1 Operating Function A.4-5

A.4.2.2 Design Description A.4-5

A.4.2.3 Safety Considerations A.4-5

A.4.3 Cask Transporter System A.4-6

A.4.3.1 Operating Function A.4-6

A.4.3.2 Design Description A.4-6

A.4.3.3 Safety Considerations A.4-6

A.4.4 Storage Module Thermal Monitoring System A.4-7

A.4.5 References A.4-8

A.4.6 Supplemental Data (Drawings) A.4-8a

; and MP187 cask configured for transfer operations.

FO-, FC- and FF-DSC and GTCC waste canisters;

A.4.2 Cask Storage System

This section is applicable to the NUHOMS® HSM Model 80.

A.4.2.1 Operating Function

and GTCC waste

The overall function of the HSM Model 80 used at the WCS CISF is to safely provide interim storage of spent nuclear fuel (SNF) canisters. These canisters provide a

The FC- and FO-DSCs are shown in drawing NUH-05-4004 Revision 16 and the FF-DSC is shown in drawing NUH-05-4005 Revision 14, included in Section A.4.6. The GTCC canister is shown in drawings 13302-1005 Revision 0 and 13302-1007 Revision 0 included in Section A.4.6.

Class C (GTCC) waste canisters are designed for storage in accordance with 10 CFR 72, and for transportation in accordance with 10 CFR 71. The main function of sealed canisters is to accommodate SNF assemblies and GTCC waste, and provide confinement and criticality control during normal operation and postulated design-basis accident conditions for on-site storage.

The HSM Model 80 is designed in accordance with 10 CFR 72, and provides horizontal on-site storage of the sealed SNF and GTCC waste canisters. The main function of the HSM Model 80 is to provide safe, long-term storage of FO-, FC- and FF-DSCs containing SNF assemblies and GTCC waste canisters containing solid reactor waste.

The HSM Model 80 design function is to passively cool the canisters by air convection. The HSM Model 80 also provides the capability for canister transfer from their associated transportation/transfer casks.

Place Insert A here

A.4.2.2 Design Description

Place Insert B here

The HSM Model 80 is a low profile, reinforced concrete structure designed to withstand all normal condition loads as well as the off-normal and accident condition loads created by earthquakes, tornadoes, flooding, and other natural phenomena. The HSM is also designed to withstand off-normal and accident condition loadings postulated to occur during design basis accident conditions such as a complete loss of ventilation.

Place Insert C here

A.4.2.3 Safety Considerations

Place Insert D here

The HSM Model 80 is an important-to-safety (ITS), Quality Category B component.

The MP-187 Cask is an ITS, Quality Category B component.

A.4.5 References

A.4-1 AREVA TN Document NUH-003, Revision 14, "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel." (Basis for NRC CoC 72-1004).

A.4-2 American Concrete Institute, "Specifications for Structural Concrete for Buildings," ACI 301, 1989.

A.4-3 Proposed SNM-1050, WCS Interim Storage Facility Technical Specifications, Amendment 0.

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

Insert E goes at the top of the next page (A.4-8a) which is between this page and the first Table.

and Appendix C, Section 7.3.1.1

A.9.1 Radiation Protection D

Details of the Storage Area shielding design features for the NUHOMS®-MP187 Cask System which includes the FO-, FC-, FF- Dry Shielded Canisters (DSCs) and Greater Than Class C (GTCC) waste canisters stored in an HSM Model 80 are documented in Section 7.3.2.1 of reference [A.9-1]. Drawings showing the shield thicknesses for the canisters, HSM Model 80 and MP187 cask are listed in Section A.4.6.

Appendix A Insert A for RSI 4.5

The drawings for the HSM Model 80 are not included in reference [A.4-4] as the HSM was incorporated by reference into the "Rancho Seco Independent Spent Fuel Storage Installation Safety Analysis Report." The applicable drawings for the HSM Model 80 are NUH-03-6008-SAR Revision 10, NUH-03-6009-SAR Revision 9, NUH-03-6010-SAR Revision 5, NUH-03-6014-SAR Revision 9, NUH-03-6015-SAR Revision 8, NUH-03-6016-SAR Revision 10, NUH-03-6017-01-SAR Revision 7, NUH-03-6018-SAR Revision 7 and NUH-03-6024-SAR Revision 5 included in Section A.4.6.

The MP187 cask, in the transfer configuration, design function is to protect the canisters and provide shielding from the radiation sources inside the canisters during transfer operations. The MP187 cask in the transfer configuration is shown in drawings NUH-05-4001 Revision 15 and NUH-05-4003 Revision 10, included in Section A.4.6.

Appendix A Insert B for RSI 4.5

The FO-, FC- and FF-DSCs and GTCC waste canisters are stainless steel flat head pressure vessels that provide confinement and are designed to withstand all normal condition loads as well as the off-normal and accident condition loads created by earthquakes, tornadoes, flooding, and other natural phenomena.

Appendix A Insert C for RSI 4.5

The MP187 cask, in the transfer configuration, is used to transfer the canisters from the CHB to the storage pad where the cask is mated to the HSM Model 80. The cask is designed to withstand all normal condition loads as well as the off-normal and accident condition loads created by earthquakes, tornadoes, flooding, and other natural phenomena.

Appendix A Insert D for RSI 4.5

The FO-, FC- and FF- DSCs are Important-to-safety (ITS), Quality Category A components. The GTCC waste canister is an ITS, Quality Category B component.

Appendix A Insert E for RSI 4.5

A.4.6 Supplemental Data (Drawings)

The following drawings are located as noted below:

1. "NUHOMS FO-DSC and FC-DSC for PWR Fuel Main Assembly (four sheets)," NUH-05-4004, Revision 16 (See Volume 4 of the "Rancho Seco Independent Spent Fuel Storage Installation Safety Analysis Report" [A.4-4]).

2. "NUHOMS FF-DSC for PWR Fuel Main Assembly (four sheets)," NUH-05-4005, Revision 14 (See Volume 4 of the "Rancho Seco Independent Spent Fuel Storage Installation Safety Analysis Report" [A.4-4]).

3. "NUHOMS® System GTCC Canister Main Assembly (five sheets)," 13302-1005, Revision 0 (Included at the end of this Section)

4. "NUHOMS® System GTCC Canister Closure Installation (one sheet)," 13302-1007, Revision 0 (Included at the end of this Section)

5. "Standardized NUHOMS® ISFSI Horizontal Storage Module ISFSI General Arrangement (three sheets)," NUH-03-6008-SAR, Revision 10 (See Section E.2 of Appendix E of the "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel" [A.4-1]).

6. "Standardized NUHOMS® ISFSI Horizontal Storage Module Main Assembly (two sheets)," NUH-03-6009-SAR, Revision 9 (See Section E.2 of Appendix E of the "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel" [A.4-1]).

7. "Standardized NUHOMS® ISFSI Horizontal Storage Module Base Unit Assembly (two sheets)," NUH-03-6010-SAR, Revision 5 (See Section E.2 of Appendix E of the "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel" [A.4-1]).

8. "Standardized NUHOMS® ISFSI Horizontal Storage Module Base Unit (three sheets)," NUH-03-6014-SAR, Revision 9 (See Section E.2 of Appendix E of the "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel" [A.4-1]).

9. "Standardized NUHOMS® ISFSI Horizontal Storage Module Roof Slab Assembly (two sheets)," NUH-03-6015-SAR, Revision 8 (See Section E.2 of Appendix E of the "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel" [A.4-1]).

10. "Standardized NUHOMS® ISFSI Horizontal Storage Module DSC Support Structure (two sheets)," NUH-03-6016-SAR, Revision 10 (See Section E.2 of Appendix E of the "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel" [A.4-1]).

11. "Standardized NUHOMS® ISFSI Horizontal Storage Module, Module Accessories (five sheets)," NUH-03-6017-01-SAR, Revision 7 (See Section E.2 of Appendix E of the "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel" [A.4-1]).

12. "Standardized NUHOMS® ISFSI Horizontal Storage Module Shield Wall Plans and Details (two sheets)," NUH-03-6018-SAR, Revision 7 (See Section E.2 of Appendix E of the "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel" [A.4-1]).

13. "Standardized NUHOMS® ISFSI Horizontal Storage Module, Module Erection Hardware (two sheets)," NUH-03-6024-SAR, Revision 5 (See Section E.2 of Appendix E of the "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel" [A.4-1]).

14. "NUHOMS MP-187 Multi-purpose Cask Main Assembly (six sheets)," NUH-05-4001 Revision 15 (See Volume 4 of the "Rancho Seco Independent Spent Fuel Storage Installation Safety Analysis Report" [A.4-4]).

15. "NUHOMS MP-187 Multi-purpose Cask Onsite Transfer Arrangement (two sheets)," NUH-05-4003 Revision 10 (See Volume 4 of the "Rancho Seco Independent Spent Fuel Storage Installation Safety Analysis Report" [A.4-4])

Drawings 13302-1005 Rev 0 and 13302-1007 Rev 0 go at the end of Section A.4 behind the last figure. No page number and marked as "SECURITY RELATED INFORMATION." Note: the text in this box is an instruction and is not to be inserted into the SAR

Proprietary Information on RSI 4.5 (next 6 pages)
Withheld Pursuant to 10 CFR 2.390

APPENDIX B.4
OPERATING SYSTEMS
Standardized Advanced NUHOMS® System

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NUHOMS(R)-24PT1 canisters;

; and MP187 cask configured for transfer operations.

B.4.2 Cask Storage System

This section is applicable to the NUHOMS® AHSM.

B.4.2.1 Operating Function

The NUHOMS(R)-24PT1 canister is shown in drawing NUH-05-4010 Revision 5, included in Section B.4.6.

im

means to place set quantities of SNF into dry storage in a way that allows easy retrieval of the canisters for off-site shipment.

The NUHOMS®-24PT1 canisters containing SNF assemblies ~~and Greater than Class C (GTCC) waste canisters~~ are designed for storage in accordance with 10 CFR 72, and for transportation in accordance with 10 CFR 71. The main function of sealed canisters is to accommodate SNF assemblies ~~and GTCC waste~~, and provide confinement and criticality control during normal operation and postulated design-basis accident conditions for on-site storage.

The AHSM is designed in accordance with 10 CFR 72, and provides horizontal on-site storage of the sealed SNF ~~and GTCC waste~~ canisters. The main function of the AHSM is to provide safe, long-term storage of NUHOMS®-24PT1 canisters containing SNF assemblies ~~and GTCC waste canisters containing solid reactor waste~~.

The AHSM is shown in drawing NUH-03-4011 Revision 7, included in Section B.4.6.

he

~~AHSM also provides the capability for canister transfer from their associated~~ transportation/transfer casks.

Place Insert A here

B.4.2.2 Design Description

Place Insert B here

The AHSM is a low profile, reinforced concrete structure designed to withstand all normal condition loads as well as the off-normal and accident condition loads created by earthquakes, tornadoes, flooding, and other natural phenomena. The AHSM is also designed to withstand off-normal and accident condition loadings postulated to occur during design basis accident conditions such as a complete loss of ventilation.

Place Insert D here

Place Insert C here

B.4.2.3 Safety Considerations

The AHSM is an important-to-safety (ITS), Quality Category B component.

The MP187 cask is an ITS, Quality Category B component.

B.4.5 References

B.4-1 AREVA TN Document, ANUH-01.0150, Revision 6, "Updated Final Safety Analysis Report for the Standardized Advanced NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel, NRC Docket No. 72-1029.

B.4-2 American Concrete Institute, "Specifications for Structural Concrete for Buildings," ACI 301, 1989.

B.4-3 Proposed SNM-1050, WCS Interim Storage Facility Technical Specifications, Amendment 0.

Insert E goes at the top of the next page (B.4-8a) which is between this page and the first Table.

B.9.1 Radiation Protection Design Features

Details of the Storage Area shielding design features for the Standardized Advanced NUHOMS® System Cask System which includes the NUHOMS®-24PT1 Dry Shielded Canister (DSC) stored in an AHSM are documented in Section 10.2.1 of reference [B.9-1]. Drawings showing the shield thicknesses for the MP187 cask are included in Section A.4.6 and drawings showing the shield thicknesses for the NUHOMS(R)-24PT1 DSC and AHSM are included in Section B.4.6.

Appendix B Insert A for RSI 4.5

The MP187 cask, in the transfer configuration, design function is to protect the canisters and provide shielding from the radiation sources inside the canisters during transfer operations. The MP187 cask in the transfer configuration is shown in drawings NUH-05-4001 Revision 15 and NUH-05-4003 Revision 10, included in Section A.4.6.

Appendix B Insert B for RSI 4.5

The NUHOMS®-24PT1 canister is a stainless steel flat head pressure vessel that provides confinement and is designed to withstand all normal condition loads as well as the off-normal and accident condition loads created by earthquakes, tornadoes, flooding, and other natural phenomena.

Appendix B Insert C for RSI 4.5

The MP187 cask, in the transfer configuration, is used to transfer the canisters from the CHB to the storage pad where the cask is mated to the AHSM. The cask is designed to withstand all normal condition loads as well as the off-normal and accident condition loads created by earthquakes, tornadoes, flooding, and other natural phenomena.

Appendix B Insert D for RSI 4.5

The NUHOMS®-24PT1 canisters are Important-to-safety (ITS), Quality Category A components.

Appendix B Insert E for RSI 4.5

B.4.6 Supplemental Data (Drawings)

The following drawings are located as noted below:

1. "General License NUHOMS® 24PT1-DSC Main Assembly (six sheets)," NUH-05-4010, Revision 5 (See Section 1.5.2 of the Standardized Advanced NUHOMS® UFSAR [B.4-1]).

2. "General License NUHOMS® Advanced Horizontal Storage Module Main Assembly (nine sheets)," NUH-03-4011, Revision 7 (See Section 1.5.2 of the Standardized Advanced NUHOMS® UFSAR [B.4-1]).

APPENDIX C.4
OPERATING SYSTEMS
Standardized NUHOMS®-61BT System

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C.4.4 Storage Module Thermal Monitoring System C.4-7

C.4.5 References C.4-8

C.4.6 Supplemental Data (Drawings) C.4-8a

NUHOMS(R) 61BT DSC;

; and MP197HB cask configured for transfer operations.

C.4.2 Cask Storage System

This section is applicable to the NUHOMS® HSM Model 102.

C.4.2.1 Operating Function

NUHOMS(R) 61BT

The overall function of the HSM Model 102 used at the WCS CISF is to safely provide interim storage of spent nuclear fuel (SNF) DSCs (canisters). These canisters provide a convenient means to place set quantities of SNF into dry storage in a way that allows easy retrieval of the canisters for off-site shipment.

The NUHOMS® 61BT DSCs containing SNF assemblies ~~and Greater than Class C (GTCC) waste canisters~~ are designed for storage in accordance with 10 CFR 72, and for transportation in accordance with 10 CFR 71. The main function of sealed canisters is to accommodate SNF assemblies ~~and GTCC waste~~, and provide confinement and criticality control during normal operation and postulated design-basis accident conditions for on-site storage. Place Insert A here

The HSM Model 102 is designed in accordance with 10 CFR 72, and provides horizontal on-site storage of the sealed SNF and GTCC waste canisters. The main function of the HSM Model 102 is to provide safe, long-term storage of NUHOMS® 61BT DSCs containing SNF assemblies ~~and GTCC waste canisters containing solid reactor waste~~.

The HSM Model 102 design function is to passively cool the canisters by air convection. The HSM Model 102 also provides the capability for canister transfer from their associated transportation/transfer casks. Place Insert B here

C.4.2.2 Design Description

Place Insert C here

The HSM Model 102 is a low profile, reinforced concrete structure designed to withstand all normal condition loads as well as the off-normal and accident condition loads created by earthquakes, tornadoes, flooding, and other natural phenomena. The HSM is also designed to withstand off-normal and accident condition loadings postulated to occur during design basis accident conditions such as a complete loss of ventilation.

Place Insert D here

C.4.2.3 Safety Considerations

Place Insert E here

~~The~~ HSM Model 102 is an important-to-safety (ITS), Quality Category B component.

The MP197HB cask is a ITS, Quality Category C component.

C.4.5 References

C.4-1 AREVA TN Document NUH-003, Revision 14, "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel." (Basis for NRC CoC 72-1004).

C.4-2 American Concrete Institute, "Specifications for Structural Concrete for Buildings," ACI 301, 1989.

C.4-3 Proposed SNM-1050, WCS Interim Storage Facility Technical Specifications, Amendment 0.

C.4-4 "NUHOMS®-MP197 Transport Packaging Safety Analysis Report," Revision 17, USNRC Docket Number 71-9302.

Insert F goes at the top of the next page (C.4-8a) which is between this page and the first Table.

C.9.1 Radiation Protection Design Features

and K.5

Details of the Storage Area shielding design features for the Standardized NUHOMS® System Cask System which includes the 61BT DSC stored in an HSM Model 102 are documented in Section 7.3.2.1 of reference [C.9-1]. Details of the shielding design features for the MP197HB cask are provided in Section A.5.1.1 of reference [C.9-2]. Drawings showing the shield thicknesses for the NUHOMS(R)-61BT DSC and MP197HB cask are listed in Section C.4.6 and for the HSM Model 102 in Section A.4.6.

Appendix C Insert A for RSI 4.5

The NUHOMS® 61BT DSCs are shown in drawings NUH-61B-1060-SAR Revision 6, NUH-61B-1061-SAR Revision 5, NUH-61B-1062-SAR Revision 6, NUH-61B-1063-SAR Revision 4, NUH-61B-1064-SAR Revision 6, NUH-61B-1065-SAR Revision 6 and NUH-61B-1066-SAR Revision 6 included in Section C.4.6.

Appendix C Insert B for RSI 4.5

The drawings for the HSM Model 102 are NUH-03-6008-SAR Revision 10, NUH-03-6009-SAR Revision 9, NUH-03-6010-SAR Revision 5, NUH-03-6014-SAR Revision 9, NUH-03-6015-SAR Revision 8, NUH-03-6016-SAR Revision 10, NUH-03-6017-01-SAR Revision 7, NUH-03-6018-SAR Revision 7 and NUH-03-6024-SAR Revision 5 included in Section A.4.6.

The MP197HB cask, in the transfer configuration, design function is to protect the canisters and provide shielding from the radiation sources inside the canisters during transfer operations. The MP197HB cask in the transfer configuration is shown in drawings MP197HB-71-1002 Revision 6, MP197HB-71-1004 Revision 4, MP197HB-71-1005 Revision 4, MP197HB-71-1006 Revision 2 and MP197HB-71-1014 Revision 1, included in Section C.4.6.

Appendix C Insert C for RSI 4.5

The NUHOMS® 61BT DSCs are stainless steel flat head pressure vessels that provides confinement that is designed to withstand all normal condition loads as well as the off-normal and accident condition loads created by earthquakes, tornadoes, flooding, and other natural phenomena.

Appendix C Insert D for RSI 4.5

The MP197HB cask, in the transfer configuration, is used to transfer the canisters from the Ask Handling Building to the storage pad where the cask is mated to the HSM Model 102. The cask is designed to withstand all normal condition loads as well as the off-normal and accident condition loads created by earthquakes, tornadoes, flooding, and other natural phenomena.

Appendix C Insert E for RSI 4.5

The NUHOMS® 61BT DSCs are Important-to-safety (ITS), Quality Category A components.

Appendix C Insert F for RSI 4.5

C.4.6 Supplemental Data (Drawings)

The following drawings are located as noted below:

1. "NUHOMS® 61BT Transportable Canister for BWR Fuel General Arrangement (two sheets)," NUH-61B-1060-SAR, Revision 6 (See Section K.1.5 of Appendix K of the "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel" [C.4-1]).

2. "NUHOMS® 61BT Transportable Canister for BWR Fuel Shell Assembly (two sheets)," NUH-61B-1061-SAR, Revision 5 (See Section K.1.5 of Appendix K of the "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel" [C.4-1]).

3. "NUHOMS® 61BT Transportable Canister for BWR Fuel Canister Details (two sheets)," NUH-61B-1062-SAR, Revision 6 (See Section K.1.5 of Appendix K of the "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel" [C.4-1]).

4. "NUHOMS® 61BT Transportable Canister for BWR Fuel Basket Assembly (one sheet)," NUH-61B-1063-SAR, Revision 4 (See Section K.1.5 of Appendix K of the "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel" [C.4-1]).

5. "NUHOMS® 61BT Transportable Canister for BWR Fuel Basket Details (two sheets)," NUH-61B-1064-SAR, Revision 6 (See Section K.1.5 of Appendix K of the "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel" [C.4-1]).

6. "NUHOMS® 61BT Transportable Canister for BWR Fuel Parts List (one sheet)," NUH-61B-1065-SAR, Revision 6 (See Section K.1.5 of Appendix K of the "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel" [C.4-1]).

7. "NUHOMS® 61BT Transportable Canister Basket Details for Damaged BWR Fuel (three sheets)," NUH-61B-1066-SAR, Revision 6 (See Section K.1.5 of Appendix K of the "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel" [C.4-1]).

8. "NUHOMS® -MP197HB Packaging Parts List (two sheets)," MP197HB-71-1002 Revision 6 (See Section A.1.4.10.1 of the "NUHOMS®-MP197 Transport Packaging Safety Analysis Report" [C.4-4]).

9. "NUHOMS® MP197HB Packaging Cask Body Assembly (one sheet)," MP197HB-71-1004 Revision 4 (See Section A.1.4.10.1 of the "NUHOMS®-MP197 Transport Packaging Safety Analysis Report" [C.4-4]).

10. "NUHOMS® MP197HB Packaging Cask Body Details (three sheets)," MP197HB-71-1005 Revision 4 (See Section A.1.4.10.1 of the "NUHOMS®-MP197 Transport Packaging Safety Analysis Report" [C.4-4]).

11. "NUHOMS® MP197HB Packaging Lid Assembly and Details (one sheet)," MP197HB-71-1006 Revision 2 (See Section A.1.4.10.1 of the "NUHOMS®-MP197 Transport Packaging Safety Analysis Report" [C.4-4]).

12. "NUHOMS® MP197HB Packaging Internal Sleeve Design (two sheets)," MP197HB-71-1014 Revision 1 (See Section A.1.4.10.1 of the "NUHOMS®-MP197 Transport Packaging Safety Analysis Report" [C.4-4]).

APPENDIX D.4
OPERATING SYSTEMS
Standardized NUHOMS®-61BTH Type 1 System

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NUHOMS(R) 61BTH Type 1 DSC;

; and MP197HB cask configured for transfer operations.

D.4.2 Cask Storage System

This section is applicable to the NUHOMS® HSM Model 102.

D.4.2.1 Operating Function

NUHOMS(R) 61BTH Type 1

The overall function of the HSM Model 102 used at the WCS CISF is to safely provide interim storage of spent nuclear fuel (SNF) DSCs (canisters). These canisters provide a convenient means to place set quantities of SNF into dry storage in a way that allows easy retrieval of the canisters for off-site shipment.

The NUHOMS® 61BTH Type 1 DSCs containing SNF assemblies ~~and GTCC waste canisters~~ are designed for storage in accordance with 10 CFR 72, and for transportation in accordance with 10 CFR 71. The main function of sealed canisters is to accommodate SNF assemblies ~~and GTCC waste~~, and provide confinement and criticality control during normal operation and postulated design-basis accident conditions for on-site storage.

Place Insert A here

The HSM Model 102 is designed in accordance with 10 CFR 72, and provides horizontal on-site storage of the sealed SNF ~~and GTCC waste~~ canisters. The main function of the HSM Model 102 is to provide safe, long-term storage of NUHOMS® 61BTH Type 1 DSCs containing SNF assemblies ~~and GTCC waste canisters containing solid reactor waste~~.

The HSM Model 102 design function is to passively cool the canisters by air convection. The HSM Model 102 also provides the capability for canister transfer from their associated transportation/transfer casks.

Place Insert B here

D.4.2.2 Design Description

Place Insert B here

The HSM Model 102 is a low profile, reinforced concrete structure designed to withstand all normal condition loads as well as the off-normal and accident condition loads created by earthquakes, tornadoes, flooding, and other natural phenomena. The HSM is also designed to withstand off-normal and accident condition loadings postulated to occur during design basis accident conditions such as a complete loss of ventilation.

Place Insert D here

D.4.2.3 Safety Considerations

Place Insert E here

~~The~~ HSM Model 102 is an important-to-safety (ITS), Quality Category B component.

The MP-197HB Cask is a ITS, Quality Category A component.

D.4.5 References

D.4-1 AREVA TN Document NUH-003, Revision 14, "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel." (Basis for NRC CoC 72-1004).

D.4-2 American Concrete Institute, "Specifications for Structural Concrete for Buildings," ACI 301, 1989.

D.4-3 Proposed SNM-1050, WCS Interim Storage Facility Technical Specifications, Amendment 0.

Insert F goes at the top of the next pate (D.4-8a) which is between this page and the first table.

D.4.6 Supplemental Data Drawings

The following drawing is located as noted below:

1. "NUHOMS® 61BTH DSC Type 1 Main Assembly (five sheets)," NUH61BH-1000-SAR, Revision 3 (See Section T.1.5 of Appendix T of the "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel" [D.4.1]).

and T.5

D.9.1 Radiation Protection Design Features

Details of the Storage Area shielding design features for the Standardized NUHOMS® System Cask System which includes the 61BTH Type 1 DSC stored in an HSM Model 102 are documented in Section 7.3.2.1 of reference [D.9-1]. Details of the shielding design features for the MP-197HB cask are provided in Section A.5.1.1 of reference [D.9-2]. Drawings showing the shield thicknesses for the NUHOMS(R)-61BTH Type 1 DSC are listed in Section D.4.6. Drawings showing the shielding thicknesses for the HSM Model 102 are listed in Section A.4.6 and for the MP197HB cask in Section C.4.6.

Appendix D Insert A for RSI 4.5

The NUHOMS® 61BTH Type 1 DSCs are shown in drawing NUH61BH-1000-SAR Revision 3 included in Section D.4.6.

Appendix D Insert B for RSI 4.5

The drawings for the HSM Model 102 are NUH-03-6008-SAR Revision 10, NUH-03-6009-SAR Revision 9, NUH-03-6010-SAR Revision 5, NUH-03-6014-SAR Revision 9, NUH-03-6015-SAR Revision 8, NUH-03-6016-SAR Revision 10, NUH-03-6017-01-SAR Revision 7, NUH-03-6018-SAR Revision 7 and NUH-03-6024-SAR Revision 5 included in Section A.4.6.

The MP197HB cask, in the transfer configuration, design function is to protect the canisters and provide shielding from the radiation sources inside the canisters during transfer operations. The MP197HB cask in the transfer configuration is shown in drawings MP197HB-71-1002 Revision 6, MP197HB-71-1004 Revision 4, MP197HB-71-1005 Revision 4, MP197HB-71-1006 Revision 2 and MP197HB-71-1014 Revision 1, included in Section C.4.6.

Appendix D Insert C for RSI 4.5

The NUHOMS® 61BTH Type 1 DSCs are stainless steel flat head pressure vessels that provides confinement that is designed to withstand all normal condition loads as well as the off-normal and accident condition loads created by earthquakes, tornadoes, flooding, and other natural phenomena.

Appendix D Insert D for RSI 4.5

The MP197HB cask, in the transfer configuration, is used to transfer the canisters from the CHB to the storage pad where the cask is mated to the HSM Model 102. The cask is designed to withstand all normal condition loads as well as the off-normal and accident condition loads created by earthquakes, tornadoes, flooding, and other natural phenomena.

Appendix D Insert E for RSI 4.5

The NUHOMS® 61BTH Type 1 DSCs are Important-to-safety (ITS), Quality Category A components.

Appendix D Insert F for RSI 4.5

D.4.6 Supplemental Data (Drawings)

The following drawing is located as noted below:

1. "NUHOMS® 61BTH DSC Type 1 Main Assembly (five sheets)," NUH61BH-1000-SAR, Revision 3 (See Section T.1.5 of Appendix T of the "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel" [D.4-1]).

4.2.2 Storage Area

Storage Area systems and operations are described in this section. The main function of the Storage Area is to provide a location to place the storage overpacks containing the canisters received at the WCS CISF. The Storage Area is designed for the transfer, storage and retrieval of canisterized SNF and GTCC waste. The Storage Area is constructed in stages, as needed, to support WCS CISF operational throughput requirements, and is contained within the double fence of the OCA. (Figures 1-2 and 1-3).

The Storage Area is designed to accommodate both horizontal and vertical systems. There are NUHOMS® pads with space for up to 148 horizontal storage systems (22 HSM Model 80s, 20 AHSMs and 106 HSM Model 102s) There are thirteen separate pads for the vertical systems that hold up to 319 storage overpacks (169 UMS, 59 MPC and 91 MAGNASTOR VCCs).

4.2.2.1 Concrete Pad Structures

Six storage systems were evaluated for storage in the WCS CISF Storage Area. These cask systems each have their own unique storage pad requirements. Table 4-1 provides a cross reference to the applicable appendix and section for each canister/storage overpack where the concrete pad structures are discussed.

4.2.2.2 Cask Storage Systems

Six storage systems were evaluated for storage in the WCS CISF Storage Area. These cask systems contain SNF or GTCC waste in sealed canisters. Table 4-1 provides a cross reference to the applicable appendix and section for each canister/storage overpack where the individual cask storage systems are discussed and drawings are provided or incorporated by reference.

4.2.2.3 Cask Transfer Systems

Six storage systems were evaluated for storage in the WCS CISF Storage Area. These cask systems use various cask transfer systems. Table 4-1 provides a cross reference to the applicable appendix and section for each canister/storage overpack where the individual cask transfer systems are discussed.

Table 4-1
Operating Systems Associated with the Storage Systems at the WCS CISF

Cask System	Canister	Overpack	Appendix
NUHOMS®-MP187 Cask System	FO-DSC	HSM (Model 80)	Appendix A.4 (Drawings listed in Section A. 4. 6.)
	FC-DSC		
	FF-DSC		
Standardized Advanced NUHOMS® System	NUHOMS® 24PT1	AHSM	Appendix B.4 (Dawings listed in Section B.4.6)
Standardized NUHOMS® System	NUHOMS® 61BT	HSM Model 102	Appendix C.4 (Drawings listed in Section C.4.6)
	NUHOMS® 61BTH Type 1		Appendix D.4 (Drawings listed in Section D.4.6)
NAC-MPC	Yankee Class	VCC	Appendix E.4 (Drawings listed in Section E.4.4)
	Connecticut Yankee	VCC	
	LACBWR	VCC	
NAC-UMS	Classes 1 thru 5	VCC	Appendix F.4 (Drawings listed in Section F.4.3)
MAGNASTOR	TSC1 thru TSC4	CC1 thru CC4	Appendix G.4 (Drawings listed in Section G.4.3)

APPENDIX A.4
OPERATING SYSTEMS
NUHOMS®-MP187 Cask System

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A.4. OPERATING SYSTEMS A.4-1

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A.4.2 Cask Storage System

This section is applicable to the FO-, FC-and FF-DSC and GTCC waste canisters; NUHOMS® HSM Model 80; and MP187 cask configured for transportation.

A.4.2.1 Operating Function

The overall function of the HSM Model 80 GTCC waste canister used at the WCS CISF is to safely provide interim storage of the canisters. These canisters provide a convenient means to place set quantities of SNF and GTCC into dry storage in a way that allows easy retrieval of the canisters for off-site shipment.

The FO-, FC- and FF-DSC canisters containing SNF assemblies and Greater than Class C (GTCC) waste canisters are designed for storage in accordance with 10 CFR 72, and for transportation in accordance with 10 CFR 71. The main function of sealed canisters is to accommodate SNF assemblies and GTCC waste, and provide confinement and criticality control during normal operation and postulated design-basis accident conditions for on-site storage. The FC-and FO-DSCs are shown in dewing NUH-05-4004 Revision 16 and the FF-DSC is shown in drawing NUH-05-1005 Revision 14, included in Section A.4.6. The GTCC canister is shown in drawings 13302-1005 Revision 0 and 13302-10007 Revision 0 included in Section A.4.6.

The HSM Model 80 is designed in accordance with 10 CFR 72, and provides horizontal on-site storage of the sealed SNF and GTCC waste canisters. The main function of the HSM Model 80 is to provide safe, long-term storage of FO-, FC- and FF-DSCs containing SNF assemblies and GTCC waste canisters containing solid reactor waste.

The HSM Model 80 design function is to passively cool the canisters by air convection. The HSM Model 80 also provides the capability for canister transfer from their associated transportation/transfer casks. The drawings for the HSM Model 80 are not included in reference [A.4-4] as the HSM was incorporated by reference into the "Racho Seco Independent Spent Fuel Storage Installation Safety Analysis Report". The applicable drawings for the HSm Model 0 are NUH-03-0068-SAR Revision 10, NUH-03-6009-SAR Revision 9, NUH-03-0610-SAR Revision 5, NUH-03-6014-SAR Revision 9, NUH-03-6015-SAR Revision 8, NUH-03-6016-SAR Revision 10, NUH-03-6017-01-SAR Revision 7, NUH-03-6018-SAR Revision 7 and NUH-03-6024-SAR Revision 5 included in Section A.4.6.

The MP187 cask, in the transfer configuration, design function is to protect the canisters and provide shielding from the radiation sources inside the canisters during transfer operations. The MP187 cask in the transfer configuration is shown in drawing NUH-05-4001 Revision 15 and NUH-05-4003 Revision 10, included in Section A.4.6.

A.4.2.2 Design Description

The FO-, FC-, and FF-DSCs and GTCC waste canisters are stainless steel flat head pressure vessels that provide confinement and are designed to withstand all normal condition loads as well as the off-normal and accident condition loads created by earthquakes, tornadoes, flooding, and other natural phenomena.

The HSM Model 80 is a low profile, reinforced concrete structure designed to withstand all normal condition loads as well as the off-normal and accident condition loads created by earthquakes, tornadoes, flooding, and other natural phenomena. The HSM is also designed to withstand off-normal and accident condition loadings postulated to occur during design basis accident conditions such as a complete loss of ventilation.

The MP187 cask, in the transfer configuration, is used to transfer the canisters from the CHB to the storage pad where the cask is mated to the HSM Model 80. The cask is designed to withstand all normal condition loads as well as the off-normal and accident condition loads created by earthquakes, tornadoes, flooding, and other natural phenomena.

A.4.2.3 Safety Considerations

THE FO-, FC- and FF-DSCs are Important to Safety (ITS), Quality Category A components. The GTCC waste canister is an ITS, Quality Category B component.

The HSM Model 80 is an important-to-safety (ITS), Quality Category B component. The MP-187 Cask is an ITS, Quality Category B component.

A.4.5 References

A.4-1 AREVA TN Document NUH-003, Revision 14, "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel." (Basis for NRC CoC 72-1004).

A.4-2 American Concrete Institute, "Specifications for Structural Concrete for Buildings," ACI 301, 1989.

A.4-3 Proposed SNM-1050, WCS Interim Storage Facility Technical Specifications, Amendment 0.

~~A.4-3~~A.4-4 "Rancho Seco Independent Spent Fuel Storage Installation Safety Analysis Report," NRC Docket No. 72-11, Revision 4

A.4.6 Supplemental Data Drawings

The following drawings are located as noted below:

1. "NUHOMS FO-DSC and FC-DSC for PWR Fuel Main Assembly (four sheets)," NUH-05-4004, Reivision 16 (See Volume 4 of the "Rancho Seco Independent Spent Fuel Storage Installation Safety Analysis Report" [A.4-4]).

2. "NUHOMS FF-DSC for PWR Fuel Main Assembly (four sheets), "NUH-05-4005, Revision 14 (See Volume 4 of the "Rancho Seco Independent Spent Fuel Storage Installation Safety Analysis Report" [A.4-4].

3. "NUHOMS® System GTCC Canister Main Assembly (five sheets)", 133002-1005, Revision 0 (included at the end of this Section)

4. "NUHOMS® System GTCC Canister Closure Installation (one sheet)," 13302-1007, Revision 0 (included at the end of this Section)

5. "Standardized NUHOMS® ISFSI Horizontal Storage Module ISFSI General Arrangement (three sheets)," NUH-03-6008-SAR, Revision 10 (see Section E.2 of Appendix E of the "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel" [A.4-1])

6. "Standardized NUHOMS® ISFSI Horizontal Storage Module Main Assembly (two sheets)," NUH-03-6009-SAR, Revision 9 (See Section E.2 of Appendix E of the "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel" [A.4-1])

7. "Standardized NUHOMS® ISFSI Horizontal Storage Module Base Unit Assembly (two sheets)," NUH-03-6010-SAR, Revision 5 (See Section E.2 of Appendix E of the "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel" [A.4-1])

8. "Standardized NUHOMS® ISFSI Horizontal Storage Module Base Unit (three sheets)," NUH-03-6014-SAR, Revision 9 (See Section E.2 of Appendix E of the "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel" [A.4-1])

9. "Standardized NUHOMS® ISFSI Horizontal Storage Module Roof Slab Assembly (two sheets)," NUH-03-6015-SAR, Revision 8 5 (See Section E.2 of Appendix E of the "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel" [A.4-1])

10. "Standardized NUHOMS® ISFSI Horizontal Storage Module DSC Support Structure (two sheets)," NUH-03-6016, Revision 10 (See Section E.2 of Appendix E of the "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel" [A.4-1])

11. "Standardized NUHOMS® ISFSI Horizontal Storage Module , Module Accessories (five sheets)," NUH-03-6017-01-SAR, Revision 7 (See Section E.2 of Appendix E of the "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel" [A.4-1])

12. Standardized NUHOMS® ISFSI Horizontal Storage Module Shield Wall Plans and Detail (two sheets)." NUH-03-6018-SAR, Revision 7 (See Section E.2 of Appendix E of the "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel" [A.4-1])

13. "Standardized NUHOMS® ISFSI Horizontal Storage Module, Module Erection Hardware (two pages) NUH-03-6024-SAR, Revision 5 (See Section E.2 of Appendix E of the "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel" [A.4-1])

14. "NUHOMS MP-187 Multi-purpose Cask Main Assembly (six sheets)," NUH-05-4001 Revision 15 (see volume 4 of the "Rancho Seco Independent Spent Fuel Storage Installation Safety Analysis Report" [A.4-4])

15. "NUHOMS MP-187 Multi-purpose Cask Onsite Transfer Arrangement (two sheets)," NUH-05-4003 Revision 10 (See Volume 4 of the Rancho Seco Independent Spent Fuel Storage Installation Safety Analysis Report [A.4-4])

Proprietary Information on RSI 4.5 (next 6 pages)
Withheld Pursuant to 10 CFR 2.390

A.9.1 Radiation Protection Design Features

Details of the Storage Area shielding design features for the NUHOMS®-MP187 Cask System which includes the FO-, FC-, FF- Dry Shielded Canisters (DSCs) and Greater Than Class C (GTCC) waste canisters stored in an HSM Model 80 are documented in Section 7.3.2.1 and Appendix C, Section 7.3.1.1 of reference [A.9-1].

APPENDIX B.4
OPERATING SYSTEMS
Standardized Advanced NUHOMS® System

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B.4.2 Cask Storage System

This section is applicable to the NUHOMS ®-24PT1 canisters; NUHOMS® AHSM; and MP187 cask configured for transfer operations.

B.4.2.1 Operating Function

The overall function of the AHSM used at the WCS CISF is to safely provide interim storage of spent nuclear fuel (SNF) canisters. These canisters provide a convenient means to place set quantities of SNF into dry storage in a way that allows easy retrieval of the canisters for off-site shipment.

The NUHOMS®-24PT1 canisters containing SNF assemblies are designed for storage in accordance with 10 CFR 72, and for transportation in accordance with 10 CFR 71. The main function of sealed canisters is to accommodate SNF assemblies and provide confinement and criticality control during normal operation and postulated design-basis accident conditions for on-site storage. The NUHOMS®-24PT1 canister is shown in drawing NUH-05-4010 Revision 5, included in Section B.4.6.

The AHSM is designed in accordance with 10 CFR 72, and provides horizontal on-site storage of the sealed SNF canisters. The main function of the AHSM is to provide safe, long-term storage of NUHOMS®-24PT1 canisters containing SNF assemblies.

The AHSM design function is to passively cool the canisters by air convection. The AHSM also provides the capability for canister transfer from their associated transportation/transfer casks. The AHSM is shown in drawing NUH-03-4011 Revision 7, included in Section B.4.6.

The MP187 cask, in the transfer configuration, design function is to protect the canisters and provide shielding from the radiation sources inside the canisters during transfer operations. The MP187 cask in the transfer configuration is show in drawings NUH-05-4001 Revision 15 and NUH-05-4003 Revision 10, included in Section A.4.6.

B.4.2.2 Design Description

The NUHOMS®-24PT1 canister is a stainless steel flat head pressure vessel that provides confinement and is designed to withstand all normal condition loads as well as the off-normal and accident condition loads created by earthquakes, tornadoes, flooding, and other natural phenomena.

The AHSM is a low profile, reinforced concrete structure designed to withstand all normal condition loads as well as the off-normal and accident condition loads created by earthquakes, tornadoes, flooding, and other natural phenomena. The AHSM is also designed to withstand off-normal and accident condition loadings postulated to occur during design basis accident conditions such as a complete loss of ventilation.

The MP187 cask, in the transfer configuration, is used to transfer the canisters from the CHB to the storage pad where the cask is mated to the AHSM. The cask is designed to withstand all normal condition loads as well as the off-normal and accident condition loads created by earthquakes, tornadoes, flooding, and other natural phenomena.

B.4.2.3 Safety Considerations

The NUHOMS®-24PT1 canisters are Important- to-Safety (ITS), Quality Category A components.

The AHSM is an important-to-safety (ITS), Quality Category B component. The MP187 cask is an ITS, Quality Category B component.

B.4.6 Supplemental Data Drawings

The following drawings are located as noted below:

1. "General License NUHOMS® 24PT1-DSC Main Assembly (six sheets)," NUH-05-4010, Revision 5 (See Section 1.5.2 of the Standardized Advanced NUHOMS® UFSAR [B.4-1]).

2. "General License NUHOMS® Advanced Horizontal Storage Module Main Assembly (nine sheets)," NUH-003-4011, Revision 7 (See Section 1.5.2 of the Standardized Advanced NUHOMS® UFSAR [B.4-1])

B.9.1 Radiation Protection Design Features

Details of the Storage Area shielding design features for the Standardized Advanced NUHOMS® System Cask System which includes the NUHOMS®-24PT1 Dry Shielded Canister (DSC) stored in an AHSM are documented in Section 10.2.1 of reference [B.9-1]. Drawings showing the shield thicknesses for the MP187 cask are included in Section A.4.6 and drawings showing the shield thicknesses for the NUHOMS®-24PT1 DSC and AHSM are included in Section B.4.6

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OPERATING SYSTEMS
Standardized NUHOMS®-61BT System

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C.4.2 Cask Storage System

This section is applicable to the NUHOMS® 61BT DSC; NUHOMS® HSM Model 102; and MP197HB cask configured for transfer operations.

C.4.2.1 Operating Function

The overall function of the HSM Model 102 used at the WCS CISF is to safely provide interim storage of spent nuclear fuel (SNF) NUHOMS® 61BT DSCs (canisters). These canisters provide a convenient means to place set quantities of SNF into dry storage in a way that allows easy retrieval of the canisters for off-site shipment.

The NUHOMS® 61BT DSCs containing SNF assemblies are designed for storage in accordance with 10 CFR 72, and for transportation in accordance with 10 CFR 71. The main function of sealed canisters is to accommodate SNF assemblies and provide confinement and criticality control during normal operation and postulated design-basis accident conditions for on-site storage. The NUHOMS® 61BT DSCs are shown in drawings NUH-61B-1060-SAR Revision 6, NUH-61B-1063-SAR Revision 4, NUH-61B-1064-SAR Rev.6, NUH-61B-1065-SAR Rev.6, NUH-61B-1061-SAR Revision 5, NUH-61B-1062-SAR Revision 6, and NUH-61B-1066-SAR Revision 6 included in Section C.4.6.

The HSM Model 102 is designed in accordance with 10 CFR 72, and provides horizontal on-site storage of the sealed SNF and GTCC waste canisters. The main function of the HSM Model 102 is to provide safe, long-term storage of NUHOMS® 61BT DSCs containing SNF assemblies.

The HSM Model 102 design function is to passively cool the canisters by air convection. The HSM Model 102 also provides the capability for canister transfer from their associated transportation/transfer casks. The drawings for the HSM model 102 are NUH-03-6008-SAR Revision 10, NUH-03-6009-SAR Revision 9, NUH-03-6010-SAR Revision 5, NUH-03-6014-SAR Revision 9, NUH-03-6015 SAR Revision 8, NUH-03-6016-SAR Revision 10, NUH-03-6017-01-SAR Revision 7, NUH-03-6018-SAR Revision 7 and NUH-03-6024-SAR Revision 5 included in Section A.4.6.

The MP197HB cask, in the transfer configuration, design function is to protect the canisters and provide shielding from the radiation sources inside the canisters during transfer operations. The MP197HB cask in the transfer configuration is shown in drawings MP197HB-71-1002 Revision 6, MP197HB-71-1004 Revision 4, MP197HB-71-1005 Revision 4, MP197HB-71-1006 Revision 2 and MP197-HB-71-1014 Revision 1, included in Section C.4.6.

C.4.2.2 Design Description

The NUHOMS® 61BT DSCs are stainless steel flat head pressure vessels that provide confinement that is designed to withstand all normal condition loads as well as the off-normal and accident condition loads created by earthquakes, tornadoes, flooding, and other natural phenomena.

The HSM Model 102 is a low profile, reinforced concrete structure designed to withstand all normal condition loads as well as the off-normal and accident condition loads created by earthquakes, tornadoes, flooding, and other natural phenomena. The HSM is also designed to withstand off-normal and accident condition loadings postulated to occur during design basis accident conditions such as a complete loss of ventilation.

The MP197HB cask, in the transfer configuration, is used to transfer the canisters from the Cask Handling Building to the storage pad where the cask is mated to the HSM Model 102. The cask is designed to withstand all normal condition loads as well as the off-normal and accident condition loads created by earthquakes, tornadoes, flooding, and other natural phenomena.

C.4.2.3 Safety Considerations

The NUHOMS® 61BT DSCs are Important-to-Safety (ITS), Quality Category A components.

The HSM Model 102 is an important-to-safety (ITS), Quality Category B component. The MP197HB cask is an ITS, Quality Category C component.

C.4.5 References

C.4-1 AREVA TN Document NUH-003, Revision 14, "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel." (Basis for NRC CoC 72-1004).

C.4-2 American Concrete Institute, "Specifications for Structural Concrete for Buildings," ACI 301, 1989.

C.4-3 Proposed SNM-1050, WCS Interim Storage Facility Technical Specifications, Amendment 0.

C.4-4 "NUHOMS® MP197 Transport Packaging Safety Analysis Report" Revision 17, USNRC Docket Number 71-9302.

C.4.6 Supplemental Data Drawings

The following drawings are located as noted below:

1. "NUHOMS® 61BT Transportable canister for BWR Fuel General Arrangement (two sheets)," NUH-61B-1060-SAR, Revision 6 (See Section K.1.5 of Appendix K of the "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel" [C.4-1]).

2. "NUHOMS® 61BT Transportable canister for BWR Fuel Shell Assembly (two sheets)," NUH-61B-1061-SAR, Revision 5 (See Section K.1.5 of Appendix K of the "Updated final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel" [C.4-1]).

3. "NUHOMS® 61BT Transportable Canister for BWR Fuel Canister Details (two sheets)," NUH-61B-1062-SAR Revision 6 (See Section K.1.5 of Appendix K of the "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel" [C.4-1]).

4. "NUHOMS® 61BT Transportable Canister for BWR Fuel Basket Assembly (one sheet)," NUH-61B-1063-SAR, Revision 4 (See Section K.1.5 of Appendix K of the "Update Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel" [C.4-1]).

5. "NUHOMS® 61BT Transportable Canister for BWR Fuel Basket Details (two sheets)," NUH-61B-1064-SAR, Revision 6 (See Section K.1.5 of Appendix K of the "Updated Final Safety Analysis Report for the standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel" [C.4-1]).

6. "NUHOMS® 61BT Transportable Canister for BWR Fuel Parts List (one sheet)," NUH-61B-11065-SAR, Revision 6 (See Section K.1.5 of Appendix K of the "Updated Final Safety Analysis Report for the standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel" [C.4-1]).

7. "NUHOMS® 61BT Transportable Canister Basket Details for Damaged BWR fuel (three sheets),"NUH-61B-1066-SAR, Revision 6 (See Section K.1.5 of Appendix K of the "Updated Final Safety Analysis Report for the standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel" [C.4-1]).

8. "NUHOMS®-MP197HB Packaging Parts List (two sheets)," MP197HB-71-1002 Revision 6 (See Section A.1.4.10.1 of the "NUHOMS®-MP197 Transport Packaging Safety Analysis Report" [C.4-5]).

9. "NUHOMS® MP197HB Packaging Cask Body Assembly (one Sheet)," MP197HB-71-1004 Revision 4 (See Section A.1.4.10.1 of the "NUHOMS®-MP197 Transport Packaging Safety Analysis Report" [C.4-4]).

10. "NUHOMS® MP197HB Packaging Cask Body Details (three sheets)," MP197HB-71-1005 Revision 4 (See Section A.1.4.10.1 of the "NUHOMS®-MP197 Transport Packaging Safety Analysis Report" [C.4-4]).

11. "NUHOMS® MP197HB Packaging Lid Assembly and Details (one sheet)," MP-197HB-71-1006 Revision 2 (See Section A.1.4.10.1 of the "NUHOMS®-MP197 Transport Packaging Safety Analysis Report" [C.4-4]).

12. "NUHOMS® MP197HB Packaging Internal Sleeve Design (two sheets)," MP197HB-71-1014 revision1 (See Section A.1.4.10.1 of the "NUHOMS®-MP197 Transport Packaging Safety Analysis Report" [C.4-4]).

C.9.1 Radiation Protection Design Features

Details of the Storage Area shielding design features for the Standardized NUHOMS® System Cask System which includes the 61BT DSC stored in an HSM Model 102 are documented in Section 7.3.2.1 and K.5 of reference [C.9-1]. Details of the shielding design features for the MP197HB cask are provided in Section A.5.1.1 of reference [C.9.2]. Drawing showing the shield thicknesses for the NUHOMS®-61BT DSC and MP197HB cask are listed in Section C.4.6 and for the HSM Model 102 in Section A.4.6.

APPENDIX D.4
OPERATING SYSTEMS
Standardized NUHOMS®-61BTH Type 1 System

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D.4.2 Cask Storage System

This section is applicable to the NUHOMS® 61BTH Type 1 DSC; NUHOMS® HSM Model 102 and MP197HB cask configured for transfer operations.

D.4.2.1 Operating Function

The overall function of the HSM Model 102 used at the WCS CISF is to safely provide interim storage of spent nuclear fuel (SNF) NUHOMS® 61BTH Type 1 DSCs (canisters). These canisters provide a convenient means to place quantities of SNF into dry storage in a way that allows easy retrieval of the canisters for off-site shipment.

The NUHOMS® 61BTH Type 1 DSCs containing SNF assemblies are designed for storage in accordance with 10 CFR 72, and for transportation in accordance with 10 CFR 71. The main function of sealed canisters is to accommodate SNF assemblies and provide confinement and criticality control during normal operation and postulated design-basis accident conditions for on-site storage. The NUHOMS® 61BTH Type 1 DSCs are shown in drawing NUH61BH-1000-SAR Revision 3 included in Section D.4.6.

The HSM Model 102 is designed in accordance with 10 CFR 72, and provides horizontal on-site storage of the sealed SNF. The main function of the HSM Model 102 is to provide safe, long-term storage of NUHOMS® 61BTH Type 1 DSCs containing SNF assemblies.

The HSM Model 102 design function is to passively cool the canisters by air convection. The HSM Model 102 also provides the capability for canister transfer from their associated transportation/transfer casks. The drawings for the HSM Model 102 are NUH-03-6008-SAR Revision 10, NUH-03-6009-SAR revision 9, NUH-03-6010-SAR Revision 5, NUH-03-6014-SAR Revision 9, NUH-03-6015-SAR Revision 8, NUH-03-6016-SAR Revision 10, NUH-03-6017-SAR Revision 7, NUH-03-6018-SAR Revision 7 and NUH-03-6024-SAR Revision 5 included in Section A.4.6.

The MP197HB cask, in the transfer configuration, design function is to protect the canisters and provide shielding from the radiation sources inside the canisters during transfer operations. The MP197HB cask in the transfer configuration is shown in drawings MP197-HB-71-1005 Revision 4, MP197HB-71-1004 Revision 1, MP197HB-71-1006 Revision 2, MP197HB-71-1002 Revision 6 and MP197HB-71-1004 Revision 4, included in Section C.4.6.

D.4.2.2 Design Description

The NUHOMS® 61BTH Type 1 DSCs are stainless steel flat head pressure vessels that provide confinement that is designed to withstand all normal condition loads as well as off-normal and accident condition loads created by earthquakes, tornadoes, flooding, and other natural phenomena.

The HSM Model 102 is a low profile, reinforced concrete structure designed to withstand all normal condition loads as well as the off-normal and accident condition loads created by earthquakes, tornadoes, flooding, and other natural phenomena. The HSM is also designed to withstand off-normal and accident condition loadings postulated to occur during design basis accident conditions such as a complete loss of ventilation.

The MP197HB cask, in the transfer configuration, is used to transfer the canisters from the Cask Handling Building to the storage pad where the cask is mated to the HSM Model 102. The cask is designed to withstand all normal condition loads as well as the off-normal and accident condition loads created by earthquakes, tornadoes, flooding, and other natural phenomena.

D.4.2.3 Safety Considerations

The NUHOMS® 61BTH Type 1 DSCs are Important-to-Safety (ITS), Quality Category A components.

The HSM Model 102 is an important-to-safety (ITS), Quality Category B component. The MP-197HB Cask is an ITS, Quality Category A component.

D.4.6 Supplemental Data (Drawings)

The following drawing is incorporated by reference as noted below:

1. "NUHOMS® 61BTH DSC Type 1 Main Assembly (five sheets)," NUH61BH-1000-SAR, Revision 3 (See Section T.1.5 of Appendix T of the "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel" [D.4.1]).

D.9.1 Radiation Protection Design Features

Details of the Storage Area shielding design features for the Standardized NUHOMS® System Cask System which includes the 61BTH Type 1 DSC stored in an HSM Model 102 are documented in Section 7.3.2.1 and T.5 of reference [D.9-1]. Details of the sheilding design features for the MP-197HB cask are provided in Section A.5.1.1 of reference [D.9-2]. Drawing showing the shield thicknesses for the NUHOMS®-61BTH Type 1 DSC are listed in section D.4.6. Drawings showing the shielding thicknesses for the HSM Model 102 are listed in Section A.4.6 and for the MP197HB cask in Section C.4.6.

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OPERATING SYSTEMS
NAC-MPC

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E.4 OPERATING SYSTEMS

The principal components of the NAC-MPC system are the canister, the vertical concrete cask and the transfer cask. The loaded canister is moved to and from the concrete cask with the transfer cask. The transfer cask provides radiation shielding while the canister is being transferred. The canister is placed in the concrete cask by positioning the transfer cask with the loaded canister on top of the concrete cask and lowering the canister into the concrete cask. Figure E.4-1 depicts the major components of the NAC-MPC system and shows the transfer cask positioned on the top of the concrete cask.

The NAC-MPC is provided in three configurations. The first is designed to store up to 36 intact Yankee Class spent fuel and reconfigured fuel assemblies and is referred to as the Yankee-MPC. The second is designed to store up to 26 Connecticut Yankee fuel assemblies, reconfigured fuel assemblies and damaged fuel in CY-MPC damaged fuel cans, and is referred to as the CY-MPC. The Yankee-MPC and CY-MPC systems are described in WCS SAR Appendix E, Section E4.1 and are generically referred to as the NAC-MPC. The third configuration, referred to as MPC-LACBWR, is designed to store up to 68 Dairyland Power Cooperative (DPC) La Crosse Boiling Water Reactor (LACBWR) spent fuel assemblies with up to 32 damaged fuel cans. The MPC-LACBWR system is described in WCS SAR Appendix E, Section E4.2.

Section E.4.4 provides a listing of all applicable license drawings (i.e., only Yankee-MPC, CY-MPC, and MPC-LACBWR fuel storage systems) from Reference [E.4-1].

E.4.4 Supplemental Data

The licensing drawings for the NAC-MPC system are listed in Section 1.7, *Drawings,* and Section 1.A.7, *MPC-LACBWR Licensing Drawings,* in volume 1 of the *NAC-MPC Final Safety Analysis Report*, Revision 10 [E.4-1].

Section 1.7.1 lists the Yankee-MPC license drawings; Section 1.7.2 lists the Yankee Class Reconfigured Fuel Assembly License drawings; and Section 1.7.3 lists the CY-MPC license drawings. These drawings appear in the FSAR immediately after the drawing lists in Section 1.7.

Section 1.A.7 lists the MPC-LACBWR licensing drawings. These drawings appear in the FSAR immediately after the drawing list in Section 1.A.7.

E.9.1 Yankee Rowe MPC and Connecticut Yankee MPC

Section 5.1 of Reference E.9.3-1 provides a summary of the results of the shielding evaluation of the NAC-MPC system when the system holds Yankee Class or Connecticut Yankee spent fuel assemblies and non-fuel hardware. Results are provided for the transfer cask and vertical concrete cask components.

A description of the Yankee Class fuel and a summary of the results of the Yankee Class fuel shielding evaluation are presented in Section 5.1.1 of Reference E.9.3-1. The description of the Connecticut Yankee fuel and a summary of the Connecticut Yankee shielding evaluation results are presented in Section 5.1.2 of Reference E.9.3-1.

The NAC-MPC storage system is comprised of a transportable storage canister, a transfer cask, and a vertical concrete storage cask. License drawings for these items are provided in Section E.4.4. The transfer cask is used to transfer the loaded canister to the storage cask where it is stored dry until transport. Shielding evaluations are performed for the storage cask with the cavity dry.

E.9.1.1 Yankee-MPC System Shielding Discussion and Results

The transfer cask has a multiwall radial shield comprised of 0.75 inches of carbon steel, 3.5 inches of lead, 2 inches of solid borated polymer (NS-4-FR), and 1.25 inches of carbon steel. An additional 0.625 inch of stainless steel shielding is provided, radially, by the canister shell. Gamma shielding is provided primarily by the steel and lead layers, and neutron shielding is provided primarily by the NS-4-FR. The transfer cask bottom shield design is a solid section of 9.50 inches of carbon steel. The top shielding is provided by the stainless steel canister shield and structural lids, which are 5 inches and 3 inches thick, respectively.

The storage cask radial shield design is comprised of a 3.5-inch thick carbon steel inner liner surrounded by 21 inches of concrete. Gamma shielding is provided by both the carbon steel and concrete, and neutron shielding is provided primarily by the concrete. As in the transfer cask, an additional 0.625 inch thickness of stainless steel radial gamma shielding is provided by the canister shell. The storage cask top shielding design is comprised of 8 inches of stainless steel from the canister lids, a shield plug containing a 1 inch thickness of NS-4-FR and 4.125 inches of carbon steel, and a 1.5 inch thick carbon steel lid. Since the bottom of the storage cask sits on a concrete pad, the storage cask bottom shielding is comprised of 1 inch of stainless steel from the canister bottom plate, 2 inches of carbon steel (pedestal plate) and 1 inch of carbon steel cask base plate. The base plate and pedestal base are structural components that position the canister above the air inlets. The cask base plate supports the storage cask during lifting, and forms the cooling air inlet channels at the cask bottom. An optional carbons steel supplemental shielding fixture, shown in Drawing 455-913, may be installed to reduce the radiation does rates at the air inlets.

E.9.2 LaCrosse MPC

Section 5.A.1 of Reference E.9.3-1 provides a summary of the results of the shielding evaluation of the MPC-LACBWR system. Results are provided for the transfer cask and vertical concrete cask components.

E.9.2.1 Shielding Discussion and Results for the MPC-LACBWR Storage System

This section provides a summary of the results of the shielding evaluation of the MPC-LACBWR system. Results are provided for the transfer cask and vertical concrete cask components.

The MPC-LACBWR storage system is comprised of a transportable storage canister, a transfer cask, and a vertical concrete storage cask. License drawings for these items are provided in Section E.4.4. The transfer cask containing the canister and the basket is loaded under water in the spent fuel pool. Once filled with fuel, the closure lid is placed on top of the canister and the transfer cask is removed from the pool. After draining approximately 50 gallons of water from the canister, the closure lid is welded, the closure ring is inserted and welded, and the canister is drained and dried. Finally, the port covers are welded in place. The transfer cask is then used to transfer the canister to the storage cask where it is stored dry until transport. Shielding evaluations are performed for the transfer cask with both a wet and dry canister cavity as would occur during the welding of the closure lid. Shielding evaluations are performed for the storage cask with the cavity dry.

The MPC-LACBWR transfer cask has a multi-wall radial shield comprised of 0.75 inch of carbon steel, 3.5 inches of lead, 2 inches of solid borated polymer (NS-4-FR), and 1.25 inches of carbon steel. An additional 0.5 inch of stainless steel shielding is provided radially by the canister shell. Gamma shielding is provided primarily by the steel and lead layers, and neutron shielding is provided primarily by the NS-4-FR. The transfer cask bottom shield design is a solid section of 9.5 inches of low alloy steel. The top shielding is provided by the stainless steel closure lid, which is 7 inches thick. Temporary shielding may be used during welding, draining, drying, and helium backfill operations but is not credited in the shielding analysis. Temporary shielding is removed prior to storage.

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OPERATING SYSTEMS
NAC-UMS

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F.4 OPERATING SYSTEMS

The primary components of the NAC-UMS Universal Storage System consist of the transportable storage canister, the vertical concrete cask, and the transfer cask. The NAC-UMS is designed to store up to 24 PWR or up to 56 BWR fuel assemblies. Since the design basis fuel assemblies have different overall lengths, the PWR fuel assemblies are grouped into three classes and the BWR fuel assemblies are grouped into two classes based on overall lengths. To accommodate the different fuel classes the NAC-UMS principal components are provided in an appropriate length for each class of fuel assemblies.

The transportable storage canister is a stainless steel cylindrical shell (with a bottom end plate and closure lids) that confines the fuel basket structure and the contents.

In long-term storage, the transportable storage canister is positioned inside a vertical concrete cask, which provides passive radiation shielding and natural convection cooling. The vertical concrete cask also provides protection during storage for the Transportable Storage Canister under adverse environmental conditions.

The transfer cask is used to lift and place a canister during fuel loading operations and to move a canister to or from the vertical concrete cask. The transfer cask provides radiation shielding while the canister is being transferred.

A loaded canister is placed into a concrete cask by positioning the transfer cask containing the loaded canister on top of the vertical concrete cask and lowering the canister into the concrete cask. The process is reversed for the removal of a canister from a concrete cask. Figure F.4-1 depicts the major components of the NAC-UMS system and shows the transfer cask positioned on the top of the concrete cask.

The Maine Yankee NAC-UMS is described in the following section, Section F.4.1.

Section F.4.3 provides a listing of all applicable license drawings (i.e., NAC-UMS drawings associated with storage PWR fuel and site-specific Maine Yankee fuel drawings) from Reference [F.4.2-1].

F.4.3 Supplemental Data

Section F.4.3 provides a listing of all applicable license drawings (i.e., NAC-UMS drawings associated with the storage PWR fuel and site-specific Maine Yankee fuel drawings) from Reference [F.4.2-1].

F.9.1 Maine Yankee

A discussion of the shielding evaluation of the NAC-UMS system containing PWR spent fuel assemblies and non-fuel hardware and a summary of the analysis results are presented in Section 5.1 of the NAC-UMS FSAR, Reference F.9.2-1. Analysis results are provided for the transfer cask and the vertical concrete cask. A description of the PWR fuel is presented in Section 5.1.1 of Reference F.9.2-1. The computer codes used in the NAC-UMS shielding analysis are defined in Section 5.1.2 of Reference F.9.2-1. A summary of the calculated dose rates for the NAC-UMS concrete cask and transfer cask are presented in Section 5.1.3 of Reference F.9.2-1. The shielding evaluation for the Maine Yankee site-specific spent fuel is presented in Section 5.6.1 of Reference F.9.2-1.

The NAC-UMS storage system is comprised of a transportable storage canister, a transfer cask (standard or advanced configuration), and a vertical concrete storage cask. Canister handling, fuel loading, and canister closing are operationally identical for both transfer cask configurations. License drawings for these components are provided in Section F.4.3. The transfer cask is used to move a loaded canister to, or from, the concrete storage cask and may be used to move a loaded canister to, or from, a transport cask. Shielding evaluations are performed for the storage cask with the canister cavity dry.

F.9.1.1 NAC-UMS System Shielding Discussion

The standard and advanced configuration transfer casks have a radial shield comprised of 0.75 inch of low alloy steel, 4.00 inches of lead, 2.75 inches of solid borated polymer (NS-4-FR), and 1.25 inches of low alloy steel. The 0.625-inch thick stainless steel canister shell provides additional radial shielding. Gamma shielding is primarily provided by the steel and lead, and neutron shielding is provided primarily by the NS-4-FR. The transfer cask bottom shield design is a solid section of 7.5-inch thick low alloy steel and a 1.5-inch thickness of NS-4-FR. The transfer cask top shielding is provided by the stainless steel shield and structural lids of the canister, which are 7 inches and 3 inches thick, respectively. The advanced transfer cask incorporates a trunnion support plate that allows it to lift a heavier canister. The support plate has no significant shielding effect due to its location above the trunnion. The evaluations and results provided for the standard transfer cask are, therefore, applicable to the advanced transfer cask.

The vertical concrete cask radial shield design is comprised of a 2.5-inch thick carbon steel inner liner surrounded by 28.25 inches of concrete. Gamma shielding is provided by both the carbon steel and the concrete. Neutron shielding is primarily provided by the concrete. As in the transfer cask, an additional 0.625-inch thickness of stainless steel radial gamma shielding is provided by the canister shell. The concrete cask top shielding design is comprised of 10 inches of stainless steel i.e., the canister lids, a shield plug containing either a 1-inch thickness of NS-4-FR or 1.5 inches of NS-3 together with 4.1

inches of carbon steel, and a 1.5-inch thick carbon steel lid. Since the bottom of the concrete cask rests on a concrete pad, the cask bottom shielding is comprised of 1.75 inch of stainless steel (canister bottom plate), 2 inches of carbon steel (pedestal plate) and 1 inch of carbon steel (concrete cask base plate). The concrete cask base plate and pedestal base are structural components that position the canister above the air inlets. The cask base plate supports the concrete cask during lifting, and forms the cooling air inlet channels at the cask bottom. An optional carbon steel supplemental shielding fixture, shown in Drawing 790-613, may be installed to reduce the radiation dose rates at the air inlets.

F.9.1.2 NAC-UMS System Shielding Radiation Sources

The NAC-UMS storage system accommodates up to 24 PWR fuel assemblies with a maximum of 40,000 MWd/MTU burnup, an initial enrichment of 3.7 wt % ^{235}U and a minimum 5-year cool time. Westinghouse 17 x 17 fuel with this burnup and cool time is defined as the design basis fuel. The physical parameters of the PWR fuel assemblies are presented in Table 5.2-2 of the NAC-UMS FSAR, Reference F.9.2-1.

A canister may contain spent fuel configurations that are unique to specific reactor sites. These site-specific fuel configurations result from conditions that occurred during reactor operations, participation in research and development programs, or testing programs intended to improve reactor operations. Site specific fuel configurations include standard fuel with inserted non fuel-bearing components, fuel assemblies with missing or replaced fuel rods or poison rods, fuel assemblies unique to the reactor design, fuel with a parameter that exceeds the design basis parameter, such as enrichment or burnup, consolidated fuel and fuel that is classified as damaged. Site-specific fuel configurations are either shown to be bounded by the analysis of the standard design basis fuel assembly configuration of the same type (PWR or BWR), or are shown to be acceptable contents by specific evaluation of the configuration. This shielding analysis considers both assembly fuel sources and sources from activated non-fuel material such as control element assemblies (CEA), in-core instrument (ICI) segments, and fuel assemblies containing activated stainless steel replacement (SSR) rods and other non-fuel material, including neutron sources. It considers the consolidated fuel, damaged fuel, and fuel debris present in the Maine Yankee spent fuel inventory, in addition to those fuel assemblies having a burnup between 45,000 and 50,000 MWd/MTU.

The Maine Yankee spent fuel inventory also contains fuel assemblies with hollow zirconium alloy tubes, removed fuel rods, axial blankets, poison rods, variable radial enrichment, and low enriched substitute rods. These components do not result in additional sources to be considered in shielding evaluations and are, therefore, enveloped by the standard fuel assembly evaluation.

APPENDIX G.4
OPERATING SYSTEMS
NAC-MAGNASTOR

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G.4 OPERATING SYSTEMS

MAGNASTOR is a spent fuel dry storage system consisting of a concrete cask and a welded stainless steel TSC with a welded closure to safely store spent fuel. The TSC is stored in the central cavity of the concrete cask. The concrete cask provides structural protection, radiation shielding, and internal airflow paths that remove the decay heat from the TSC contents by natural air circulation. MAGNASTOR is designed and analyzed for a 50-year service life.

The loaded TSC is moved to and from the concrete cask using the transfer cask. The transfer cask provides radiation shielding during TSC closure and preparation activities. The TSC is transferred into the concrete cask by positioning the transfer cask with the loaded TSC on top of the concrete cask, opening the shield doors, and lowering the TSC into the concrete cask. Figure G.4-1 depicts the major components of MAGNASTOR in such a configuration.

Section G.4.3 provides a listing of all applicable license drawings (i.e., only undamaged and damaged PWR fuel storage systems) from Reference [G.4-1].

G.4.3 Supplemental Data

The licensing drawings for the MAGNASTOR® System are listed in Section 1.8, *License Drawings* of the *MAGNASTOR® System Final Safety Analysis Report*, Revision 7 [G.4-1]. These drawings appear in the FSAR immediately after the drawing list in Section 1.8.1.

G.9.1 Undamaged and Damaged PWR Fuel

Section 5.1 of Reference G.9-1 provides a summary of the results of the shielding evaluation of the MAGNASTOR system. With the exception of the offsite dose discussion, the dose results are presented based on bounding heat loads and corresponding source terms based on a 35.5 kW PWR cask heat load. Offsite dose results are produced by similar bounding values of a 40 kW PWR cask heat load. Cool time tables for the thermally restricting payloads are listed in Section 5.8.9 of Reference G.9-1. Based on the code validation discussion in Section 5.2 of Reference G.9-1, a 5% uncertainty is applied to the heat loads for fuel burnups above 45 GWd/MTU. This results in an extension in minimum allowed cool time for high burnup fuel assemblies. All dose rates calculated at higher cask heat loads are bounding for the reduced heat load. For any fuel type, burnup, initial enrichment, and cool time combination allowed, additional cool time and, therefore, reduced sources are associated with the lower cask heat load. This conclusion applies also to the PWR preferential loading patterns.

A reduced minimum cool time of 2.5 years and four-zone preferential loading pattern (max 1.8 kW/assy heat load) are evaluated in Section 5.9 of Reference G.9-1 for undamaged or damaged PWR assembles in the CC4 or MTC2.

Dose rates (detector tallies) presented in Chapter 5 of Reference G.9-1 are calculated using Monte Carlo methods and, therefore, contain a result and statistical uncertainty of the result. The statistical uncertainty is expressed as a percentage and referred to as fractional standard deviation (FSD) or relative uncertainty.

G.9.1.1 Transfer Cask Shielding Discussion and Dose Results

The transfer cask radial shield is comprised of steel inner and outer shells connected by solid steel top and bottom forgings. License drawings for these components are provided in Section G.4.3 The shell encloses a lead gamma shield and a solid borated polymer (NS-4-FR) neutron shield. The TSC shell and the basket internal structure provide additional radial shielding. The transfer operation bottom shielding is provided by the TSC bottom plate and solid steel transfer cask doors. The TSC closure lid provides radiation shielding at the top of the TSC.

The three-dimensional transfer cask shielding analysis provides a complete, nonhomogenized representation of the transfer cask and TSC structure. The model assumes the following TSC/transfer cask configuration for all dose rate evaluations.

- Dry canister cavity: The majority of the TSC operations, in particular closure lid welding, are performed with the TSC cavity filled with water. Evaluating a dry canister cavity is conservative. Note that the water filling the TSC/transfer cask annulus between the inflatable seals is modeled. Transfer cask dose rates from a wet canister, while containing an increased neutron source due to a higher subcritical multiplication resulting from a higher k_{eff}, are lower than those of the dry system due to the additional radiation shielding provided by the water within and surrounding the source region. Confirmatory calculations

added mass compensating for the increase in source, damaged fuel dose rates for the first scenario are bounded by either the corresponding undamaged fuel dose rates or the second damaged fuel scenario.

In the second scenario, damaged fuel is assumed to migrate from the active fuel into the lower end fitting region of the fuel assembly, filling all the modeled void space. However, no credit is taken for the reduction in the lower end fitting hardware dose rate due to the added UO_2 mass and self-shielding nor for the reduction in fuel mass migrated from the active fuel region. In this case, transfer cask bottom surface dose rates increase due to the addition of damaged fuel. The transfer cask bottom axial dose rate increases 53 mrem/hr, increasing the bottom axial dose rate by approximately 0.9 percent.

Damaged fuel dose rates are computed using the carbon steel transfer cask, as it produces higher dose rates than the stainless steel transfer cask due to the higher density of stainless steel versus carbon steel.

Damaged fuel maximum dose rates in the carbon steel transfer cask are summarized in Table 5.1.3-9 of Reference G.9-1.

G.9.1.2 Concrete Cask Shielding Discussion and Dose Results

The concrete cask is composed of body and lid components. License drawings for these components are provided in Section G.4.3. The body contains the air inlets, air outlets, and the cavity for TSC placement. The lid provides environmental closure for the TSC. The radial shield design is comprised of a carbon steel inner liner surrounded by concrete. The concrete contains radial and axial rebar for structural support. As in the transfer cask, the TSC shell provides additional radial shielding. The concrete cask top shielding design is comprised of the TSC lid and concrete cask lid. The concrete cask lid incorporates both concrete and steel plate to provide additional gamma shielding. The bottom shielding is comprised of the stainless steel TSC bottom plate, the pedestal/air inlet structure, and a carbon steel base plate. Radiation streaming paths consist of air inlets located at the bottom and air outlets located above the top of the TSC, and above the annulus between the concrete cask body and the TSC. Air inlets and outlets are radial openings to the concrete cask. The inlets and outlets are axially offset from the source regions to minimize dose and meet ALARA principles.

No auxiliary shielding is considered in the concrete cask shielding evaluation. All components relevant to safety performance are explicitly included in the concrete cask model. Homogenization of materials used in the models is limited to the fuel assembly as described in Section 5.1.1 of Reference G.9-1.

Undamaged Fuel Dose Rates

Refer to Table 5.1.3-2, Table 5.1.3-5, and Table 5.1.3-7 of Reference G.9-1 for a summary of the concrete cask normal condition and accident event maximum calculated dose rates for the standard (CC1/ CC2), augmented shield (CC3), and short,

RSI NP-4.6

Identify the SSCs that are important to safety (ITS) for the different storage systems intended for use at the proposed CISF.

Section 1.4.3.4 of the CISF SAR states that the SSC classifications are the same as was identified in the casks' FSARs. The CISF SAR should include the classifications. Doing so through incorporation by reference is acceptable, but the reference must be clear and specific. The references also need to capture any transportation package SSCs that are used at the site for storage operations (e.g., the MP197HB packaging, which is used as a transfer cask).

This information is needed to determine compliance with 10 CFR 72.18 and 72.24.

WCS Response to RSI 4.6:

The last paragraph of Section 1.4.3.4 of the WCS CISF SAR has been deleted. Section 3.4, *Design Criteria for Transportable Storage Cask and Cask/Canister Systems,* has been revised to provide specific references that identify SSCs that are important-to-safety (ITS) for each storage system used at the CISF. The references include transportation packages that are used during storage operations. A new table has been created, *Table 3-4, References for WCS CISF Structures, Systems and Components Important-to-Safety,* that provides the specific references for SSC safety classifications and to drawings on which the SSC safety classifications are depicted.

See response to RSI 5.1 for further discussion on confinement boundary SSCs important-to-safety.

WCS SAR Impact:

The last paragraph of WCS SAR Chapter 1, Section 1.4.3.4 has been deleted.

~~The NRC approved transportation and storage system ITS design features include the transportation casks, canisters, storage units, and other equipment as specified in the previously NRC-approved CoC or site-specific materials license.~~

Added to WCS SAR Chapter 3, Section 3.4, as the last paragraph:

The safety classifications for SSCs for the storage systems and transportation/transfer casks used at the WSC CISF will be the same as those specified in the referenced previously approved NRC CoCs or site-specific licenses. Table 3-4 provides the specific references to where SSCs deemed important-to-safety are discussed for the storage systems used at the WCS CISF.

Added table to Chapter 3:

Table 3-4 References for WCS CISF Structures, Systems, and Components-Important to-Safety

Storage System	Section in WCS CISF SAR	Section in Specific License or Certificate SAR	Drawings Containing ITS Items
NUHOMS®-MP187 Cask System	Appendix A.3.1 Table A.3-2	Section 3.4 and Table 3-11 of Ref. [A.3-1]	Drawings listed in Appendix A.4.6
Standardized Advanced NUHOMS® System	Appendix B.3.1 Table B.3-2	Section 2.5 and Table 2.5-1 of Ref. [B.3-1]	Drawings listed in Appendix B.4.6 and Appendix A.4.6 numbers 14 and 15
Standardized NUHOMS®-61BT System	Appendix C.3.1 Table C.3-2	Section K.2.3.1 and Table K.2-8 of Ref. [C.3-1] and The Quality Category Column of the parts list on Drawing MP197HB-71-1002, Rev 6 in Section A.1.4.10.1 of Ref. [C.3-2]	Drawings listed in Appendix C.4.6 and Appendix A.4.6 numbers 5 through 13 inclusive
Standardized NUHOMS®-61BTH Type 1 System	Appendix D.3.1 Table D.3-2	Section T.2.3 and T.2-15 of Ref. [D.3-1]	Drawings listed in Appendix D.4.6 and C.4.6 numbers 8 through 12 inclusive and Appendix A.4.6 numbers 5 through 13 inclusive
Yankee-MPC	Appendix E.3.1.2.1	Section 2.3.1 and Table 2.3-1 of Ref. [E.4-1]	Drawings listed in Appendix E.4.4
CY-MPC	Appendix E.3.1.2.1	Section 2.3.1 and Table 2.3-2 of Ref. [E.4-1]	Drawings listed in Appendix E.4.4
MPC-LACBWR	Appendix E.3.2.2.1	Section 2.A.3.1 and Table 2.A.3-1 of Ref. [E.4-1]	Drawings listed in Appendix E.4.4
NAC-UMS	Appendix F.3.1.2.1	Section 2.3.1 and Table 2.3-1 of Ref. [F.4-1]	Drawings listed in Appendix F.4.3
NAC-MAGNSTOR	Appendix G.3.1.2.1	Section 2.4.1 and Table 2.4-1 of Ref. [F.4-1]	Drawings listed in Appendix G.4.3

1.4.3.2 Safety Analysis Methodology

The storage of spent nuclear fuel at the WCS CISF is based on the use of cask systems that have been previously certified by the NRC. The associated systems' storage FSARs and transportation SARs provide design basis information regarding radiological hazards for the individual systems to be used at the WCS CISF. The FSARs/SARs identify design basis events that are classified as either normal, off-normal or accidents for each approved system. Normal events include such operations as transportation package receipt, inspection, transfer of the canisters to the storage overpack and storage at the WCS CISF until ready to be transported off-site. Off-normal events are those events which are expected to occur with moderate frequency during transfer and storage operations. In general, the consequences of these events have no radiological safety implications and do not have a significant impact on ITS design functions. Accident conditions are those events that occur infrequently and could reasonably be expected to occur during the lifetime of the WCS CISF. These events include low probability design basis accidents which establish a conservative design basis for ITS SSCs. These events include natural phenomena such as earthquakes and tornados, and man-made events such as cask drop.

1.4.3.3 Results

For most of the accidents analyzed, there are no radiological consequences produced as a direct result of the event, and there are no impacts on ITS design functions. These negligible consequences are attributed primarily to the use of NRC approved storage systems and the implementation of operating controls and limits. However, recovery operations may involve some occupational exposure to personnel. The analyses results indicate that there are no credible accident scenarios for the WCS CISF which would result in a loss of confinement accident or a radiological release in excess of the radiological dose criterion of 10 CFR 72.106.

1.4.3.4 Technical Specifications

The WCS CISF Technical Specifications [1-4] define the operating controls and limits and the administrative controls. The Technical Specifications, including the relevant portions of the individual storage system Technical Specifications, provide defined operating limits and controls for each system for storage at the WCS CISF.

The administrative controls presented in this SAR include the organization and management structure, response plans, procedures, programs, controls, record keeping requirements, review and audit procedures, and reporting necessary to assure that the operations involved in the storage of canisterized spent nuclear fuel at the WCS CISF are performed in a safe manner.

3.4 Design Criteria for Transportable Storage Casks and Cask/Canister Systems

The authorized storage systems are designed to provide long-term storage of spent fuel. The canister materials are selected to protect against degradation during the storage period, including the application of system specific aging management programs. Section 2.1 of the Technical Specifications [3-1] lists the canisters authorized for storage at the WCS CISF. Table 3-1 provides the cross reference to the applicable appendix for each canister/storage overpack where the Design Criteria for each system is provided and comparison of those criteria to the WCS CISF specific criteria to demonstrate that the identified systems are safe for storage at the WCS CISF.

The safety classification for SSCs for the storage systems and transportation/transfer casks used at the WCS CISF will be the same as those specified in the referenced previously approved NRC CoCs or site-specific licenses. Table 3-4 provides the specific references to where SSCs deemed important-to-safety for the storage systems used at the WCS CISF.

Table 3- 4 References for WCS CISF Storage System Components Important–to-Safety

Storage System	Section in WCS CISF SAR	Section in Specific License or Certificate SAR	Drawings Containing ITS Items
NUHOMS® - MP187 Cask System	Appendix A.3.1 Table A.3-2	Section 3.4 and Table 3-11 of Ref [A.3-1]	Drawings listed in Appendix A.4.6
Standardized Advanced NUHOMS® System	Appendix B.3.1 Table B.3-2	Section 2.5 and Table 2.5-1 of Ref. [B.3-1]	Drawings listed in Appendix B.4.6 and Appendix A.4.6 numbers 14 and 15
Standardized NUHOMS®-61-BT System	Appendix C.3.1 Table C.3-2	Section K.2.3.1 and Table K.2-8 of Ref. [C.3-1] and The Quality Category Column of the parts lists on Drawing MP197-HB-71-1002, Rev.6 in Section A.1.4.10.1 of Ref [C.3-2]	Drawings listed in Appendix C.4.6 and Appendix A.4.6 numbers 5 through 13 inclusive
Standardized NUHOMS®-61BTH Type 1 System	Appendix D.3.1 Table D.3-2	Section T.2.3 and T.2-15 of Ref. [D.3-1]	Drawings listed in Appendix D.4.6 and C.4.6 numbers 8 through 12 inclusive and Appendix A.4.6 numbers 5 through 13 inclusive
Yankee-MPC	Appendix E.3.1.2.1	Section 2.3.1 and Table 2.3-1 of Ref. [E.4-1]	Drawings listed in Appendix E.4.4
CY-MPC	Appendix E.3.1.2.1	Section 2.3.1 and Table 2.3-2 of Ref. [E.4-1]	Drawings listed in Appendix E.4.4
MPC-LACBWR	Appendix E.3.2.2.1	Section 2.A.3.1 and Table 2.A.3-1 of Ref. [E.4-1]	Drawings listed in Appendix E.4.4
NAC-UMS	Appendix F.3.1.2.1	Section 2.3.1 and Table 2.3-1 of Ref. [F.4-1]	Drawings listed in Appendix F.4.3
NAC-MAGNASTOR	Appendix G.3.1.2.1	Section 2.4.1 and Table 2.4-1 of Ref. [F.4.-1]	Drawings listed in Appendix G.4.3

RSI NP-4.7

Provide design criteria for the Fuel Handling Building (FHB) in Table 1-3, "Summary of WCS CISF Principal Design Criteria," and corresponding SAR text. Provide FHB SSC designs in the SAR to demonstrate that the FHB is structurally adequate to prevent massive building collapse or dropping of heavy objects on to spent fuel cask systems and related ITS SSCs.

72.122(b)(2)(ii) states, "[T]he ISFSI or MRS also should be designed to prevent massive collapse of building structures or the dropping of heavy objects as a result of building structural failure on the spent fuel, high-level radioactive waste, or reactor-related GTCC waste or on to structures, systems, and components important to safety." As such, the applicant must provide a design basis and criteria evaluation for the FHB and submit its design in the SAR accordingly.

This information is needed to determine compliance with 10 CFR 72.122(b)(2)(ii).

WCS Response to RSI 4.7:

The design criteria for the Cask Handling Building have been added to WCS SAR Chapter 1, Table 1-2, "Summary of WCS CISF Principal Design Criteria." WCS SAR Chapter 1, Section 1.2.3 has been updated to reference new Figure 1-7, "Cask Handling Building Plan" and new Figure 1-8, "Cask Handling Building Section View." A new Section was added to WCS SAR Chapter 7, Section 7.5.3, "Cask Handling Building Structure Design," to address design criteria and requirements. Additional conforming edits have been made to WCS SAR Chapter 3, Sections 3.2.1, "Cask Handling Building and Equipment," and WCS SAR Chapter 4, Section 4.1.2.5, "Cask Handling Building", consistent with the WCS SAR Chapter 7, Section 7.5.3. Table 7-1 has been updated to indicate ITS components of the building.

New Figures 1-7 and 1-8 referenced in Chapter 1, Section 1.2.3 were added as part of the Response to RSI 4.3.

SAR Impacts:

WCS SAR Chapter 1, Table 1-2 was updated to include design criteria for the Cask Handling Building (see attached).

WCS SAR Chapter 1, Section 1.2.3 Facility Descriptions was updated and references to new figures were added (see attached).

WCS SAR Chapter 3, Section 3.2.1 Cask Handling Building and Equipment has been updated (see attached).

WCS SAR Chapter 4, Section 4.1.2.5 Cask Handling Building, building size and crane information was updated and references to new figures were added (see attached).

WCS SAR Chapter 7, Table 7-1 was updated to include the QA classification for the Cask Handling Building (see attached).

WCS SAR Chapter 7, Section 7.5 Cask Handling Building was updated to include a reference to new Section 7.5.3 "Cask Handling Building Structural Design," (see attached).

WCS SAR Chapter 7, Section 7.7 References have been updated to include two additional references (see attached).

Addition to WCS SAR Chapter 7, new section:

7.5.3 Cask Handling Building Structural Design

This section presents the structural description and design criteria for the WCS CISF Cask Handling Building (CHB). The CHB is designed to meet the requirements of 10 CFR 72.122(b)(2)(ii). The CHB is a two bay commercially designed and fabricated steel frame structure with metal siding designed to support two commercial overhead cranes used to move transportation casks from the rail car to the transport vehicle. The overhead cranes will also be used to remove / install personnel barriers, impact limiters, from the transportation casks upon receipt of the rail car at the CHB. All operations to move the NUHOMS® system MP187 and MP197HB transportation casks are accomplished with the transportation casks in a horizontal orientation. The overhead cranes are NITS as all lifts are limited to a maximum height of 80 inches.

7.5.3.1 Descriptions of Systems, Structures, and Components

In order to ensure that the CHB is structurally adequate to prevent massive building collapse or the dropping of heavy objects onto spent fuel cask systems and related ITS SSCs, the building structures, systems, and components have been evaluated and assigned a QA classification. The classification of SSCs are shown in Table 7-25.

The CHB structural system (including crane supports) is a Category C, Important to Safety (ITS) commercially designed and fabricated structure. All remaining components of the building are classified as NITS.

Table 7-25. Cask Handling Building SSCs and QA Classification

SSC	**QA Classification**
Building Structural Steel	Important-to-Safety
Overhead Crane Support Beams	Important-to-Safety
Concrete Foundations and Slab on Grade	Important-to-Safety
Overhead Cranes	Not Important-to-Safety
Building Cladding	Not Important-to-Safety
Electrical Systems	Not Important-to-Safety
Mechanical and HVAC Systems	Not Important-to-Safety
Fire Protection System	Not Important-to-Safety

7.5.3.2 Design Analysis

This section describes loads, loading combinations and analysis methods to be met for design of the WCS CISF reinforced concrete and structural steel structures.

Loads

Loads used in analysis and design of CHB structure include the following:

D Dead load
L Live load
H Lateral soil pressure load
T_o Thermal load
W Wind load
F' Flood load
E' Design Basis Earthquake seismic load
W_t Tornado loads - including:

W_w Tornado wind pressure load

W_P Tornado-created differential pressure load

W_m Tornado-generated missile load

These loads are categorized into three areas: normal loads, severe environmental loads and extreme environmental loads. Values for these loads are based on the WCS site design parameters identified in Chapter 3. Definitions for the loads in these categories are provided in the following sections for dry storage reinforced concrete components.

Normal Loads

Normal loads are those encountered during normal operation. They include: dead loads, live loads, hydrostatic fluid pressure loads, soil pressure loads, and thermal loads. The following definitions are provided for normal loads.

Dead Load - Defined as any load, including related internal moments and forces, that is constant in magnitude, orientation, and point of application. Dead loads include the mass of the structure, and any permanent equipment loads. The effects of differential settlement are considered when determining dead loads. In addition, a minimum uniform load allowance of 20 lb/ft^2 is applied to roof areas to account for miscellaneous electrical conduits, handrails and ladders for which the actual dead load contribution is not precisely known at the time the analysis or design is performed.

Live Load - Defined as any normal load, including related internal moments and forces that may vary with intensity, orientation and/or location of application. Movable equipment loads, loads due to vibration and any support movement effects and operating loads are types of live loads. The following descriptions provide design requirements for various types of live loads.

- **Rain, Snow and Ice-** Described in Chapter 3, the design live load due to rain, snow, and ice is 10 lb/ft^2, which is the ground snow load. Determination of roof snow and ice loads is in accordance with the requirements of American Society of Civil Engineers (ASCE) Standard 7-05 [7-34].

- **Transportation Vehicle Loads and Heavy Floor Loads** - Loads due to vehicular truck and rail traffic in designated building areas are in accordance

with standard loadings defined by the American Association of State Highway and Transportation Officials (AASHTO) and by the American Railway Engineers Association. Special heavy loading conditions resulting from transport of SNF and storage casks on truck and rail transporters/carriages are considered. Design basis cask weights bound the worst-case condition of all vendor designs handled at the WCS CISF. Floor loadings from transportation, transfer and storage mode casks are also considered, along with sufficient allowance for any impact resulting from placing the moving loads on the floor or other areas of the structure. Within the building, the floor under the Canister Transfer System will be designed to handle the specific loads produced by the hydraulic gantry system.

- **Crane and Hoist Loads** - Design loads for the transfer facility permanently installed cranes and hoists envelop the fully-rated capacity of the equipment, including allowances for impact loads and test load requirements. The rated capacity of each of the two overhead bridge cranes in the transfer facility is 130 tons. Crane test loads are considered in the design at 125% of the rated capacity of the cranes, increased by an additional 15% to account for impact. Minimum lateral design loads on crane runway supports are 20% of the sum of the rated hoist capacity, plus the weight of the crane trolley to account for the effects of the moving trolley. The lateral load on crane supports is determined by applying the load at the top of the rail in either direction, and distributing it according to the relative stiffness of the end supports. Minimum longitudinal design loads on supports for each crane rail are 10% of the maximum crane wheel load. Seismic effects considered on fully loaded cranes and hoists are also included as described in Section 7.5.3.7.

- **Floor Live Loads** - A floor live load of 300 lb/ft^2 is applied in areas of heavy operation in the CHB. Office areas will be designed for 40 lb/ft^2.

Hydrostatic Fluid Pressure Loads - Are due to fluids held in internal building compartments, such as tanks. There are no reinforced concrete tanks in the transfer facility. All tanks located in the transfer facility are designed in accordance with mechanical equipment design criteria.

Soil Load (H) - Based on the density of the soil and includes the effects of groundwater, see attachment E of the WCS CISF SAR Chapter 2. Since the WCS CISF site is a dry, relatively flat site and the dry storage component support pads and transfer facility are all slab-on-grade structure, no groundwater or soil pressure loads are exerted on building structures. Therefore, determination of lateral soil pressure loads is not necessary for structural analysis or design.

Thermal Load (T_o) - Consist of thermally induced forces and moments resulting from operation and environmental conditions affecting the dry storage components and transfer facility building structure. Thermal loads are based on the most critical transient or steady-state condition. Thermal expansion loads due to axial restraint, as well as loads resulting from thermal gradients, are considered. The ambient temperature values during normal

operating conditions identified in Chapter 3 are used for structural analysis and design.

Severe Environmental Loads

Severe environmental loads are those that could infrequently be encountered during the life of the WCS CISF. They include: wind loads (W) and flood loads (F'). These loads are defined as follows:

Wind Loads (W) - Are those pressure loads generated by the design wind. These loads do not incorporate any loads associated with tornados. The basic wind speed used to determine design wind loads on the CHB walls and roof areas is 90 mph, as described in Chapter 3.

Wind loads are determined in accordance with the requirements of ASCE Standard 7-05 (Ref. 7.4-7), Section 6. The velocity pressures (q_z) for the transfer facility main wind-force resisting structures and the dry storage systems determined in accordance with ASCE Standard 7-05, Equation 6-15. Design basis wind pressures for each component are computed using the methodology of Section 6.4 either Method 1 (Simplified Method) or Method 2 (Analytical Method) of ASCE Standard 7-05 for the configuration and dimensions of each component.

$$q_z = 0.00256 K_z K_{zt} K_d V^2 I = 27.9 \text{ lb/ft}^2$$

where:

K_z = normal wind velocity pressure exposure coefficient for different heights above ground, from Table 6-3 of ASCE Standard 7-05, Exposure Category C, since the WCS CISF site is flat, h = 70 feet above ground and exposure C, gives $K_z = 1.17$.

K_{zt} = topographic factor from Section 6.5.7.1, ASCE Standard 7-05, $K_{zt} = 1.0$

K_d = wind direction factor, from Section 6.5.4.4 ASCE Standard 7-05, $K_d = 1.0$

I = importance factor for normal wind load determination of 1.15 for important-to-safety SSCs (Category IV) as defined in ASCE Standard 7-05 Table 6-1

V = basic wind speed = 90 mph, ASCE Standard 7-05 Figure 6-1

Flood Loads (F') - Are due to exterior flood waters from the design-basis flood exerting forces and moments on exterior building structures, or entering a building and exerting loads on interior building structures. As described in Chapter 2, the CHB finished floor elevation is above the PMF elevation and flood loads are not applicable.

Extreme Environmental Loads

Extreme environmental loads are loads which are credible but are highly improbable. They include seismic loads (E') and tornado loads (W_t). These loads are defined as follows:

Seismic Loads (E')- Are loads generated by the design basis earthquake (DBE). For the WCS CISF, the DBE is similar to a safe shutdown earthquake, and no operating basis earthquake is required to be considered in the design of the WCS CISF SSCs. As specified in Chapter 3, the DBE loads (E') are based on a 0.25g maximum peak horizontal seismic acceleration. This will be applied to the building and crane support structural members and components.

Tornado Loads (Wt)- Are loads generated by the design tornado specified for the CISF. They include loads due to tornado wind pressure (Ww), loads created by tornado-induced differential pressure (Wp), and loads resulting from tornado-generated missiles (Wm). The tornado load criteria from Chapter 3 apply to the CHB structural system only.

- **Tornado Wind Pressure Loads** - Tornado wind loads (W_w) are those pressure loads generated by tornado wind velocity, which is the combined translational and rotational wind speed of 200 mph. Tornado wind loads are similar to those for basic design wind speed. NUREG-0800 Standard Review Plan 3.3.2 [7-43] provides guidance for determining tornado loads for nuclear power plant structures, and this guidance is used for the CHB structural system. Tornado wind pressure loads, W_w are determined as follows.

$$W_w = p_w = q_h G C_p$$

where:

q_h = velocity pressure determined as described for Wind Loads except that the wind speed is 200 mph and the product of the values of the coefficients K_z, K_{zt} ,K_d, the Importance Factor I and the gust effect factor G are all assumed to be equal to 1.0 as specified by NUREG-0800 Standard Review Plan 3.3.2.

C_p = external pressure coefficient for windward wall, leeward wall, side wall or roof, from ASCE Standard 7-05, Figure 6-6.

$$W_w = p_w = 0.00256 V^2 C_p$$

Simplifying this formula for tornado wind pressure load determination for the design basis 200 mph translational plus rotational tornado wind speed:

$$P_w = 102 C_p \text{ lb/ft}^2$$

- **Tornado Differential Pressure Loads-** Tornado-induced differential pressure

(W_p) loads are those exerting an internal pressure loading on structures due to the negative pressure created by the tornado. The design pressure drop is 0.9 psi, which occurs at a rate of 0.4 psi/sec. This internal pressure is applied to the interior surfaces of the transfer facility exterior building walls and roof. The magnitude of this pressure is reduced for structures that are vented. The CHB is a steel frame with cladding to provide weather protection. In the case of a tornado the cladding is assumed to fail providing openings in the building. In addition, the CHB has large open areas that will adequately vent the interior of the building resulting in no significant pressure differential due to the tornado suction loads. Therefore, the effect of the tornado differential pressure loads are considered negligible and are not evaluated.

- **Tornado Missile Loads** - Tornado-generated missile loads (W_m) are impact loads applied to structures due to strikes by any of the missiles specified in Chapter 3. When converting tornado-generated missile loadings into structural loads, the effects of impact are considered. Consideration of tornado-generated missile impact loadings is discussed further in Section 7.4.3.3.

7.5.3.2.1 Reinforced Concrete Load Combinations

Concrete sections for the CHB foundation and slab on grade will be designed in accordance with ultimate strength design methods as specified in ACI 349 [7.31]. Ductility and impact design requirements of ACI 349, Appendix C, are incorporated into the design. Design of ITS embedded plates and concrete anchors are in accordance with the requirements of ACI 349, Appendix B.

The following load combinations described in Table 7-26 are used for the design of the WCS CISF ITS reinforced concrete CHB structures. The reinforced concrete structure load combinations are in accordance with ANSI-57.9. These loading combinations are used in conjunction with the ultimate strength design method for reinforced concrete structural design. The value "U" is the section strength required to resist design loads based upon the ultimate strength design methods described in ACI 349 (Ref. 7-31). Loading combinations consider two conditions of structural loading: service load conditions and factored load conditions.

Service load combinations represent the expected loading conditions for WCS CISF ITS structures during normal facility operations and during severe environmental conditions. Service load combinations are comparable to the "Normal Events and Conditions", "Off-Normal Events and Conditions" and "Accident-Level Events and Conditions" loading combinations specified in NUREG-1567 [7-28]. Service load combinations include dead loads (D), live loads (L), design wind loads (W), flood loads (F), and normal condition thermal loads (T_o) plus Design Basis Earthquake loads (E) and tornado loads (W_t). Extreme environmental loads (i.e., seismic and tornado loadings) are not considered to act simultaneously because of the extremely low probability that an earthquake and a tornado could occur at the same time. Service load combinations used for design of ITS concrete structures are provided in Table 7-26.

Table 7-26 Load Combinations

Case	Load Combination(1)	Loading Notation
1	U = 1.4D + 1.7L	D = Dead Weight(3) E = Earthquake Load F = Flood Induced Loads H = Lateral Soil Pressure Load(2) L = Live Load(4) T = Normal Condition Thermal Load Ta =Off-normal or Accident Condition Thermal Load W = Wind Load(5)
2	U = 1.4D + 1.7L + 1.7H	
3	U = 0.75 (1.4D + 1.7L + 1.7H + 1.7T + 1.7W)	
4	U = 0.75 (1.4D + 1.7L + 1.7H + 1.7T)	
5	U = D + L + H + T + E	
6	U = D + L + H + T + F	
7	U = D + L + H + Ta	

(1) The load combinations are in accordance with ANSI-57.9. In Case 6 flood loads (F) are substituted for drop loads (A) which are not applicable to the WCS CISF concrete structures.

(2) ANSI 57.9 defines lateral soil pressure load case H which is not applicable to the WCS CISF (H=0).

(3) Dead load (D) is increased +5% to simulate most adverse loading as required by ANSI 57.9.

(4) Live loads (L) are varied between 0 and 100% of design load to simulate most adverse conditions for the WCS CISF.

(5) Wind loads are conservatively taken the same as Design Basis Tornado (DBT) wind pressure loads. Missile loads are analyzed for local damage, overall damage, overturning and sliding effects.

7.5.3.2.2 Structural Steel Loading Combinations

The loading combinations in Table 7-27 are used for the design of the transfer facility structural steel. These loading combinations are used in conjunction with elastic design methods for structural steel. The value "S" is the required section strength based on allowable stresses defined in AISC 360[7-62]. Loading combinations consider two structural loading conditions: service load conditions and factored load conditions. Loads specified in each combination are defined in Section 7.5.3.2.

Service load combinations represent the expected loading conditions for steel structures during normal facility operations and during severe environmental conditions. Service load combinations are comparable to the Normal Events and Conditions and Off-Normal Events and Conditions loading combinations. Service load combinations include dead loads (D), live loads (L), hydrostatic fluid pressure loads (F), lateral soil pressure loads (H), design wind / tornado loads (W), flood loads (F'), thermal loads (T_o), Earthquake (E'), and

Crane (C). Service load combinations used for design of steel structures are provided in Table 7-27.

Table 7-27. Service Combinations for Steel Structures

Allowable Stress (S)	
Case No.	Load Combination
1	S > D + L
2	S > D + L + H
3	1.33S > D + L + H + W
4	1.5S > D + L + H + T + W
5	1.6S > D + L + H + T + E
6	1.33S > D + L + H + T
7	1.7S > D + L + H + T_a

(1) Load combinations are per ANSI 57.9 except lateral soil pressure (H = 0) and drop loads (A = 0).
(2) Dead load (D) is increased +5% to simulate most adverse loading.
(3) Live loads (L) are varied between 0 and 100% of design load to simulate most adverse conditions for the WCS CISF.

In addition to the service load and factored load combinations, the following load combinations are checked to ensure overall stability of the transfer facility and dry storage system components against the effects of overturning, sliding and flotation. Neither tornado internal pressure loadings, W_p, nor tornado missile impact loadings, W_m, appreciably affect structure overturning, sliding or flotation for the transfer facility. The minimum safety factors required for each loading combination are presented in Table 7-28.

Table 7-28. Minimum Factors of Safety

Loading Combination	Overturning	Sliding	Flotation
D + F + H + W	1.5	1.5	-
D + F + H + E	1.1	1.1	-
D + F + H + W_t	1.1	1.1	-
D + F	-	-	1.1

The following load considerations are used when combining loads for the CHB design.

- Live loads are applied fully to structural members, partially to members, totally removed from members, or shifted in location and pattern as necessary to obtain worst-case loading conditions for maximizing internal forces and moments for all load combinations and for investigating overall building stability. Impact forces due to moving loads are applied where appropriate.

- Appropriate construction loadings are considered in the service load combinations, as are construction methods and sequence, and appropriate loading conditions are applied to ensure structural integrity of partially erected or open structures.

- Tornado loads are applied to roofs and all exterior walls of the CHB. Where the exterior walls do not establish the tornado pressure boundary, appropriate interior walls are designed as the tornado pressure boundary.

7.5.3.3 Reinforced Concrete Structural Analysis and Design

The Cask Handling Building ITS reinforced concrete foundations are analyzed and designed to resist the loads and loading combinations specified in Section 7.5.3.2. For the CHB, static analysis methods are used to determine forces and moments on structural members as a result of applied service loading conditions. Dynamic analysis methods are used to determine structural member forces and moments for factored loading conditions where structural components are subjected to seismic or tornado-generated missile impact loads. A computer model will be generated and used to analyze the CHB for appropriate loading conditions. Construction of the reinforced concrete components will be in accordance with ACI 318-08 [7-39].

The Cask Transfer System (CTS) is a standalone hydraulic gantry system that will be housed in the CHB. The CTS is independent of the CHB structural system. The CHB slab-on-grade that supports the CTS will be designed to meet the requirements of the CTS as described in 7.5.1.

7.5.3.4 Structural Steel Design

Structural steel beams are provided in the CHB along the crane runways to support the rails for two 130-ton capacity overhead bridge cranes. The steel crane runway support beams are classified as category C Important to Radiological Safety since they provide support for the overhead cranes during a seismic event and prevent the cranes falling onto the transportation cask stations. The steel crane runway support beams are supported on steel columns that are tied to the main structural steel columns of the CHB on one end and steel brackets that protrude from the main structural steel columns of the CHB at the other end. In order to provide lateral support for the steel crane runway support beams, tie members are provided between the steel beams and the CHB frame to resist lateral forces on the steel beams due to crane trolley movement and seismic thrust loads. The steel crane runway support beams are shown in plan on Figure 1-7 and in elevation on Figure 1-8.

The CHB steel crane runway support beams are constructed using ASTM A992 and A36 mild carbon steel rolled shapes and/or plate sections. Standard carbon steel crane rails are connected by bolts to the top flanges of the steel crane runway support beams. All bolts used for primary structural connections are either A325 or A490. Welding electrodes are compatible with the joined materials.

7.5.3.5 Tornado Missile Impact Analysis and Design

The CHB is a steel frame with cladding to provide weather protection. In the case of a tornado the cladding is assumed to fail and therefore the only concern is for the overall effects of a missile impact on the steel frame. The steel frame will be designed to ensure that the frame retains its integrity and functionality subsequent to a missile strike. Overall effects of a deformable missile, such as an automobile striking the frame, are considered. Overall effects of a nondeformable missile are also evaluated to ensure the stability of the transfer facility frame.

7.5.3.6 Structural Steel Design Criteria

Structural steel members are designed in accordance with elastic allowable strength design methods, as specified in Part 1 of American National Standards Institute/American Institute of Steel Construction (ANSI/AISC) N690 [7-61].

7.5.3.7 Structural Analysis and Design

CHB structural steel components are analyzed and designed to resist the specified loading combinations. Static analysis methods are used for determining forces and moments on structural steel members as a result of applied service loading conditions. Dynamic analysis methods are used for determining structural steel member forces and moments for factored loading conditions where structural components are subjected to seismic loads. For determining seismic load effects on structural steel components, a damping value of 4% is used for welded structures, and a damping value of 7% is used for bolted structures, as required by Regulatory Guide 1.61 [7-38].

The steel crane runway support beams are included in the structural system analysis

model. Beams are analyzed and designed for worst-case crane wheel loads, assuming both of the overhead bridge cranes are fully loaded to their rated capacity. Loadings on the beams from the cranes are appropriately increased for impact effects as described in Section 7.5.3.2 for live crane and hoist loads. Both cranes are assumed to be fully loaded during a seismic event, the full weights of the cranes are considered in contributing mass during seismic events, and the full weight of the suspended load on each crane is considered for vertical participation during seismic events. To account for the pendulum effect of the flexible cabling that supports the suspended load on each crane, lateral seismic load contributions from the 130-ton suspended loads are considered to be similar to lateral effects due to trolley movement. That is, 20% of the suspended load is applied horizontally in the direction perpendicular to the steel crane runway support beams and 10% of the suspended load is applied horizontally along the longitudinal axis of the steel crane runway support beams.

The positions of the cranes are varied along the crane runways to determine the worst case for maximum stresses on the steel crane runway support beams. To determine worst-case loadings on the beams, crane lifting trolleys are positioned to one side of each crane with the two cranes adjacent to each other.

Table 1-2
Summary of WCS CISF Principal Design Criteria
(3 pages)

Design Parameter	Design Criteria	Condition	Applicable Codes, Standards and Basis
Radiological Protection	Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 Rem Public lens of eye ≤ 15 Rem	Accident	10 CFR 72.106
Radiological Protection	Public wholebody ≤ 25 mrem/yr (1) Public thyroid ≤ 75 mrem/yr(1) Public critical organ ≤ 25 mrem/yr(1)	Normal	10 CFR 72.104
Confinement	Per design basis for systems listed in Table 1-1	N/A	N/A
Nuclear Criticality	Per design basis for systems listed in Table 1-1	N/A	N/A
Decommissioning	Minimize potential contamination	Normal	10 CFR 72.130
Materials Handling and Retrieval Capability	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site	Normal	10 CFR 72.122(1)
Cask Handling Building	Structural System prevent massive building collapse of building structures or the dropping of heavy objects as a result of building structural failure on the spent fuel, high-level radioactive waste, or GTCC waste or onto other ITS SSCs.	Accident	10 CFR 72.122(b)(2)(ii)

1.2.3 Facility Descriptions

The major facilities at the WCS CISF are the Cask Handling Building and the storage area. The Cask Handling Building is ~~a steel building~~ approximately 140 feet long by 150 feet wide by 65 feet high. The purpose of the Cask Handling Building is to receive and prepare for storage shipments of dual-purpose canister systems. It will also receive GTCC waste canisters for storage at the site. It is also designed to process canisters stored at the site for off-site shipment. The Cask Handling Building is designed to handle canisterized fuel only and does not have the capability to handle bare fuel. ~~The Cask Handling Building is designed to withstand all normal operating loads and off-normal loads created by natural phenomena.~~

The building is a two bay commercially designed and fabricated steel frame structure with metal siding and reinforced concrete foundations and floors. The steel structure is designed to support two commercial overhead cranes used to move transportation casks from the rail car to the transport vehicle. One bay of the building will house the Canister Transfer System described in Section 1.3.1.2 and the other bay will be available for direct transfer of transportation casks from the rail car to the transport vehicle. A 2,400 square foot area of the building is set aside for cask storage and maintenance. The building plan view is shown in Figure 1-7. Figure 1-8 is a section through the building showing the overhead crane location. Air monitors and dosimeters are located in the building for monitoring purposes. The building is not designed or intended to provide confinement or shielding for SNF or GTCC materials. The building structure, including crane supports, are classified as ITS to prevent massive building collapse or the dropping of heavy objects on to spent fuel cask systems and related ITS SSCs. the remainder of the building components will be NITS. For design specifics, see Section 7.5.3.

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~~equipment used to make the transfer to the storage overpacks is substantially identical~~ to that used to transfer the canister into dry storage at the reactor facilities where the fuel was initially stored.

The storage area is a large area comprised of concrete storage pads and storage overpacks. The purpose of the storage area is to provide safe storage for the canisterized spent nuclear fuel in cask systems that were previously approved by the NRC. The pads and approach aprons are designed to meet the applicable requirements of these previously approved cask systems. The storage area will be constructed in phases, as necessary. Phase 1 is designed to accommodate approximately 5,000 MTHM of spent nuclear fuel and GTCC waste in approximately 470 storage overpacks.

The remainder of the WCS CISF facilities provide support functions such as administrative activities, fuel receipt, security and fire protection. Table 1-3 provides a list of the WCS CISF facilities and their functions. The facility locations are provided in Figure 1-2.

3.2 Classification of WCS Interim Storage Facility Structures, Systems and Components

Components are classified in accordance with the criteria of 10 CFR Part 72. Structures, systems, and components classified as important-to-safety (ITS) are defined in 10 CFR 72.3 as the features of the WCS CISF whose function is:

- To maintain the conditions required to store spent fuel and GTCC waste safely.
- To prevent damage to the canister during handling and storage.
- To provide reasonable assurance that spent fuel can be received, handled, packaged, stored, and retrieved without undue risk to the health and safety of the public.

These criteria are applied to the WCS CISF components in determining their classification in the paragraphs that follow.

3.2.1 Cask Handling Building and Equipment

The purpose of the Cask Handling Building and associated lifting equipment is to receive, inspect and prepare for storage, shipments of canisterized spent nuclear fuel and GTCC waste canisters and to provide for cask and rail car light maintenance. The Vertical Cask Transporter (VCT) used for upending the transportation cask and placing it under the Canister Transfer System is ITS. The Canister Transfer System and associated lifting hardware used for stack up and transfer operations for the NAC canisters is ITS because the canisters are lifted above the specified Technical Specifications [3-1] limits. The 130-ton overhead crane and associated NUHOMS® MP197HB and MP187 Casks Lift Beam Assembly are not-important-to-safety (NITS) because the NUHOMS® cask and canister are not lifted above the Technical Specifications [3-1] height limits. The balance of the facility is also NITS as the fuel remains sealed from the environment inside the confinement boundary provided by the canister for all operations and the overpacks provide protection from natural phenomena and postulated off-normal and accident events.

3.2.2 Storage Systems and Pads

The classificat
storage at the
transfer equip
E.3, F.3 and G cal
Specifications
Table 3-1 prov ch
canister/storage overpack where the classifications of the components of that system are identified.

The building structure (structural steel and column foundations) will be classified as ITS to ensure prevention of massive building collapse or the dropping of heavy objects onto cask systems and related ITS SSCs.

4.1.2.3 Protected Area

The Protected Area (PA) is approximately 36 acres within the OCA which includes the concrete storage pads, storage overpacks, Cask Handling Building, and the Security and Administration Building. The PA is surrounded by a double fence with a minimum 20-foot space between each fence. The exterior fence acts as a "nuisance" fence and the interior fence is the primary fence for intruder barrier and detection. Personnel will access the PA through the Security and Administration Building. There is a minimum of 200 meters between the PA fence and the OCA fence.

4.1.2.4 Storage Area and Concrete Storage pads

SNF is placed in storage overpacks located on concrete pads in the Storage Area. The Storage Area is 350 feet wide by 800 feet long and consists of concrete storage pads, concrete access aprons, and access roadways. There is a minimum of 100 meters between the Storage Area and the PA fence.

Concrete pad thickness and steel reinforcing depends of which type of storage overpack that is used on each pad. Concrete aprons and access roadways are constructed as necessary to facilitate VCT and transfer vehicle access and final storage placement of canisters.

4.1.2.5 Cask Handling Building

Transfer of each canister from the rail car to the transfer vehicle or VCT occurs inside the Cask Handling Building. The Cask Handling Building ~~is a 22,500 square foot building wit~~contains two overhead, capable of lifting and manipulating the transportation cask and canister. ~~A back-up crane may be installed in the Cask Handling Building to provide operational redundancy.~~ For canisters stored in horizontal storage overpacks, the overhead bridge crane is used to transfer the transportation cask from the rail car to a transfer vehicle that will move the canister to the concrete pad. For canisters stored in Vertical Concrete Casks (VCCs), the Cask Transfer System and VCT are used to transfer the canister from the transportation cask a VCC that is then moved to the Storage Area. Figures 1-7 and 1-8 show the Cask Handling Building Layout and Section

4.1.2.6 Transportation Cask Queuing Areas

The rail side track that brings rail cars to the Cask Handling Building has queuing length of approximately 800 feet inside of the PA. This length will accommodate five primary rail cars and five accompanying buffer cars, all within the PA. Once a rail car has been unloaded, it will be released through the east end of the Cask Handling Building and outside of the PA.

Table 7-1
WCS CISF Structures and QA Classification

Structure	QA Classification
Storage Overpacks (VCCs and HSMs), Transfer Casks	Important-to-Safety
Cask Handling Building including overhead cranes (Except for Structural System)	Not important to safety
Canister Transfer System	Important-to-Safety
Storage pads, NUHOMS® Systems	Not important to safety
Storage pads, VCCs	Important-to-Safety
NUHOMS® Transfer Equipment (Except Transfer Cask)	Not important to safety
Vertical Cask Transporter	Important-to-Safety
Cask Handling Building Structural System	Important-to-Safety

7.5 Cask Handling Building

The Cask Handling Building is a two bay commercially designed and fabricated ~~(NITS)~~ steel frame structure with metal siding designed to support two commercial bridge cranes used to remove / install personnel barriers, impact limiters and small items from the transportation casks upon receipt of the rail car at the Cask Handling Building. All transfer operations to move the NUHOMS® system MP187 and MP197HB transportation casks are accomplished with the transportation casks in a horizontal orientation utilizing a NITS bridge crane as all lifts are limited to a maximum height of 80 inches.

Design Criteria for the Cask Handling Building is included in Section 7.5.3.

The Cask Handling Building also house tem that is classified as an ITS component. to be utilized at the WCS CISF. The WCS CISF is used for interim storage of commercial SNF and reactor-related Greater Than Class C (GTCC) wastes under the provisions per 10 CFR Part 72.

7.5.1 Canister Transfer System

7.5.1.1 Introduction

Three (3) types of VCC systems, provided by NAC International, are stored at the WCS CISF – the NAC MAGNASTOR, NAC-UMS and NAC-MPC. Each canister system has an associated transportation configuration in which the canister arrives at the WCS CISF. The function of the CTS is to perform a shielded transfer of the canister from the transportation package and subsequently perform placement of the canister into the VCC. The CTS is essentially a hydraulic gantry crane with a dedicated transfer cask (unique for each of the three system types being loaded). Figure 7-1 is a rendering of the CTS.

The following sections provide the necessary information to demonstrate compliance with the United States Nuclear Regulatory Commission (NRC) NUREG-0554, "Single-Failure-Proof Cranes for Nuclear Power Plants" [7-2] and all adjunct requirements.

7-59 ENERCON email from Jonathan Hurff to Huy Tran dated Wednesday December 30, 2015 11:03 AM, Subject: NAC ISFSI Pad Geometry and Damping.

7-60 AREVA TN Document, ANUH-01.0150, Revision 6, "Updated Final Safety Analysis Report for the Standardized Advanced NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel, NRC Docket No. 72-1029.

7-61 ANSI/AISC N690-06, "Specification for the Design, Fabrication, and Erection of Steel Safety-Related Structures in Nuclear Facilities."

7-62 ANSI/AISC 360-05, "Specification for Structural Steel Buildings"

Table 1-2
Summary of WCS CISF Principal Design Criteria
(3 pages)

Design Parameter	Design Criteria	Condition	Applicable Codes, Standards and Basis
Radiological Protection	Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 Rem Public lens of eye ≤ 15 Rem	Accident	10 CFR 72.106
Radiological Protection	Public wholebody ≤ 25 mrem/yr (1) Public thyroid ≤ 75 mrem/yr(1) Public critical organ ≤ 25 mrem/yr(1)	Normal	10 CFR 72.104
Confinement	Per design basis for systems listed in Table 1-1	N/A	N/A
Nuclear Criticality	Per design basis for systems listed in Table 1-1	N/A	N/A
Decommissioning	Minimize potential contamination	Normal	10 CFR 72.130
Materials Handling and Retrieval Capability	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site	Normal	10 CFR 72.122(1)
Cask Handling Building	Structural system prevents massive building collapse of building structures or the dropping of heavy objects as a result of building structural failure on the spent fuel, high-level radioactive waste, or GTCC waste or onto other ITS SSCs.	Accident	10 CFR 72.122(b)(2)(ii)

Note:

1. In accordance with 10 CFR 72.104(3) limits include any other radiation from uranium fuel cycle operations within the region.

1.2.3 Facility Descriptions

The major facilities at the WCS CISF are the Cask Handling Building and the storage area. The Cask Handling Building is approximately 140 feet long by 150 feet wide by 65 feet high. The building is a two bay commercially designed and fabricated steel frame structure with metal siding and reinforced concrete foundations and floors. The steel structure is designed to support two commercial overhead cranes used to move transportation casks from the rail car to the transport vehicle. One bay of the building will house the Canister Transfer System described in Section 1.3.1.2 and the other bay will be available for direct transfer of transportation casks from the rail car to the transport vehicle. A 2,400 squre foot area of the building is set aside for cask storage is a section through the building showing the overhead crane location. Air monitors and dosimeters are located in the building for monitoring purposes. The building is not designed or intended to provided confinement or shielding for SNF or GTCC materials. The building structure, including crane supports, are classified as ITS to prevent massive building collapse or the dropping of heavy objects onto spent fuel cask systems and related to ITS SSCs. The remainder of the building component will NITS. For design specifics, see Section and maintenance. The building plan view is shown in Figure 1-7. Figure The purpose -of the Cask Handling Building is to receive and prepare for storage shipments of dual-purpose canister systems. It will also receive GTCC waste canisters for storage at the site. It is also designed to process canisters stored at the site for off-site shipment. The Cask Handling Building is designed to handle canisterized fuel only and does not have the capability to handle bare fuel. The Cask Handling Building is designed to withstand all normal operating loads and off-normal loads created by natural phenomena.

As Low As Reasonably Achievable (ALARA) principles are incorporated, to the maximum extent practical, throughout the facility design to reduce radiation exposure to facility personnel. Cranes/lifting devices for transferring the NUHOMS® transportation/transfer casks from the transportation skid to the transfer trailer/skid are designed to minimize the need for facility personnel to be near the loaded cask. This equipment is NITS as the lift heights of the loaded casks are maintained below 80 inches at all times after removal of the impact limiters. The analysis of bounding drop scenarios shows that a NUHOMS® transportation/transfer cask will maintain structural integrity of the DSC confinement boundary and maintain basket geometry from an 80 inch (from the bottom of the cask to the "ground") drop. The ITS canister transfer system for the vertical transfer of canisters is remotely operated and the transfer equipment used to make the transfer to the storage overpacks is substantially identical to that used to transfer the canister into dry storage at the reactor facilities where the fuel was initially stored.

3.2 Classification of WCS Interim Storage Facility Structures, Systems and Components

Components are classified in accordance with the criteria of 10 CFR Part 72. Structures, systems, and components classified as important-to-safety (ITS) are defined in 10 CFR 72.3 as the features of the WCS CISF whose function is:

- To maintain the conditions required to store spent fuel and GTCC waste safely.
- To prevent damage to the canister during handling and storage.
- To provide reasonable assurance that spent fuel can be received, handled, packaged, stored, and retrieved without undue risk to the health and safety of the public.

These criteria are applied to the WCS CISF components in determining their classification in the paragraphs that follow.

3.2.1 Cask Handling Building and Equipment

The purpose of the Cask Handling Building and associated lifting equipment is to receive, inspect and prepare for storage, shipments of canisterized spent nuclear fuel and GTCC waste canisters and to provide for cask and rail car light maintenance. The Vertical Cask Transporter (VCT) used for upending the transportation cask and placing it under the Canister Transfer System is ITS. The Canister Transfer System and associated lifting hardware used for stack up and transfer operations for the NAC canisters is ITS because the canisters are lifted above the specified Technical Specifications [3-1] limits. The 130-ton overhead crane and associated NUHOMS® MP197HB and MP187 Casks Lift Beam Assembly are not-important-to-safety (NITS) because the NUHOMS® cask and canister are not lifted above the Technical Specifications [3-1] height limits. The building structure (structural steel and column foundations) will be classified as ITS to prevent massive building collapse or dropping of heavy objects onto cask systems an related to ITS SSCs. The balance of the facility is also NITS as the fuel remains sealed from the environment inside the confinement boundary provided by the canister for all operations and the overpacks provide protection from natural phenomena and postulated off-normal and accident events.

3.2.2 Storage Systems and Pads

The classification of the components that make up the cask systems authorized for storage at the WCS CISF, including canister, transfer casks, storage overpacks, transfer equipment and storage pads are provided in Appendices A.3, B.3, C.3, D.3, E.3, F.3 and G.3, depending on the canister/cask system. Section 2.1 of the Technical Specifications [3-1] lists the canisters authorized for storage at the WCS CISF. Table 3-1 provides the cross reference to the applicable appendix and section for each canister/storage overpack where the classifications of the components of that system are identified.

4.1.2.3 Protected Area

The Protected Area (PA) is approximately 36 acres within the OCA which includes the concrete storage pads, storage overpacks, Cask Handling Building, and the Security and Administration Building. The PA is surrounded by a double fence with a minimum 20-foot space between each fence. The exterior fence acts as a "nuisance" fence and the interior fence is the primary fence for intruder barrier and detection. Personnel will access the PA through the Security and Administration Building. There is a minimum of 200 meters between the PA fence and the OCA fence.

4.1.2.4 Storage Area and Concrete Storage pads

SNF is placed in storage overpacks located on concrete pads in the Storage Area. The Storage Area is 350 feet wide by 800 feet long and consists of concrete storage pads, concrete access aprons, and access roadways. There is a minimum of 100 meters between the Storage Area and the PA fence.

Concrete pad thickness and steel reinforcing depends of which type of storage overpack that is used on each pad. Concrete aprons and access roadways are constructed as necessary to facilitate VCT and transfer vehicle access and final storage placement of canisters.

4.1.2.5 Cask Handling Building

Transfer of each canister from the rail car to the transfer vehicle or VCT occurs inside the Cask Handling Building. The Cask Handling Building ~~is a 19,000 square foot building with~~ contains two overhead cranes capable of lifting and manipulating the transportation cask and canister. A back-up crane may be installed in the Cask Handling Building to provide operational redundancy. For canisters stored in horizontal storage overpacks, the overhead bridge crane is used to transfer the transportation cask from the rail car to a transfer vehicle that will move the canister to the concrete pad. For canisters stored in Vertical Concrete Casks (VCCs), the Cask Transfer System and VCT are used to transfer the canister from the transportation cask a VCC that is then moved to the Storage Area. Figures 1-7 and 1-8 show the Cask Handling Building Layout.

4.1.2.6 Transportation Cask Queuing Areas

The rail side track that brings rail cars to the Cask Handling Building has queuing length of approximately 800 feet inside of the PA. This length will accommodate five primary rail cars and five accompanying buffer cars, all within the PA. Once a rail car has been unloaded, it will be released through the east end of the Cask Handling Building and outside of the PA.

7.5 Cask Handling Building

The Cask Handling Building is a two bay commercially designed and fabricated steel frame structure with metal siding designed to support two commercial bridge cranes used to remove / install personnel barriers, impact limiters and small items from the transportation casks upon receipt of the rail car at the Cask Handling Building. All transfer operations to move the NUHOMS® system MP187 and MP197HB transportation casks are accomplished with the transportation casks in a horizontal orientation utilizing a NITS bridge crane as all lifts are limited to a maximum height of 80 inches. Design Criteria for the Cask Handling Building is included in Section 7.5.3.

The Cask Handling Building also houses the stand-alone Canister Transfer System that is classified as an ITS component. The Canister Transfer System (CTS) is to be utilized at the WCS CISF. The WCS CISF is used for interim storage of commercial SNF and reactor-related Greater Than Class C (GTCC) wastes under the provisions per 10 CFR Part 72.

7.5.1 Canister Transfer System

7.5.1.1 Introduction

Three (3) types of VCC systems, provided by NAC International, are stored at the WCS CISF – the NAC MAGNASTOR, NAC-UMS and NAC-MPC. Each canister system has an associated transportation configuration in which the canister arrives at the WCS CISF. The function of the CTS is to perform a shielded transfer of the canister from the transportation package and subsequently perform placement of the canister into the VCC. The CTS is essentially a hydraulic gantry crane with a dedicated transfer cask (unique for each of the three system types being loaded). Figure 7-1 is a rendering of the CTS.

The following sections provide the necessary information to demonstrate compliance with the United States Nuclear Regulatory Commission (NRC) NUREG-0554, "Single-Failure-Proof Cranes for Nuclear Power Plants" [7-2] and all adjunct requirements.

7.5.3 Cask Handling Building Structural Design

This section presents the structural description and design criteria for the WCS CISF Cask Handling Building (CHB). The CHB is designed to meet the requirements of 10 CFR 72.122(b)(2)(ii). The CHB is a two bay commercially designed and fabricated steel frame structure with metal siding designed to support two commercial overhead cranes used to move transportation casks from the rail car to the transport vehicle. The overhead cranes will also be used to remove/ install personnel barriers, impact limiters from the transportation casks upon receipt of the rail care at the CHB. All operations to move the NUHOMS® System MP187 and MP197HB transportation casks are accomplished with the transportation casks in a horizontal orientation. The overhead cranes are NITS as all lifts are limited to a maximum height of 80 inches.

7.5.3.1 Descriptions of Systems, Structures and Components

In order to ensure that the CHB is structurally adequate to prevent massive building collapse or the dropping of heavy objects spent fuel cask systems and related ITS SSCs, the building structures, systems, and components have been evaluated and assigned a QA classification. The classification of SSCs are shown in Table 7-25. The CHB structural system (including crane supports) is Category C, Important-to-safety (ITS) commercially designed and fabricated structure. All remaining components of the building are classified as NITS.

7.5.3.2 Design Analysis

This section describes loads, loading combinations and analysis methods to be met for design of the WCS CISF reinforced concrete and structural steel structures.

Loads

Loads used in analysis and design of CHB structure include the following:

- D Dead load
- L Live load
- H lateral soil pressure load
- T_o Thermal load
- W Wind load
- F' Flood load
- E' Design Basis Earthquake seismic load
- W_t Tornado loads – including:
  - W_w Tornado wind pressure load

- W_p Tornado-created differential pressure load
- W_m Tornado-generated missile load

These loads are categorized into three areas: normal loads, severe environmental loads and extreme environmental loads. Values for these loads are based on the WCS site design parameters identified in Chapter 3. Definitions for the loads in these categories are provided in the following sections for dry storage reinforced concrete components.

Normal Loads

Normal loads are those encountered during normal operation. They include: dead loads, live loads, hydrostatic fluid pressure loads, soil pressure loads, and thermal loads. The following definitions are provided for normal loads.

- **Dead Load** – Defined as any load, including related internal moments and forces, that is constant in magnitude, orientation, and point of application. Dead loads include the mass of the structure, and any permanent equipment loads. The effects of differential settlement are considered when determining dead loads. In addition, a minimum uniform load allowance of 20 lb/ft^2 is applied to roof areas to account for miscellaneous electrical conduits, handrails and ladders for which the actual dead load contribution is not precisely known at the time the analysis or design is performed.

- **Live Load** – Defined as any normal load, including related internal moments and forces that may vary with intensity, orientation and/or location of application. Movable equipment loads, loads due to vibration and any support movement effects and operating load are types of live loads. The following descriptions provide design requirements for various types of live loads.

    - **Rain, Snow and Ice** – Described in Chapter 3, the design live load due to rain, snow, and ice is 10 lb/ft^2 which is the ground snow load. Determination of roof snow and ice loads is in accordance with the requirements of American Society of Civil Engineers (ASCE) Standard 7-05 [7-34].

- **Transportation Vehicle Loads and Heavy Floor Loads** – Loads due to vehicular truck and rail traffic in designated building areas are in accordance with standard loadings defined by the American Association of State Highway and transportation Officials (AASHTO) and by the American Railway Engineers Association. Special heavy loading conditions resulting from transport of SNF and storage casks on truck and rail transporters/carriages are considered. Design basis cask weights bound the worst-case condition of all vendor designs handled at the WCS CISF. Floor loadings from transportation, transfer and storage mode casks are also considered, along with sufficient allowance for any impact resulting from placing the moving loads on the floor or other areas of the structure. Within the building, the floor under the Canister Transfer System will be designed to handle the specific loads produced by the hydraulic gantry system.

- **Crane and Hoist Loads** – Design loads for the transfer facility permanently installed cranes and hoists envelop the fully-rated capacity of the equipment, including allowances for impact loads and test load requirements. The rated capacity of each of the two overhead bridge cranes in the transfer facility is 130 tons. Crane test loads are considered in the design at 125% of the rated capacity of the cranes, increased by an additional 15% to account for impact. Minimum lateral design loads on crane runway supports are 20% of the sum of the rated hoist capacity, plus the weight of the crane trolley to account for the effects of the moving trolley. The lateral load on crane supports is determined by applying the load at the top of the rail in either direction, and distributing it according to the relative stiffness of the end supports. Minimum longitudinal design loads on supports for each crane rail are 10% of the maximum crane wheel load. Seismic effects considered on fully loaded cranes and hoists are also included as described in Section 7.5.3.7.

- **Floor Live Loads** – A floor live load of 300 lb/ft^2 is applied in areas of heavy operation in the CHB. Office areas will be designed for 40 lb/ft^2.

- **Hydrostatic Fluid Pressure Loads** – Are due to fluids held in internal building compartments, such as tanks. There are no reinforced concrete tanks in the transfer facility. All tanks located in the transfer facility are designed in accordance with mechanical equipment design criteria.

- **Soil Load(H)** - Based on the density of the soil and includes the effects of groundwater, see attachment E of the WCS CISF SAR Chapter 2. Since the WCS CISF site is a dry, relatively flat site and the dry storage component support pads and transfer facility are all slab-on-grade structure, no groundwater or soil pressure loads are exerted on building structures. Therefore, determination of lateral soil pressure loads is not necessary for structural analysis or design.

Thermal Load (T_o) – Consist of thermally induced forces and moments resulting from operation and environmental conditions affecting the dry storage components and transfer facility building structure. Thermal loads are based on the most critical transient or steady-state condition. Thermal expansion loads due to axial restraint, as well as loads resulting from thermal gradients, are considered. The ambient temperature values during normal operating conditions identified in Chapter 3 are used for structural analysis and design.

Severe Environmental Loads

Severe environmental loads are those that could infrequently be encountered during the life of the WCS CIF. They include: wind loads (W) and flood loads (F'). These loads are defined as follows:

Wind Loads (W) – Are those pressure loads generated by the design wind. These loads do not incorporate any loads associated with tornados. The basic wind speed used to determine design wind loads on the CHB walls and roof areas is 90 mph, as described in Chapter 3.

Wind loads are determined in accordance with the requirements of ASCE Standard 7-05 (Ref.7.4-7), Section 6. The velocity pressures (q_z) for the transfer facility main wind-force resisting structures and the dry storage systems determined in accordance with ASCE Standard 7-05, Equation 6-15. Design basis wind pressures for each component are computed using the methodology of Section 6.4 either Method 1 (Simplified Method) or Method 2 (Analytical Method) of ASCE Standard 7-05 for the configuration and dimensions of each component.

$$q_z = 0.00256 K_z K_{zt} K_d V^2 I = 27.9 \text{ lb/ft}^2$$

where:

K_z = normal wind velocity pressure exposure coefficient for different heights above ground, from Table 6-3 of ASCE Standard 7-05, Exposure Category C, since the WCS CISF site is flat, h = 70 feet above ground and exposure C, gives $K_z = 1.17$

K_{zt} = topographic factor from section 6.5.7.1, ASCE Standard 7-05, $K_{zt} = 1.0$

K_d = wind direction factor, from Section 6.5.4.4 ASCE Standard 7-05, $K_d = 1.0$

I = importance factor for normal wind load determination of 1.15 for important-to-safety SSC (Category IV) as defined in ASCE Standard 7-05 Table 6-1

V = basic wind speed = 90 mph, ASCE Standard 7-05 Figure 6-1

Flood Loads (F') – Are due to exterior flood waters from the design-basis flood exerting forces and moments on exterior buildings structures, or entering a building and exerting loads on interior building structures. As described in Chapter 2, the CHB finished floor elevation is above the PMF elevation and flood loads are not applicable.

Extreme Environmental Loads

Extreme environmental loads are loads which are credible but are highly improbable. They include seismic loads (E') and tornado loads (W_t). These loads are defined as follows:

Seismic Loads (E') – Are loads generated by the design basis earthquake (DBE). For the WCS CISF, the DBE is similar to a safe shutdown earthquake, and no operating basis earthquake is required to be considered in the design of the WCS CISF SSCs. As specified in Chapter 3, the DBE(E') loads are based on a 0.25g maximum peak horizontal seismic acceleration. This will be applied to the building and crane support structural members and components.

Tornado Loads (W_t) – Are loads generated by the design tornado specified for the CISF. They include loads due to tornado wind pressure (W_w), loads created by tornado-induced differential pressure (Wp), and loads resulting from tornado-generated missiles (Wm). The tornado load criteria from Chapter 3 apply to the CHB structural system only.

- **Tornado Wind Pressure Loads** – Tornado wind loads (W_w) are those pressure loads generated by tornado wind velocity, which is the combined translational and rotational wind speed of 200 mph. Tornado wind loads are similar to those for basic design wind speed. NUREG-0800 Standard Review Plan 3.3.2 [7-43] provides guidance for determining tornado loads for nuclear power plant structures, and this guidance is used for the CHB structural system. Tornado wind pressure loads, W_w are determined as follows:

$$W_w = p_w = q_h G C_p$$

where:

q_h = velocity pressure determined as described for Wind Loads except that the wind speed is 200 mph and the product of the values of the coefficients K_z, K_{zt} ,K_d, the Importance Factor I and the gust effect factor G are all assumed to be equal to 1.0 as specified by NUREG-0800 Standard Review Plan 3.3.2.

C_p = external pressure coefficient for windward wall, leeward wall, side wall or roof, from ASCE Standard 7-05, Figure 6-6.

$$W_w = p_w = 0.00256V^2C_p$$

Simplifying this formula for tornado wind pressure load determination for the design basis 200 mph translational plus rotational tornado wind speed:

$$P_w = 102C_p \text{ lb/ft}^2$$

- **Tornado Differential Pressure Loads-** Tornado-induced differential pressure (W_p) loads are those exerting an internal pressure loading on structures due to the negative pressure created by the tornado. The design pressure drop is 0.9

psi, which occurs at a rate of 0.4 psi/sec. This internal pressure is applied to the interior surfaces of the transfer facility exterior building walls and roof. The magnitude of this pressure is reduced for structures that are vented. The CHB is a steel frame with cladding to provide weather protection. In the case of a tornado the cladding is assumed to fail providing openings in the building. In addition, the CHB has large open areas that will adequately vent the interior of the building resulting in no significant pressure differential due to the tornado suction loads. Therefore, the effect of the tornado differential pressure loads are considered negligible and are not evaluated.

- **Tornado Missile Loads** - Tornado-generated missile loads (W_m) are impact loads applied to structures due to strikes by any of the missiles specified in Chapter 3. When converting tornado-generated missile loadings into structural loads, the effects of impact are considered. Consideration of tornado-generated missile impact loadings is discussed further in Section 7.4.3.3.

7.5.3.2.1 Reinforced Concrete Load Combinations

Concrete sections for the CHB foundation and slab will be designed in accordance with ultimate strength design methods as specified in ACI 349 [7.31]. Ductility and impact design requirements of ACI 349, Appendix C, are incorporated into the design. Design of ITS embedded plates and concrete anchors are in accordance with the requirements of ACI 349, Appendix B.

The following load combinations described in Table 7-26 are used for the design of the WCS CISF ITS reinforced concrete CHB structures. The reinforced concrete structure load combinations are in accordance with ANSI-57.9. These loading combinations are used in conjunction with the ultimate strength design method for reinforced concrete structural design. The value "U" is the section strength required to resist design loads based upon the ultimate strength design methods described in ACI 349 (Ref. 7-31). Loading combinations consider two conditions of structural loading: service load conditions and factored load conditions.

Service load combinations represent the expected loading conditions for WCS CISF ITS structures during normal facility operations and during severe environmental conditions. Service load combinations are comparable to the "Normal Events and Conditions", "Off-Normal Events and Conditions", and "Accident-Level Events and Conditions" loading combinations specified in NUREG-1567 [7-28]. Service load combinations include dead loads (D), live loads (L), design wind loads (W), flood loads (F), and normal condition thermal loads (T_o) plus Design Basis Earthquake loads (E) and tornado loads (W_t). Extreme environmental loads (i.e., seismic and tornado loadings) are not considered to act simultaneously because of the extremely low probability that an earthquake and a tornado could occur at the same time. Service load combinations used for design of ITS concrete structures are provided in Table 7-26.

7.5.3.2.2 Structural Steel Loading Combinations

The loading combinations in Table 7-27 are used for the design of the transfer facility structural steel. These loading combinations are used in conjunction with elastic design methods for structural steel. The value "S" is the required section strength based on allowable stresses defined in AISC 360[7-62]. Loading combinations consider two structural loading conditions: service load conditions and factored load conditions. Loads specified in each combination are defined in Section 7.5.3.2.

Service load combinations represent the expected loading conditions for steel structures during normal facility operations and during severe environmental conditions. Service load combinations are comparable to the Normal Events and Conditions and Off-Normal Events and Conditions loading combinations. Service load combinations include dead loads (D), live loads (L), hydrostatic fluid pressure loads (F), lateral soil pressure loads (H), design wind / tornado loads (W), flood loads (F'), thermal loads (T_o), earthquake (E'), and crane (C). Service load combinations used for design of steel structures are provided in Table 7-28.

In addition to the service load and factored load combinations, the following load combinations are checked to ensure overall stability of the transfer facility and dry storage system components against the effects of overturning, sliding and flotation. Neither tornado internal pressure loadings, W_p, nor tornado missile impact loadings, W_m, appreciably affect structure overturning, sliding or flotation for the transfer facility. The minimum safety factors required for each loading combination are presented in Table 7-26.

7.5.3.3 Reinforced Concrete Structural Analysis and Design

The Cask Handling Building ITS reinforced concrete foundations are analyzed and designed to resist the loads and loading combinations specified in this Section 7.5.3.2. For the CHB, static analysis methods are used to determine forces and moments on structural members as a result of applied service loading conditions. Dynamic analysis methods are used to determine structural member forces and moments for factored loading conditions where structural components are subjected to seismic or tornado-generated missile impact loads. A computer model will be generated and used to analyze the CHB for appropriate loading conditions. Construction of the reinforced concrete components will be in accordance with ACI 318-08 [7-39].

The Cask Transfer System (CTS) is a standalone hydraulic gantry system that will be housed in the CHB. The CTS is independent of the CHB structural system. The CHB slab-on-grade that supports the CTS will be designed to meet the requirements of the CTS as described in 7.5.1.

7.5.3.4 Structural Steel Design

Structural steel beams are provided in the CHB along the crane runways to support the rails for two 130-ton capacity overhead bridge cranes. The steel crane runway support beams are classified as category C Important to Radiological Safety since they provide support for the overhead cranes during a seismic event and prevent the cranes falling onto the transportation cask stations. The steel crane runway support beams are supported on steel columns that are tied to the main structural steel columns of the CHB on one end and steel brackets that protrude from the main structural steel columns of the CHB at the other end. In order to provide lateral support for the steel crane runway support beams, tie members are provided between the steel beams and the CHB frame to resist lateral forces on the steel beams due to crane trolley movement and seismic thrust loads. The steel crane runway support beams are shown in plan on Figure 4-4 and in elevation on Figure 4-5.

The CHB steel crane runway support beams are constructed using ASTM A992 and A36 mild carbon steel rolled shapes and/or plate sections. Standard carbon steel crane rails are connected by bolts to the top flanges of the steel crane runway support beams. All bolts used for primary structural connections are either A325 or A490. Welding electrodes are compatible with the joined materials.

7.5.3.5 Tornado Missile Impact Analysis and Design

The CHB is a steel frame with cladding to provide weather protection. In the case of a tornado the cladding is assumed to fail and therefore the only concern is for the overall effects of a missile impact on the steel frame. The steel frame will be designed to ensure that the frame retains its integrity and functionality subsequent to a missile strike. Overall effects of a deformable missile, such as an automobile striking the frame, are considered. Overall effects of a nondeformable missile are also evaluated to ensure the stability of the transfer facility frame.

7.5.3.6 Structural Steel Design Criteria

Structural steel members are designed in accordance with elastic allowable strength design methods, as specified in Part 1 of American National Standards Institute/American Institute of Steel Construction (ANSI/AISC) N690 [7-61].

7.5.3.7 Structural Analysis and Design

CHB structural steel components are analyzed and designed to resist the specified loading combinations. Static analysis methods are used for determining forces and moments on structural steel members as a result of applied service loading conditions. Dynamic analysis methods are used for determining structural steel member forces and moments for factored loading conditions where structural components are subjected to seismic loads. For determining seismic load effects on structural steel components, a damping value of 4% is

used for welded structures, and a damping value of 7% is used for bolted structures, as required by Regulatory Guide 1.61 [7-38].

The steel crane runway support beams are included in the structural system analysis model. Beams are analyzed and designed for worst-case crane wheel loads, assuming both of the overhead bridge cranes are fully loaded to their rated capacity. Loadings on the beams from the cranes are appropriately increased for impact effects as described in Section 7.5.3.2 for live crane and hoist loads. Both cranes are assumed to be fully loaded during a seismic event, the full weights of the cranes are considered in contributing mass during seismic events, and the full weight of the suspended load on each crane is considered for vertical participation during seismic events. To account for the pendulum effect of the flexible cabling that supports the suspended load on each crane, lateral seismic load contributions from the 130-ton suspended loads are considered to be similar to lateral effects due to trolley movement. That is, 20% of the suspended load is applied horizontally in the direction perpendicular to the steel crane runway support beams and 10% of the suspended load is applied horizontally along the longitudinal axis of the steel crane runway support beams.

The positions of the cranes are varied along the crane runways to determine the worst case for maximum stresses on the steel crane runway support beams. To determine worst-case loadings on the beams, crane lifting trolleys are positioned to one side of each crane with the two cranes adjacent to each other. In addition, the worst-case location of the overhead bridge cranes is determined for the overall structure design.

7-56 Excel Computer Program, Microsoft Inc., Version 15.0.4771.1004.

7-57 SC-SASSI Manual, Version 2.1.7, SC Solutions, Inc., November 6, 2015.

7-58 Nuclear Energy Institute (NEI), "Consistent Site-Response/Soil-Structure Interaction Analysis and Evaluation," June 2009.

7-59 ENERCON email from Jonathan Hurff to Huy Tran dated Wednesday December 30, 2015 11:03 AM, Subject: NAC ISFSI Pad Geometry and Damping.

7-60 AREVA TN Document, ANUH-01.0150, Revision 6, "Updated Final Safety Analysis Report for the Standardized Advanced NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel, NRC Docket No. 72-1029.

7-61 ANSI/AISC N690-06, Specification for the Design, Fabrication, and erection of Steel Safety-Related Structures in Nuclear Facilities."

7-62 ANSI/AISC 360-05, "Specification for Structural Steel Buildings"

Table 7-1
WCS CISF Structures and QA Classification

Structure	QA Classification
Storage Overpacks (VCCs and HSMs), Transfer Casks	Important-to-Safety
Cask Handling Building Structural System	Important-to-Safety
Cask Handling Building including overhead cranes (Except for Structural System)	Not important to safety
Canister Transfer System	Important-to-Safety
Storage pads, NUHOMS® Systems	Not important to safety
Storage pads, VCCs	Important-to-Safety
NUHOMS® Transfer Equipment (Except Transfer Cask)	Not important to safety
Vertical Cask Transporter	Important-to-Safety

Table 7- 25 Cask Handling Building SSCs and QA Classification

SSC	QA Classification
Building Structural steel	Important-to-Safety
Overhead Crane Support Beams	Important-to-Safety
Concrete Foundations and Slab on Grade	Important-to-Safety
Overhead Cranes	Not Important-to-safety
Building Classing	Not Important-to-safety
Electrical Systems	Not Important-to-safety
Mechanical and HVAC Systems	Not Important-to-safety
Fire Protection System	Not Important-to-safety

The CHB structural system (including crane supports) is Category C, Important-to-safety (ITS) commercially designed and fabricated structure. All remaining components of the building are classified as NITS.

Table 7-26
Load Combinations

Case	Load Combination(1)	Loading Notation
1	U= 1.4D = 1.7L	D = Dead weight (3)
2	U = 1.4D = 1.7L = 1.7H	E = Earthquake Load
3	U = 0.75 (1.4D + 1.7L + 1.7H + 1.7T + 1.7W)	F = Flood Induced Loads
4	U = 0.75 (1.4D + 1.7L + 1.7H + 1.7T)	H = Lateral Soil Pressure Load (2)
5	U = D + L + H + T + E	L = Live Load (4)
6	U = D + L + H + T + F	T = Normal Condition Thermal Load
7	U = D + L + H + Ta	Ta = Off–normal or Accident Condition Thermal Load W = Wind Load (5)

(1) The load combinations are in accordance with ANSI-57.9. In Case 6flood loads (F) are substituted for drop loads (A) which are not applicable to the WCS CISF concrete structures.

(2) ANSI 57.9 defines lateral soil pressure load case H which is not applicable to the WCS CISF (H = 0).

(3) Dead load (D) is increased + 5% to simulate most adverse loading as required by ANSI 57.9.

(4) Live loads (L) are varied between 0 and 100% of design load to simulate most adverse conditions for the WCS CISF.

(5) Wind loads are conservatively taken the same as Design Basis Tornado (DBT) wind pressure loads. Missile loads are analyzed for local damage, overall damage, overturning and sliding effects.

Table 7-27
Service Combinations for Steel Structures

Allowable Stress (S)	
Case No.	Load Combination
1	S > D + L
2	S > D+ L H
3	1.33S > D+ L + H + W
4	15S > D + L + H + T + W
5	1.6S > D + L + H + T +E
6	1.33S > D + L + H + T
7	1.7S > D + L + H + Ta

(1) Load combinations are per ANSI 57.9 except lateral soil pressure (H = 0) and drop loads (A = 0).

(2) Dead load (D) is increased +5% to simulate most adverse loading.

(3) Live loads (L) are varied between 0 and 100% of design load to simulate most adverse conditions for the WCS CISF.

Table 7-28
Minimum Factors of Safety

Loading Combination	Overturning	Sliding	Flotation
D + F + H + W	1.5	1.5	———
D + F + H + E	1.1	1.1	———
D + F + H + W_t	1.1	1.1	———
D + F	———	———	1.1

The following load considerations are used when combining loads for the CHB design.

- Live loads are applied fully to structural members, partially to members, totally removed from members, or shifted in location and pattern as necessary to obtain worst-case loading conditions for maximizing internal forces and moments for all load combinations and for assuring overall building stability. Impact forces due to moving loads are applied where appropriate.

- Appropriate construction loadings are considered in the service load combinations, as are construction methods and sequence, and appropriate loading conditions are applied to ensure structural integrity of partially erected or open structures.

- Tornado loads are applied to roofs and all exterior walls for the CHB. Where the exterior walls do not establish the tornado pressure boundary, appropriate interior walls are designed as the tornado pressure boundary.

RSI NP-4.8

Provide a clear and consistent description of the spent fuel to be stored at the proposed site and ensure the SAR evaluations support and are consistent with that description. Also see RSI 8-1.

The SAR includes descriptions regarding the spent fuel contents in sections in addition to those specifically designated for describing the spent fuel contents. Considering these descriptions, it is not clear what the applicant proposes to store at the CISF and that SAR evaluations are consistent with and support the proposed contents descriptions. For example, Section D.5.1.1 of the SAR includes a note with Paragraph 7 that states that the CISF is "not authorized to accept high burnup fuel assemblies in the 61 BTH Type 1 DSC at this time." However, Section D.3.2 simply refers to CoC 72-1004 Technical Specifications Table 1-1t and Section T.2.1 of the NUHOMS FSAR to describe the contents of the 61 BTH Type 1 DSC. Both of these references include high burn up fuel in the 61 BTH Type 1 DSC's contents. Thus, either the contents descriptions for the 61 BTH Type 1 DSC in the CISF SAR should clearly preclude high burnup fuel, or the evaluations for this DSC should address high burnup fuel.

This information is needed to determine compliance with 10 CFR 72.24 and 10 CFR 72.120.

WCS Response to RSI 4.8:

WCS has revised Section 2.1 "Functional and Operating Limits" of the proposed Technical Specifications and proposed License Condition 7.A. to specify which types of canisterized spent fuel may be stored at the WCS CISF. As revised Section 2.1 incorporate the approved content descriptions from specific amendments (and corresponding technical specification) for each of the six storage systems used at WCS CISF. In addition, a citation to License Condition 9 of the WCS CISF license has been added to Section 2.1 of the proposed Technical Specifications prohibiting the storage of uncanned high burnup fuel (≥ 45 GWd/MTU).

WCS has also revised WCS CISF SAR Chapter 1, Section 1.2.4 and Appendix D, Section D.3.2 to clarify the spent fuel that may be stored at the WCS CISF and to provide a cross reference to the Technical Specifications. The changes clarify that only those portions of Table 1-1t that are specific to the 61BTH Type 1 DSC are applicable, and that, even though included in Table 1-1t, fuels with burnups greater than 45 GWd/MTU will not be stored at the WCS CISF in a 61BTH Type 1 DSC.

WCS SAR Impact:

WCS SAR Chapter 1, Section 1.2.4 and Appendix D, Section D.3.2 of the SAR have been revised as discussed in the response (see attached).

WCS Proposed TS Impact:

Section 2.1 of the proposed Technical Specifications for the WCS CISF has been revised as discussed in the response (see attached).

WCS Proposed License Condition Impact:

WCS has revised License Condition 7.A. as discussed in the response, see below:

Intact fuel assemblies, damaged fuel assemblies, failed fuel and fuel debris, as allowed by Materials License SNM-2510, ~~including any~~ amendment 4; Table 1-1c or Table 1-1j ~~or Table 1-1t~~ of Certificate of Compliance No. 1004 (Amendments 3-13)~~,~~ ~~including any amendment~~; Table 1-1t of Certificate of Compliance No. 1004 (Amendments 10-13); Section 2.1 of Certificate of Compliance No. 1029, ~~including any~~ amendments 0,1 and 3; Section B 2.1 of Certificate of Compliance No. 1025, ~~including any~~ amendments 0-6; Section B 2.1.2 of Certificate of Compliance No. 1015, ~~including any~~ amendments 0-5; ~~Sections~~ Table B2-1~~1.0 and 2.0~~ of Certificate of Compliance No. 1031, ~~including any~~ amendments 0-3 revision 1 and 4-5, modified as described in condition~~paragraph~~ 9 below.

1.2.4 Materials To Be Stored

include

Only canisters that have been previously approved by the NRC to store and transport commercial light water (PWR and BWR) spent nuclear fuel and GTCC waste will be received at the WCS CISF. The controls for limiting the types and forms of spent nuclear fuel received at the WCS CISF ~~are the same as~~ those placed on the cask systems by the NRC-issued site licenses or certificates of compliance for the included transportation and storage systems. The approved systems are listed in Section 2.1 of the Technical Specifications [1-4]. The type, form and sources authorized for storage include:

which include on additional limitation on uncanned high burnup fuel

- Canisterized spent nuclear fuel elements from commercial nuclear utilities licensed pursuant to 10 CFR Part 50 and associated radioactive materials related to the receipt, transfer, and storage of that spent nuclear fuel.

as specified in Section 2.1 of the WCS CISF Technical Specifications [1-4].

- Uranium or Mixed ~~Oxide~~ (MOX) in the form of intact spent fuel assemblies, damaged fuel assemblies, and fuel debris, ~~as allowed by Materials License SNM-2510, any amendment; Table 1-1c or Table 1-1j or Table 1-1t of Certificate of Compliance No. 1004, any amendment; Section 2.1 of Certificate of Compliance No. 1029, any amendment; Section B 2.1 of Certificate of Compliance No. 1025, and amendment; Section B 2.1 of Certificate of Compliance No. 1015, and amendment; Sections 1.0 and 2.0 of Certificate of Compliance No. 1031, any amendment, modified as described in paragraph 9 below.~~
- Canisterized GTCC Waste, non-fuel related material generated as a result of plant operations and decommissioning where radionuclide concentration limits of Class C waste in 10 CFR 61.55 are exceeded.
- GTCC waste, as activated metals comprised of miscellaneous solid waste resulting from segmentation and decommissioning processes.

Aging Management considerations for the canisters and storage overpacks are discussed in Section 11.5.

1.2.5 Waste Products Generated During Operations

As described in Chapter 6, there are minimal radioactive wastes generated at the WCS CISF. Gaseous and liquid wastes are not generated at the WCS CISF. Small volumes of solid radioactive waste may be produced from routine operations involving contamination surveys and decontamination activities involving incoming and outgoing transportation casks and equipment. Potential solid waste streams are collected and temporarily stored on site for processing and disposal at the WCS Federal Waste Disposal Facility (FWF).

D.3.2 Spent Fuel to Be Stored

The authorized content for the 61BTH Type 1 DSCs are described in Certificate of Compliance 72-1004 [D.3-6] and the "Standardized NUHOMS® Horizontal Modular Storage System Safety Analysis Report" [D.3-1].

Certificate of Compliance 72-1004 Technical Specifications Table 1-1t [D.3-6] provides a description of the fuels stored in the 61BTH Type 1 DSCs as referenced in Section T.2.1 "Spent Fuel to be Stored" of the "Standardized NUHOMS® Horizontal Modular Storage System Safety Analysis Report" [D.3-1].

except fuel assemblies with burnups greater than 45 GWd/MTU will not be stored at the WCS CISF in a 61BTH Type 1 canister.

except fuel assemblies with burnups greater than 45 GWd/MTU will not be stored at the WCS CISF in a 61BTH Type 1 canister.

2.0 FUNCTIONAL AND OPERATING LIMITS

2.1 Functional and Operating Limits

~~The~~ Subject to the limitation of the last sentence of Condition 9 of this license SNM-1050, the used nuclear fuel to be stored in an HSM or VCC at the WCS CISF shall meet the Approved Contents requirements of one of the following:

2.1.1 NRC Materials License SNM-2510, ~~including any~~ amendment 4.

2.1.2 Table 1-1c or Table 1-1j (NUHOMS® 61BT DSC) of Certificate of Compliance 1004 Appendix A Technical Specifications For The Standardized NUHOMS® Horizontal Modular Storage System, including ~~any~~ amendments 3 through 13 inclusive.

2.1.3 Table 1-1t (NUHOMS® 61BTH DSC) of Certificate of Compliance 1004 Appendix A Technical Specifications For The Standardized NUHOMS® Horizontal Modular Storage System, including ~~any~~ amendments 10 through 13 inclusive.

2.1.4 Section 2.1 (NUHOMS® 24PT1) of Certificate of Compliance 1029 Appendix A Technical Specifications For The Standardized Advanced NUHOMS® System Operating Controls And Limits, including ~~any~~ amendments 0, 1 and 3.

2.1.5 Section B 2.1 (NAC-MPC System) of Certificate of Compliance 1025 Appendix B Technical Specification For The NAC-MPC System Approved Contents and Design Features, including any amendment.

2.1.6 Section B 2.1 (NAC-UMS System) of Certificate of Compliance 1015 Appendix B Technical Specification For The NAC-UMS System Approved Contents and Design Features, including any amendment.

2.1.7 Section 1.0 and 2.0 (MAGNASTOR System) of Certificate of Compliance 1031 Appendix B Technical Specification For The MAGNASTOR System Approved Contents, including any amendment.

Section B 2.1.2, "Maine Yankee SITE SPECIFIC FUEL Preferential Loading",

2.0 FUNCTIONAL AND OPERATING LIMITS

2.1 Functional and Operating Limits

The used nuclear fuel to be stored in an HSM or VCC at the WCS CISF shall meet the Approved Contents requirements of one of the following:

2.1.1 NRC Materials License SNM-2510, including any amendment.

2.1.2 Table 1-1c or Table 1-1j (NUHOMS® 61BT DSC) of Certificate of Compliance 1004 Appendix A Technical Specifications For The Standardized NUHOMS® Horizontal Modular Storage System, including any amendment.

2.1.3 Table 1-1t (NUHOMS® 61BTH DSC) of Certificate of Compliance 1004 Appendix A Technical Specifications For The Standardized NUHOMS® Horizontal Modular Storage System, including any amendment.

2.1.4 Section 2.1 (NUHOMS® 24PT1) of Certificate of Compliance 1029 Appendix A Technical Specifications For The Standardized Advanced NUHOMS® System Operating Controls And Limits, including any amendment.

2.1.5 Section B 2.1 (NAC-MPC System) of Certificate of Compliance 1025 Appendix B Technical Specification For The NAC-MPC System Approved Contents and Design Features, including any amendment.

2.1.6 Section B 2.1 (NAC-UMS System) of Certificate of Compliance 1015 Appendix B Technical Specification For The NAC-UMS System Approved Contents and Design Features, including any amendment.

2.1.7 Section 1.0 and 2.0 (MAGNASTOR System) of Certificate of Compliance 1031 Appendix B Technical Specification For The MAGNASTOR System Approved Contents, including any amendment.

Table B2-1, "PWR Fuel",

, including Amendments 0 thru 6.

, including Amendments 0 thru 5.

, including Amendments 0 thru 3, Revision 1, and Amendments 4 and 5.

The storage area is a large area comprised of concrete storage pads and storage overpacks. The purpose of the storage area is to provide safe storage for the canisterized spent nuclear fuel in cask systems that were previously approved by the NRC. The pads and approach aprons are designed to meet the applicable requirements of these previously approved cask systems. The storage area will be constructed in phases, as necessary. Phase 1 is designed to accommodate approximately 5,000 MTHM of spent nuclear fuel and GTCC waste in approximately 470 storage overpacks.

The remainder of the WCS CISF facilities provide support functions such as administrative activities, fuel receipt, security and fire protection. Table 1-3 provides a list of the WCS CISF facilities and their functions. The facility locations are provided in Figure 1-2.

1.2.4 Materials To Be Stored

Only canisters that have been previously approved by the NRC to store and transport commercial light water (PWR and BWR) spent nuclear fuel and GTCC waste will be received at the WCS CISF. The controls for limiting the types and forms of spent nuclear fuel received at the WCS CISF include those placed on the cask systems by the NRC-issued site licenses or certificates of compliance for the included transportation and storage systems. The approved systems are listed in Section 2.1 of the Technical Specifications [1-4] which include an additional limitation on uncanned high burnup fuel. The type, form and sources authorized for storage include:

- Canisterized spent nuclear fuel elements from commercial nuclear utilities licensed pursuant to 10 CFR Part 50 and associated radioactive materials related to the receipt, transfer, and storage of that spent nuclear fuel.
- Uranium or Mixed-Oxide (MOX) in the form of intact spent fuel assemblies, damaged fuel assemblies, and fuel debris, as specified in Section 2.1 of the WCS CISF Technical Specifications [1-4].
- Canisterized GTCC Waste, non-fuel related material generated as a result of plant operations and decommissioning where radionuclide concentration limits of Class C waste in 10 CFR 61.55 are exceeded.
- GTCC waste, as activated metals comprised of miscellaneous solid waste resulting from segmentation and decommissioning processes.

Aging Management considerations for the canisters and storage overpacks are discussed in Section 11.5.

1.2.5 Waste Products Generated During Operations

As described in Chapter 6, there are minimal radioactive wastes generated at the WCS CISF. Gaseous and liquid wastes are not generated at the WCS CISF. Small volumes of solid radioactive waste may be produced from routine operations involving contamination surveys and decontamination activities involving incoming and outgoing transportation casks and equipment. Potential solid waste streams are collected and temporarily stored on site until authorization under WCS Low Level Radioactive Waste (LLRW) License RML R04100 allows for processing and disposal. at the WCS Federal Waste Disposal Facility (FWF).

D.3.2 Spent Fuel to Be Stored

The authorized content for the 61BTH Type 1 DSCs are described in Certificate of Compliance 72-1004 [D.3-6] and the "Standardized NUHOMS® Horizontal Modular Storage System Safety Analysis Report" [D.3-1]; except fuel assemblies with burnups greater than 45 GSd/MTU will not be stored at the WCS CISF in a 61BTH Type 1 canister.

Certificate of Compliance 72-1004 Technical Specifications Table 1-1t [D.3-6] provides a description of the fuels stored in the 61BTH Type 1 DSCs as referenced in Section T.2.1 "Spent Fuel to be Stored" of the "Standardized NUHOMS® Horizontal Modular Storage System Safety Analysis Report" [D.3-1]; except fuel assemblies with burnups greater than 45 GWd/MTU will not be stored at the WCS CISF in a 61BTH Type 1 canister.

2.0 FUNCTIONAL AND OPERATING LIMITS

2.1 Functional and Operating Limits

Subject to the limitation of the last sentence of Condition 9 of this license SNM-1050, the used nuclear fuel to be stored in an HSM or VCC at the WCS CISF shall meet the Approved Contents requirements of one of the following:

2.1.1 NRC Materials License SNM-2510, amendment 4.

2.1.2 Table 1-1c or Table 1-1j (NUHOMS® 61BT DSC) of Certificate of Compliance 1004 Appendix A Technical Specifications For The Standardized NUHOMS® Horizontal Modular Storage System, including amendments 3 through 13.

2.1.3 Table 1-1t (NUHOMS® 61BTH DSC) of Certificate of Compliance 1004 Appendix A Technical Specifications For The Standardized NUHOMS® Horizontal Modular Storage System, including amendments 10 through 13.

2.1.4 Section 2.1 (NUHOMS® 24PT1) of Certificate of Compliance 1029 Appendix A Technical Specifications For The Standardized Advanced NUHOMS® System Operating Controls And Limits, including amendments 0,1, and 3.

2.1.5 Section B 2.1 (NAC-MPC System) of Certificate of Compliance 1025 Appendix B Technical Specification For The NAC-MPC System Approved Contents and Design Features, including amendment 0 through 6.

2.1.6 Section B 2.1.2, "Main Yankee SITE SPECIFIC FUEL preferential Loading" (NAC-UMS System) of Certificate of Compliance 1015 Appendix B Technical Specification For The NAC-UMS System Approved Contents and Design Features, including amendments 0 through 5.

2.1.7 Table B2-1, "PWR Fuel", (MAGNASTOR System) of Certificate of Compliance 1031 Appendix B Technical Specification For The MAGNASTOR System Approved Contents, including amendments 0 through 3, revision1, and amendments 4 and 5.

LICENSE FOR INDEPENDENT STORAGE OF SPENT NUCLEAR FUEL AND HIGH-LEVEL RADIOACTIVE WASTE

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and Title 10, Code of Federal Regulations, Chapter 1, Part 72, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, and possess the power reactor spent fuel and other radioactive materials associated with spent fuel storage designated below; to use such material for the purpose(s) and at the place(s) designated below; and to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations, and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified herein.

Licensee

1. Waste Control Specialists LLC

2. Waste Control Specialists
Consolidated Interim Storage Facility
9998 Highway 176 West
Andrews, Texas, 79714

3. License No. SNM-1050
Amendment No. 0

4. Expiration Date December XX, 20XX

5. Docket or Reference No. 72-1050

6. Byproduct, Source, and/or Special Nuclear Material	7. Chemical and/or Physical Form	8. Maximum Amount That Licensee May Possess at Any One Time Under This License
A. Spent nuclear fuel elements from commercial nuclear utilities licensed pursuant to 10 CFR Part 50 and associated fuel assembly control components and associated radioactive materials related to the receipt, transfer, and storage of that spent nuclear fuel.	A. Intact fuel assemblies, damaged fuel assemblies, failed fuel and fuel debris, as allowed by Materials License SNM-2510, amendment 4; Table 1-1c or Table 1-1j of Certificate of Compliance No. 1004 (Amendments 3-13);Table 1-1t of Certificate of Compliance No.1004 Amendments 10-13; Section 2.1 of Certificate of Compliance No. 1029, amendments 0,1 and 3; Section B2.1 of Certificate of Compliance No. 1025, amendments 0-6; Section B 2.1.2 of Certificate of Compliance No 1015, Amendments 0-5; Table B 2-1 of Certificate of Compliance No. 1031, amendments 0-3 revision 1 and 4-5, modified as described in condition 9 below.	A. 5,000 MT of Uranium or Mixed-Oxide (MOX) in the form of intact spent fuel assemblies, damaged fuel assemblies, failed fuel assemblies, and fuel debris. In addition, the cumulative amount of material received and accepted during the licensed term of the facility may not exceed 5,000 Metric Tons of Uranium plus MOX.
B. Greater than Class C Waste, non-fuel related material generated as a result of plant operations and decommissioning where radionuclide concentration limits of Class C waste in 10 CFR 61.55 are exceeded.	B. Greater than Class C Waste, as activated metals comprised of miscellaneous solid waste resulting from segmentation and decommissioning processes.	B. Any amount of Greater than Class C Waste.

RSI NP-5.1

Describe the confinement boundary structures, systems, and components (SSCs) in Section 7.2, "Confinement SSCs" of the WCS SAR.

Section 7.2 of the WCS SAR states, "The ITS WCS CISF confinement SSCs are the canister shells and closure welds." The components of the entire canister confinement boundary are ITS SSCs, not only the canister shells and closure welds. See Sections 5.4.1.1 and 5.5.1.1, "Description of Confinement Structures" of NUREG 1567.

WCS Response to RSI 5.1:

WCS CISF SAR Section 7.2 has been revised to confirm that structures and components of the canister confinement boundary are classified as important-to-safety. Section 7.2, as revised, will also provide specific references to a description of the confinement boundary for each of the storage canisters to be used at the WCS facility.

WCS SAR Impact:

Sections A.11.1, B.11.1, C.11.1, D.11.1, E.11, F.11 and G.11 of the CISF SAR Appendices have been revised in response to RSI 9.2 to reference descriptions and figures in the dry storage system FSARs describing the confinement boundary for each canister type.

WCS SAR Chapter 7, Section 7.2 has been revised to confirm that structures and components of the confinement boundary are classified as ITS and incorporated in response to RSI 5.3.

See below updates to WCS SAR Chapter 7, Section 7.2

Updates and additions to WCS SAR Chapter 7, Section 7.2, Confinement SSCs:

~~The ITS WCS CISF confinement SSCs are the canister shells and closure welds. The cask systems evaluated for use at the WCS CISF are described in Chapter 4 and Appendices A.4 through G.4.~~

Only NRC-approved storage systems are used at the WCS CISF. The proposed cask systems to be utilized at the WCS CISF are evaluated against site parameters and are generally shown to bound the site parameters ~~(see Chapter 3 and referenced appendices).~~ Section 3.3 identifies the design criteria for the WCS CISF ITS Structures, Systems, and Components. Section 3.3.3 specifically addresses confinement .Section 3.4 addresses the design criteria for the transportable storage casks and cask/canister systems. Table 3-1 cross-references the appendices that discuss those design criteria in more detail. Tables A.3-1, B.3-1, C.3-1, D.3-1, E.3-1, F.3-1, and G.3-1 compare the WCS CISF design criteria with the design criteria for each cask system. Where the actual site parameters exceed the bounds of those assumed in the individual cask certificates of compliance, the difference ~~delta~~ is addressed for those areas affected by the variations and are documented in the appropriate WCS SAR Chapter, and associated Appendices. No new analyses are required for the NAC storage systems. Tables A.3-1, B.3-1, C.3-1, and D.3-1 include cross-references where new evaluations are described for the NUHOMS® Systems.

~~For purposes of the WCS CISF design, the cask systems have been evaluated against the WCS CISF design criteria detailed in Chapter 3. The results of this evaluation are presented in Section 3.4 and the appendices referenced in Table 3-1.~~ Spent nuclear fuel (SNF) characteristics are addressed in the individual canister/cask system thermal safety evaluations which are provided in Appendices A.8, B.8, C.8, D.8, E.8, F.8 and G.8, for each ~~depending on the~~ canister/cask system. It is required that packages received at the WCS CISF are loaded in accordance with SAR and regulatory requirements applicable at the site where the SNF was originally loaded and stored. To provide assurance that the packages received at the WCS CISF are acceptable for storage, prior to receipt of a canister~~,~~ a records review is performed to verify that the canister being received was fabricated, loaded, stored and maintained in accordance with the Site Specific or General License requirements and will comply with WCS License Conditions and Technical Specification. ~~prior to shipment.~~ In addition, a ~~the~~ receipt inspection of the canisters is performed upon arrival at the WCS CISF which includes a post transport package evaluation ~~is to be~~ in accordance with reference [7-1].

The primary confinement boundary for the six storage systems used at the WCS CISF is a metal canister that is welded shut. All components of the canister confinement boundary are classified as important-to-safety. Section 3.4 and Table 3-4 provide references where the classification of the SSCs can be found in the WCS CISF SAR Appendices and in the FSARs for each of the storage systems.

A description of the confinement boundary for each of the six systems used at the WCS CISF is provided in the locations in the Appendices of the WCS SAR identified in Table 7-24.

Table 7-24 Description of Confinement Boundaries

System	Appendix Location
NUHOMS® MP187 Cask System	Section A.11.1
Advanced Standardized NUHOMS® System	Section B.11.1
Standardized NUHOMS®-61 BT System	Section C.11.1
Standardized NUHOMS®-61 BTH Type 1 System	Section D.11.1
Yankee-MPC	Section E.11.1.1
CY-MPC	Section E.11.1.1
MPC-LACBWR	Section E.11.2.1
NAC-UMS	Section F.11.1.1
NAC-MAGNASTOR	Section G.11.1.1

7.2 Confinement SSCs

Only NRC-approved storage systems are used at the WCS CISF. The proposed cask systems to be utilized at the WCS CISF are evaluated against site parameters and are generally shown to bound the site parameters. Section 3.3 identifies the design criteria for the WCS CISF ITS Structures, Systems and Components. Section 3.3.3 specifically addresses confinement. Section 3.4 addresses the design criteria for the transportable storage casks and cask/canister systems. Table 3-1 cross-references the appendices that discuss those design criteria in more detail. Tables A.3-1, B.3-1, C.3-1, D.3-1, E.3-1, F.3-1, and G.3-1 compare the WCS CISF design criteria with the design criteria for each cask system. Where the actual site parameters exceed the bounds of those assumed in the individual cask certificates of compliance, the difference is addressed for those areas affected by the variations and are documented in the appropriate WCS SAR Chapter, and associated Appendices. No new analyses are required for the NAC storage systems Tables A.3-1, B.3-1, C.3-1, and D.3-1 include cross references where new evaluations are described for the NUHOMS® Systems.

Spent nuclear fuel (SNF) characteristics are addressed in the individual canister/cask system thermal safety evaluations which are provided in Appendices A.8, B.8, C.8, D.8, E.8, F.8 and G.8, for each canister/cask system. It is required that packages received at the WCS CISF are loaded in accordance with SAR and regulatory requirements applicable at the site where the SNF was originally loaded and stored. To provide assurance that the packages received at the WCS CISF are acceptable for storage, prior to receipt of a canister, a records review is performed to verify that the canister being received was fabricated, loaded, stored and maintained in accordance with the Site Specific or General License requirements and will comply with WCS License Conditions and Technical Specification. In addition, a receipt inspection of the canisters is performed upon arrival at the WCS CISF which includes a post transport package evaluation in accordance with reference [7-1].

The primary confinement boundary for each of the six storage systems used at the WCS CISF is a metal canister that is welded shut. All components of the canister confinement boundary are classified as important-to-safety. Section 3.4 and Table 3-4 provide references where the classification of the SSCs can be found in the WCS CISF SAR Appendices and in the FSARs for each of the storage systems.

A description of the confinement boundary for each of the six systems used at the WCS CISF is provided in the locations in the Appendices of the WCS SAR identified in Table 7-24.

Table 7-24 Description of Confinement Boundaries

System	Appendix Location
NUHOMS® MP187 Cask System	Section A.11.1
Advanced Standardized NUHOMS® System	Section B.11.1
Standardized NUHOMS®-61 BT System	Section C.11.1
Standardized NUHOMS®-61 BTH Type 1 System	Section D.11.1
Yankee-MPC	Section E.11.1.1
CY-MPC	Section E.11.1.1
MPC-LACBWR	Section E.11.2.1
NAC-UMS	Section F.11.1.1
NAC-MAGNASTOR	Section G.11.1.1

RSI NP-5.2

Provide specific application chapter sections, specific appendices sections, and summarize the deltas where actual site parameters exceed the bounds of those assumed in the individual cask certificates. Also address that the confinement SSCs and confinement integrity are maintained during normal, off-normal, and accident conditions.

Section 7.2, "Confinement SSCs" of the WCS safety analysis report states, "Only NRC approved storage systems are used at the WCS CISF. The proposed cask systems to be utilized at the WCS CISF are evaluated against site parameters and generally shown to bound the site parameters (see Chapter 3 and referenced appendices). Where the actual site parameters exceed the bounds of those assumed in the individual cask certificates of compliance, the delta is addressed for those areas affected by the variations and are documented in the appropriate Chapter, and associated appendices." Specific pointers to chapter sections and associated appendices of the WCS SAR have not been provided in Section 7.2 of the WCS SAR, nor has a summary of deltas where actual site parameters exceed the bounds of those assumed in the individual cask certificates been provided. It also has not been summarized in Section 7.2 of the WCS SAR that confinement integrity is maintained during normal, off-normal, and accident conditions. See Sections 5.4.1.2 and 5.5.1.2, "Design Criteria for Confinement Structures" in NUREG 1567.

This information is needed to determine compliance with 10 CFR 72.24.

WCS Response to RSI 5.2:

WCS site-parameters are bounded by the limits assumed in the NAC certificates for the NAC-M PC, MPC-LACBWR, NAC-UMS, and NAC-MAGNASTOR systems. These are specifically addressed in the WCS SAR Appendix Section E.3.1, E.3.2, F.3.1 and G.3.1, respectfully. The current licensing basis for each NAC storage system certificate is bounding for the WCS SAR page 7-3, has been revised to state the current storage system FSARs demonstrate the confinement integrity is maintained during normal, off-normal, and accident conditions.

WCS SAR Impacts:

WCS CISF SAR, Tables A.3-1, B.3-1, C.3-1, and D.3-1 in Appendices A through D have been updated.

Table A.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NUHOMS®-MP187 Design Criteria
Type of fuel	Commercial, light water reactor spent fuel	Normal (Bounded)	Rancho Seco SAR, Section 10.3.1.1 and 10.3.1.2 of Volume 1~~See Section A.3.2~~
Storage Systems	Transportable canisters and storage overpacks docketed by the NRC	Normal (Bounded)	71-9255 72-11 (SNM-2510)
Fuel Characteristics	Criteria as specified in previously approved licenses for included systems	Normal (Bounded)	Rancho Seco SAR, Section 10.3.1.1 and 10.3.1.2 of Volume 1~~See Section A.3.2~~
Tornado (Wind Load) (HSM Model 80)	Max translational speed: 40 mph Max rotational speed: 160 mph Max tornado wind speed: 200 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 0.9 psi Rate of pressure drop: 0.4 psi/sec	Accident (Bounded)	Rancho Seco SAR Section 3.2.1 of Volume 1 Max translational speed: 70 mph Max rotational speed: 290 mph Max tornado wind speed: 360 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 3.0 psi Rate of pressure drop: 2.0 psi/sec
Tornado (Wind Load) (MP187 TC)	Max translational speed: 40 mph Max rotational speed: 160 mph Max tornado wind speed: 200 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 0.9 psi Rate of pressure drop: 0.4 psi/sec	Accident (Bounded)	Rancho Seco SAR Section 3.2.1 of Volume 1 Max translational speed: N/A Max rotational speed: N/A Max tornado wind speed: 360 mph Radius of max rotational speed: N/A Tornado pressure drop: N/A Rate of pressure drop: N/A
Tornado (Missile)	Automobile 4000 lb, 112 ft/s Schedule 40 Pipe 287 lb, 112 ft/s Solid Steel Sphere 0.147 lb, 23 ft/s	Accident (Bounded)	Rancho Seco SAR Table 3-1 of Volume 2 Automobile 4000 lb, 185 ft/s 8" diameter shell 276 lb, 185 ft/s Solid Steel Sphere 0.147 lb, 23 ft/s

Table A.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NUHOMS®-MP187 Design Criteria
Floods	Flood height 1.1 inches Water velocity 1.7 ft/s	Accident (Bounded)	Rancho Seco SAR Table 3-1 of Volume 2 Flood height 50 ft Water velocity 15 ft/s
Seismic (Ground Motion)	Site-specific ground-surface uniform hazard response spectra (UHRS) with 1E-4 annual frequency of exceedance (AFE) having peak ground acceleration (PGA) of 0.250 g horizontal and 0.175 g vertical. (Table 1-5 and Figure 1-5)	Accident (Bounded)	Rancho Seco SAR, Section 3.2.3 of Volume 1 and Tables 3-1 and 3-2 of Volume 2 Reg Guide 1.60 Response Spectra anchored at 0.25 g horizontal and 0.17 g vertical peak accelerations
Vent Blockage	For NUHOMS® Systems: Inlet and outlet vents blocked 40 hrs	Accident (Same)	Rancho Seco SAR Section 8.3.5 of Volume 2 Inlet and outlet vents blocked 40 hrs
Fire/Explosion	For NUHOMS® Systems: Equivalent fire 300 gallons of diesel fuel	Accident (Same)	Rancho Seco SAR Section 8.3.8 of Volume 2 Equivalent fire 300 gallons of diesel fuel
Cask Drop	For NUHOMS® Systems: Transfer Cask Horizontal side drop or slap down 80 inches[3]	Accident (Same)	Rancho Seco SAR Section 8.2.1 of Volume 1 and Appendix B page 8.2-27 Transfer Cask Horizontal side drop or slap down 80 inches[3]
Transfer Load	For NUHOMS® Systems only: Normal insertion load 60 kips Normal extraction load 60 kips	Normal (Same)	Rancho Seco SAR Appendix B page 8.1-26 Normal insertion load 60 kips Normal extraction load 60 kips
Transfer Load	For NUHOMS® Systems only: Maximum insertion load 80 kips Maximum extraction load 80 kips	Off-Normal/ Accident (Same)	Rancho Seco SAR Appendix B page 8.1-29 Maximum insertion load 80 kips Maximum extraction load 80 kips
Ambient Temperatures	Normal temperature 44.1 – 81.5°F	Normal (Bounded)	Rancho Seco SAR Section 8.1.1.3 of Volume 1 Normal temperature 0 - 101~~110~~°F[1]

Table A.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NUHOMS®-MP187 Design Criteria
Off-Normal Temperature	Minimum temperature 30.1°F Maximum temperature 94.6°F	Off-Normal (Bounded)	Rancho Seco SAR Section 8.1.1.3 of Volume 1 Minimum temperature -20.0°F Maximum temperature 117~~120~~°F[2]
Extreme Temperature	Maximum temperature 113°F	Accident (Bounded)	Rancho Seco SAR Section 8.1.1.3 of Volume 1 Maximum temperature 117~~120~~°F[2]
Solar Load (Insolation)	Horizontal flat surface insolation 2949.4 BTU/day-ft^2 Curved surface solar insolation 1474.7 BTU/day-ft^2	Normal (Same)	Rancho Seco FSAR Table 8-1 of Volume 2 Horizontal flat surface insolation 2949.4 BTU/day-ft^2 Curved surface solar insolation Not Specified
Snow and Ice	Snow Load 10 psf	Normal (Bounded)	Rancho Seco SAR Section 3.2.4 Volume 1 Snow Load 110 psf
Dead Weight	Per design basis for systems listed in Table 1-1	Normal (Same)	Section 8.1.1.1 of Volume 1of reference [A.3-1]
Internal and External Pressure Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Sections 3.2.2 and 8.1.1.2 of Volume 1 of reference [A.3-1]
Design Basis Thermal Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Section 8.1.1.3 and 8.1.1.9 of Volume 1 of reference [A.3-1]
Operating Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Sections 8.1.1.4, 8.1.1.5, 8.1.1.7 and 8.1.1.8 of Volume 1 of reference [A.3-1]
Live Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Rancho Seco SAR Section 3.2.4 of Volume 1 Design Load (including snow and ice) 200psf

Table A.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NUHOMS®-MP187 Design Criteria
Radiological Protection	Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 mrem Public lens of eye ≤ 15 mrem	Accident (Same)	Chapter 9 demonstrates these limits are met Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 Rem Public lens of eye ≤ 15 Rem
Radiological Protection	Public wholebody ≤ 25 mrem/yr(4) Public thyroid ≤ 75 mrem/yr(4) Public critical organ ≤ 25 mrem/yr(4)	Normal (Same)	Chapter 9 demonstrates these limits are met Public wholebody ≤ 25 mrem/yr(4) Public thyroid ≤ 75 mrem/yr(4) Public critical organ ≤ 25 mrem/yr(4)
Confinement	Per design basis for systems listed in Table 1-1	N/A	Section 3.3.2.1 and Appendix B pages 3.3-1 to 3.3-2 reference [A.3-1]
Nuclear Criticality	Per design basis for systems listed in Table 1-1	N/A	Section 3.3.4 of Volume 1 of reference [A.3-1]
Decommissioning	Minimize potential contamination	Normal (Same)	Rancho Seco SAR Section 3.5 and 9.6 of Volume 1 Minimize potential contamination
Materials Handling and Retrieval Capability	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site	Normal (Same)	Rancho Seco SAR Section 3.2.5.2 of Volume 1 Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site

Notes

1. ~~"Rancho Seco Independent Spent Fuel Storage Installation Safety Analysis Report" [A.3-1] normal ambient temperature range is 0 – 101°F. Section 8 of this SAR evaluates a normal ambient temperature range of 0 – 110°F.~~ Not Used

2. ~~"Rancho Seco Independent Spent Fuel Storage Installation Safety Analysis Report" [A.3-1] maximum off-normal temperature is 117°F. Section 8 of this SAR evaluates a maximum off-normal temperature is 120°F.~~ Not Used

3. 75g Vertical 75g Horizontal and 25g corner is equivalent to 80 inch drop.

4. In accordance with 10 CFR 72.104(a)(3) limits include any other radiation from uranium fuel cycle operations within the region.

Table B.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	Standardized Advanced NUHOMS® System Design Criteria
Type of fuel	Commercial, light water reactor spent fuel	Normal (Bounded)	Advanced NUHOMS® SAR Section 2.1~~See Section B.3.2~~
Storage Systems	Transportable canisters and storage overpacks docketed by the NRC	Normal (Bounded)	71-9255 72-1029
Fuel Characteristics	Criteria as specified in previously approved licenses for included systems	Normal (Bounded)	Advanced NUHOMS® SAR Section 2.1~~See Section B.3.2~~
Tornado (Wind Load) (AHSM)	Max translational speed: 40 mph Max rotational speed: 160 mph Max tornado wind speed: 200 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 0.9 psi Rate of pressure drop: 0.4 psi/sec	Accident (Bounded)	Advanced NUHOMS® SAR Section 2.2.1 Max translational speed: 70 mph Max rotational speed: 290 mph Max tornado wind speed: 360 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 3.0 psi Rate of pressure drop: 2.0 psi/sec
Tornado (Wind Load) (MP187 Cask)	Max translational speed: 40 mph Max rotational speed: 160 mph Max tornado wind speed: 200 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 0.9 psi Rate of pressure drop: 0.4 psi/sec	Accident (same)	Advanced NUHOMS® SAR Section 3.2.1 Max translational speed: 40 mph Max rotational speed: 160 mph Max tornado wind speed: 200 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 0.9 psi Rate of pressure drop: 0.4 psi/sec

Table B.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	Standardized Advanced NUHOMS® System Design Criteria
Tornado (Missile)	Automobile 4000 lb, 112 ft/s Schedule 40 Pipe 287 lb, 112 ft/s Solid Steel Sphere 0.147 lb, 23 ft/s	Accident (Bounded)	Advanced NUHOMS® SAR Section 2.2.1 Automobile 4000 lb, 195 ft/s 8" diameter shell 276 lb, 185 ft/s Solid Steel Sphere 0.147 lb, 23 ft/s 12" OD Steel Pipe 1500 lb, 185 fps Wood pole 1500 lb, 294 ft/s
Floods	Flood height 4 ft Water velocity 8 ft/s	Accident (Bounded)	Advanced NUHOMS® SAR Section 2.2.2 Flood height 50 ft Water velocity 15 ft/s
Seismic (Ground Motion)	Site-specific ground-surface uniform hazard response spectra (UHRS) with 1E-4 annual frequency of exceedance (AFE) having peak ground acceleration (PGA) of 0.250 g horizontal and 0.175 g vertical. (Table 1-5 and Figure 1-5)	Accident (Bounded)	Advanced NUHOMS® SAR Section 2.2.3 Reg Guide 1.60 Response Spectra anchored at 1.5 g horizontal and 1.0 g vertical peak accelerations
Vent Blockage	For NUHOMS® Systems: Inlet and outlet vents blocked 40 hrs	Accident (Same)	Advanced NUHOMS® SAR Section 4.6.2 Inlet and outlet vents blocked 40 hrs
Fire/Explosion	For NUHOMS® Systems: Equivalent fire 300 gallons of diesel fuel	Accident (Same)	Advanced NUHOMS® SAR Section 4.6.4 Equivalent fire 300 gallons of diesel fuel
Cask Drop	For NUHOMS® Systems: Transfer Cask Horizontal side drop or slap down 80 inches[3]	Accident (Same)	Section B.7.3 (New Evaluation) Transfer Cask Horizontal side drop or slap down 80 inches[3]
Transfer Load	For NUHOMS® Systems only: Normal insertion load 60 kips Normal extraction load 60 kips	Off-Normal/ Accident (Same)	Section B.7.3 (New Evaluation) and Advance NUHOMS® FSAR Section 3.6.2.2.7 Normal insertion load 60 kips Normal extraction load 60 kips

Table B.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	Standardized Advanced NUHOMS® System Design Criteria
Transfer Load	For NUHOMS® Systems only: Maximum insertion load 80 kips Maximum extraction load 80 kips	Off-Normal/ Accident (Same)	Section B.7.3 (New Evaluation) and Advance NUHOMS® FSAR Section 3.6.2.2.7 Maximum insertion load 80 kips Maximum extraction load 80 kips
Ambient Temperatures	Normal temperature 44.1 – 81.5°F	Normal (Bounded)	Advanced NUHOMS® SAR Table 4.1-1 Normal temperature 0 - 104~~110~~°F(1)
Off-Normal Temperature	Minimum temperature 30.1°F Maximum temperature 94.6°F	Off-Normal (Bounded)	Advanced NUHOMS® SAR Table 4.1-1 Minimum temperature -40.0°F Maximum temperature 117~~120~~°F(2)
Extreme Temperature	Maximum temperature 113°F	Accident (Bounded)	Advanced NUHOMS® SAR Table 4.1-1 Maximum temperature 120°F
Solar Load (Insulation)	Horizontal flat surface insolation 2949.4 BTU/day-ft^2 Curved surface solar insolation 1474.7 BTU/day-ft^2	Normal (Same)	Advanced NUHOMS® SAR Section 4.4.2.2 Horizontal flat surface insolation 2952 BTU/day-ft^2 Curved surface solar insolation 1474.7 BTU/day-ft^2
Snow and Ice	Snow Load 10 psf	Normal (Bounded)	Advanced NUHOMS® SAR 2.2.4 Snow Load 110 psf
Dead Weight	Per design basis for systems listed in Table 1-1	Normal (Same)	Sections 3.1.2.1.3.1, 3.6.1.1.3 and 3.6.2.2.1 of reference [B.3-1]
Internal and External Pressure Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Section 3.1.2.1.3.2 of reference [B.3-1]
Design Basis Thermal Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Section 3.1.2.1.3.3 of reference [B.3-1]

Table B.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	Standardized Advanced NUHOMS® System Design Criteria
Operating Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Ssection 3.1.2.2.2 of reference [B.3-1]
Live Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Advanced NUHOMS® SAR Table 3.6-10 Design Load (including snow and ice) 200psf
Radiological Protection	Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 Rem Public lens of eye ≤ 15 Rem	Accident (Same)	Chapter 9 demonstrates these limits are met Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 Rem Public lens of eye ≤ 15 Rem
Radiological Protection	Public wholebody ≤ 25 mrem/yr(4) Public thyroid ≤ 75 mrem/yr(4) Public critical organ ≤ 25 mrem/yr(4)	Normal (Same)	Chapter 9 demonstrates these limits are met Public wholebody ≤ 25 mrem/yr(4) Public thyroid ≤ 75 mrem/yr(4) Public critical organ ≤ 25 mrem/yr(4)
Confinement	Per design basis for systems listed in Table 1-1	N/A	Section 7 of reference [B.3-1] (leaktight)
Nuclear Criticality	Per design basis for systems listed in Table 1-1	N/A	Section 6 of reference [B.3-1]
Decommissioning	Minimize potential contamination	Normal (Same)	Advanced NUHOMS® SAR Section 14 Minimize potential contamination
Materials Handling and Retrieval Capability	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site	Normal (Same)	Advanced NUHOMS® SAR Section 2.5.1 Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site

Notes

1. ~~"Advanced NUHOMS® Horizontal Modular Storage System Safety Analysis Report" [B.3-1] normal ambient temperature range is 0 – 104°F. Section 8 of this SAR evaluates a normal ambient temperature range of 0 – 110°F.~~ Not Used
2. ~~"Advanced NUHOMS® Horizontal Modular Storage System Safety Analysis Report" [B.3-1] maximum off-normal temperature is 117°F. Section 8 of this SAR evaluates a maximum off-normal temperature is 120°F.~~ Not Used
3. 75g Side drop and 25g corner is equivalent to 80 inch drop.
4. In accordance with 10 CFR 72.104(3) limits include any other radiation from uranium fuel cycle operations within the region.

Table C.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NUHOMS®-61BT Design Criteria
Type of fuel	Commercial, light water reactor spent fuel	Normal (Bounded)	Standardized NUHOMS® SAR Section K.2.1 ~~See Section C.3.2~~
Storage Systems	Transportable canisters and storage overpacks docketed by the NRC	Normal (Bounded)	71-9302 72-1004
Fuel Characteristics	Criteria as specified in previously approved licenses for included systems	Normal (Bounded)	Standardized NUHOMS® SAR Section K.2.1 ~~See Section C.3.2~~
Tornado (Wind Load) (HSM Model 102)	Max translational speed: 40 mph Max rotational speed: 160 mph Max tornado wind speed: 200 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 0.9 psi Rate of pressure drop: 0.4 psi/sec	Accident (Bounded)	Standardized NUHOMS® SAR Sections 3.2.1 and Section K.2.2.1 Max translational speed: 70 mph Max rotational speed: 290 mph Max tornado wind speed: 360 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 3.0 psi Rate of pressure drop: 2.0 psi/sec
Tornado (Wind Load) (MP197HB TC)	Max translational speed: 40 mph Max rotational speed: 160 mph Max tornado wind speed: 200 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 0.9 psi Rate of pressure drop: 0.4 psi/sec	Accident (Bounded)	Sections C.7.7.4 (New Evaluation) Max translational speed: N/A Max rotational speed: N/A Max tornado wind speed: 360 mph Radius of max rotational speed: N/A Tornado pressure drop: N/A Rate of pressure drop: N/A

Table C.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NUHOMS®-61BT Design Criteria
Tornado (HSM Missile)	Automobile 4000 lb, 112 ft/s Schedule 40 Pipe 287 lb, 112 ft/s Solid Steel Sphere 0.147 lb, 23 ft/s	Accident (Bounded)	Standardized NUHOMS® SAR Sections 3.2.1 and Section K.2.2.1 Automobile 4000 lb, 195 ft/s 8" diameter shell 276 lb, 185 ft/s Solid Steel Sphere 0.147 lb, 23 ft/s Wood plank missile 1500 lb, 440 ft/s
Tornado (MP197HB Missile)	Automobile 4000 lb, 112 ft/s Schedule 40 Pipe 287 lb, 112 ft/s Solid Steel Sphere 0.147 lb, 23 ft/s	Accident (Same)	Sections C.7.7.1 (New Evaluation) Automobile 4000 lb, 112 ft/s Schedule 40 Pipe 287 lb, 112 ft/s Solid Steel Sphere 0.147 lb, 23 ft/s
Floods	Flood height 1.1 inches Water velocity 1.7 ft/s	Accident (Bounded)	Standardized NUHOMS® SAR Sections 3.2.2 and Section K.2.2.2 Flood height 50 ft Water velocity 15 ft/s
Seismic (Ground Motion)	Site-specific ground-surface uniform hazard response spectra (UHRS) with 1E-4 annual frequency of exceedance (AFE) having peak ground acceleration (PGA) of 0.250 g horizontal and 0.175 g vertical. (Table 1-5 and Figure 1-5)	Accident (Bounded)	Standardized NUHOMS® SAR Sections 3.2.3 and Section K.2.2.3 Reg Guide 1.60 Response Spectra anchored at 0.25 g horizontal and 0.17 g vertical peak accelerations
Vent Blockage	For NUHOMS® Systems: Inlet and outlet vents blocked 40 hrs	Accident (Same)	Standardized NUHOMS® SAR Section K.4.6.1 Inlet and outlet vents blocked 40 hrs
Fire/Explosion	For NUHOMS® Systems: Equivalent fire 300 gallons of diesel fuel	Accident (Same)	Section C.8.5 (New Evaluation) Standardized NUHOMS® SAR Section K.4.6.5 Equivalent fire 300 gallons of diesel fuel

Table C.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NUHOMS®-61BT Design Criteria
Cask Drop	For NUHOMS® Systems: Transfer Cask Horizontal side drop or slap down 80 inches(2)	Accident (Same)	Section C.7.7 (New Evaluation) Transfer Cask Horizontal side drop or slap down 80 inches(2)
Transfer Load	For NUHOMS® Systems only: Normal insertion load 60 kips Normal extraction load 60 kips	Norma (Same)	Section C.7.7 (New Evaluation) and Standardized NUHOMS® SAR Section K.3.6.1.1 Normal insertion load 60 kips Normal extraction load 60 kips
Transfer Load	For NUHOMS® Systems only: Maximum insertion load 80 kips Maximum extraction load 80 kips	Off-Normal/ Accident (Same)	Section C.7.7 (New Evaluation) and Standardized NUHOMS® SAR Section K.3.6.2.1 Maximum insertion load 80 kips Maximum extraction load 80 kips
Ambient Temperatures	Normal temperature 44.1 – 81.5°F	Normal (Bounded)	Section C.8.5 (New Evaluation) and Standardized NUHOMS® SAR Section K.4.4.1 Normal temperature 0 - 100°F(1)
Off-Normal Temperature	Minimum temperature 30.1°F Maximum temperature 94.6°F	Off-Normal (Bounded)	Section C.8.5 (New Evaluation) and Standardized NUHOMS® SAR Section K.5.2 Minimum temperature -40.0°F Maximum temperature 125°F
Extreme Temperature	Maximum temperature 113°F	Accident (Bounded)	Section C.8.5 (New Evaluation) and Standardized NUHOMS® SAR Section K.5.2 Maximum temperature 125°F

Table C.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NUHOMS®-61BT Design Criteria
Solar Load (Insolation)	Horizontal flat surface insolation 2949.4 BTU/day-ft^2 Curved surface solar insolation 1474.7 BTU/day-ft^2	Normal (Same)	Section C.8.5 (New Evaluation) and Standardized NUHOMS® SAR Table 8.1-17 Horizontal flat surface insolation 2949.4 BTU/day-ft^2 Curved surface solar insolation 1474.7 BTU/day-ft^2
Snow and Ice	Snow Load 10 psf	Normal (Bounded)	Standardized NUHOMS® SAR Sections 3.2.4 and K.2.2.4 Snow Load 110 psf
Dead Weight	Per design basis for systems listed in Table 1-1	Normal (Same)	Sections 8.1.1.4, K.3.2, K.3.6.1.2 and Tables K.2-10 and K.3.2-1 of reference [C.3-1]
Internal and External Pressure Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Section K.3.6.1.2 and Tables K.2-10, K.3.4-5 and K.4-5 of reference [C.3-1]
Design Basis Thermal Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Sections K.3.6.1.2 and K.3.6.1.3 ~~K.3.6.1.1, K.3.6.1.2, K.3.6.1.4, K.3.6.2.1 and Tables K.2-5 and K.2-10~~ of reference [C.3-1]
Operating Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	K.3.6.1.1, K.3.6.1.2, K.3.6.1.4, K.3.6.2.1 and Tables K.2-5 and K.2-10 of reference [C.3-1~~See reference [C.3-1]~~
Live Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Standardized NUHOMS® SAR Section K.3.6.1.1 Design Load (including snow and ice) 200psf

Table C.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NUHOMS®-61BT Design Criteria
Radiological Protection	Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 Rem Public lens of eye ≤ 15Rem	Accident (Same)	Chapter 9 demonstrates these limits are met Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 Rem Public lens of eye ≤ 15 Rem
Radiological Protection	Public wholebody ≤ 25 mrem/yr(3) Public thyroid ≤ 75 mrem/yr(3) Public critical organ ≤ 25 mrem/yr(3)	Normal (Same)	Chapter 9 demonstrates these limits are met Public wholebody ≤ 25 mrem/yr(3) Public thyroid ≤ 75 mrem/yr(3) Public critical organ ≤ 25 mrem/yr(3)
Confinement	Per design basis for systems listed in Table 1-1	N/A	Section K.7 of reference [C.3-1]
Nuclear Criticality	Per design basis for systems listed in Table 1-1	N/A	Section K.6 of reference [C.3-1]
Decommissioning	Minimize potential contamination	Normal (Same)	Standardized NUHOMS® SAR Sections 9.6 and K.14 Minimize potential contamination
Materials Handling and Retrieval Capability	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site	Normal (Same)	Standardized NUHOMS® SAR Section K.2.3.2 Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site

Notes

1. ~~"Standardized NUHOMS® Horizontal Modular Storage System Safety Analysis Report" [C.3-1] normal ambient temperature range is 0 - 100°F. Section 8 of this SAR evaluates a normal ambient temperature range of 0° - 110°F.~~ Not Used
2. 75g Vertical, 75g Horizontal and 25g corner is equivalent to 80 inch drop.
3. In accordance with 10 CFR 72.104(a)(3) limits include any other radiation from uranium fuel cycle operations within the region.

Table D.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NUHOMS®-61BTH Type 1 Design Criteria
Type of fuel	Commercial, light water reactor spent fuel	Normal (Bounded)	Standardized NUHOMS® SAR Section T.2.1 ~~See Section D.3.2~~
Storage Systems	Transportable canisters and storage overpacks docketed by the NRC	Normal (Bounded)	71-9302 72-1004
Fuel Characteristics	Criteria as specified in previously approved licenses for included systems	Normal (Bounded)	Standardized NUHOMS® SAR Section T.2.1~~See Section D.3.2~~
Tornado (Wind Load) (HSM Model 102)	Max translational speed: 40 mph Max rotational speed: 160 mph Max tornado wind speed: 200 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 0.9 psi Rate of pressure drop: 0.4 psi/sec	Accident (Bounded)	Standardized NUHOMS® SAR Sections 3.2.1 and T.2.2.1 Max translational speed: 70 mph Max rotational speed: 290 mph Max tornado wind speed: 360 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 3.0 psi Rate of pressure drop: 2.0 psi/sec
Tornado (Wind Load) (MP197HB TC)	Max translational speed: 40 mph Max rotational speed: 160 mph Max tornado wind speed: 200 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 0.9 psi Rate of pressure drop: 0.4 psi/sec	Accident (Bounded)	Sections D.7.7 and C.7.7.4 (New Evaluation) Max translational speed: N/A Max rotational speed: N/A Max tornado wind speed: 360 mph Radius of max rotational speed: N/A Tornado pressure drop: N/A Rate of pressure drop: N/A

Table D.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NUHOMS®-61BTH Type 1 Design Criteria
Tornado (HSM Missile)	Automobile 4000 lb, 112 ft/s Schedule 40 Pipe 287 lb, 112 ft/s Solid Steel Sphere 0.147 lb, 23 ft/s	Accident (Bounded)	Standardized NUHOMS® SAR Sections 3.2.1 and T.2.2.1 Automobile 4000 lb, 195 ft/s 8" diameter shell 276 lb, 185 ft/s Solid Steel Sphere 0.147 lb, 23 ft/s Wood plank missile 200 lb, 440 ft/s
Tornado (MP197HB Missile)	Automobile 4000 lb, 112 ft/s Schedule 40 Pipe 287 lb, 112 ft/s Solid Steel Sphere 0.147 lb, 23 ft/s	Accident (Same)	Sections D.7.7 and C.7.7.1 (New Evaluation) Automobile 4000 lb, 112 ft/s Schedule 40 Pipe 287 lb, 112 ft/s Solid Steel Sphere 0.147 lb, 23 ft/s
Floods	Flood height 1.1 inches Water velocity 1.7 ft/s	Accident (Bounded)	Standardized NUHOMS® SAR Sections 3.2.2 and T.2.2.2 Flood height 50 ft Water velocity 15 ft/s
Seismic (Ground Motion)	Site-specific ground-surface uniform hazard response spectra (UHRS) with 1E-4 annual frequency of exceedance (AFE) having peak ground acceleration (PGA) of 0.250 g horizontal and 0.175 g vertical. (Table 1-5 and Figure 1-5)	Accident (Bounded)	Standardized NUHOMS® SAR Sections 3.2.3 and T.2.2.3 Reg Guide 1.60 Response Spectra anchored at 0.25 g horizontal and 0.17 g vertical peak accelerations
Vent Blockage	For NUHOMS® Systems: Inlet and outlet vents blocked 40 hrs	Accident (Same)	Standardized NUHOMS® SAR Section T.4.4.5 Inlet and outlet vents blocked 40 hrs
Fire/Explosion	For NUHOMS® Systems: Equivalent fire 300 gallons of diesel fuel	Accident (Same)	Standardized NUHOMS® SAR Sections 3.3.6 and T.2.3.6 Equivalent fire 300 gallons of diesel fuel

Table D.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NUHOMS®-61BTH Type 1 Design Criteria
Cask Drop	For NUHOMS® Systems: Transfer Cask Horizontal side drop or slap down 80 inches[2]	Accident (Same)	Sections D.7.7 and C.7.7 (New Evaluation) Transfer Cask Horizontal side drop or slap down 80 inches[2]
Transfer Load	For NUHOMS® Systems only: Normal insertion load 60 kips Normal extraction load 60 kips	Normal (Same)	Sections D.7.7 and C.7.7 (New Evaluation) and Standardized NUHOMS® SAR T.3.6.1.1 Normal insertion load 60 kips Normal extraction load 60 kips
Transfer Load	For NUHOMS® Systems only: Maximum insertion load 80 kips Maximum extraction load 80 kips	Off-Normal/ Accident (Same)	Sections D.7.7 and C.7.7.7 (New Evaluation) and Standardized NUHOMS® SAR T.3.6.2.1 Maximum insertion load 80 kips Maximum extraction load 80 kips
Ambient Temperatures	Normal temperature 44.1 – 81.5°F	Normal (Bounded)	Sections D.8.5 (New Evaluation) and Standardized NUHOMS® SAR T.4.4.3 Normal temperature 0 - 100°F[1]
Off-Normal Temperature	Minimum temperature 30.1°F Maximum temperature 94.6°F	Off-Normal (Bounded)	Sections D.8.5 (New Evaluation) and Standardized NUHOMS® SAR T.4.4.3 Minimum temperature -40.0°F Maximum temperature 125°F
Extreme Temperature	Maximum temperature 113°F	Accident (Bounded)	Sections D.8.5 (New Evaluation) and Standardized NUHOMS® SAR T.4.4.3 Maximum temperature 125°F
Solar Load (Insolation)	Horizontal flat surface insolation 2949.4 BTU/day-ft^2 Curved surface solar insolation 1474.7 BTU/day-ft^2	Normal (Same)	Sections D.8.5 (New Evaluation) and Standardized NUHOMS® Table 8.1-17 Horizontal flat surface insolation 2949.4 BTU/day-ft^2 Curved surface solar insolation 1474.7 BTU/day-ft^2

Table D.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NUHOMS®-61BTH Type 1 Design Criteria
Snow and Ice	Snow Load 10 psf	Normal (Bounded)	Standardized NUHOMS® SAR Sections 3.2.4 and T.2.2.4 Snow Load 110 psf
Dead Weight	Per design basis for systems listed in Table 1-1	Normal (Same)	Sections T.3.2, T.3.6.1.1, T.3.6.1.2, T.3.6.1.3 and Tables T.2-14, T.3.2-1 and T.3.2-2 of reference [D.3-1]
Internal and External Pressure Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Sections T.3.6.1, T.3.6.2, and Table T.2-14 of reference [D.3-1]
Design Basis Thermal Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Sections T.3.6.1.1, T.3.6.1.2, T.3.6.1.3, T.3.6.2 and Table T.2-14 of reference [D.3-1]
Operating Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Sections T.3.6.1.1, T.3.6.1.2, T.3.6.1.3 and Table T.2-14 of reference [D.3-1]
Live Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Standardized NUHOMS® SAR Section T.3.6.1.1 Design Load (including snow and ice) 200psf
Radiological Protection	Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 Rem Public lens of eye ≤ 15 Rem	Accident (Same)	Chapter 9 demonstrates these limits are met Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 Rem Public lens of eye ≤ 15 Rem
Radiological Protection	Public wholebody ≤ 25 mrem/yr(3) Public thyroid ≤ 75 mrem/yr(3) Public critical organ ≤ 25 mrem/yr(3)	Normal (Same)	Chapter 9 demonstrates these limits are met Public wholebody ≤ 25 mrem/yr(3) Public thyroid ≤ 75 mrem/yr(3) Public critical organ ≤ 25 mrem/yr(3)

Table D.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NUHOMS®-61BTH Type 1 Design Criteria
Confinement	Per design basis for systems listed in Table 1-1	N/A	Section T.7 of reference [D.3-1]
Nuclear Criticality	Per design basis for systems listed in Table 1-1	N/A	Section T.6 of reference [D.3-1]
Decommissioning	Minimize potential contamination	Normal (Same)	Standardized NUHOMS® SAR Sections 9.6 and T.14 Minimize potential contamination
Materials Handling and Retrieval Capability	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site	Normal (Same)	Standardized NUHOMS® SAR Sections T.2.3.2 and T.7 Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site

Notes

1. Not Used ~~"Standardized NUHOMS® Horizontal Modular Storage System Safety Analysis Report" [D.3-1] normal ambient temperature range is 0° - 100°F. Section 8 of this SAR evaluates a normal ambient temperature range of 0° - 110°F.~~
2. 75g Vertical, 75g Horizontal and 25g corner is equivalent to 80 inch drop.
3. In accordance with 10 CFR 72.104(a)(3) limits include any other radiation from uranium fuel cycle operations within the region.

Table A.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NUHOMS®-MP187 Design Criteria
Type of fuel	Commercial, light water reactor spent fuel	Normal (Bounded)	Rancho Seco SAR, Section 10.3.1.1 and 10.3.1.2 of Volume 1
Storage Systems	Transportable canisters and storage overpacks docketed by the NRC	Normal (Bounded)	71-9255 72-11 (SNM-2510)
Fuel Characteristics	Criteria as specified in previously approved licenses for included systems	Normal (Bounded)	Rancho Seco SAR, Section 10.3.1.1 and 10.3.1.2 of Volume 1
Tornado (Wind Load) (HSM Model 80)	Max translational speed: 40 mph Max rotational speed: 160 mph Max tornado wind speed: 200 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 0.9 psi Rate of pressure drop: 0.4 psi/sec	Accident (Bounded)	Rancho Seco SAR, Section 3.2.1 of Volume 1 Max translational speed: 70 mph Max rotational speed: 290 mph Max tornado wind speed: 360 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 3.0 psi Rate of pressure drop: 2.0 psi/sec
Tornado (Wind Load) (MP187 TC)	Max translational speed: 40 mph Max rotational speed: 160 mph Max tornado wind speed: 200 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 0.9 psi Rate of pressure drop: 0.4 psi/sec	Accident (Bounded)	Rancho Seco SAR, Section 3.2.1 of Volume 1 Max translational speed: N/A Max rotational speed: N/A Max tornado wind speed: 360 mph Radius of max rotational speed: N/A Tornado pressure drop: N/A Rate of pressure drop: N/A
Tornado (Missile)	Automobile 4000 lb, 112 ft/s Schedule 40 Pipe 287 lb, 112 ft/s Solid Steel Sphere 0.147 lb, 23 ft/s	Accident (Bounded)	Rancho Seco SAR, Table 3-1 of Volume 2 Automobile 4000 lb, 185 ft/s 8" diameter shell 276 lb, 185 ft/s Solid Steel Sphere 0.147 lb, 23 ft/s

Table A.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NUHOMS®-MP187 Design Criteria
Floods	Flood height 1.1 inches Water velocity 1.7 ft/s	Accident (Bounded)	Rancho Seco SAR, Table 3-1 of Volume 2 Flood height 50 ft Water velocity 15 ft/s
Seismic (Ground Motion)	Site-specific ground-surface uniform hazard response spectra (UHRS) with 1E-4 annual frequency of exceedance (AFE) having peak ground acceleration (PGA) of 0.250 g horizontal and 0.175 g vertical. (Table 1-5 and Figure 1-5)	Accident (Bounded)	Rancho Seco SAR, Section 3.2.3 of Volume 1 and Tables 3-1 and 3-2 of Volume 2 Reg Guide 1.60 Response Spectra anchored at 0.25 g horizontal and 0.17 g vertical peak accelerations
Vent Blockage	For NUHOMS® Systems: Inlet and outlet vents blocked 40 hrs	Accident (Same)	Rancho Seco SAR, Section 8.3.5 of Volume 2 Inlet and outlet vents blocked 40 hrs
Fire/Explosion	For NUHOMS® Systems: Equivalent fire 300 gallons of diesel fuel	Accident (Same)	Rancho Seco SAR, Section 8.3.8 of Volume 2 Equivalent fire 300 gallons of diesel fuel
Cask Drop	For NUHOMS® Systems: Transfer Cask Horizontal side drop or slap down 80 inches[3]	Accident (Same)	Rancho Seco SAR, Section 8.2.1 of Volume 1 and Appendix B page 8.2-27 Transfer Cask Horizontal side drop or slap down 80 inches[3]
Transfer Load	For NUHOMS® Systems only: Normal insertion load 60 kips Normal extraction load 60 kips	Normal (Same)	Rancho Seco SAR, Appendix B page 8.126 Normal insertion load 60 kips Normal extraction load 60 kips
Transfer Load	For NUHOMS® Systems only: Maximum insertion load 80 kips Maximum extraction load 80 kips	Off-Normal/ Accident (Same)	Rancho Seco SAR, Appendix B page 8.1-29 Maximum insertion load 80 kips Maximum extraction load 80 kips
Ambient Temperatures	Normal temperature 44.1 – 81.5°F	Normal (Bounded)	Rancho Seco SAR, Section 8.1.13 of Volume 1 Normal temperature 0 - 101°F[1]

Table A.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NUHOMS®-MP187 Design Criteria
Off-Normal Temperature	Minimum temperature 30.1°F Maximum temperature 94.6°F	Off-Normal (Bounded)	Rancho Seco SAR, Section 8.1.1.3 of Volume 1 Minimum temperature -20.0°F Maximum temperature 117°F(2)
Extreme Temperature	Maximum temperature 113°F	Accident (Bounded)	Rancho Seco SAR, Section 8.1.1.3 of Volume 1 Maximum temperature 117°F(2)
Solar Load (Insolation)	Horizontal flat surface insolation 2949.4 BTU/day-ft² Curved surface solar insolation 1474.7 BTU/day-ft²	Normal (Same)	Rancho Seco FSAR Table 8-1 of Volume 2 Horizontal flat surface insolation 2949.4 BTU/day-ft² Curved surface solar insolation Not Specified
Snow and Ice	Snow Load 10 psf	Normal (Bounded)	Rancho Seco SAR, Section 3.2.4 of Volume 1 Snow Load 110 psf
Dead Weight	Per design basis for systems listed in Table 1-1	Normal (Same)	Section 8.1.1.1 of Volume 1of reference [A.3-1]
Internal and External Pressure Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Sections 3.2.2 and 8.1.1.2 of Volume 1 of reference [A.3-1]
Design Basis Thermal Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Sections 8.1.1.3 and 8.1.1.9 of Volume 1 of reference [A.3-1]
Operating Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Sections 8.1.1.4, 8.1.1.5, 8.1.1.7 and 8.1.1.8 of Volume 1 of reference [A.3-1]
Live Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Rancho Seco SAR, Section 3.2.4 of Volume 1 Design Load (including snow and ice) 200psf

Table A.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NUHOMS®-MP187 Design Criteria
Radiological Protection	Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 mrem Public lens of eye ≤ 15 mrem	Accident (Same)	Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 Rem Public lens of eye ≤ 15 Rem
Radiological Protection	Public wholebody ≤ 25 mrem/yr(4) Public thyroid ≤ 75 mrem/yr(4) Public critical organ ≤ 25 mrem/yr(4)	Normal (Same)	Public wholebody ≤ 25 mrem/yr(4) Public thyroid ≤ 75 mrem/yr(4) Public critical organ ≤ 25 mrem/yr(4)
Confinement	Per design basis for systems listed in Table 1-1	N/A	Section 3.3.2.1 and Appendix B pages 3.3-1 to 3.3-2 of reference [A.3-1]
Nuclear Criticality	Per design basis for systems listed in Table 1-1	N/A	Section 3.3.4 of Volume 1 of reference [A.3-1]
Decommissioning	Minimize potential contamination	Normal (Same)	Minimize potential contamination
Materials Handling and Retrieval Capability	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site	Normal (Same)	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site

Notes

1. Not Used
2. Not Used
3. 75g Vertical 75g Horizontal and 25g corner is equivalent to 80 inch drop.
4. In accordance with 10 CFR 72.104(a)(3) limits include any other radiation from uranium fuel cycle operations within the region.

Table B.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	Standardized Advanced NUHOMS® System Design Criteria
Type of fuel	Commercial, light water reactor spent fuel	Normal (Bounded)	Advanced NUHOMS® SAR, Section 2.1
Storage Systems	Transportable canisters and storage overpacks docketed by the NRC	Normal (Bounded)	71-9255 72-1029
Fuel Characteristics	Criteria as specified in previously approved licenses for included systems	Normal (Bounded)	Advanced NUHOMS® SAR, Section 2.1
Tornado (Wind Load) (AHSM)	Max translational speed: 40 mph Max rotational speed: 160 mph Max tornado wind speed: 200 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 0.9 psi Rate of pressure drop: 0.4 psi/sec	Accident (Bounded)	Advanced NUHOMS® SAR, Section 2.2.1 Max translational speed: 70 mph Max rotational speed: 290 mph Max tornado wind speed: 360 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 3.0 psi Rate of pressure drop: 2.0 psi/sec
Tornado (Wind Load) (MP187 Cask)	Max translational speed: 40 mph Max rotational speed: 160 mph Max tornado wind speed: 200 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 0.9 psi Rate of pressure drop: 0.4 psi/sec	Accident (same)	Advanced NUHOMS® SAR, Section 3.2.1 Max translational speed: 40 mph Max rotational speed: 160 mph Max tornado wind speed: 200 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 0.9 psi Rate of pressure drop: 0.4 psi/sec

Table B.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	Standardized Advanced NUHOMS® System Design Criteria
Tornado (Missile)	Automobile 4000 lb, 112 ft/s Schedule 40 Pipe 287 lb, 112 ft/s Solid Steel Sphere 0.147 lb, 23 ft/s	Accident (Bounded)	Advanced NUHOMS® SAR, Section 2.2.1 Automobile 4000 lb, 195 ft/s 8" diameter shell 276 lb, 185 ft/s Solid Steel Sphere 0.147 lb, 23 ft/s 12" OD Steel Pipe 1500 lb, 185 fps Wood pole 1500 lb, 294 ft/s
Floods	Flood height 4 ft Water velocity 8 ft/s	Accident (Bounded)	Advanced NUHOMS® SAR, Section 2.2.2 Flood height 50 ft Water velocity 15 ft/s
Seismic (Ground Motion)	Site-specific ground-surface uniform hazard response spectra (UHRS) with 1E-4 annual frequency of exceedance (AFE) having peak ground acceleration (PGA) of 0.250 g horizontal and 0.175 g vertical. (Table 1-5 and Figure 1-5)	Accident (Bounded)	Advanced NUHOMS® SAR, Section 2.2.3 Reg Guide 1.60 Response Spectra anchored at 1.5 g horizontal and 1.0 g vertical peak accelerations
Vent Blockage	For NUHOMS® Systems: Inlet and outlet vents blocked 40 hrs	Accident (Same)	Advanced NUHOMS® SAR, Section 4.6.2 Inlet and outlet vents blocked 40 hrs
Fire/Explosion	For NUHOMS® Systems: Equivalent fire 300 gallons of diesel fuel	Accident (Same)	Advanced NUHOMS® SAR, Section 4.6.4 Equivalent fire 300 gallons of diesel fuel
Cask Drop	For NUHOMS® Systems: Transfer Cask Horizontal side drop or slap down 80 inches[3]	Accident (Same)	Section B.7.3 (New Evaluation) Transfer Cask Horizontal side drop or slap down 80 inches[3]
Transfer Load	For NUHOMS® Systems only: Normal insertion load 60 kips Normal extraction load 60 kips	Off-Normal/ Accident (Same)	Section B.7.3 (New Evaluation) and Advanced NUHOMS® FSAR Section 3.6.2.2.7 Normal insertion load 60 kips Normal extraction load 60 kips

Table B.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	Standardized Advanced NUHOMS® System Design Criteria
Transfer Load	For NUHOMS® Systems only: Maximum insertion load 80 kips Maximum extraction load 80 kips	Off-Normal/ Accident (Same)	Section B.7.3 (New Evaluation) and Advanced NUHOMS® FSAR Section 3.6.2.2.7 Maximum insertion load 80 kips Maximum extraction load 80 kips
Ambient Temperatures	Normal temperature 44.1 – 81.5°F	Normal (Bounded)	Advanced NUHOMS® SAR, Table 4.1-1 Normal temperature 0 - 104°F(1)
Off-Normal Temperature	Minimum temperature 30.1°F Maximum temperature 94.6°F	Off-Normal (Bounded)	Advanced NUHOMS® SAR, Minimum temperature -40.0°F Maximum temperature 117°F(2)
Extreme Temperature	Maximum temperature 113°F	Accident (Bounded)	Maximum temperature 120°F
Solar Load (Insulation)	Horizontal flat surface insulation 2949.4 BTU/day-ft^2 Curved surface solar insulation 1474.7 BTU/day-ft^2	Normal (Same)	Horizontal flat surface insulation 2952 BTU/day-ft^2 Curved surface solar insulation 1474.7 BTU/day-ft^2
Snow and Ice	Snow Load 10 psf	Normal (Bounded)	Snow Load 110 psf
Dead Weight	Per design basis for systems listed in Table 1-1	Normal (Same)	Sections 3.1.2.1.3.1, 3.6.1.1.3 and 3.6.2.2.1 of reference [B.3-1]
Internal and External Pressure Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Section 3.1.2.1.3.2 of reference [B.3-1]
Design Basis Thermal Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Section 3.1.2.1.3.3 of reference [B.3-1]
Operating Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Section 3.1.2.2.2 of reference [B.3-1]

Table B.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	Standardized Advanced NUHOMS® System Design Criteria
Live Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Advanced NUHOMS® SAR, Table 3.6-10 Design Load (including snow and ice) 200psf
Radiological Protection	Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 Rem Public lens of eye ≤ 15 Rem	Accident (Same)	Chapter 9 demonstrates these limits are met Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 Rem Public lens of eye ≤ 15 Rem
Radiological Protection	Public wholebody ≤ 25 mrem/yr(4) Public thyroid ≤ 75 mrem/yr(4) Public critical organ ≤ 25 mrem/yr(4)	Normal (Same)	Chapter 9 demonstrates these limits are met Public wholebody ≤ 25 mrem/yr(4) Public thyroid ≤ 75 mrem/yr(4) Public critical organ ≤ 25 mrem/yr(4)
Confinement	Per design basis for systems listed in Table 1-1	N/A	Section 7 of reference [B.3-1] (leaktight)
Nuclear Criticality	Per design basis for systems listed in Table 1-1	N/A	Section 6 of reference [B.3-1]
Decommissioning	Minimize potential contamination	Normal (Same)	Advanced NUHOMS® SAR, Section 2.5.1 Minimize potential contamination
Materials Handling and Retrieval Capability	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site	Normal (Same)	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site

Notes

1. Not Used.
2. Not Used
3. 75g Side drop and 25g corner is equivalent to 80 inch drop.
4. In accordance with 10 CFR 72.104(a)(3) limits include any other radiation from uranium fuel cycle operations within the region.

Table C.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NUHOMS®-61BT Design Criteria
Type of fuel	Commercial, light water reactor spent fuel	Normal (Bounded)	Standardized NUHOMS® SAR, Section K.2.1
Storage Systems	Transportable canisters and storage overpacks docketed by the NRC	Normal (Bounded)	71-9302 72-1004
Fuel Characteristics	Criteria as specified in previously approved licenses for included systems	Normal (Bounded)	Standardized NUHOMS® SAR, Section K.2.1
Tornado (Wind Load) (HSM Model 102)	Max translational speed: 40 mph Max rotational speed: 160 mph Max tornado wind speed: 200 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 0.9 psi Rate of pressure drop: 0.4 psi/sec	Accident (Bounded)	Standardized NUHOMS® SAR, Sections 3.2.1 and K.2.2.1 Max translational speed: 70 mph Max rotational speed: 290 mph Max tornado wind speed: 360 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 3.0 psi Rate of pressure drop: 2.0 psi/sec
Tornado (Wind Load) (MP197HB TC)	Max translational speed: 40 mph Max rotational speed: 160 mph Max tornado wind speed: 200 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 0.9 psi Rate of pressure drop: 0.4 psi/sec	Accident (Bounded)	Sections C.7.7.4 (New Evaluation) Max translational speed: N/A Max rotational speed: N/A Max tornado wind speed: 360 mph Radius of max rotational speed: N/A Tornado pressure drop: N/A Rate of pressure drop: N/A

Table C.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NUHOMS®-61BT Design Criteria
Tornado (HSM Missile)	Automobile 4000 lb, 112 ft/s Schedule 40 Pipe 287 lb, 112 ft/s Solid Steel Sphere 0.147 lb, 23 ft/s	Accident (Bounded)	Standardized NUHOMS® SAR, Sections 3.2.1 and K.2.2.1 Automobile 4000 lb, 195 ft/s 8" diameter shell 276 lb, 185 ft/s Solid Steel Sphere 0.147 lb, 23 ft/s Wood plank missile 1500 lb, 440 ft/s
Tornado (MP197HB Missile)	Automobile 4000 lb, 112 ft/s Schedule 40 Pipe 287 lb, 112 ft/s Solid Steel Sphere 0.147 lb, 23 ft/s	Accident (Same)	Section C.7.7.1 (New Evaluation) Automobile 4000 lb, 112 ft/s Schedule 40 Pipe 287 lb, 112 ft/s Solid Steel Sphere 0.147 lb, 23 ft/s
Floods	Flood height 1.1 inches Water velocity 1.7 ft/s	Accident (Bounded)	Standardized NUHOMS® SAR, Sections 3.2.2 and K.2.2.2 Flood height 50 ft Water velocity 15 ft/s
Seismic (Ground Motion)	Site-specific ground-surface uniform hazard response spectra (UHRS) with 1E-4 annual frequency of exceedance (AFE) having peak ground acceleration (PGA) of 0.250 g horizontal and 0.175 g vertical. (Table 1-5 and Figure 1-5)	Accident (Bounded)	Standardized NUHOMS® SAR, Sections 3.2.3 and K.2.2.3Reg Guide 1.60 Response Spectra anchored at 0.25 g horizontal and 0.17 g vertical peak accelerations
Vent Blockage	For NUHOMS® Systems: Inlet and outlet vents blocked 40 hrs	Accident (Same)	Standardized NUHOMS® SAR, Section K.4.6.1 Inlet and outlet vents blocked 40 hrs
Fire/Explosion	For NUHOMS® Systems: Equivalent fire 300 gallons of diesel fuel	Accident (Same)	Section C.8.5 (New Evaluation) Standardized NUHOMS® SAR, Section K.4.6.5 Equivalent fire 300 gallons of diesel fuel

Table C.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NUHOMS®-61BT Design Criteria
Cask Drop	For NUHOMS® Systems: Transfer Cask Horizontal side drop or slap down 80 inches(2)	Accident (Same)	Section C.7.7 (New Evaluation Transfer Cask Horizontal side drop or slap down 80 inches(2)
Transfer Load	For NUHOMS® Systems only: Normal insertion load 60 kips Normal extraction load 60 kips	Norma (Same)	Section C.7.7 (New Evaluation) and Standardized NUHOMS® SAR, Section K.3.6.1.1 Normal insertion load 60 kips Normal extraction load 60 kips
Transfer Load	For NUHOMS® Systems only: Maximum insertion load 80 kips Maximum extraction load 80 kips	Off-Normal/ Accident (Same)	Section C.7.7 (New Evaluation) and Standardized NUHOMS® SAR, K.3.6.2.1 Maximum insertion load 80 kips Maximum extraction load 80 kips
Ambient Temperatures	Normal temperature 44.1 – 81.5°F	Normal (Bounded)	Section C.8.5 (New Evaluation) and Standardized NUHOMS® SAR, Section K.3.6.2.1 Normal temperature 0 - 100°F(1)
Off-Normal Temperature	Minimum temperature 30.1°F Maximum temperature 94.6°F	Off-Normal (Bounded)	Section C.8.5 (New Evaluation and Standardized NUHOMS® SAR, Section K.5.2 Minimum temperature -40.0°F Maximum temperature 125°F
Extreme Temperature	Maximum temperature 113°F	Accident (Bounded)	Section C.8.5 (New Evaluation) and Standardized NUHOMS® SAR, Section K.5.2 Maximum temperature 125°F
Solar Load (Insolation)	Horizontal flat surface insolation 2949.4 BTU/day-ft^2 Curved surface solar insolation 1474.7 BTU/day-ft^2	Normal (Same)	Horizontal flat surface insolation 2949.4 BTU/day-ft^2 Curved surface solar insolation 1474.7 BTU/day-ft^2

Table C.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NUHOMS®-61BT Design Criteria
Solar Load (Insolation)	Horizontal flat surface insolation 2949.4 BTU/day-ft^2 Curved surface solar insolation 1474.7 BTU/day-ft^2	Normal (Same)	Section C.8.5 (New Evaluation) and Standardized NUHOMS® SAR, Table 8.1-17 Horizontal flat surface insolation 2949.4 BTU/day-ft^2 Curved surface solar insolation 1474.7 BTU/day-ft^2
Snow and Ice	Snow Load 10 psf	Normal (Bounded)	Standardized NUHOMS® SAR, Sections 3.2.4 and K.2.2.4 Snow Load 110 psf
Dead Weight	Per design basis for systems listed in Table 1-1	Normal (Same)	Sections 8.1.1.4, K.3.2, K.3.6.1.2 and Tables K.2-10 and K.3.2-1 of reference [C.3-1]
Internal and External Pressure Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Section K.3.6.1.2 and Tables K.2-10, K.3.4-5 and K.4-5 of reference [C.3-1]
Design Basis Thermal Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Sections K.3.6.1.2 and K.3.6.1.3 of reference [C.3-1]
Operating Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Sections K.3.6.1.1, K.3.6.1.2, K.3.6.1.4, K.3.6.2.1 and Tables K.2-5 and K.2-10 of reference [C.3-1]
Live Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Standardized NUHOMS® SAR, Section K.3.6.1.1 Design Load (including snow and ice) 200psf

Table C.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NUHOMS®-61BT Design Criteria
Radiological Protection	Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 Rem Public lens of eye ≤ 15Rem	Accident (Same)	Chapter 9 demonstrates these limits are met Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 Rem Public lens of eye ≤ 15 Rem
Radiological Protection	Public wholebody ≤ 25 mrem/yr(3) Public thyroid ≤ 75 mrem/yr(3) Public critical organ ≤ 25 mrem/yr(3)	Normal (Same)	Chapter 9 demonstrates these limits are met Public wholebody ≤ 25 mrem/yr(3) Public thyroid ≤ 75 mrem/yr(3) Public critical organ ≤ 25 mrem/yr(3)
Confinement	Per design basis for systems listed in Table 1-1	N/A	Section K.7 of reference [C.3-1]
Nuclear Criticality	Per design basis for systems listed in Table 1-1	N/A	Section K.6 of reference [C.3-1]
Decommissioning	Minimize potential contamination	Normal (Same)	Standardized NUHOMS® SAR, Sections 9.6 and K.14 Minimize potential contamination
Materials Handling and Retrieval Capability	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site	Normal (Same)	Standardized NUHOMS® SAR, Section K.2.3.2 Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site

Notes

1. Not Used
2. 75g Vertical, 75g Horizontal and 25g corner is equivalent to 80 inch drop.
3. In accordance with 10 CFR 72.104(a)(3) limits include any other radiation from uranium fuel cycle operations within the region.

Table D.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NUHOMS®-61BTH Type 1 Design Criteria
Type of fuel	Commercial, light water reactor spent fuel	Normal (Bounded)	Standardized NUHOMS® SAR Section, T.2.1
Storage Systems	Transportable canisters and storage overpacks docketed by the NRC	Normal (Bounded)	71-9302 72-1004
Fuel Characteristics	Criteria as specified in previously approved licenses for included systems	Normal (Bounded)	Standardized NUHOMS® SAR Section, T.2.1
Tornado (Wind Load) (HSM Model 102)	Max translational speed: 40 mph Max rotational speed: 160 mph Max tornado wind speed: 200 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 0.9 psi Rate of pressure drop: 0.4 psi/sec	Accident (Bounded)	Standardized NUHOMS® SAR Sections, 3.2.1 and T.2.2.1 Max translational speed: 70 mph Max rotational speed: 290 mph Max tornado wind speed: 360 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 3.0 psi Rate of pressure drop: 2.0 psi/sec
Tornado (Wind Load) (MP197HB TC)	Max translational speed: 40 mph Max rotational speed: 160 mph Max tornado wind speed: 200 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 0.9 psi Rate of pressure drop: 0.4 psi/sec	Accident (Bounded)	Sections D.7.7 and C.7.7.4 (New Evaluation Max translational speed: N/A Max rotational speed: N/A Max tornado wind speed: 360 mph Radius of max rotational speed: N/A Tornado pressure drop: N/A Rate of pressure drop: N/A

Table D.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NUHOMS®-61BTH Type 1 Design Criteria
Tornado (HSM Missile)	Automobile 4000 lb, 112 ft/s Schedule 40 Pipe 287 lb, 112 ft/s Solid Steel Sphere 0.147 lb, 23 ft/s	Accident (Bounded)	Standardized NUHOMS® SAR Sections 3.2.1 and T.2.2.1 Automobile 4000 lb, 195 ft/s 8" diameter shell 276 lb, 185 ft/s Solid Steel Sphere 0.147 lb, 23 ft/s Wood plank missile 200 lb, 440 ft/s
Tornado (MP197HB Missile)	Automobile 4000 lb, 112 ft/s Schedule 40 Pipe 287 lb, 112 ft/s Solid Steel Sphere 0.147 lb, 23 ft/s	Accident (Same)	Sections D.7.7 and C.7.7.1 (New Evaluation) Automobile 4000 lb, 112 ft/s Schedule 40 Pipe 287 lb, 112 ft/s Solid Steel Sphere 0.147 lb, 23 ft/s
Floods	Flood height 1.1 inches Water velocity 1.7 ft/s	Accident (Bounded)	Standardized NUHOMS® SAR Sections, 3.2.2 and T.2.2.2Flood height 50 ft Water velocity 15 ft/s
Seismic (Ground Motion)	Site-specific ground-surface uniform hazard response spectra (UHRS) with 1E-4 annual frequency of exceedance (AFE) having peak ground acceleration (PGA) of 0.250 g horizontal and 0.175 g vertical. (Table 1-5 and Figure 1-5)	Accident (Bounded)	Standardized NUHOMS® SAR Sections, 3.2.3 and T.2.2.3 Reg Guide 1.60 Response Spectra anchored at 0.25 g horizontal and 0.17 g vertical peak accelerations
Vent Blockage	For NUHOMS® Systems: Inlet and outlet vents blocked 40 hrs	Accident (Same)	Standardized NUHOMS® SAR Section, T.4.4.5 Inlet and outlet vents blocked 40 hrs
Fire/Explosion	For NUHOMS® Systems: Equivalent fire 300 gallons of diesel fuel	Accident (Same)	Standardized NUHOMS® SAR Sections, 3.3.6 and T.2.3.6 Equivalent fire 300 gallons of diesel fuel
Cask Drop	For NUHOMS® Systems: Transfer Cask Horizontal side drop or slap down 80 inches[2]	Accident (Same)	Sections D.7.7 and C.7.7 (New Evaluation Transfer Cask Horizontal side drop or slap down 80 inches[2]

Table D.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NUHOMS®-61BTH Type 1 Design Criteria
Cask Drop	For NUHOMS® Systems: Transfer Cask Horizontal side drop or slap down 80 inches(2)	Accident (Same)	Sections D.7.7 and C.7.7 (New Evaluation Transfer Cask Horizontal side drop or slap down 80 inches(2)
Transfer Load	For NUHOMS® Systems only: Normal insertion load 60 kips Normal extraction load 60 kips	Normal (Same)	Sections D.7.7 and C.7.7 (New Evaluation) and Standardized NUHOMS® SAR Section, T.3.6.1.1 Normal insertion load 60 kips Normal extraction load 60 kips
Transfer Load	For NUHOMS® Systems only: Maximum insertion load 80 kips Maximum extraction load 80 kips	Off-Normal/ Accident (Same)	Sections D.7.7 and C.7.7 (New Evaluation0 and Standardized NUHOMS® SAR Section, T.3.6.2.1 Maximum insertion load 80 kips Maximum extraction load 80 kips
Ambient Temperatures	Normal temperature 44.1 – 81.5°F	Normal (Bounded)	Section D.8.5 (New Evaluation) and Standardized NUHOMS® SAR Section, T.4.4.3 Normal temperature 0 - 100°F(1)
Off-Normal Temperature	Minimum temperature 30.1°F Maximum temperature 94.6°F	Off-Normal (Bounded)	Section D.8.5 (New Evaluation) and Standardized NUHOMS® SAR Section, T.4.4.3 Minimum temperature -40.0°F Maximum temperature 125°F
Extreme Temperature	Maximum temperature 113°F	Accident (Bounded)	Sections D.8.5 (New Evaluation) and Standardized NUHOMS® SAR Section, T.4.4.3 Maximum temperature 125°F

Table D.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NUHOMS®-61BTH Type 1 Design Criteria
Solar Load (Insolation)	Horizontal flat surface insolation 2949.4 BTU/day-ft^2 Curved surface solar insolation 1474.7 BTU/day-ft^2	Normal (Same)	Sections D.8.5 (New Evaluation) and Standardized NUHOMS® SAR Table, 8.1-17 Horizontal flat surface insolation 2949.4 BTU/day-ft^2 Curved surface solar insolation 1474.7 BTU/day-ft^2
Snow and Ice	Snow Load 10 psf	Normal (Bounded)	Standardized NUHOMS® SAR Sections, 3.2.4 and T.2.2.4 Snow Load 110 psf
Dead Weight	Per design basis for systems listed in Table 1-1	Normal (Same)	Sections T.3.2, T.3.6.1.1, T.3.6.1.2, T.3.6.1.3 and Tables T.2-14, T.3.2-1 and T.3.2-2 of reference [D.3-1]
Internal and External Pressure Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Sections T.3.6.1, T.3.6.2, and Table T.2-14 of reference [D.3-1]
Design Basis Thermal Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Sections T.3.6.1.1, T.3.6.1.2, T.3.6.1.3, T.3.6.2 and Table T.2-14 of reference [D.3-1]
Operating Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Sections T.3.6.1.1, T.3.6.1.2, T.3.6.1.3 and Table T.2-14 of reference [D.3-1]
Live Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Standardized NUHOMS® SAR Section, T.3.6.1.1 Design Load (including snow and ice) 200psf

Table D.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NUHOMS®-61BTH Type 1 Design Criteria
Radiological Protection	Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 Rem Public lens of eye ≤ 15 Rem	Accident (Same)	Chapter 9 demonstrates these limits are met Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 Rem Public lens of eye ≤ 15 Rem
Radiological Protection	Public wholebody ≤ 25 mrem/yr(3) Public thyroid ≤ 75 mrem/yr(3) Public critical organ ≤ 25 mrem/yr(3)	Normal (Same)	Chapter 9 demonstrates these limits are met Public wholebody ≤ 25 mrem/yr(3) Public thyroid ≤ 75 mrem/yr(3) Public critical organ ≤ 25 mrem/yr(3)
Confinement	Per design basis for systems listed in Table 1-1	N/A	Section T.7 of reference [D.3-1]
Nuclear Criticality	Per design basis for systems listed in Table 1-1	N/A	Section T.6 of reference [D.3-1]
Decommissioning	Minimize potential contamination	Normal (Same)	Standardized NUHOMS® SAR Sections, T.2.3.2 and T.7 Minimize potential contamination
Materials Handling and Retrieval Capability	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site	Normal (Same)	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site

Notes

1. Not Used
2. 75g Vertical, 75g Horizontal and 25g corner is equivalent to 80 inch drop.
3. In accordance with 10 CFR 72.104(a)(3) limits include any other radiation from uranium fuel cycle operations within the region.

RSI NP-5.3:

Provide clear and specific sections with regards to the WCS CISF design criteria detailed in Chapter 3 of WCS SAR.

Section 7.2, "Confinement SSCs" of the WCS SAR states, "For purposes of the WCS CISF design, the cask systems have been evaluated against the WCS CISF design criteria detailed in Chapter 3." Specific pointers to sections of Chapter 3 of the WCS SAR have not been provided. See Sections 5.4.1.2 and 5.5.1.2, "Design Criteria for Confinement Structures" in NUREG-1567. This information is needed to determine compliance with 10 CFR 72.24 and 10 CFR 72.122.

WCS Response to RSI 5.3:

WCS has revised WCS CISF SAR Section 7.2 to provide specific pointers to sections of Chapter 3 that address the WCS CISF design criteria and to remove two redundant sentences. Those pointers also include references to the tables in the SAR appendices (including new tables in Appendices E, F, and G in response to RSI 10.3) that compare the WCS CISF design criteria with the design criteria for each cask system. In response to RSI 5.1, WCS also revised other portions of Section 7.2 to provide specific references to a description of the confinement boundary for each of the storage canisters to be used at the WCS facility.

WCS SAR Impact:

WCS SAR Chapter 7, Section 7.2 has been revised to confirm that structures and components of the confinement boundary are classified as ITS and incorporated in response to RSI 5.1.

See below updates to WCS SAR Chapter 7, Section 7.2

Updates and additions to WCS SAR Chapter 7, Section 7.2, Confinement SSCs:

~~The ITS WCS CISF confinement SSCs are the canister shells and closure welds. The cask systems evaluated for use at the WCS CISF are described in Chapter 4 and Appendices A.4 through G.4.~~

Only NRC-approved storage systems are used at the WCS CISF. The proposed cask systems to be utilized at the WCS CISF are evaluated against site parameters and are generally shown to bound the site parameters ~~(see Chapter 3 and referenced appendices).~~ Section 3.3 identifies the design criteria for the WCS CISF ITS Structures, Systems, and Components. Section 3.3.3 specifically addresses confinement .Section 3.4 addresses the design criteria for the transportable storage casks and cask/canister systems. Table 3-1 cross-references the appendices that discuss those design criteria in more detail. Tables A.3-1, B.3-1, C.3-1, D.3-1, E.3-1, F.3-1, and G.3-1 compare the WCS CISF design criteria with the design criteria for each cask system. Where the actual site parameters exceed the bounds of those assumed in the individual cask certificates of compliance, the difference ~~delta~~ is addressed for those areas affected by the variations and are documented in the appropriate WCS SAR Chapter, and associated Appendices. No new analyses are required for the NAC storage systems. Tables A.3-1, B.3-1, C.3-1, and D.3-1 include cross-references where new evaluations are described for the NUHOMS® Systems.

~~For purposes of the WCS CISF design, the cask systems have been evaluated against the WCS CISF design criteria detailed in Chapter 3. The results of this evaluation are presented in Section 3.4 and the appendices referenced in Table 3-1.~~ Spent nuclear fuel (SNF) characteristics are addressed in the individual canister/cask system thermal safety evaluations which are provided in Appendices A.8, B.8, C.8, D.8, E.8, F.8 and G.8, for each ~~depending on the~~ canister/cask system. It is required that packages received at the WCS CISF are loaded in accordance with SAR and regulatory requirements applicable at the site where the SNF was originally loaded and stored. To provide assurance that the packages received at the WCS CISF are acceptable for storage, prior to receipt of a canister~~,~~ a records review is performed to verify that the canister being received was fabricated, loaded, stored and maintained in accordance with the Site Specific or General License requirements and will comply with WCS License Conditions and Technical Specification. ~~prior to shipment.~~ In addition, a ~~the~~ receipt inspection of the canisters is performed upon arrival at the WCS CISF which includes a post transport package evaluation ~~is to be~~ in accordance with reference [7-1].

The primary confinement boundary for the six storage systems used at the WCS CISF is a metal canister that is welded shut. All components of the canister confinement boundary are classified as important-to-safety. Section 3.4 and Table 3-4 provide references where the classification of the SSCs can be found in the WCS CISF SAR Appendices and in the FSARs for each of the storage systems.

A description of the confinement boundary for each of the six systems used at the WCS CISF is provided in the locations in the Appendices of the WCS SAR identified in Table 7-24.

Table 7-24 Description of Confinement Boundaries

System	Appendix Location
NUHOMS® MP187 Cask System	Section A.11.1
Advanced Standardized NUHOMS® System	Section B.11.1
Standardized NUHOMS®-61 BT System	Section C.11.1
Standardized NUHOMS®-61 BTH Type 1 System	Section D.11.1
Yankee-MPC	Section E.11.1.1
CY-MPC	Section E.11.1.1
MPC-LACBWR	Section E.11.2.1
NAC-UMS	Section F.11.1.1
NAC-MAGNASTOR	Section G.11.1.1

7.2 Confinement SSCs

Only NRC-approved storage systems are used at the WCS CISF. The proposed cask systems to be utilized at the WCS CISF are evaluated against site parameters and are generally shown to bound the site parameters. Section 3.3 identifies the design criteria for the WCS CISF ITS Structures, Systems and Components. Section 3.3.3 specifically addresses confinement. Section 3.4 addresses the design criteria for the transportable storage casks and cask/canister systems. Table 3-1 cross-references the appendices that discuss those design criteria in more detail. Tables A.3-1, B.3-1, C.3-1, D.3-1, E.3-1, F.3-1, and G.3-1 compare the WCS CISF design criteria with the design criteria for each cask system. Where the actual site parameters exceed the bounds of those assumed in the individual cask certificates of compliance, the difference is addressed for those areas affected by the variations and are documented in the appropriate WCS SAR Chapter, and associated Appendices. No new analyses are required for the NAC storage systems Tables A.3-1, B.3-1, C.3-1, and D.3-1 include cross references where new evaluations are described for the NUHOMS® Systems.

Spent nuclear fuel (SNF) characteristics are addressed in the individual canister/cask system thermal safety evaluations which are provided in Appendices A.8, B.8, C.8, D.8, E.8, F.8 and G.8, for each canister/cask system. It is required that packages received at the WCS CISF are loaded in accordance with SAR and regulatory requirements applicable at the site where the SNF was originally loaded and stored. To provide assurance that the packages received at the WCS CISF are acceptable for storage, prior to receipt of a canister, a records review is performed to verify that the canister being received was fabricated, loaded, stored and maintained in accordance with the Site Specific or General License requirements and will comply with WCS License Conditions and Technical Specification. In addition, a receipt inspection of the canisters is performed upon arrival at the WCS CISF which includes a post transport package evaluation in accordance with reference [7-1].

The primary confinement boundary for each of the six storage systems used at the WCS CISF is a metal canister that is welded shut. All components of the canister confinement boundary are classified as important-to-safety. Section 3.4 and Table 3-4 provide references where the classification of the SSCs can be found in the WCS CISF SAR Appendices and in the FSARs for each of the storage systems.

A description of the confinement boundary for each of the six systems used at the WCS CISF is provided in the locations in the Appendices of the WCS SAR identified in Table 7-24.

Table 7-24 Description of Confinement Boundaries

System	Appendix Location
NUHOMS® MP187 Cask System	Section A.11.1
Advanced Standardized NUHOMS® System	Section B.11.1
Standardized NUHOMS®-61 BT System	Section C.11.1
Standardized NUHOMS®-61 BTH Type 1 System	Section D.11.1
Yankee-MPC	Section E.11.1.1
CY-MPC	Section E.11.1.1
MPC-LACBWR	Section E.11.2.1
NAC-UMS	Section F.11.1.1
NAC-MAGNASTOR	Section G.11.1.1

Proprietary Information on RSI 5.5 (66 pages) Withheld
Pursuant to 10 CFR 2.390

Proprietary Information on RSI 5.6 (312 pages) Withheld
Pursuant to 10 CFR 2.390

RSI NP-6.1

Provide thermal evaluation, analysis, and results to demonstrate that all casks systems meet the WCS CISF site specific environmental conditions.

Appendices A.8, B.8, C.8, and D.8 of the application provide a normal ambient temperature range of 97°F to 101°F for the NUHOMS®-MP197, Standardized Advanced NUHOMS®, and Standardized NUHOMS® casks systems, respectively. Appendices E.8, F.8, and G.8 of the application state that for the NAC-MPC, NAC-UMS, and MAGNASTOR, the maximum average yearly temperatures allowed are 75°F, 76°F, and 76°F, respectively. However, in Appendices A.8, B.8, C.8, and D.8 of the application, it is stated that "As specified in Table 1.2, normal ambient temperature is considered in the range of 0°F to 110°F." This indicates that a temperature of 110°F should be considered to perform the thermal evaluations for these cask systems because the ambient temperature defined in the previous thermal evaluations does not bound the site specific normal ambient temperature. Other factors such as elevation, effects from other casks, low speed wind, etc. should also be considered, as applicable. See also NUREG.2174,"Impact of Variation in Environmental Conditions on the Thermal Performance of Dry Storage Casks," for a discussion of environmental factors that could affect the cask thermal performance.

The staff needs this information to perform the thermal evaluation of these casks systems for the WCS CISF site to have assurance allowable thermal limits are not exceeded.

This information is needed to determine compliance with 10 CFR 72.122 and 10 CFR 72.128.

WCS Response to RSI 6.1:

Chapter 1, Table 1-2 of the WCS CISF SAR provides the ambient temperatures at the WCS CISF. This table and WCS CISF SAR Chapter 2, Section 2.3.2.1 (revised to Section 2.3.3.1) have been revised to incorporate additional temperature values. The WCS SAR appendices also have been revised to clarify the discussion of the temperature values.

WCS CISF SAR Chapter 8, Section 8.3 has been revised to address the potential effects of cask spacing, wind speed, and elevation.

Table 8-2 has been added to WCS SAR Chapter 8, Section 8.4 to compare the temperature values for the WCS site with the normal, off-normal, and accident temperature for the cask systems identified in the WCS CISF SAR. Other factors affecting the thermal evaluation are discussed below.

WCS SAR Impact:

Appendices A.8, B.8, C.8 and D.8 have been revised to eliminate any inconsistency regarding the ambient temperature specification at the WCS CISF and now refer directly to the site-specific ambient temperatures listed in Table 1-2.

Sections E.8.1.3, F.8.1.3 and G.8.1.3 have been revised to reflect the maximum 3-day average temperature.

WCS SAR Appendices have been updated; Sections A.8.3.1, A.8.3.2, B.8.4.1, B.8.4.2, B.8.4.3, C.8.4.1, C.8.4.1.1, C.8.5.1, C.8.5.2, D.8.4.1, D.8.4.1.1, and D.8.5.2; and Tables Table C.8-1, Table C.8-2, Table D.8-1 and Table D.8-2 (see attached).

WCS SAR Chapter 1 Table 1-2 has been updated (see attached).

WCS SAR Chapter 2, Section 2.3.2.1 (revised to Section 2.3.3.1) has been updated (see attached SAR page).

WCS SAR Chapter 8, Sections 8.3, 8.4, and 8.5 have been updated with the information below.

Addition to WCS SAR Chapter 8, Section 8.3 after first paragraph and revision to the last sentence:

WCS has considered the effects of other factors on the thermal assessment, such as cask spacing, elevation, and wind speed.

Effects from Cask Spacing

The proposed Technical Specifications for NAC vertical storage systems have minimum spacing requirements which assure allowable thermal limits are not exceeded at the WCS CISF for those storage systems.

Elevation Effects

Elevation effects on the NUHOMS® systems, have been previously evaluated in response to RAI 4-10 from NRC on the Amendment 10 application for the CoC 1004 license and has been reviewed by the staff. As shown in the response to RAI 4-10 [8-3], there is no effect on the NUHOMS® system up to an elevation of 5000 ft. As noted in WCS SAR Chapter 2, the WCS CISF is at an elevation of about 3500 feet. Since the elevation at the WCS CISF is lower than those previously evaluated for the NUHOMS® system, no further evaluation is performed.

NAC's storage systems are aboveground ventilated vertical cask designs, which are comparable in design to the aboveground ventilated vertical cask design evaluated in NUREG-2174, "Impact of Variation in Environmental Conditions on the Thermal Performance of Dry Storage Casks". According to NUREG-2174, Section 4.8.4, Paragraph 3, "... the PCT increases by about 6 K (11°F) for every 500 m (1640.5 ft) of increased elevation". Since the WCS facility is at an elevation of approximately 3500 ft. and based on the results shown in NUREG-2174, it is expected the PCT for an aboveground ventilated vertical cask would increase by approximately 23.5°F compared to sea level.

The evaluations using storage design basis heat loads for the Yankee-MPC, CY-MPC, and MPC-LACBWR demonstrates that at sea level the margin between the peak clad temperature (PCT) and the long-term allowable is approximately 81°F, 123°F, and 357°F, respectively. Therefore, the effect of elevation (i.e., 23.5°F increase) is within the margins.

The evaluation using the storage design basis heat load for the NAC-UMS loaded with PWR fuel demonstrates that at sea level the margin between the PCT and the long-term allowable is

approximately 104°F. Therefore, the effect of elevation (i.e., 23.5°F increase) is within the margin.

The evaluation using the storage design basis heat load for the NAC-MAGNASTOR loaded with PWR fuel demonstrates that at sea level the margin between the PCT and the long-term allowable is approximately 34°F. Therefore, the effect of elevation (i.e., 23.5°F increase) is within the margin. It is important to note that this margin is based on a significantly higher PWR storage heat load of 35.5 kW than would be allowed at the WCS facility. In order for a NAC-MAGANSTOR canister to be shipped to the WCS facility it must be below the maximum permissible heat load of the MAGNATRAN transportation cask, which is 23 kW for PWR fuel. This is a design basis storage canister heat load reduction of approximately 35% prior to transportation. Applying this reduction to the design basis storage PCT would increase the margin to approximately 262°F (i.e., [752 – (718°F x 0.65)] – 23.5°F = 262°F). Therefore, the effect of elevation for a NAC-MAGNASTOR PWR canister that was previously in dry storage and subsequently shipped and placed back into storage at the WCS facility is not significant.

The Effect of Low Speed Wind

1 Standardized NUHOMS® system

According to NUREG-2174, wind does not have any significant effect on the thermal performance of Standardized NUHOMS® systems. Therefore, no additional analyses are needed for low wind speed.

2 Advanced NUHOMS® systems.

According to NUREG-2174, a wind evaluation should be included for Advanced NUHOMS® systems (AHSM) when there is not sufficient margin.

Advanced NUHOMS® system is considered for storage in Appendix B.8. The maximum fuel cladding temperature for thermal evaluations presented in Appendix B.8 has a significant margin to the fuel cladding temperature limit.

The maximum fuel cladding temperature for normal storage operations is 618°F (Table 4.4-7 of CoC 1029 UFSAR). As noted in Section B.8.5.2, thermal evaluation for AHSM was based on a heat load of 24 kW compared to the maximum allowed heat load of 14.0 kW, providing sufficient margin. Therefore, no additional analyses are needed for low wind speed.

3 NAC Vertical Storage Systems

NAC's spent fuel storage cask designs are vertical-ventilated aboveground systems (i.e., the NAC-MPC, NAC-UMS, and NAC-MAGNASTOR systems). All of these systems have four air-inlet and four air-outlet vents. They are similar in design to the vertical-ventilated aboveground storage system evaluated for low wind speed in NUREG-2174. As concluded in the NUREG, the maximum fuel cladding temperature for the evaluated vertical-ventilated aboveground system with four air-inlet and four air-outlet vents was lower when subjected to a low wind speed scenario versus a no wind speed scenario. Therefore, the results and conclusions of the NUREG are applicable to NAC's storage systems and the effects of low wind speed on NAC's systems would result in lower maximum fuel cladding temperature. Therefore, no additional analyses are needed for low wind speed.

Based on the assessment of cask spacing, elevation, and wind speed, ~~There is~~ no thermal analysis is required beyond that documented in the Appendices for each system identified in Section 8.4.

Addition to WCS SAR Chapter 8, Section 8.4 at the end:

Table 8-2 compares the maximum ambient temperatures at the WCS site with the equivalent maximum ambient temperatures in Appendices A-G. Note that some ambient temperatures where designated are based on 3-day average high temperatures.

Table 8-2 Maximum Ambient Temperatures for Section 8 of All WCS SAR Appendices

	Normal (°F)	**Off-Normal (°F)**	**Accident (°F)**
WCS CISF (Chapter 1, Table 1-2)	81.5°F	94.6°F	113°F
	Normal (°F)	**Off-Normal (°F)**	**Accident (°F)**
Appendix A.8	101°F	117°F	Bounded by Off-Normal
Appendix B.8	104°F	117°F	Bounded by Off-Normal
Appendix C.8	100°F	125°F (Storage) 105°F (Transfer)	Bounded by Off-Normal (Storage)
Appendix D.8	100°F	125°F (Storage) 105°F (Transfer)	Bounded by Off-Normal (Storage)
WCS CISF (Chapter 1, Table 1-2)	3-Day Avg 67.1°F Maximum Yearly Avg 67.1°F	94.6°F	3-Day Avg low temperature 17.6°F 3-Day Avg high temperature 102.2°F
Appendix E.8	Maximum Yearly Avg 75°F	3-Day Avg 100°F (Yankee-MPC & CY-MPC) 3 Day Avg 105°F (MPC-LACBWR)	3-Day Avg low temperature -40°F 3-Day Avg high temperature 125°F
Appendix F.8	Maximum Yearly Avg 76°F	3-Day Avg 106°F	3-Day Avg low temperature -40°F 3-Day Avg high

			temperature 133°F
Appendix G.8	Maximum Yearly Avg 76°F	3-Day Avg 106°F	3-Day Avg low temperature -40°F 3-Day Avg high temperature 133°F

Based on the Table 8-2 and the revised application, no new evaluations are performed for the various systems, because the existing analyses bound the ambient temperatures at the WCS CISF.

Addition to WCS SAR Chapter 8, Section 8.5, References:

[8-3] Letter from Robert Grubb (TN) to NRC Document Control Desk, "Revision 1 to Transnuclear, Inc. (TN) Application for Amendment 10 to the Standardized NUHOMS® System (Docket No. 72-1004; TAC NO. L24052)," November 7, 2007 (E-25506) ML073180235.

Table 1-2
Summary of WCS CISF Principal Design Criteria
(3 pages)

Design Parameter	Design Criteria	Condition	Applicable Codes, Standards and Basis
Cask Drop	For NUHOMS® Systems: Transfer Cask Horizontal side drop or slap down 80 inches VCCs for MPC Systems: Drop height 6 inches VCCs for UMS and MAGNASTOR Systems: Drop height 24 inches	Accident	N/A
Transfer Load	For NUHOMS® Systems only: Normal insertion load 60 kips Normal extraction load 60 kips	Normal	NA
Transfer Load	For NUHOMS® Systems only: Maximum insertion load 80 kips Maximum extraction load 80 kips	Off-Normal/ Accident	N/A
Ambient Temperatures	Normal temperature 44.1 – 81.5°F 3 Day Average 67.1 F	Normal	Section 2.3.2
Off-Normal Temperature	Minimum temperature 30.1°F Maximum temperature 94.6°F	Off-Normal	Section 2.3.2
Extreme Temperature	Maximum temperature 113°F	Accident	Section 2.3.2
Solar Load (Insulation)	Horizontal flat surface insolation 2949.4 BTU/d Curved surface solar insolation 1474.7 BTU/day-ft²		
Snow and Ice	Snow Load 10 psf	Normal	Section 2.3.2.4
Dead Weigl	Yearly Temperature	Maximum Average 67.1 F	Normal	Section 2.3.2
Internal and External Pressure Loads	Per design basis for systems listed in Table 1-1	Normal	N/A
Design Basis Thermal Loads	Per design basis for systems listed in Table 1-1	Normal	N/A
Operating Loads	Per design basis for systems listed in Table 1-1	Normal	N/A
Live Loads	Per design basis for systems listed in Table 1-1	Normal	N/A

3 Day Average low temperature 17.6 F
3 Day Average high temperature 102.2 F

Table 1-2
Summary of WCS CISF Principal Design Criteria
(3 pages)

Design Parameter	Design Criteria	Condition	Applicable Codes, Standards and Basis
Radiological Protection	Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 Rem Public lens of eye ≤ 15 Rem	Accident	10 CFR 72.106
Radiological Protection	Public wholebody ≤ 25 mrem/yr (1) Public thyroid ≤ 75 mrem/yr(1) Public critical organ ≤ 25 mrem/yr(1)	Normal	10 CFR 72.104
Confinement	Per design basis for systems listed in Table 1-1	N/A	N/A
Nuclear Criticality	Per design basis for systems listed in Table 1-1	N/A	N/A
Decommissioning	Minimize potential contamination	Normal	10 CFR 72.130
Materials Handling and Retrieval Capability	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site	Normal	10 CFR 72.122(1)

Note:

1. In accordance with 10 CFR 72.104(3) limits include any other radiation from uranium fuel cycle operations within the region.

The normal temperature range for the WCS CISF is 44.1 degrees Fahrenheit to 81.5 degrees Fahrenheit (mean monthly temperature). The off-normal maximum and minimum temperature is 30.1 degrees Fahrenheit and 94.6 degrees Fahrenheit (mean daily temperature). The extreme temperature minimum is -1 degree Fahrenheit and the maximum is 113 degrees Fahrenheit (Table 2-2).

2.3.2.2 Extreme Winds

Regionally wind speeds are usually more moderate, although relatively strong winds often accompany occasional frontal activity during late winter and spring months and sometimes occur j
meters per second
than 22 meters pe

In addition to the temperature information provided in Table 2-2, temperature data from the Midland-Odessa monitoring station between January 1, 2000 and December 31, 2015 was used to provide the 3-day average ambient temperature (67.1), the 3-day extreme average low temperature (17.6), the 3 day maximum average high temperature (102.2).

Wind speed and d
from 2010 to 201
2-6, Figure 2-7, a
located on compact discs in Attachment A. The wind roses show the percent of the time (rings) that the wind blows from each of the 16 directions (N, NNE, NE, … NNW) by the length of the bars. The shading of the bars also indicates the frequency of occurrence of wind speeds within the wind speed classes shown on the figures. The on-site data indicates that for this period from 2010 to 2015 the average wind speed ranged from 6.07 knots to 10.53 knots. The wind direction is predominantly from the south. The diagrams indicate that wind gusts in excess of 22 mph generally blow from the southwest or northeast.

2.3.2.3 Tornado and Sever Weather Conditions

Two F2 Class (wind speed from 113 to 157 mph) tornadoes have been recorded in Andrews County, TX from 1950 through 2015 according to data reported by NOAA. NOAA reports there were eight F1 Class (wind speed 73 to 112 mph) tornadoes recorded in Andrews County since 1950. No F4 or F5 tornados have ever been reported in the vicinity of the WCS CISF.

Tornados are classified using the F-scale with classifications ranging from F0-F5 as follows:

- F0-classified tornados have winds of 64 to 116 kilometers per hour (40 to 72 miles per hour)
- F1-classified tornados have winds of 117 to 181 kilometers per hour (73 to 112 miles per hour)
- F2-classified tornados have winds of 182 to 253 kilometers per hour (113 to 157 miles per hour)
- F3-classified tornados have winds of 254 to 332 kilometers per hour (158 to 206 miles per hour)

Accident ambient temperature is considered as 113°F.

44.1°F to 81.5°F

30.1°F to 94.6°F

A.8.3 Ambient Conditions at the WCS CISF

A.8.3.1 Ambient Temperature Specification at WCS CISF

As specified in Table 1-2 the normal ambient temperature is considered in the range of ~~0°F to 110°F.~~ Off-normal ambient temperature is considered in the range of ~~-20°F to 120°F. Based on the discussion in Appendix M, Section M.4.5 of [A.8-2], the average daily ambient temperatures of 95°F and 105°F are considered for the normal and off-normal hot storage conditions, respectively in the thermal analyses. Ambient temperatures of 0°F and -20°F are considered for the normal and off-normal cold storage conditions, respectively in the thermal analyses.~~

A.8.3.2 Comparison of WCS CISF Ambient Conditions with Ambient Conditions Used in the Rancho Seco ISFSI SAR [A.8-3]

A review of the thermal evaluation presented in Section 8.1.1.1, Volume II of [A.8-3] shows that average daily ambient temperatures of 101°F and 117°F are used for normal and off-normal hot storage conditions, respectively. These temperatures bound the ~~daily average ambient~~ temperatures ~~of 95°F and 105°F~~ for normal and off-normal ~~conditions, respectively~~ at the WCS CISF. Similarly, the lowest off-normal ambient temperature evaluated for the WCS CISF is ~~-20°F, which is identical~~ to cold conditions considered in [A.8-3].

Based on this discussion, the ambient conditions used for the thermal evaluations for storage and transfer operations in [A.8-3] are bounding for the WCS CISF.

30.1°F and is bounded by the -20°F

and accident conditions

Accident ambient temperature is considered as 113°F.

44.1°F to 81.5°F

B.8.4 Ambient Conditions at the WCS CISF

30.1°F to 94.6°F

B.8.4.1 Ambient Temperature Specification at WCS CISF

As specified in Table 1-2, normal ambient temperature is considered in the range of ~~0°F to 110°F~~. Off-normal ambient temperature is considered in the range of ~~-20°F to 120°F. Based on the discussion in Section 4.1.2 of [B.8-1], the average daily ambient temperatures of 95°F and 105°F are considered for the normal and off-normal hot storage conditions, respectively in the thermal analyses. Ambient temperatures of 0°F and -20°F are considered for the normal and off-normal cold storage conditions, respectively in the thermal analyses.~~ corresponding to a maximum ambient temperatures of 101°F and 117°F

B.8.4.2 Comparison of WCS CISF Ambient Conditions with Ambient Conditions Used in the AHSM Thermal Evaluation from ANUH UFSAR [B.8-1] for Storage Conditions

INSERT-1

A review of the ambient temperatures used in the thermal evaluation of AHSM in Section 4.1.2 of [B.8-1] shows that average daily ambient temperatures of 97°F and 107°F are used for normal and off-normal hot storage conditions, respectively. These temperatures bound the ~~daily average~~ ambient temperatures ~~of 95°F and 105°F~~ for normal and off-normal conditions, ~~respectively~~ at the WCS CISF. Similarly, the lowest off-normal ambient temperature at the WCS CISF is ~~-20°F~~, which is bounded by the -40°F considered for the off-normal conditions as noted in Table 4.1-1 of [B.8-1].

30.1°F

Based on this discussion, the ambient conditions used for the thermal evaluations for storage operations in the thermal evaluation of AHSM in [B.8-1] are bounding for the WCS CISF.

B.8.4.3 Comparison of WCS CISF Ambient Conditions with Ambient Conditions Used in the Rancho Seco ISFSI SAR [B.8-4] for Transfer Conditions

A review of the thermal evaluation presented in Section 8.1.1.1, Volume II of [B.8-4] shows that average daily ambient temperatures of 101°F and 117°F are used for normal and off-normal hot storage conditions, respectively. These temperatures bound the ~~daily average~~ ambient temperatures ~~of 95°F and 105°F~~ for normal and off-normal conditions, respectively at the WCS CISF. Similarly, the lowest off-normal ambient temperature at the WCS CISF is ~~-20°F, which is identical to~~ cold conditions considered in [B.8-4].

and accident conditions

Based on this discussion, the ambient conditions used for the thermal evaluations for transfer operations in [B.8-4] are bounding for the WCS CISF.

30.1°F and is bounded by the -20°F

INSERT-1:
In addition, the accident ambient temperature of 113°F listed in Table 1-2 for the WCS CISF is the daily maximum ambient temperature. This is bounded by the daily maximum temperature of 117°F considered for the off-normal conditions.

C.8.4 Thermal Analysis of HSM Model 102 with 61BT DSC for Storage Conditions

As discussed in Section C.8.1, 61BT DSCs will be stored inside the HSM Model 102 at the WCS CISF. This configuration for storage operations is approved under CoC 1004 and a discussion on the thermal evaluation for this configuration is presented in Chapter K.4 of [C.8-3]. Because this configuration is previously approved, this section only presents a reconciliation of the ambient temperatures between [C.8-3] and the WCS CISF.

44.1°F to 81.5°F

C.8.4.1 Ambient Temperature Specification at WCS CISF

30.1°F to 94.6°F

As specified in Table 1-2, normal ambient temperature is considered in the range of ~~0°F to 110°F~~. Off-normal ambient temperature is considered in the range of ~~-20°F to 120°F. Based on the discussion in Appendix M, Section M.4.5 of [C.8-3], the average daily ambient temperatures of 95°F and 105°F are considered for the normal and off-normal hot storage conditions, respectively. Ambient temperatures of 0°F and -20°F are considered for the normal and off-normal cold storage conditions, respectively~~

Accident ambient temperature is considered as 113°F.

C.8.4.1.1 Comparison of WCS CISF Ambient Conditions with Ambient Conditions Used in the Standardized NUHOMS® UFSAR

A review of the thermal evaluation presented in Section K.4.4.1, Chapter K.4 of [C.8-3] shows that average daily ambient temperatures of 100°F and 125°F are used for normal and off-normal hot storage conditions, respectively. These temperatures bound the ~~daily average~~ ambient temperatures ~~of 95°F and 105°F~~ for normal ~~and~~ off-normal ~~conditions, respectively~~ at the WCS CISF. Similarly, the lowest off-normal ambient temperature at the WCS CISF is ~~-20°F, which~~ is bounded by the -40°F used in [C.8-3].

and accident conditions

Based on this discussion, the thermal evaluation for storage conditions presented in Chapter K.4 of [C.8-3] is bounding for the WCS CISF and no additional evaluations are performed. Sections C.8.4.2 through C.8.4.4 present the references to the appropriate section within [C.8-3] as it relates to the thermal evaluations performed for 61BT DSC and HSM Model 102 for storage conditions.

30.1°F and is

C.8.4.2 Thermal Model of HSM Model 102 with 61BT DSC

The HEATING7 thermal model of the HSM Model 102 is described in Section 8.1.3 of [C.8-3].

The three-dimensional ANSYS model of the 61BT DSC with a heat load of 18.3 kW is described in Appendix K, Section K.4.4.1 of [C.8-3].

The 61BT DSC model for accident analysis is based on the HSM model described in Section 8.1.3.1 of [C.8-3]. The accident analysis is performed with HSM vents totally blocked for 40 hours and with a maximum ambient steady state temperature of 125°F.

C.8.5 Thermal Analysis of MP197HB Cask with 61BT DSC for Transfer Operations

As discussed in Section C.8.1, the 61BT DSC will be transported to the WCS CISF under the NRC Certificate of Compliance No. 9302 [C.8-2]. Within the WCS CISF, the transfer operations i.e. movement of the canister from the MP197HB cask into the storage module will be performed under 10 CFR Part 72. This section presents the thermal evaluation for this on-site transfer operation.

C.8.5.1 Thermal Model of MP197HB Cask with 61BT DSC

The MP197HB cask in the transportation configuration is shown in the design drawings included in Section A.1.4.10.1, Chapter A.1 of [C.8-4]. The ANSYS model of the MP197HB cask is presented in Section A.3.3.1.1, Appendix A.3 of [C.8-4]. ANSYS 10.0 [C.8-5] is used for the MP197HB cask modeling and thermal analysis. This transportation model of the MP197HB cask is modified to replicate the transfer configuration of the MP197HB cask as follows:

- The impact limiters are removed
- Convection, insolation and radiation are applied on additional surfaces exposed to ambient as a result of removing the impact limiters
- Helium gas within the MP197HB cask/canister annulus is replaced with air during transfer operations. In addition, the internal sleeve of the MP197HB cask is considered to be painted white (see Note 5 of drawing MP197HB-71-1014 of [C.8-4]).

The thermal properties of the materials used in the analysis of the MP197HB cask with 61BT DSC in transfer mode are the same as those presented in Section A.3.2.1, Appendix A.3 of [C.8-4] except for the effective conductivity of the internal sleeve.

ANSYS 10.9 [C.8-5] is used for the MP197HB cask modeling and thermal analysis.

The effective thermal conductivity for the MP197HB cask inner sleeve with air gap in axial ($k_{eff,axl}$) and radial ($k_{eff,rad}$) directions is recalculated using the methodology described in Item 5, Section A.3.3.1.3 of [C.8-4]. Table below lists the effective thermal conductivity of inner sleeve of the MP197HB cask for transfer.

10.0

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Effective Thermal Conductivity of MP197HB Cask Inner Sleeve with Air Gap

Temperature (°F)	$k_{eff,axl}$ (Btu/hr-in-°F)	$k_{eff,rad}$ (Btu/hr-in-°F)
70	0.403	7.646
100	0.420	7.710
150	0.445	7.798
200	0.469	7.878
250	0.494	7.941
300	0.519	8.005
350	0.543	8.061
400	0.567	8.109

C.8.5.2 MP197HB Cask Thermal Model Results

Normal and Off-Normal Conditions:

For the WCS CISF, the off-normal transfer case with 120°F ambient temperature (105°F daily average temperature) bounds the normal transfer case with 110°F ambient (95°F daily average temperature). Therefore, only the off-normal transfer case is evaluated.

The maximum temperatures of the components of the MP197HB cask loaded with the 61BT DSC for transfer at the WCS CISF for off-normal ambient temperature of 120°F (105°F daily average temperature) are presented in the table below. Also listed for comparison are the maximum component temperatures of the MP197HB cask loaded with the 61BT DSC for transportation [C.8-4].

at an

As noted in Table 1-2, the maximum ambient temperature for normal and off-normal conditions are 81.5°F and 94.6°F, respectively. However, an ambient temperature of 105°F is conservatively used in the thermal evaluation for transfer operations at the WCS CISF.

Comparison of MP197HB Cask Component Maximum Temperatures for Transportation v/s Transfer of 61BT DSC

(1)

Transfer/Transportation Operation	Transportation MP197HB Cask with 61BT DSC[2] Normal T_{amb}=100°F	Transfer at WCS CISF MP197HB Cask with 61BT DSC ~~Off-normal T_{amb}=120°F[1]~~
Heat load	18.3 kW	18.3 kW
Component	T_{max}, °F	T_{max}, °F
Canister shell	365	386
Inner sleeve	286	260
Cask inner shell	284	248
Gamma shield	283	247
Outer shell	276	222
Shield shell	248	204
Cask lid	228	142
Cask bottom plate	277	166

1 – Daily ambient average temperature of 105°F is used for analysis.

2 – From Table A.3-8 of [C.8-4].

the WCS CISF

As seen from table above, the maximum MP197HB cask component temperatures for transfer at ~~120°F off-normal temperature (105°F daily average ambient temperature)~~ are below those for transportation at 100°F in the MP197HB cask. The maximum temperatures of the MP197HB cask components for the transfer case decreases compared to the transportation case due to the increased heat rejection from the MP197HB cask external surface to the ambient. This is due to the removal of impact limiters (which cover parts of MP197HB cask outside surface) and higher emissivity of white paint used on the inner surface of the MP197HB cask inner sleeve.

The maximum 61BT DSC shell temperature increases by 21°F. This increase is due to the use of air in the MP197HB cask/canister annulus versus the use of helium in the transportation case.

The maximum temperatures of the components of the MP197HB cask at the WCS CISF for normal and off-normal transfer conditions are listed in Table C.8-1.

Since the maximum 61BT DSC surface temperature for transfer is higher than the maximum 61BT DSC surface temperature for transportation, the 61BT DSC shell temperature profile from the MP197HB cask transfer evaluation is mapped to the 61BT DSC basket model described in Section K.4.4.1, Appendix K.4 of [C.8-3]. The results of this evaluation provide the maximum 61BT DSC basket component temperatures and the maximum SNF cladding temperature for off-normal conditions.

Table C.8-1
Maximum Temperature of MP197HB Cask Components for 61BT DSC Transfer at the WCS CISF

	Canister Heat Load 18.3 kW				
	Normal T_{amb}=~~0~~ °F	Normal T_{amb}=~~110~~ °F	Off-normal T_{amb}=~~-20~~ °F	Off-normal T_{amb}=~~120~~ °F	Accident[1] T_{amb}=~~120~~ °F
Component	T_{max}, °F				
Inner sleeve	44.1	<260	30.1	260	409
Cask inner shell		<248		248	413
Gamma shield		<247		247	508
Outer shell		<222		222	645
Shield shell		<204		204	1071
Cask lid		<142		142	367
Cask bottom plate		<166		166	309

1 – Bounded by value from Table A.3-19 of [C.8-4].

81.5 94.6 113

Maximum Temperature

Table C.8-2
NUHOMS® 61BT DSC Fuel Cladding and Canister Component Temperatures for Transfer in MP197HB Cask at the WCS CISF

	Normal Conditions			Off-Normal Conditions		Accident Conditions	
Component	Maximum Temperature[1] (°F)	Minimum Temperature[5] (°F)	Allowable Range (°F)	~~120 °F Ambient~~ (°F)	Allowable Range (°F)	Maximum Temperature[4] (°F)	Allowable Range (°F)
Canister Shell	<387	-20	[2]	387	[2]	<662	[2]
Basket Rails	<519	-20	[2]	519	[2]	<722	[2]
Fuel Compartment	<637	-20	[2]	637	[2]	<787	[2]
SNF Cladding	<658	-20	752[3]	658	752[3]	<809	1058[3]
Average Cavity Gas	<369	-20	N/A	369	N/A	<651	N/A

1 – Bounded by off-normal condition.

2 – The components perform their intended safety function within the operating range.

3 – From ISG-11, Revision 3 [C.8-6].

4 – Bounded by HSM blocked vent condition, Section K.4.6.5 [C.8-3].

5 – Assuming no credit for decay heat and a daily average ambient temperature of -20°F. The -20°F off-normal temperature is used to bound the 0°F normal temperature.

minimum

of 44.1°F listed in Table 1.2, Chapter 1.

ambient

D.8.4 Thermal Analysis of HSM Model 102 with Canister for Storage Conditions

As discussed in Section D.8.1, NUHOMS® 61BTH Type 1 DSC will be stored inside the HSM Model 102 at the WCS CISF. This configuration for storage operations is approved under CoC 1004 and a discussion on the thermal evaluation for this configuration is presented in Chapter T.4 of [D.8-3]. Because this configuration is previously approved, this section only presents a reconciliation of the ambient temperatures between [D.8-3] and the WCS CISF.

44.1°F to 81.5°F

30.1°F to 94.6°F

D.8.4.1 Ambient Temperature Specification at WCS CISF

As specified in Table 1-2, normal ambient temperature is considered in the range of ~~0°F to 110°F~~. Off-normal ambient temperature is considered in the range of ~~-20°F to 120°F~~. ~~Based on the discussion in Appendix M, Section M.4.5 of [D.8-3], the average daily ambient temperatures of 95°F and 105°F are considered for the normal and off-normal hot storage conditions, respectively. Ambient temperatures of 0°F and -20°F are considered for the normal and off-normal cold storage conditions, respectively~~

Accident ambient temperature is considered as 113°F.

D.8.4.1.1 Comparison of ~~WCS CISF Ambient Conditions with Ambient Conditions Used in the~~ Standardized NUHOMS® UFSAR

As described in Chapter T.4, Section T.4.4 of [D.8-3], the thermal evaluation for HSM is presented in Section 8.1.3 of [D.8-3]. A review of the thermal evaluation presented in Section 8.1.3 of [D.8-3] shows that average daily ambient temperatures of 100°F and 125°F are used for normal and off-normal hot storage conditions, respectively. These temperatures bound the ~~daily average~~ ambient temperatures ~~of 95°F and 105°F~~ for normal ~~and~~ off-normal ~~conditions, respectively~~ at the WCS CISF. Similarly, the lowest off-normal ambient ~~temperature~~ at the WCS CISF is ~~-20°F, which is~~ bounded by the ~~-40°F~~ used in [D.8-3].

,

and accident conditions

30.1°F and is

Based on this discussion, the thermal evaluation for storage conditions presented in Chapter T.4 of [D.8-3] is bounding for the WCS CISF and no additional evaluations are performed. Sections D.8.4.2 through D.8.4.5 present the references to the appropriate section within [D.8-3] as it relates to the thermal evaluations performed for NUHOMS® 61BTH Type 1 DSC and HSM Model 102 for storage conditions.

D.8.4.2 Thermal Model of HSM Model 102 with 61BTH Type 1 DSC

The HEATING7 thermal model of the HSM Model 102 is described in Section 8.1.3 of [D.8-3].

The three-dimensional ANSYS model of the 61BTH Type 1 DSC with a heat load of 22.0 kW is described in Section T.4.6.2, Appendix T of [D.8-3]. Section T.4.6 of [D.8-3] presents a thermal analysis for the 61BTH Type 1 DSC.

As noted in Table 1-2, the maximum ambient temperature for normal and off-normal conditions are 81.5°F and 94.6°F, respectively. However, an ambient temperature of 105°F is conservatively used in the thermal evaluation for transfer operations at the WCS CISF.

D.8.5.2 MP197HB TC Thermal Model Results (Normal and Off-Normal Conditions):

For the WCS CISF, the off-normal transfer case with 120°F ambient temperature (105°F daily average temperature) bounds the normal transfer case with 110°F ambient (95°F daily average temperature). Therefore, only the off-normal transfer case is evaluated.

at an

The maximum temperatures of the components of the MP197HB cask loaded with the 61BTH Type 1 DSC for transfer at the WCS CISF for off-normal ambient temperature of 120°F (105°F daily average temperature) are presented in the table below. Also listed for comparison are the maximum component temperatures of the MP197HB cask loaded with the 61BTH Type 1 DSC for normal transportation condition [D.8-4].

Comparison of MP197HB TC Component Maximum Temperatures for Transportation v/s Transfer of 61BTH Type 1 DSC

Transfer/Transportation Operation	Transportation MP197HB TC with 61BTH Type 1 DSC[2] Normal T_{amb}=100°F	Transfer MP197HB TC with 61BTH Type 1 DSC Off-normal T_{amb}=120°F[1]
Heat load	22 kW	22 kW
Component	T_{max}, °F	T_{max}, °F
Canister shell	406	423
Inner sleeve	317	286
Cask inner shell	315	272
Gamma shield	314	271
Outer shell	306	242
Shield shell	272	221
Cask lid	248	146
Cask bottom plate	307	175

(1)

1 – Daily ambient average temperature of 105°F is used for analysis as described in Section D.8.4.1.

2 – From Table A.3-8 of [D.8-4].

the WCS CISF

As seen from the table above, the maximum MP197HB cask component temperatures for transfer at 120°F off-normal ambient temperature (105°F daily average ambient temperature) are below the maximum component temperatures for transportation at 100°F. The maximum temperature of the MP197HB cask components for the transfer case decrease compared to the transportation case due to the increased heat rejection from the TC external surface to the ambient. This is due to the removal of impact limiters (which cover parts of MP197HB cask outside surface) and higher emissivity of white paint used on the internal surface of the MP197HB cask inner sleeve.

Table D.8-1
Maximum Temperatures of MP197HB TC Components for 61BTH Type 1
DSC Transfer at the WCS CISF

	DSC Heat Load 22 kW				
	Normal T_{amb}=0°F	Normal T_{amb}=110°F	Off-normal T_{amb}=-20°F	Off-normal T_{amb}=120°F	Accident[1] T_{amb}=120°F
Component	T_{max}, °F				
Inner sleeve	<286		286	409	
Cask inner shell	<272		272	413	
Gamma shield	<271		271	508	
Outer shell	<242		242	645	
Shield shell	<221		221	107	
Cask lid	<146		146	367	
Cask bottom plate	<175		175	309	

1 – Bounded by values from Table A.3-19 of [D.8-4].

44.1 81.5 30.1 94.6 113

Table D.8-2
NUHOMS® 61BTH Type 1 DSC Fuel Cladding and DSC Component Temperatures for Transfer in MP197HB TC at the WCS CISF

	Normal Conditions			Off-Normal Conditions		Accident Conditions	
Component	Maximum Temperature[1] (°F)	Minimum Temperature[5] (°F)	Allowable Range (°F)	Maximum Temperature (°F)	Allowable Range (°F)	Maximum Temperature[4] (°F)	Allowable Range (°F)
Canister Shell	<424	-20	[2]	424	[2]	<467	[2]
Top Grid	<426	-20	[2]	426	[2]	<531	
Basket Rails	<562	-20	[2]	562	[2]	<609	[2]
Neutron Absorber	<682	-20	[2]	682	[2]	<727	
Fuel Compartment	<683	-20	[2]	683	[2]	<727	[2]
Fuel Cladding	<706	-20	752[3]	706	752[3]	<749	1058[3]
Average Cavity Gas Temperature	<489	NA	NA	489	NA	<550[6]	NA

1 – Bounded by off-normal condition.

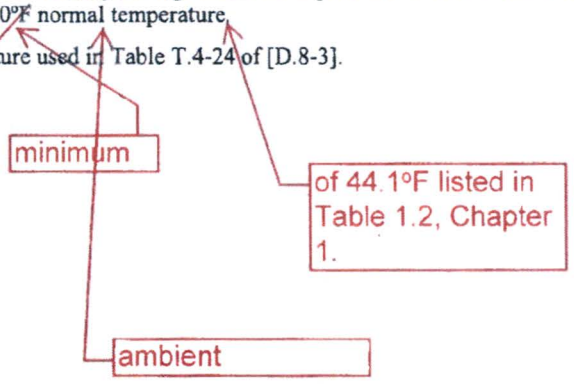
2 – The components perform their intended safety function within the operating range.

3 – From ISG-11, Revision 3 [D.8-6].

4 – Bounded by accident transfer condition in OS197 TC. See Table 4-21 and Table 4-22 of [D.8-3].

5 – Assuming no credit for decay heat and a daily average ambient temperature of -20°F. The -20°F off-normal temperature is used to bound the 0°F normal temperature.

6 – Design basis average He temperature used in Table T.4-24 of [D.8-3].



E.8.1 Connecticut Yankee MPC, Yankee Rowe MPC, and La Crosse MPC

Reference E.8-1 provides the thermal evaluations used to determine the limiting environmental conditions (thermal) for the use of the CY-MPC, Yankee-MPC, and MPC-LACBWR. The following are those limiting thermal environmental conditions.

E.8.1.1 Maximum Average Yearly Ambient Temperature

For the CY-MPC, Yankee-MPC, and MPC-LACBWR, the maximum average yearly temperature allowed is 75°F. The average yearly temperature for the site is conservatively bounded by using the maximum average annual temperature in the 48 contiguous United States, of 75°F. This temperature meets the normal condition thermal boundary defined in NUREG-1536. Therefore, no further WCS site-specific evaluations are required.

E.8.1.2 Maximum Average 3-Day Ambient Temperature

The maximum average 3-day ambient temperature allowed is 100°F for the CY-MPC and the Yankee-MPC. The maximum average 3-day ambient temperature allowed for the MPC-LACBWR is 105°F. These limits bound the WCS facility maximum average 3-day ambient temperature 94.6°F. Therefore, no further site-specific evaluations are needed.

E.8.1.3 Maximum Extreme 3-Day Ambient Temperature Range

For the CY-MPC, Yankee-MPC, and MPC-LACBWR, the maximum allowed temperature extremes, averaged over a 3-day period, shall be greater than -40°F and less than 125°F. This bounds the WCS facility maximum 3-day average temperature extremes of ~~30.1°F and 113°F~~ 17.6°F and 102.2°F. No further site-specific evaluations are needed.

F.8.1 Maine Yankee

Chapter 4 of the NAC-UMS Final Safety Analysis Report (FSAR), Reference F.8.2-1, presents the thermal design conditions, the allowable component temperatures and the thermal evaluations for the operation of the NAC-UMS spent fuel storage system. The established bounding thermal environmental conditions are summarized in FSAR Table 4.1-1. The maximum allowable component material temperatures are tabulated in FSAR Table 4.1-3. The bounding thermal environmental conditions are described in the following paragraphs.

F.8.1.1 Maximum Average Yearly Ambient Temperature

This is a long-term storage condition that is analyzed in FSAR Section 4.4. The maximum average yearly ambient design temperature for the NAC-UMS is 76°F. The average yearly temperature for the site is conservatively bounded by using the maximum average annual temperature in the 48 contiguous United States, of 76°F. This temperature meets the normal condition thermal boundary defined in NUREG-1536. Therefore, no further WCS site-specific evaluations are required.

F.8.1.2 Maximum Average 3-Day Ambient Temperature

This is an off-normal severe heat condition that is analyzed in FSAR Section 11.1.1. The maximum average 3-day ambient temperature for the NAC-UMS is 106°F. This temperature bounds the WCS facility maximum average 3-day ambient temperature of 94.6°F. Therefore, no further site-specific evaluations are needed.

F.8.1.3 Maximum Extreme 3-Day Ambient Temperature

This is an extreme heat accident condition that is analyzed in FSAR Section 11.2.7. ~~The maximum extreme 3-day ambient temperature for the NAC-UMS is 133°F.~~ This bounds the WCS facility maximum 3-day average temperature extreme of ~~113°F~~ 17.6°F and 102.2°F. No further site-specific evaluations are needed.

For the NAC-UMS, the maximum allowed temperature extremes, average over a 3-day period, shall be greater than -40°F and less than 133°F.

G.8.1 Undamaged and Damaged PWR Fuel

Chapter 4 of Reference G.8-1 provides the thermal analyses used evaluate the thermal performance of the MAGNASTOR system. The limiting environmental conditions (thermal) used in these evaluations are presented and compared to WCS site specific conditions in the following sections. Additionally, surveillance requirements used to ensure the concrete cask heat removal system is operable are presented.

G.8.1.1 Maximum Average Yearly Ambient Temperature

For the MAGNASTOR system, the maximum average yearly temperature allowed is 76°F. The the average yearly temperature for the site is conservatively bounded by using the maximum average annual temperature in the 48 contiguous United States, of 75.6°F. This temperature meets the normal condition thermal boundary defined in NUREG-1536. Therefore, no further WCS site-specific evaluations are required.

G.8.1.2 Maximum Average 3-Day Ambient Temperature

The maximum average 3-day ambient temperature allowed is 106°F for the MAGNASTOR system. This temperature bounds the WCS facility maximum average 3-day ambient temperature of 94.6°F. Therefore, no further site-specific evaluations are needed.

G.8.1.3 Maximum Extreme 3-Day Ambient Temperature Range

For the MAGNASTOR system, the maximum allowed temperature extremes, averaged over a 3-day period, shall be greater than -40°F and less than 133°F. This bounds the WCS facility maximum 3-day average temperature extreme of ~~30.1°F and 113°F~~ 17.6°F and 102.2°F. No further site-specific evaluations are needed.

G.8.1.4 Thermal Performance Surveillance Requirements

For the MAGNASTOR system, in order to confirm that the concrete cask heat removal system is operable, one of the following two surveillance options with a frequency of 24 hours is required:

1. Visually verify all concrete cask air inlet and outlet screens are free of blockage.

2. Verify the difference between the concrete cask air outlet average temperature and the ambient temperature is less than 119°F for the PWR concrete cask configurations CC1, CC2, and CC4 or less than 134°F for PWR concrete cask configuration CC3.

Table 1-2
Summary of WCS CISF Principal Design Criteria
(3 pages)

Design Parameter	Design Criteria	Condition	Applicable Codes, Standards and Basis
Type of fuel	Commercial, light water reactor spent fuel	Normal	N/A
Storage Systems	Transportable canisters and storage overpacks docketed by the NRC	Normal	See Table 1-1
Fuel Characteristics	Criteria as specified in previously approved CoCs and licenses for included systems	Normal	See Table 1-1
Tornado (Wind Load)	Max translational speed: 40 mph Max rotational speed: 160 mph Max tornado wind speed: 200 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 0.9 psi Rate of pressure drop: 0.4 psi/sec	Accident	Reg Guide 1.76 [1-5] NUREG-800[1-6]
Tornado (Missile)	Automobile 4000 lb, 112 ft/s Schedule 40 Pipe 287 lb, 112 ft/s Solid Steel Sphere 0.147 lb, 23 ft/s	Accident	NUREG-800[1-7]
Floods	Flood height 1.1 in Water velocity 1.7 ft/s	Accident	Section 2.4.2.2
Seismic (Ground Motion)	Site-specific ground-surface uniform hazard response spectra (UHRS) with 1E-4 annual frequency of exceedance (AFE) having peak ground acceleration (PGA) of 0.250 g horizontal and 0.175 g vertical. (Table 1-5 and Figure 1-5)	Accident	AECON Study Number WCS-12-05-100-001[1-10]
Vent Blockage	For NUHOMS® Systems: Inlet and outlet vents blocked 40 hrs For MPC and UMS Systems: Inlet and outlet vents blocked 24 hrs For MAGNASTOR Systems: Inlet vents blocked 58 hrs	Accident	N/A
Fire/Explosion	For NUHOMS® Systems: Equivalent fire 300 gallons of diesel fuel For Vertical Systems: Equivalent fire 50 gallons of fuel	Accident	N/A

Table 1-2
Summary of WCS CISF Principal Design Criteria
(3 pages)

Design Parameter	Design Criteria	Condition	Applicable Codes, Standards and Basis
Type of fuel	Commercial, light water reactor spent fuel	Normal	N/A
Storage Systems	Transportable canisters and storage overpacks docketed by the NRC	Normal	See Table 1-1
Fuel Characteristics	Criteria as specified in previously approved CoCs and licenses for included systems	Normal	See Table 1-1
Tornado (Wind Load)	Max translational speed: 40 mph Max rotational speed: 160 mph Max tornado wind speed: 200 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 0.9 psi Rate of pressure drop: 0.4 psi/sec	Accident	Reg Guide 1.76 [1-5] NUREG-800[1-6]
Tornado (Missile)	Automobile 4000 lb, 112 ft/s Schedule 40 Pipe 287 lb, 112 ft/s Solid Steel Sphere 0.147 lb, 23 ft/s	Accident	NUREG-800[1-7]
Floods	Flood height 1.1 in Water velocity 1.7 ft/s	Accident	Section 2.4.2.2
Seismic (Ground Motion)	Site-specific ground-surface uniform hazard response spectra (UHRS) with 1E-4 annual frequency of exceedance (AFE) having peak ground acceleration (PGA) of 0.250 g horizontal and 0.175 g vertical. (Table 1-5 and Figure 1-5)	Accident	AECON Study Number WCS-12-05-100-001[1-10]
Vent Blockage	For NUHOMS® Systems: Inlet and outlet vents blocked 40 hrs For MPC and UMS Systems: Inlet and outlet vents blocked 24 hrs For MAGNASTOR Systems: Inlet vents blocked 58 hrs	Accident	N/A
Fire/Explosion	For NUHOMS® Systems: Equivalent fire 300 gallons of diesel fuel For Vertical Systems: Equivalent fire 50 gallons of fuel	Accident	N/A

Table 1-2
Summary of WCS CISF Principal Design Criteria
(3 pages)

Design Parameter	Design Criteria	Condition	Applicable Codes, Standards and Basis
Cask Drop	For NUHOMS® Systems: Transfer Cask Horizontal side drop or slap down 80 inches VCCs for MPC Systems: Drop height 6 inches VCCs for UMS and MAGNASTOR Systems: Drop height 24 inches	Accident	N/A
Transfer Load	For NUHOMS® Systems only: Normal insertion load 60 kips Normal extraction load 60 kips	Normal	NA
Transfer Load	For NUHOMS® Systems only: Maximum insertion load 80 kips Maximum extraction load 80 kips	Off-Normal/ Accident	N/A
Ambient Temperatures	Normal temperature 44.1 – 81.5°F 3 Day Average 67.1°F	Normal	Section 2.3.2
Off-Normal Temperature	Minimum temperature 30.1°F Maximum temperature 94.6°F	Off-Normal	Section 2.3.2
Extreme Temperature	Maximum temperature 113°F 3 Day Average low temperature 17.6°F 3 Day Average high temperature 102.2°F	Accident	Section 2.3.2
Yearly Temperature	Maximum Average 67.1°F	Normal	Section 2.3.2
Solar Load (Insolation)	Horizontal flat surface insolation 2949.4 BTU/day-ft^2 Curved surface solar insolation 1474.7 BTU/day-ft^2	Normal	10 CFR Part 71
Snow and Ice	Snow Load 10 psf	Normal	Section 2.3.2.4
Dead Weight	Per design basis for systems listed in Table 1-1	Normal	N/A
Internal and External Pressure Loads	Per design basis for systems listed in Table 1-1	Normal	N/A
Design Basis Thermal Loads	Per design basis for systems listed in Table 1-1	Normal	N/A
Operating Loads	Per design basis for systems listed in Table 1-1	Normal	N/A
Live Loads	Per design basis for systems listed in Table 1-1	Normal	N/A

Table 1-2
Summary of WCS CISF Principal Design Criteria
(3 pages)

Design Parameter	Design Criteria	Condition	Applicable Codes, Standards and Basis
Radiological Protection	Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 Rem Public lens of eye ≤ 15 Rem	Accident	10 CFR 72.106
Radiological Protection	Public wholebody ≤ 25 mrem/yr [1] Public thyroid ≤ 75 mrem/yr[1] Public critical organ ≤ 25 mrem/yr[1]	Normal	10 CFR 72.104
Confinement	Per design basis for systems listed in Table 1-1	N/A	N/A
Nuclear Criticality	Per design basis for systems listed in Table 1-1	N/A	N/A
Decommissioning	Minimize potential contamination	Normal	10 CFR 72.130
Materials Handling and Retrieval Capability	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site	Normal	10 CFR 72.122(1)
Cask Handling Building	Structural system prevents massive building collapse of building structures or the dropping of heavy objects as a result of building structural failure on the spent fuel, high-level radioactive waste, or GTCC waste or onto other ITS SSCs.	Accident	10 CFR 72.122(b)(2)(ii)

Note:

1. In accordance with 10 CFR 72.104(a)(3) limits include any other radiation from uranium fuel cycle operations within the region.

The normal temperature range for the WCS CISF is 44.1 degrees Fahrenheit to 81.5 degrees Fahrenheit (mean monthly temperature). The off-normal maximum and minimum temperature is 30.1 degrees Fahrenheit and 94.6 degrees Fahrenheit (mean daily temperature). The extreme temperature minimum is -1 degree Fahrenheit and the maximum is 113 degrees Fahrenheit (Table 2-2). In addition to the temperature information provided in Table 2-2, temperature data from the Midland-Odessa monitoring station between January 1, 2000 and December 31, 2015 was used to provide 3-day average ambient temperature (67.1), the 3-day extreme average low temperature (17.6), the 3-day maximum average high temperature (102.2).

2.3.3.2 Extreme Winds and Atmospheric Stability

Regionally wind speeds are usually more moderate, although relatively strong winds often accompany occasional frontal activity during late winter and spring months and sometimes occur just in advance of thunderstorms. Frontal winds may exceed 13 meters per second (30 miles per hour) for several hours and reach peak speeds of more than 22 meters per second (50 miles per hour).

Wind speed and direction data measured at the on-site WCS meteorological stations from 2010 to 2015 is shown on wind rose diagrams in Figure 2-4, Figure 2-5, Figure 2-6, Figure 2-7, and Figure 2-8. The data used to create the wind rose diagrams is located on compact discs in Attachment A. The wind roses show the percent of the time (rings) that the wind blows from each of the 16 directions (N, NNE, NE, NNW) by the length of the bars. The shading of the bars also indicates the frequency of occurrence of wind speeds within the wind speed classes shown on the figures. The on-site data indicates that for this period from 2010 to 2015 the average wind speed ranged from 6.07 knots to 10.53 knots. The wind direction is predominantly from the south. The diagrams indicate that wind gusts in excess of 22 mph generally blow from the southwest or northeast.

The neighboring NEF site analyzed wind speed and direction from the Midland-Odessa First Order weather station for the years 1987 to 1991. Calculated annual mean wind speed was 5.1 meters per second (11.4 miles per hour), with prevailing winds from the south and a maximum 5-second wind speed of 31.2 meters per second (70 miles per hour). The Pasquill stability classes range from A to F, with the most stable classes – E and F – occurring 18.9 and 13 atmospheric percent of the time, respectively. The least stable classes, A and B, occur 0.3 and 3.5 percent of the time, respectively. NEF compared this data against data generated at WCS from October 1999 through August 2002, and found similar wind patterns and distribution of wind speed between Midland-Odessa and WCS locations (EIS for NEF, 2005).

8.3 Thermal Assessment

Section 8.4 provides the reference to the appropriate Appendix for each authorized canister/cask system listed in the Technical Specifications [8-1] as acceptable for storage at the WCS CISF. Each Appendix then provides reference to the applicable design/licensing basis thermal analysis bounding the conditions of operations and storage at the WCS CISF.

WCS has considered the effects of other factors on the thermal assessment, such as cask spacing, elevation, and wind speed.

Effects from Cask Spacing

The proposed Technical Specifications for NAC vertical storage systems have minimum spacing requirements which assure allowable thermal limits are not exceeded at the WCS CISF for those storage systems

Elevation Effects

Elevation effects on the NUHOMS® Systems, have been previously evaluated in response to RAI 4-10 from NRC on the application for Amendment 10 application for the CoC 1004 license and have been reviewed by the staff. As shown in the response to RAI 4-10 [8-3], there is no effect on the NUHOMS® System up to an elevation of 5,000ft. As noted in WCS SAR Chapter 2, the WCS CISF is at an elevation of about 3,500 ft. Since the elevation at the WCS CISF is lower than those previously evaluated for the NUHOMS® System, no further evaluation was performed.

NAC's storage systems are aboveground ventilated vertical cask designs, which are comparable in design to the aboveground ventilated vertical cask design evaluated in NUREG-2174, "Impacts of variation in Environmental Conditions on the Thermal Performance of Dry Storge casks". According to NUREG-2174, Section 4.8.4, Paragraph 3, "...the PCT increases by about 6° K (11°F) for every 500 m (1640.5 ft) of increased elevation". Since the WCS facility is at an elevation of approximately 3500 ft. and based on the results shown in NUREG-2174, it is expected the PCT for an aboveground ventilated vertical cask would increase by approximately 23.5°F compared to sea level.

The evaluations using storage design basis heat loads for Yankee-MPC, CY-MPC, and MPC-LACBWR canisters demonstrate that at sea level the margin between the peak clad temperature (PCT) and the long-term allowable is approximately 81°F, 123°F, and 357°F, respectively. Therefore, the effect of elevation (i.e., 23.5°F increase) is within the margin for each canister type.

The elevation using the storage design basis heat load for the NAC-UMS loaded with PWR fuel demonstrates that at sea level the margin between the PCT and the long-term allowable is approximately 104°F. Therefore, the effect of elevation (i.e., 23.5°F increase) is within the margin.

The evaluation using the storage design basis heat load for the NAC-MAGNASTOR loaded with PWR fuel demonstrates that at sea level the margin between the PCT and the long-term allowable is approximately 34°F. Therefore, the effect of elevation (i.e., 23.5°F increase) is within the margin. It is important to note that this margin is based on a significantly higher PWR storage heat load of 35.5 kW than would be allowed at the WCS facility. In order for a NAC-MAGNASTOR canister to be shipped to the WCS facility it must be below the maximum permissible heat load of the MAGNATRAN transportation cask, which is 23kW for PWR fuel. This is a design basis storage canister heat load reduction of approximately 35% prior to transportation. Applying this reduction to the design basis storage PCT would increase the margin to approximately 262°F (i.e., [752 - (718°F X 0.65)] – 23.5°F = 262°F). Therefore, the effect of elevation for a NAC-MAGNASTOR PWR canister that was previously in dry storage and subsequently shipped and placed back into storage at the WCS facility is not significant.

The Effect of Low Speed Wind

1 Standardized NUHOMS® System

According to NUREG-2174, wind does not have any significant effect on the thermal performance of Standardized NUHOMS® Systems. Therefore, no additional analyses are needed for low wind speed.

2 Advanced NUHOMS® Systems

According to NUREG-2174, a wind evaluation should be included for Advanced NUHOMS® Systems (AHSM) when there is not sufficient margin.

Advanced NUHOMS® System is considered for storage in Appendix B.8. The maximum fuel cladding temperature for thermal evaluations presented in Appendix B.8 has a significant margin to the fuel cladding temperature limit.

The maximum fuel cladding temperature for normal storage operations is 618°F (Table 4.4-7 of CoC 1029 UFSAR). As noted in Section B.8.5.2, thermal evaluation for AHSM was based on a heat load of 24kW compared to the maximum allowed head load of 14.0kW, providing sufficient margin. Therefore, no additional analyses are needed for low wind speed.

3 NAC Vertical Storage Systems

NAC's spent fuel storage cask designs are vertical-ventilated aboveground systems (i.e., the NAC-MPC, NAC-UMS, and NAC-MAGNASTOR systems). All of these systems have four air-inlet and four air-outlet vents. They are similar in design to the vertical-ventilated aboveground storage system evaluated for low wind speed in NUREG-2174. As concluded in the NUREG, the maximum fuel cladding temperature for the evaluated vertical-ventilated aboveground system with four air-inlet and four air-outlet vents was lower when subjected to a low wind speed scenario versus a no wind speed scenario. Therefore, the results and conclusion of the NUREG are applicable to NAC's storage systems and the effects of low wind speed on NAC's systems would result in lower maximum fuel cladding temperature. Therefore no additional analyses are need for low wind speed.

Based on the assessment of cask spacing, elevation and wind speed, no thermal analysis required beyond that documented in the Appendices for each system identified in Section 8.4.

8.4 Thermal Analysis

Section 2.1 of the Technical Specifications [8-1] lists the canisters authorized for storage at the WCS CISF. Table 8-1 provides the cross reference to the applicable appendix and section for each canister/storage overpack where the thermal evaluation is discussed. Table 8-2 compares the maximum ambient temperatures at the WCS site with the equivalent maximum ambient temperatures in Appendices A-G. Note that some ambient temperatures, where designated, are based on 3-day average high temperatures. Based on the Table 8-2 and the revised application, no new evaluations are performed for the various systems, because the existing analyses bound the ambient temperatures at the WCS CISF.

8.5 References

8-1 Proposed SNM-1050, WCS Interim Storage Facility Technical Specifications, Amendment 0.

8-2 "Post Transport Package Evaluation," QP-10.02, Revision 1.

8-3 Letter from Robert Grubb (TN) to NRC Document Control Desk, "Revision 1 to Transnuclear, Inc. (TN) Application for Amendment 10 to the Standardized NUHOMS® System (Docket No. 72-1004; TAC NO. L24052)," November 7, 2007 (E-25506) ML073180235.

Table 8-2 Maximum Ambient Temperatures for Section 8 of all WCS SAR Appendices

	Normal (°F)	**Off-Normal (°F)**	**Accident (°F)**
WCS CISF (Chapter 1, Table 1-2)	81.5°F	94.6°F	113°F
	Normal (°F)	**Off-Normal (°F)**	**Accident (°F)**
Appendix A.8	101°F	117°F	Bounded by Off-Normal
Appendix B.8	104°F	117°F	Bounded by Off-Normal
Appendix C.8	100°F	125°F (Storage) 105°F (Transfer)	Bounded by Off-Normal (Storage)
Appendix D.8	100°F	125°F (Storage) 105°F (Transfer)	Bounded by Off-Normal (Storage
WCS CISF (Chapter 1, Table 1-2)	3-Day Avg 67.1°F Maximum Yearly Avg 67.1°F	94.6°F	3-Day Avg low temperature 17.6°F 3-Day Avg high temperature 102.2°F
Appendix E.8	Maximum yearly Avg 75°F	3-Day Avg 100°F (Yankee-MPC & CY-MPC) 3-Day Avg 105°F (MPC-LACBWR)	3-Day Avg low Temperature 40°F 3-Day Avg high temperature 125°F
Appendix F.8	Maximum yearly Avg 76°F	3-Day Avg 106°F	3-Day Avg low temperature -40°F 3-Day Avg high temperature 133°F
Appendix G.8	Maximum Yearly Avg 76°F	3-Day Avg 106°F	3-Day Avg low temperature -40°F 3-Day Avg high temperature 133°F

A.8.3 Ambient Conditions at the WCS CISF

A.8.3.1 Ambient Temperature Specification at WCS CISF

As specified in Table 1-2 the normal ambient temperature is considered in the range of 44.1°F to 81.5°F. Off-normal ambient temperature is considered in the range of 30.1°F to 94.6°F. Accident ambient temperature is considered as 113°F.

A.8.3.2 Comparison of WCS CISF Ambient Conditions with Ambient Conditions Used in the Rancho Seco ISFSI SAR [A.8-3]

A review of the thermal evaluation presented in Section 8.1.1.1, Volume II of [A.8-3] shows that average daily ambient temperatures of 101°F and 117°F are used for normal and off-normal hot storage conditions, respectively. These temperatures bound the temperatures for normal, off-normal, and accident conditions at the WCS CISF. Similarly, the lowest off-normal ambient temperature evaluated for the WCS CISF is 30.1°F and is bounded by the -20°F cold conditions considered in [A.8-3].

Based on this discussion, the ambient conditions used for the thermal evaluations for storage and transfer operations in [A.8-3] are bounding for the WCS CISF.

B.8.4 Ambient Conditions at the WCS CISF

B.8.4.1 Ambient Temperature Specification at WCS CISF

As specified in Table 1-2, normal ambient temperature is considered in the range of 44.1°F to 81.5°F. Off-normal ambient temperature is considered in the range of 30.1°F to 94.6°F. Accident ambient temperature is considered as 113°F.

B.8.4.2 Comparison of WCS CISF Ambient Conditions with Ambient Conditions Used in the AHSM Thermal Evaluation from ANUH UFSAR [B.8-1] for Storage Conditions

A review of the ambient temperatures used in the thermal evaluation of AHSM in Section 4.1.2 of [B.8-1] shows that average daily ambient temperatures of 97°F and 107°F corresponding to a maximum ambient temperatures of 10°F and 117°F are used for normal and off-normal hot storage conditions, respectively. These temperatures bound the ambient temperature for normal and off-normal conditions at the WCS CISF. In addition, the accident ambient temperature of 113°F listed in Table 1-2 for the WCs CISF is the daily maximum ambient temperature. This is bounded by the daily maximum temperature of 117°F considered for the off-normal conditions. Similarly, the lowest off-normal ambient temperature at the WCS CISF is 30.1°F, which is bounded by the -40°F considered for the off-normal conditions as noted in Table 4.1-1 of [B.8-1].

Based on this discussion, the ambient conditions used for the thermal evaluations for storage operations in the thermal evaluation of AHSM in [B.8-1] are bounding for the WCS CISF.

B.8.4.3 Comparison of WCS CISF Ambient Conditions with Ambient Conditions Used in the Rancho Seco ISFSI SAR [B.8-4] for Transfer Conditions

A review of the thermal evaluation presented in Section 8.1.1.1, Volume II of [B.8-4] shows that average daily ambient temperatures of 101°F and 117°F are used for normal and off-normal hot storage conditions, respectively. These temperatures bound the ambient temperatures for normal, off-normal, and accident conditions, respectively at the WCS CISF. Similarly, the lowest off-normal ambient temperature at the WCS CISF is 30.1°F and is bounded by the -20°F cold conditions considered in [B.8-4].

Based on this discussion, the ambient conditions used for the thermal evaluations for transfer operations in [B.8-4] are bounding for the WCS CISF.

C.8.4 Thermal Analysis of HSM Model 102 with 61BT DSC for Storage Conditions

As discussed in Section C.8.1, 61BT DSCs will be stored inside the HSM Model 102 at the WCS CISF. This configuration for storage operations is approved under CoC 1004 and a discussion on the thermal evaluation for this configuration is presented in Chapter K.4 of [C.8-3]. Because this configuration is previously approved, this section only presents a reconciliation of the ambient temperatures between [C.8-3] and the WCS CISF.

C.8.4.1 Ambient Temperature Specification at WCS CISF

As specified in Table 1-2, normal ambient temperature is considered in the range of 44.1°F to 81.5°F. Off-normal ambient temperature is considered in the range of 30.1°F to 94.6°F. Accident ambient temperature is considered as 113°F.

C.8.4.1.1 Comparison of WCS CISF Ambient Conditions with Ambient Conditions Used in the Standardized NUHOMS® UFSAR

A review of the thermal evaluation presented in Section K.4.4.1, Chapter K.4 of [C.8-3] shows that average daily ambient temperatures of 100°F and 125°F are used for normal and off-normal hot storage conditions, respectively. These temperatures bound the ambient temperatures for normal, off-normal, and accident conditions at the WCS CISF. Similarly, the lowest off-normal ambient temperature at the WCS CISF is 30.1°F and is bounded by the -40°F used in [C.8-3].

Based on this discussion, the thermal evaluation for storage conditions presented in Chapter K.4 of [C.8-3] is bounding for the WCS CISF and no additional evaluations are performed. Sections C.8.4.2 through C.8.4.4 present the references to the appropriate section within [C.8-3] as it relates to the thermal evaluations performed for 61BT DSC and HSM Model 102 for storage conditions.

C.8.4.2 Thermal Model of HSM Model 102 with 61BT DSC

The HEATING7 thermal model of the HSM Model 102 is described in Section 8.1.3 of [C.8-3].

The three-dimensional ANSYS model of the 61BT DSC with a heat load of 18.3 kW is described in Appendix K, Section K.4.4.1 of [C.8-3].

The 61BT DSC model for accident analysis is based on the HSM model described in Section 8.1.3.1 of [C.8-3]. The accident analysis is performed with HSM vents totally blocked for 40 hours and with a maximum ambient steady state temperature of 125°F.

C.8.5 Thermal Analysis of MP197HB Cask with 61BT DSC for Transfer Operations

As discussed in Section C.8.1, the 61BT DSC will be transported to the WCS CISF under the NRC Certificate of Compliance No. 9302 [C.8-2]. Within the WCS CISF, the transfer operations i.e. movement of the canister from the MP197HB cask into the storage module will be performed under 10 CFR Part 72. This section presents the thermal evaluation for this on-site transfer operation.

C.8.5.1 Thermal Model of MP197HB Cask with 61BT DSC

The MP197HB cask in the transportation configuration is shown in the design drawings included in Section A.1.4.10.1, Chapter A.1 of [C.8-4]. The ANSYS model of the MP197HB cask is presented in Section A.3.3.1.1, Appendix A.3 of [C.8-4]. ANSYS 10.0 [C.8-5] is used for the MP197HB cask modeling and thermal analysis. This transportation model of the MP197HB cask is modified to replicate the transfer configuration of the MP197HB cask as follows:

- The impact limiters are removed
- Convection, insolation and radiation are applied on additional surfaces exposed to ambient as a result of removing the impact limiters
- Helium gas within the MP197HB cask/canister annulus is replaced with air during transfer operations. In addition, the internal sleeve of the MP197HB cask is considered to be painted white (see Note 5 of drawing MP197HB-71-1014 of [C.8-4]).

The thermal properties of the materials used in the analysis of the MP197HB cask with 61BT DSC in transfer mode are the same as those presented in Section A.3.2.1, Appendix A.3 of [C.8-4] except for the effective conductivity of the internal sleeve. ANSYS 10.0 [C.8-5] is used for the MP197HB cask modeling and thermal analysis.

The effective thermal conductivity for the MP197HB cask inner sleeve with air gap in axial ($k_{eff,axl}$) and radial ($k_{eff,rad}$) directions is recalculated using the methodology described in Item 5, Section A.3.3.1.3 of [C.8-4]. Table below lists the effective thermal conductivity of inner sleeve of the MP197HB cask for transfer.

Effective Thermal Conductivity of MP197HB Cask Inner Sleeve with Air Gap

Temperature (°F)	$k_{eff,axl}$ (Btu/hr-in-°F)	$k_{eff,rad}$ (Btu/hr-in-°F)
70	0.403	7.646
100	0.420	7.710
150	0.445	7.798
200	0.469	7.878
250	0.494	7.941
300	0.519	8.005
350	0.543	8.061
400	0.567	8.109

C.8.5.2 MP197HB Cask Thermal Model Results

Normal and Off-Normal Conditions:

As noted in Table 1-2, the maximum ambient temperature for normal and off-normal conditions are 81.5°F and 94.6°F, respectively. However, an ambient temperature of 105°F is conservatively used in the thermal evaluation for transfer operations at the WCS CISF.

The maximum temperatures of the components of the MP197HB cask loaded with the 61BT DSC for transfer at the WCS CISF at an ambient temperature of 105°F are presented in the table below. Also listed for comparison are the maximum component temperatures of the MP197HB cask loaded with the 61BT DSC for transportation [C.8-4].

Comparison of MP197HB Cask Component Maximum Temperatures for Transportation v/s Transfer of 61BT DSC

Transfer/Transportation Operation	Transportation MP197HB Cask with 61BT DSC(2) Normal T_{amb}=100°F	Transfer at WCS CISF MP197HB Cask with 61BT DSC(1)
Heat load	18.3 kW	18.3 kW
Component	T_{max}, °F	T_{max}, °F
Canister shell	365	386
Inner sleeve	286	260
Cask inner shell	284	248
Gamma shield	283	247
Outer shell	276	222
Shield shell	248	204
Cask lid	228	142
Cask bottom plate	277	166

1 – Daily ambient average temperature of 105°F is used for analysis.

2 – From Table A.3-8 of [C.8-4].

As seen from table above, the maximum MP197HB cask component temperatures for transfer at the WCS CISF are below those for transportation at 100°F in the MP197HB cask. The maximum temperatures of the MP197HB cask components for the transfer case decreases compared to the transportation case due to the increased heat rejection from the MP197HB cask external surface to the ambient. This is due to the removal of impact limiters (which cover parts of MP197HB cask outside surface) and higher emissivity of white paint used on the inner surface of the MP197HB cask inner sleeve.

The maximum 61BT DSC shell temperature increases by 21°F. This increase is due to the use of air in the MP197HB cask/canister annulus versus the use of helium in the transportation case.

The maximum temperatures of the components of the MP197HB cask at the WCS CISF for normal and off-normal transfer conditions are listed in Table C.8-1.

Since the maximum 61BT DSC surface temperature for transfer is higher than the maximum 61BT DSC surface temperature for transportation, the 61BT DSC shell temperature profile from the MP197HB cask transfer evaluation is mapped to the 61BT DSC basket model described in Section K.4.4.1, Appendix K.4 of [C.8-3]. The results of this evaluation provide the maximum 61BT DSC basket component temperatures and the maximum SNF cladding temperature for off-normal conditions.

Table C.8-1
Maximum Temperature of MP197HB Cask Components for 61BT DSC Transfer at the WCS CISF

	Canister Heat Load 18.3 kW				
	Normal T_{amb}=44.1°F	Normal T_{amb}=81.5 °F	Off-normal T_{amb}=30.1 °F	Off-normal T_{amb}=94.6 °F	Accident[1] T_{amb}=113 °F
Component	T_{max}, °F				
Inner sleeve	<260			260	409
Cask inner shell	<248			248	413
Gamma shield	<247			247	508
Outer shell	<222			222	645
Shield shell	<204			204	1071
Cask lid	<142			142	367
Cask bottom plate	<166			166	309

1 – Bounded by value from Table A.3-19 of [C.8-4].

Table C.8-2
NUHOMS® 61BT DSC Fuel Cladding and Canister Component Temperatures for Transfer in MP197HB Cask at the WCS CISF

	Normal Conditions			Off-Normal Conditions		Accident Conditions	
Component	**Maximum Temperature[1] (°F)**	**Minimum Temperature[5] (°F)**	**Allowable Range (°F)**	**Maximum Temperature (°F)**	**Allowable Range (°F)**	**Maximum Temperature[4] (°F)**	**Allowable Range (°F)**
Canister Shell	<387	-20	[2]	387	[2]	<662	[2]
Basket Rails	<519	-20	[2]	519	[2]	<722	[2]
Fuel Compartment	<637	-20	[2]	637	[2]	<787	[2]
SNF Cladding	<658	-20	752[3]	658	752[3]	<809	1058[3]
Average Cavity Gas	<369	-20	N/A	369	N/A	<651	N/A

1 – Bounded by off-normal condition.

2 – The components perform their intended safety function within the operating range.

3 – From ISG-11, Revision 3 [C.8-6].

4 – Bounded by HSM blocked vent condition, Section K.4.6.5 [C.8-3].

5 – Assuming no credit for decay heat and a daily average ambient temperature of -20°F. The -20°F off-normal temperature is used to bound the minimum normal ambient temperature of 44.1°F listed in Table 1-2, Chapter 1.

D.8.4 Thermal Analysis of HSM Model 102 with Canister for Storage Conditions

As discussed in Section D.8.1, NUHOMS® 61BTH Type 1 DSC will be stored inside the HSM Model 102 at the WCS CISF. This configuration for storage operations is approved under CoC 1004 and a discussion on the thermal evaluation for this configuration is presented in Chapter T.4 of [D.8-3]. Because this configuration is previously approved, this section only presents a reconciliation of the ambient temperatures between [D.8-3] and the WCS CISF.

D.8.4.1 Ambient Temperature Specification at WCS CISF

As specified in Table 1-2, normal ambient temperature is considered in the range of 44.1°F to 81.5°F. Off-normal ambient temperature is considered in the range of 30.1°F to 94.6°F. Accident ambient temperature is considered as 113°F.

D.8.4.1.1 Comparison of WCS CISF Ambient Conditions with Ambient Conditions Used in the Standardized NUHOMS® UFSAR

As described in Chapter T.4, Section T.4.4 of [D.8-3], the thermal evaluation for HSM is presented in Section 8.1.3 of [D.8-3]. A review of the thermal evaluation presented in Section 8.1.3 of [D.8-3] shows that average daily ambient temperatures of 100°F and 125°F are used for normal and off-normal hot storage conditions, respectively. These temperatures bound the ambient temperatures for normal, off-normal, and accident conditions at the WCS CISF. Similarly, the lowest off-normal ambient temperature at the WCS CISF is 30.1°F and is bounded by the -40°F used in [D.8-3].

Based on this discussion, the thermal evaluation for storage conditions presented in Chapter T.4 of [D.8-3] is bounding for the WCS CISF and no additional evaluations are performed. Sections D.8.4.2 through D.8.4.5 present the references to the appropriate section within [D.8-3] as it relates to the thermal evaluations performed for NUHOMS® 61BTH Type 1 DSC and HSM Model 102 for storage conditions.

D.8.4.2 Thermal Model of HSM Model 102 with 61BTH Type 1 DSC

The HEATING7 thermal model of the HSM Model 102 is described in Section 8.1.3 of [D.8-3].

The three-dimensional ANSYS model of the 61BTH Type 1 DSC with a heat load of 22.0 kW is described in Section T.4.6.2, Appendix T of [D.8-3]. Section T.4.6 of [D.8-3] presents a thermal analysis for the 61BTH Type 1 DSC.

The 61BTH Type 1 DSC model for accident analysis is based on the HSM model described in Section 8.1.3.1 of [D.8-3]. The accident analysis is performed with HSM vents totally blocked for 40 hours, decay heat of 24 kW and with a maximum ambient steady state temperature of 125°F.

D.8.5.2 MP197HB TC Thermal Model Results (Normal and Off-Normal Conditions):

As noted in Table 1-2, the maximum ambient temperature for normal and off-normal conditions are 81.5°F and 94.6°F, respectively. However, an ambient temperature of 105°F is conservatively used in the thermal evaluation for transfer operations at the WCS CISF.

The maximum temperatures of the components of the MP197HB cask loaded with the 61BTH Type 1 DSC for transfer at the WCS CISF at an ambient temperature of 105°F daily average temperature are presented in the table below. Also listed for comparison are the maximum component temperatures of the MP197HB cask loaded with the 61BTH Type 1 DSC for normal transportation condition [D.8-4].

Comparison of MP197HB TC Component Maximum Temperatures for Transportation v/s Transfer of 61BTH Type 1 DSC

Transfer/Transportation Operation	**Transportation MP197HB TC with 61BTH Type 1 DSC(2)** Normal T_{amb}=100°F	**Transfer MP197HB TC with 61BTH Type 1 DSC(1)**
Heat load	22 kW	22 kW
Component	T_{max}, °F	T_{max}, °F
Canister shell	406	423
Inner sleeve	317	286
Cask inner shell	315	272
Gamma shield	314	271
Outer shell	306	242
Shield shell	272	221
Cask lid	248	146
Cask bottom plate	307	175

1 – Daily ambient average temperature of 105°F is used for analysis.

2 – From Table A.3-8 of [D.8-4].

As seen from the table above, the maximum MP197HB cask component temperatures for transfer at the WCS CSIF are below the maximum component temperatures for transportation at 100°F. The maximum temperature of the MP197HB cask components for the transfer case decrease compared to the transportation case due to the increased heat rejection from the TC external surface to the ambient. This is due to the removal of impact limiters (which cover parts of MP197HB cask outside surface) and higher emissivity of white paint used on the internal surface of the MP197HB cask inner sleeve.

Table D.8-1
Maximum Temperatures of MP197HB TC Components for 61BTH Type 1 DSC Transfer at the WCS CISF

	DSC Heat Load 22 kW				
	Normal T_{amb}=44.1°F	**Normal** T_{amb}=81.5°F	**Off-normal** T_{amb}=30.1°F	**Off-normal** T_{amb}=94.6°F	**Accident**[1] T_{amb}=113°F
Component	T_{max}, °F				
Inner sleeve	<286			286	409
Cask inner shell	<272			272	413
Gamma shield	<271			271	508
Outer shell	<242			242	645
Shield shell	<221			221	1071
Cask lid	<146			146	367
Cask bottom plate	<175			175	309

1 – Bounded by values from Table A.3-19 of [D.8-4].

Table D.8-2
NUHOMS® 61BTH Type 1 DSC Fuel Cladding and DSC Component Temperatures for Transfer in MP197HB TC at the WCS CISF

	Normal Conditions			Off-Normal Conditions		Accident Conditions	
Component	Maximum Temperature[1] (°F)	Minimum Temperature[5] (°F)	Allowable Range (°F)	Maximum Temperature (°F)	Allowable Range (°F)	Maximum Temperature[4] (°F)	Allowable Range (°F)
Canister Shell	<424	-20	[2]	424	[2]	<467	[2]
Top Grid	<426	-20	[2]	426	[2]	<531	
Basket Rails	<562	-20	[2]	562	[2]	<609	[2]
Neutron Absorber	<682	-20	[2]	682	[2]	<727	
Fuel Compartment	<683	-20	[2]	683	[2]	<727	[2]
Fuel Cladding	<706	-20	752[3]	706	752[3]	<749	1058[3]
Average Cavity Gas Temperature	<489	NA	NA	489	NA	<550[6]	NA

1 – Bounded by off-normal condition.

2 – The components perform their intended safety function within the operating range.

3 – From ISG-11, Revision 3 [D.8-6].

4 – Bounded by accident transfer condition in OS197 TC. See Table 4-21 and Table 4-22 of [D.8-3].

5 – Assuming no credit for decay heat and a daily average ambient temperature of -20°F. The -20°F off-normal temperature is used to bound the minimum normal ambient temperature of 44.1°F listed in Table 1.2, Chapter 1.

6 – Design basis average He temperature used in Table T.4-24 of [D.8-3].

E.8.1 Connecticut Yankee MPC, Yankee Rowe MPC, and La Crosse MPC

Reference E.8-1 provides the thermal evaluations used to determine the limiting environmental conditions (thermal) for the use of the CY-MPC, Yankee-MPC, and MPC-LACBWR. The following are those limiting thermal environmental conditions.

E.8.1.1 Maximum Average Yearly Ambient Temperature

For the CY-MPC, Yankee-MPC, and MPC-LACBWR, the maximum average yearly temperature allowed is 75°F. The average yearly temperature for the site is conservatively bounded by using the maximum average annual temperature in the 48 contiguous United States, of 75°F. This temperature meets the normal condition thermal boundary defined in NUREG-1536. Therefore, no further WCS site-specific evaluations are required.

E.8.1.2 Maximum Average 3-Day Ambient Temperature

The maximum average 3-day ambient temperature allowed is 100°F for the CY-MPC and the Yankee-MPC. The maximum average 3-day ambient temperature allowed for the MPC-LACBWR is 105°F. These limits bound the WCS facility maximum average 3-day ambient temperature 94.6°F. Therefore, no further site-specific evaluations are needed.

E.8.1.3 Maximum Extreme 3-Day Ambient Temperature Range

For the CY-MPC, Yankee-MPC, and MPC-LACBWR, the maximum allowed temperature extremes, averaged over a 3-day period, shall be greater than -40°F and less than 125°F. This bounds the WCS facility maximum 3-day average temperature extremes of 17.6°F and 102.2°F. No further site-specific evaluations are needed.

F.8.1 Maine Yankee

Chapter 4 of the NAC-UMS Final Safety Analysis Report (FSAR), Reference F.8.2-1, presents the thermal design conditions, the allowable component temperatures and the thermal evaluations for the operation of the NAC-UMS spent fuel storage system. The established bounding thermal environmental conditions are summarized in FSAR Table 4.1-1. The maximum allowable component material temperatures are tabulated in FSAR Table 4.1-3. The bounding thermal environmental conditions are described in the following paragraphs.

F.8.1.1 Maximum Average Yearly Ambient Temperature

This is a long-term storage condition that is analyzed in FSAR Section 4.4. The maximum average yearly ambient design temperature for the NAC-UMS is 76°F. The average yearly temperature for the site is conservatively bounded by using the maximum average annual temperature in the 48 contiguous United States, of 76°F. This temperature meets the normal condition thermal boundary defined in NUREG-1536. Therefore, no further WCS site-specific evaluations are required.

F.8.1.2 Maximum Average 3-Day Ambient Temperature

This is an off-normal severe heat condition that is analyzed in FSAR Section 11.1.1. The maximum average 3-day ambient temperature for the NAC-UMS is 106°F. This temperature bounds the WCS facility maximum average 3-day ambient temperature of 94.6°F. Therefore, no further site-specific evaluations are needed.

F.8.1.3 Maximum Extreme 3-Day Ambient Temperature

This is an extreme heat accident condition that is analyzed in FSAR Section 11.2.7. For the NAC-UMS, the maximum allowed temperature extremes, average over a 3-day period, shall be greater than -40°F and less than 133°F. This bounds the WCS facility maximum 3-day average temperature extreme of 17.6°F and 102.2°F. No further site-specific evaluations are needed.

G.8.1 Undamaged and Damaged PWR Fuel

Chapter 4 of Reference G.8-1 provides the thermal analyses used evaluate the thermal performance of the MAGNASTOR system. The limiting environmental conditions (thermal) used in these evaluations are presented and compared to WCS site specific conditions in the following sections. Additionally, surveillance requirements used to ensure the concrete cask heat removal system is operable are presented.

G.8.1.1 Maximum Average Yearly Ambient Temperature

For the MAGNASTOR system, the maximum average yearly temperature allowed is 76°F. The the average yearly temperature for the site is conservatively bounded by using the maximum average annual temperature in the 48 contiguous United States, of 75.6°F. This temperature meets the normal condition thermal boundary defined in NUREG-1536. Therefore, no further WCS site-specific evaluations are required.

G.8.1.2 Maximum Average 3-Day Ambient Temperature

The maximum average 3-day ambient temperature allowed is 106°F for the MAGNASTOR system. This temperature bounds the WCS facility maximum average 3-day ambient temperature of 94.6°F. Therefore, no further site-specific evaluations are needed.

G.8.1.3 Maximum Extreme 3-Day Ambient Temperature Range

For the MAGNASTOR system, the maximum allowed temperature extremes, averaged over a 3-day period, shall be greater than -40°F and less than 133°F. This bounds the WCS facility maximum 3-day average temperature extreme of 17.6°F and 102.2°F. No further site-specific evaluations are needed.

G.8.1.4 Thermal Performance Surveillance Requirements

For the MAGNASTOR system, in order to confirm that the concrete cask heat removal system is operable, one of the following two surveillance options with a frequency of 24 hours is required:

1. Visually verify all concrete cask air inlet and outlet screens are free of blockage.

2. Verify the difference between the concrete cask air outlet average temperature and the ambient temperature is less than 119°F for the PWR concrete cask configurations CC1, CC2, and CC4 or less than 134°F for PWR concrete cask configuration CC3.

RSI NP-6.2:

Provide accident analysis and results which consider adiabatic heat up or clarify why analysis of this accident is not necessary.

Section 12.2 of the application provides a list of accident considered for each of the cask systems. However, adiabatic heat up is not included. The staff needs the thermal analysis and results for the postulated accident to verify allowable limits are not exceeded.

This information is needed to determine compliance with 10 CFR 72.122 and 10 CFR 72.128.

WCS Response to RSI 6.2:

Accident analyses that consider near adiabatic heat up (blocked vents) were completed for each of the six storage systems as part of a previous Specific License, or Certificate review. The references for the analyses are provided below:

1. NUHOMS® MP187 Cask System

   WCS SAR Appendix A, Section A.12.2.1 *Blockage of Air Inlets/Outlets* refers to:

   Section 8.3.5, *Complete Blockage of HSM Air Inlet and Outlet Vents*, in "Rancho Seco Independent Spent Fuel Storage Installation Report", Volume II, Revision 4, NRC Docket No. 72-11.

2. Advanced Standardized NUHOMS® System

   WCS SAR Appendix B, Section B.12.2.1 *Blockage of Air Inlets/Outlets* refers to:

   Section 4.6.2, *Blockage of AHSM Inlet and Outlet Vents* and Section 11.2.7.2, of "Updated Final Safety Analysis Report for the Standardized Advanced NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel," AREVA Americas Document No. ANUH-01.0150, Revision 6, NRC Docket No. 72-1029.

3. Standardized NUHOMS® System – 61BT

   WCS SAR Appendix C, Section C.12.2.1 *Blockage of Air Inlets/Outlets* refers to:

   Section 8.27, *Blockage of Air Inlet and Outlet* and Appendix K, Sections K11.2.7.2, K3.7.7, K3.4.4.3, and Section K4.6, *Thermal Evaluation for Accident Conditions* (NUHOMS® 61BT DSC) of "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel," AREVA Americas Document No. NUH-003, Revision 14, NRC Docket No. 72-1004.

4. Standardized NUHOMS® System – 61BTH Type 1

   WCS SAR Appendix D, Section D.12.2.1 *Blockage of Air Inlets/Outlets* refers to:

Sections T.11.2.7.1, *Blockage of Air Inlets and Outlets* and Section 8.2.7 *Blockage of Air Inlets and Outlets* of "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel," AREVA Americas Document No. NUH-003, Revision 14, NRC Docket No. 72-1004.

5. NAC-MPC Storage System

   WCS SAR Appendix E, Section E.12.1.2 *Accidents* refers to:

   Section 11.2.8, *Full Blockage of Air Inlets and Outlets* for Yankee Connecticut Fuel in Chapter 11, *Accident* Analysis, of "NAC Multipurpose Cask Final Safety Analysis Report", Revision 10, NRC Docket No. 72-1025.

   WCS SAR Appendix E, Section E.12.2.2 *Accidents* refers to:

   Section 11.A.2.8, *Full Blockage of Air Inlets and Outlets* for La Cross Fuel in Chapter 11, *Accident Analysis*, of "NAC Multipurpose Cask Final Safety Analysis Report", Revision 10, NRC Docket No. 72-1025.

6. NAC-UMS Storage System

   WCS SAR Appendix F, Section F.12.1.2 *Accidents* refers to:

   Section 11.2.13, *Full Blockage of Vertical Concrete Cask Air Inlets and Outlets*, in Chapter 11, *Accident Analyses*, of "Final Safety Analysis Report for the UMS Universal Storage System", Revision 10, NRC Docket No. 72-1015.

7. MAGNASTOR Storage System

   WCS SAR Appendix G, Section G.12.1.2 *Accidents* refers to:

   Section 12.2.13, *Full Blockage of Concrete Air Inlets* in Chapter 12, *Accident Analyses, of* "MAGNASTOR Final Safety Analysis Report", Revision 7, NRC Docket No. 72-1031.

These analyses are incorporated by reference into the WCS CISF SAR.

SAR Impact:

WCS SAR Chapter 12 Section 12.2, page 12-3 has been revised to include:

- Adiabatic Heat Up/-Blockage of Air Inlets/Outlets

12.2 Accidents

The design basis accident events specified by ANSI/ANS 57.9-1984, and other credible accidents postulated to affect the normal safe operation of the WCS CISF are described in this section. Analyses are provided for a range of hypothetical accidents, including those with the potential to result in an total effective dose equivalent of greater than 5 Rem outside the owner controlled area or the sum of the deep-dose equivalent specified in 10 CFR 72.106.

Table 12-1 points to the appropriate Appendix for each authorized canister/cask system listed in the Technical Specifications [12-3] where each accident condition is analyzed to demonstrate that the requirements of 10 CFR 72.122 are met and that adequate safety margins exist for the WCS CISF system design. Radiological calculations are provided to confirm that on-site and off-site dose rates are within acceptable limits. The resulting accident condition stresses in the WCS CISF system components are evaluated, and compared with the applicable code limits. Where appropriate, the accident condition stresses are combined with those of normal operating loads in accordance with the load combination definitions. Load combination results for the WCS CISF and the evaluation for fatigue effects are also presented.

The postulated accident conditions addressed, as applicable to each system, in the Appendices are:

- Adiabatic Heat Up/Blockage of Air Inlets/Outlets
- Drop Accidents
- Earthquakes
- Lightning
- Fire/Explosion
- Flood
- Tornado Wind and Missiles
- Tip Over/ Overturning

12.2.1 Canister Transfer System Fire Accident

In the unlikely event of a fire inside the Cask Handling Building during canister (TSC) transfer operations of the Canister Transfer System (CTS), there is the potential that either the vertical cask transporter (VCT) or the CTS will be in proximity with the loaded TSC. There are no other combustible or flammable materials within the transfer area and as such only fuel supporting the operation of the VCT or CTS can contribute to this postulated fire accident. Three conditions are considered:

a. Loaded Transport Cask positioned in the VCT

RSI NP-6.3

Provide consistent bounding site specific ambient temperatures which consider seasonal variations.

Table 1-2 of the application provides a normal ambient temperature range of 41.1 to 81.5°F. However, Section A.8.3.1 of the application states: "As specified in Table 1-2 the normal ambient temperature is considered in the range of 0°F to 110°F." Also, Section A.8.3.2 of the application states: " ... the daily average ambient temperatures of 95°F and 105°F for normal and off-normal conditions, respectively at the WCS CISF." The staff needs to have information regarding the normal average ambient temperature to make sure the considered cask systems bound WCS CISF site specific parameters. Also, seasonal variations are necessary because ambient temperature may persist for prolonged periods of time for the cask systems to reach steady state conditions which may differ from the use of an annual average, as analyzed in the respective FSARs.

This information is needed to determine compliance with 10 CFR 72.122 and 10 CFR 72.128.

WCS Response to RSI 6.3:

The NUHOMS® cask systems at the WCS CISF are evaluated using the maximum temperature and the NAC/MAGNASTOR systems at the WCS CISF are evaluated using a 3-day maximum average. See revised Table 1-2. Therefore, seasonal variations are bounded.

Appendices A.8, B.8, C.8 and D.8

Ambient temperatures specified in Appendices A.8, B.8, C.8 and D.8 have been revised to be consistent with Chapter 1, Table 1-2. As indicated in response to RSI 6.1, the ambient temperatures considered in the thermal evaluation of the NUHOMS® systems in their respective FSARs far exceed the ambient temperatures specified for the WCS CISF in Table 1-2.

In addition, the thermal evaluation in Appendices A.8, C.8 and D.8 are based on the maximum ambient temperatures listed in a new table added to WCS SAR Chapter 8, Section 8.4, Table 8-2. See response to RSI 6.1. For the thermal evaluation in Appendix B.8, daily average (24 hour period) temperatures based on the maximum ambient temperatures listed in table in the RSI 6.1 response are used in the thermal evaluation. Because of the large thermal inertia of the systems, averaging the ambient temperature over a 24 hour period has been previously approved by the NRC.

WCS SAR Impact:

Changes are made to the WCS CISF SAR Table 1-2 as discussed in the response to RSI 6.1.

RSI NP-8.1

Specify which fuel types are to be stored within the NAC UMS and NAC MAGNASTOR dry storage systems at the WCS CISF. Also see RSI 4-8.

Section 2.1 of the WCS Interim Storage Facility proposed Technical Specifications, "Functional and Operating Limits," includes a list of storage system Technical Specification sections incorporated by reference, describing the fuel to be stored in an horizontal storage module (HSM) or ventilated concrete cask (VCC) at the WCS CISF. Section 2.1 references the entire Technical Specifications Appendix B Section B 2.1 for the NAC UMS system, and the entire Technical Specifications Appendix B Sections 1.0 and 2.0 for the NAC MAGNASTOR system. However, Sections G.10 and F.10, for the NAC UMS and NAC MAGNASTOR systems, respectively, discuss only a subset of fuel authorized by the Technical Specifications for these systems (Maine Yankee fuel for the UMS and PWR fuel for the MAGNASTOR). Either the SAR should discuss the complete set of fuel types authorized by the NAC UMS and NAC MAGNASTOR Technical Specifications, or the facility Technical Specifications should refer to the section of the NAC UMS and NAC MAGNASTOR Technical Specifications that describes the specific fuel types to be stored at the WCS facility.

This information is needed to determine compliance with 10 CFR 72.24.

WCS Response to RSI 8.1:

WCS has revised Section 2.1 "Functional and Operating Limits" of the proposed Technical Specifications and proposed License Condition 7.A. to specify which storage system CoC Amendments apply to the types of canisterized spent fuel that will stored at the WCS CISF. Section 2.1 incorporates the approval content descriptions from specific amendments (and corresponding technical specifications) for each of the six storage systems used at WCS CISF. In addition, a citation to License Condition 9 of the WCS CISF license has been added to Section 2.1 of the proposed Technical Specifications to prohibit the storage of uncanned high burnup fuel (≥ 45 GWd/MTU).

For the NAC-UMS system, the only fuel type to be stored at the WCS facility is the Maine Yankee fuel as noted in this RSI and described in Appendix F, Section F.3.1 of the WCS SAR and Section 2.1.3.1 of NAC-UMS FSAR Revision 10. No other fuel types for the NAC-UMS system are intended to be stored at the WCS facility at this time. Section 2.1 of the WCS proposed Technical Specifications has been revised to incorporate the specific section of the NAC-UMS Technical Specifications for the Maine Yankee fuel, which is Section B.2.1.2.

For the NAC-MAGNASTOR system, the only fuel type to be stored at the WCS facility is undamaged and damaged PWR fuel as noted in this RSI and described in Appendix G, Section G.3.1 of the WCS SAR and Section 2.2 of the NAC-MAGNASTOR FSAR, Revision 7. No other fuel types for the NAC-MAGNASTOR system are intended to be stored at the WCS facility at this time. Section 2.1 of the WCS proposed Technical Specifications has been revised to incorporate the specific section for the PWR fuel in the NAC-MAGNASTOR Technical Specifications for damage and undamaged PWR fuel, which is Table B2-1.

WCS SAR Impact:

None.

WCS Proposed TS Impact:

Section 2.1 of the proposed Technical Specifications for the WCS CISF has been revised as discussed in the response to RSI 4.8.

WCS Proposed License Condition Impact:

WCS has revised License Condition 7.A. as discussed in the response to RSI 4.8.

RSI NP-9.2

Provide a clear and specific reference to a figure(s), or provide the figure(s) in each of the appendices of Chapter 11, "Confinement Evaluation" of the WCS SAR that shows the confinement boundary and redundant closure for each canister.

It is not clear what the confinement boundary and redundant closure is for each canister, this is often shown in a figure(s). This information was not provided in the following sections of the WCS safety analysis report appendices:

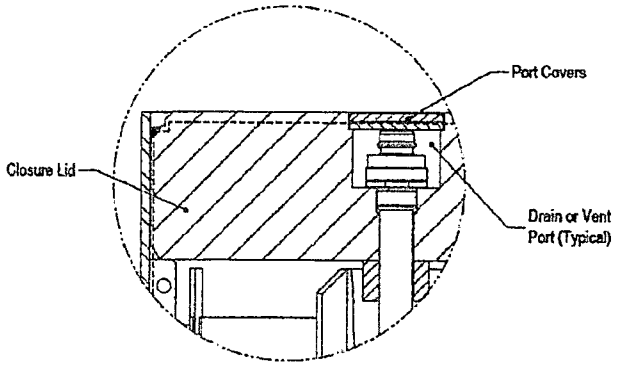
- A.11.1, "Confinement Boundary,"
- B.11.1, "Confinement Boundary,"
- C.11.1, "Confinement Boundary,"
- D.11.1, "Confinement Boundary,"
- E.11.1.1, "Confinement Boundary," and E.11.2.1, "Confinement Boundary,"
- F.11.1, "Confinement Boundary," and
- G.11.1.1 "Confinement Boundary." (Specifically for Section G.11.1.1 of the WCS safety analysis report ensure the redundant boundary is shown in the figure)

This information is needed to determine compliance with 10 CFR 72.18 and 72.24.

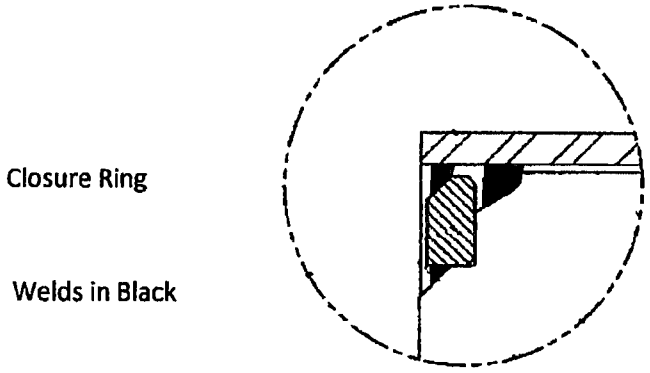
WCS Response to RSI 9.2:

Sections A.11.1, B.11.1, C.11.1, D.11.1, E.11, F.11, and G.11 of the WCS CISF SAR Appendices have been revised to reference descriptions and figures in the corresponding storage systems FSARs that describe the confinement boundary for each canister type. The figures in these references show the confinement boundary and redundant closure for each canister.

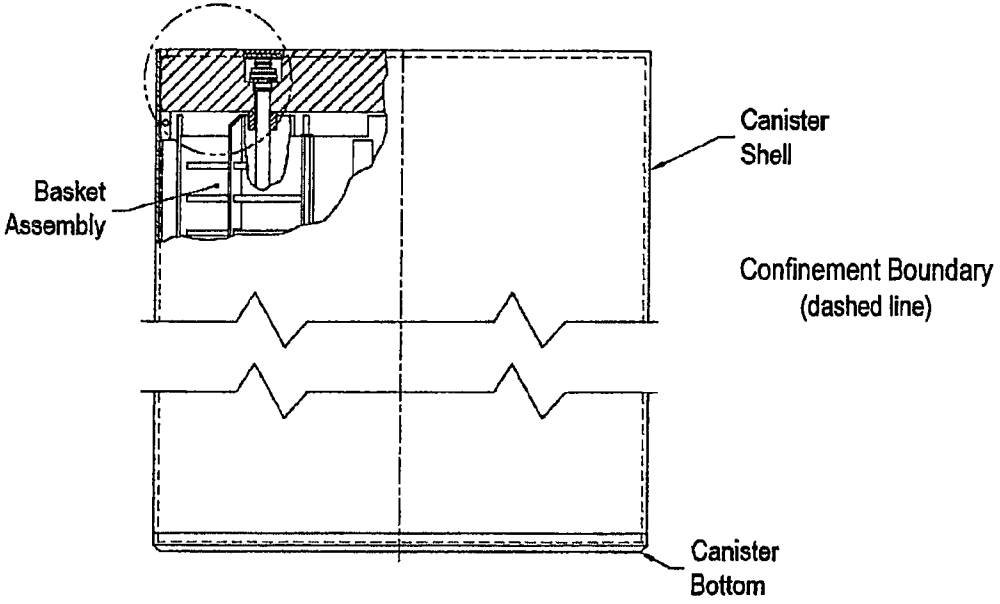
The illustration provided further displays the confinement boundary and redundant closure referenced in Section G.11.1.1.



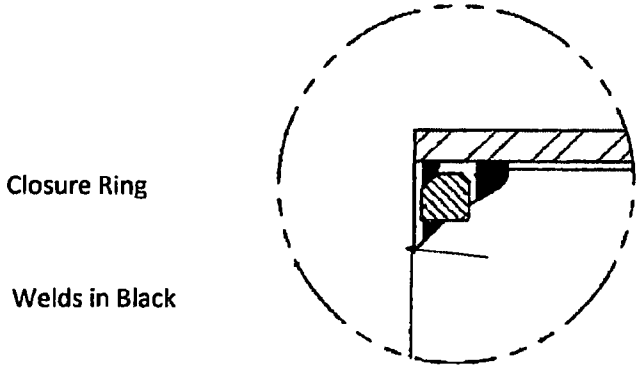
Adapted from Figure 7.1-1 of Reference G.11-1



Adapted from 71160-585, Rev. 11, Sheet 1, Detail Section A-A of MAGNASTOR FSAR, Rev.10 (Closure Ring Option 1)



Adapted from Figure 7.1-1 of Reference G.11-1



Adapted from 71160-585, Rev. 11, Sheet 2, Detail Section A-A of MAGNASTOR FSAR, Rev.10 (Closure Ring Option 2)

The redundant closure of the TSC confinement boundary consists of the closure ring, the outer vent and drain port covers, and the welds that join these components to the TSC shell and closure lid.

MAGNASTOR TSC Confinement Boundary and Redundant Closure

WCS SAR Impacts:

WCS SAR Section 11 of Appendices A-G has been updated (see attached).

A.11.1 Confinement Boundary

The confinement boundary for the FO-, FC- and FF-DSCs is documented in Section 3.3.2.1 of [A.11-1].

The canisters will not release radioactive contents under all normal, off-normal, and accident conditions; see Section 3.3.2 and Section 8.2.2 of [A.11-1]. However, during fabrication and closure operations the confinement boundary was leak tested to 10^{-5} std cm^3/sec in accordance with ANSI N14.5 [A.11-2]. Therefore, for these canister designs, a non-mechanistic release is postulated based on a leakage rate of 10^{-5} std cm^3/sec.

Reference [A.11-1] does not include a figure showing the confinement boundary for the FO-, FC- and FF-DSCs. However, Figure 7.1-1 of reference [A.11-12] provides a figure that shows the components and welds that make up the confinement boundary for the 24PT1-DSC which is also applicable to the FO-, FC- and FF-DSCs with one exception, the FO-, FC- and FF-DSCs do not have a "helium Leak Test Plug" in the Outer Top Cover Plate. Drawings for the canisters, including the confinement boundary are referenced in Section A.4.6.

A.11.4 References

A.11-1 "Rancho Seco Independent Spent Fuel Storage Installation, Final Safety Analysis Report, Volume 1, ISFSI System," NRC Docket No. 72-11, Revision 4.

A.11-2 ANSI N14.5, "Leakage Tests on Packages for Shipment of Radioactive Materials," 1997.

A.11-3 NRC Spent Fuel Project Office, Interim Staff Guidance, ISG-5, Rev. 1, "Confinement Evaluation."

A.11-4 NUREG-1536, Revision 1, "Standard Review Plan for Spent Fuel Dry Cask Storage Systems at a General License Facility," U.S. 200 Regulatory Commission, Office of Nuclear Material Safety and Safeguards.

A.11-5 NUREG-1567, "Standard Review Plan for Spent Fuel Dry Storage Facilities," Revision 0, U.S. Nuclear Regulatory Commission, Office of Nuclear Material Safety and Safeguards, March 2000.

A.11-6 Calvert Cliffs Nuclear Power Plant Calculation CA07718, "2011 Update of ISFSI USAR DSC Leakage Dose Analysis," NRC Ascension Number ML11364A025.

A.11-7 NUREG/CR-6672, Sandia National Laboratories, "Reexamination of Spent Fuel Shipment Risk Estimates," Volume 1, NRC Ascension Number ML003698324.

A.11-8 U.S. NRC Regulatory Guide 1.145, "Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants," Revision 1, November 1982.

A.11-9 Federal Guidance Report No. 11, "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion," EPA-520/1-88-020, September 1988.

A.11-10 Federal Guidance Report No. 12, "External Exposure to Radionuclides in Air, Water, and Soil," ~~EPA-402-R-93-081~~, September 1993.

A.11-11 added as part of response to RSI NP-9.1

A.11-12 AREVA TN Document, ANUH-01.0150, Revision 6, "Updated Final Safety Analysis Report for the Standardized Advanced NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel," NRC Docket No. 72-1029.

B.11.1 Confinement Boundary

The 24PT1 DSC confinement is documented in Chapter 7 of the "Standardized Advanced NUHOMS® System Updated Final Safety Analysis Report" [B.11-1]. Section 7.1 of [B.11-1] details the requirements of the confinement boundary. ~~Section 4.3 of the Technical Specifications [B.11-2] lists the codes and standards for design, fabrication, and inspection of the 24PT1 DSC.~~

already deleted as part of the response to RSI NP 9.1.

Figure 7.1-1 of reference [B.11-1] provides a figure that shows the components and welds that make up the confinement boundary for the 24PT1-DSC. Drawings for the canisters, including the confinement boundary are referenced in Section B.4.6.

C.11.1 Confinement Boundary

The NUHOMS®-61BT DSC confinement is documented in Appendix K Chapter 7 of the "Standardized NUHOMS® System Updated Final Safety Analysis Report" [C.11-1]. Section K.7.1 of reference [C.11-1] details the requirements of the confinement boundary.

Figure K.3.1-1 of reference [C.11-1] provides a figure that shows the components and welds that make up the confinement boundary for the 61BT DSC. Drawings for the canisters, including the confinement boundary are referenced in Section C.4.6.

D.11.1 Confinement Boundary

The 61BTH Type 1 DSC confinement is documented in Appendix T Chapter 7 of the "Standardized NUHOMS® System Updated Final Safety Analysis Report" [D.11-1]. Section T.7.1 of [D.11-1] details the requirements of the confinement boundary. ~~Section 1.1.12.4 of the Technical Specifications [D.11-2] lists the codes and standards for design, fabrication, and inspection of the 61BTH Type 1 DSC.~~

already deleted as part of the response to RSI NP 9.1.

Figure T.3.1-1 of reference [D.11-1] provides a figure that shows the components and welds that make up the confinement boundary for the 61BTH Type 1 DSC. Drawings for the canisters, including the confinement boundary are referenced in Section D.4.6.

E.11 CONFINEMENT EVALUATION

The NAC-MPC storage system is provided in three configurations. The Yankee-MPC provides storage for up to 36 intact Yankee Class spent fuel assemblies and reconfigured fuel assemblies (RFA). The CY-MPC holds up to 26 Connecticut Yankee spent fuel assemblies, reconfigured fuel assemblies or damaged fuel cans. The MPC-LACBWR provides storage for up to 68 Dairyland Power Cooperative La Crosse Boiling Water Reactor spent fuel assemblies with 32 damaged fuel cans. These three configurations of the NAC-MPC have similar components and operating features, but have different physical dimensions, weights and storage capacities. Confinement features for the Yankee-MPC and CY-MPC systems are addressed in the main body of Chapter 7 of Reference E.11-1. Appendix 7.A of Reference E.11-1 has been added to address the MPC-LACBWR system.

Figures illustrating the confinement boundary for the Yankee-MPC and CY-MPC are found in Figures 7.1-1 and 7.1-2 of Reference E.11-1. The figure illustrating the confinement boundary for the MPC-LACBWR is found in Figure 7.A.1-1 of Reference E.11.1.

F.11 CONFINEMENT EVALUATION

The NAC-UMS storage system is provided in two configurations, PWR – 3 different lengths and BWR – 2 different lengths. The NAC-UMS provides storage for up to 24 PWR spent fuel assemblies or up to 56 BWR spent fuel assemblies. These configurations of the NAC-UMS have similar components and operating features, but have different physical dimensions, weights and storage capacities.

Confinement features for the NAC-UMS system are addressed in the main body of Chapter 7 of the NAC-UMS FSAR, Reference F.11.2-1.

Figures illustrating the confinement boundary for the NAC-UMS are found in Figures 7.1-1 and 7.1-2 of Reference F.11.2-1.

G.11 CONFINEMENT EVALUATION

The MAGNASTOR TSC provides confinement for its radioactive contents in long-term storage. The confinement boundary provided by the TSC is closed by welding, creating a solid barrier to the release of contents in the design basis normal conditions and off-normal or accident events. The welds are visually inspected and nondestructively examined to verify integrity.

The sealed TSC contains a pressurized inert gas (helium). The confinement boundary retains the helium and also prevents the entry of outside air into the TSC in long-term storage. The exclusion of air precludes fuel rod cladding oxidation failures during storage.

The TSC confinement system meets the requirements of 10 CFR 72.24 for protection of the public from release of radioactive material. The design of the TSC allows the recovery of stored spent fuel should it become necessary per the requirements of 10 CFR 72.122. The TSC meets the requirements of 10 CFR 72.122 (h) for protection of the spent fuel contents in long-term storage such that future handling of the contents would not pose an operational safety concern.

The figure illustrating the confinement boundary for the NAC-MAGNASTOR is found in Figure 7.1-1 of Reference G.11-1.

A.11.1 Confinement Boundary

The confinement boundary for the FO-, FC- and FF-DSCs is documented in Section 3.3.2.1 of [A.11-1]. Reference [A.11-1} does not include a figure showing the confinement boundary for the FO-, FC- and FF-DSCs. However, Figure 7.1-1 of reference [A.11-12] provides a figures that shows the component and welds that make up the confinement boundary for the 24PT1-DSC which is also applicable to the FO-, FC-, and FF-DSCs with one exception, the FO-, FC-, and FF-DSCs do not have a "helium Leak Test Plug" in the Outer Top Cover Plate. Drawings for the canisters, including the confinement boundary are referenced in SectionA.4.6.

The canisters will not release radioactive contents under all normal, off-normal, and accident conditions; see Section 3.3.2 and Section 8.2.2 of [A.11-1]. However, during fabrication and closure operations the confinement boundary was leak tested to 10^{-5} std cm^3/sec in accordance with ANSI N14.5 [A.11-2]. Therefore, for these canister designs, a non-mechanistic release is postulated based on a leakage rate of 10^{-5} std cm^3/sec.

Section 4.3, Codes and Standards, of the Technical Specifications for the Rancho Seco ISFSI [A.11-11] cites the applicable ASME Code for the MP187 FO, FC-, and FF-DSCs.

Section 3.1, "DSC Integrity", of the Technical Specifications for the Rancho Seco ISFSI ; [A.11-11] includes limiting condition for operation (LCO) 3.1.1 for DSC vacuum pressure, LCO 3.1.2 for DSC helium leakage rate, and LC 3.1.3 for DSC helium backfill pressure. These LCOs create dry, inert, leak tight atmosphere, which contributes to preventing the leakage of radioactive material.

A.11.4 References

A.11-1 "Rancho Seco Independent Spent Fuel Storage Installation, Final Safety Analysis Report, Volume 1, ISFSI System," NRC Docket No. 72-11, Revision 4.

A.11-2 ANSI N14.5, "Leakage Tests on Packages for Shipment of Radioactive Materials," 1997.

A.11-3 NRC Spent Fuel Project Office, Interim Staff Guidance, ISG-5, Rev. 1, "Confinement Evaluation."

A.11-4 NUREG-1536, Revision 1, "Standard Review Plan for Spent Fuel Dry Cask Storage Systems at a General License Facility," U.S. 200 Regulatory Commission, Office of Nuclear Material Safety and Safeguards.

A.11-5 NUREG-1567, "Standard Review Plan for Spent Fuel Dry Storage Facilities," Revision 0, U.S. Nuclear Regulatory Commission, Office of Nuclear Material Safety and Safeguards, March 2000.

A.11-6 Calvert Cliffs Nuclear Power Plant Calculation CA07718, "2011 Update of ISFSI USAR DSC Leakage Dose Analysis," NRC Ascension Number ML11364A025.

A.11-7 NUREG/CR-6672, Sandia National Laboratories, "Reexamination of Spent Fuel Shipment Risk Estimates," Volume 1, NRC Ascension Number ML003698324.

A.11-8 U.S. NRC Regulatory Guide 1.145, "Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants," Revision 1, November 1982.

A.11-9 Federal Guidance Report No. 11, "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion," EPA-520/1-88-020, September 1988.

A.11-10 Federal Guidance Report No. 12, "External Exposure to Radionuclides in Air, Water, and Soil," EPA 402-R-93-081, September 1993.

A.11-11 "Technical Specifications for the Rancho Seco Independent Spent Fuel Installation, Amendment 3, USNRC Docket Number 72-0011.

A.11-12 AREVA TN document, ANUH-01.0150, revision 6, "Updated final safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated nuclear Fuel," NRC Docket 72-1029.

B.11.1 Confinement Boundary

The 24PT1 DSC confinement is documented in Chapter 7 of the "Standardized Advanced NUHOMS® System Updated Final Safety Analysis Report" [B.11-1]. Section 7.1 of [B.11-1] details the requirements of the confinement boundary. Figure 7.1-1 of reference [B.11-1] provides a figure that shows the components and welds that m ake up the confinement boundary for the 24PT1-DSC. Drawings for the canisters, including the confinement boundary are referenced in Section B.4.6.

The Technical Specifications for Standardized Advanced NUHOMS® [B.11-2] outline the requirements for preventing the leakage of radioactive materials in the 24PT1 DSC. Section 4.3, "Codes and Standards", lists the codes and standards for design, fabrication, and inspection of the 24PT1 DSC, including alternatives to the ASME Code for the 24PT1 DSC shell assembly and basket.

Section 3.1, "DSC Integrity", of the Technical Specifications for the Standardized Advanced NUHOMS® [B.11-2] includes limiting condition for operations (LCO) 3.1.1.a for DSC vacuum drying time and pressure and LCO 3.1.2.a for DSC helium backfill pressure. These LCOs create a dry, inert atmosphere, which contributes to preventing the leakage of radioactive material.

C.11.1 Confinement Boundary

The NUHOMS®-61BT DSC confinement is documented in Appendix K Chapter 7 of the "Standardized NUHOMS® System Updated Final Safety Analysis Report" [C.11-1]. Section K.7.1 of reference [C.11-1] details the requirements of the confinement boundary. Figure K.3.1-1 of reference [C.11-1] provides a figure that shows the components and welds that make up the confinement boundary for the 61BT DSC. Drawings for the canisters, including the confinement boundary are referenced in Section C.4.6.

The Technical Specifications for Standards NUHOMS® [C.11-2] outline the requirements for preventing the leakage of radioactive materials in the 61BT-DSC. Section 4.2, "Codes and Standards", lists the codes and standards for design, fabrication, and inspection of the 61BT DSC, including alternatives to the ASME Code for the 61BT DSC confinement boundary and basket.

Section 3.1, "Fuel Integrity", of the Technical Specifications for the Standardized NUHOMS® [C.11-2] includes limiting conditions for operation (LCO) 3.1.1 for DSC bulkwater removal medium and vacuum drying pressure and LCO 3.1.2 for DSC helium backfill pressure. These LCOs create a dry, inert atmosphere which contributes to preventing the leakage of radioactive material.

D.11.1 Confinement Boundary

The 61BTH Type 1 DSC confinement is documented in Appendix T Chapter 7 of the "Standardized NUHOMS® System Updated Final Safety Analysis Report" [D.11-1]. Section T.7.1 of [D.11-1] details the requirements of the confinement boundary. Figure T.3.1-1 of reference [D.11-1] provides a figure that shows the components and welds that make up the confinement boundary for the 61BTH Type 1 DSC. Drawings for the canisters, including the confinement boundary are referenced in Section D.4.6.

The Technical Specifications for Standardized NUHOMS® [D.11-2] outline the requirements for preventing the leakage of radioactive materials in the 61BTH Type 1 DSC. Section 4.2, "Codes and Standards", lists the codes and standards for design, fabrication, and inspection of the 61BTH (Type 1 and Type 2) DSC, including alternatives to the ASME Code for the 61BTH (Type1 and Type 2) DSC confinement boundary and basket.

Section 3.1, "Fuel Integrity", of the Technical Specifications for the Standardized NUHOMS® [D.11-2] includes limiting condition for operations (LCO) 3.1.1 for DSC bulkwater removal medium and vacuum drying pressure and LCO 3.1.2 for DSC helium backfill pressure. These LCOs create a dry, inert atmosphere, which contributes to preventing the leakage of radioactive material.

E.11 CONFINEMENT EVALUATION

The NAC-MPC storage system is provided in three configurations. The Yankee-MPC provides storage for up to 36 intact Yankee Class spent fuel assemblies and reconfigured fuel assemblies (RFA). The CY-MPC holds up to 26 Connecticut Yankee spent fuel assemblies, reconfigured fuel assemblies or damaged fuel cans. The MPC-LACBWR provides storage for up to 68 Dairyland Power Cooperative La Crosse Boiling Water Reactor spent fuel assemblies with 32 damaged fuel cans. These three configurations of the NAC-MPC have similar components and operating features, but have different physical dimensions, weights and storage capacities. Confinement features for the Yankee-MPC and CY-MPC systems are addressed in the main body of Chapter 7 of Reference E.11-1. Appendix 7.A of Reference E.11-1 has been added to address the MPC-LACBWR system. Figures illustrating the confinement boundary for the Yankee-MPC and CY-MPC are found in Figures 7.1-1 and 7.1-2 of Reference E.11-1. The Figure illustrating the confinement boundary for the MPC-LACBWR is found in Figure 7.A.1-1 of Reference E.11.1.

The codes and standards for the design, fabrication, and inspection of the canister and confinement boundary are detailed in Reference E.11-2. Specifically, Appendix B, Section B.3.3, "Codes and Standards", which states the ASME Boiler and Pressure Vessel Code (ASME Code), 1995 Edition with Addenda through 1995, is the governing Code for the NAC-MPC System canister except that Addenda through 1997, are applied for critical flaw evaluation of the canister closure weld and Section B.3.3.1, "Alternatives to the ASME Code", which lists the Code alternatives for the canister in Table B3-1. Included in this table is the leaktight criterion of ANSI N14.5 for the canister.

Appendix A, Section A 3.1, "NAC-MPC System Integrity", of Reference E.11.2, includes limiting condition for operation (LCO) 3.1.1 for canister maximum vacuum drying time, LCO 3.1.2 for canister vacuum drying pressure, and LCO 3.1.3 for canister helium backfill pressure. These LCOs create a dry, inert, leaktight atmosphere, which contributes to preventing the leakage of radioactive material.

F.11 CONFINEMENT EVALUATION

The NAC-UMS storage system is provided in two configurations, PWR – 3 different lengths and BWR – 2 different lengths. The NAC-UMS provides storage for up to 24 PWR spent fuel assemblies or up to 56 BWR spent fuel assemblies. These configurations of the NAC-UMS have similar components and operating features, but have different physical dimensions, weights and storage capacities.

Confinement features for the NAC-UMS system are addressed in the main body of Chapter 7 of the NAC-UMS FSAR, Reference F.11.2-1. Figures illustrating the confinement boundary for the NAC-UMS are found in Figures 7.1-1 and 7.1-2 or Reference F.11.2-1.

The codes and standards for the design, fabrication, and inspection of the canister and confinement boundary are detailed in Reference F.11-2. Specifically, Appendix B, Section B 3.3, "Codes and Standards", which states the ASME Code, 1995 Edition with Addenda through 1995, is the governing Code for the NAC-UMS canister and Section B 3.3.1, "Exception to Codes, Standards, and Criteria" , which lists the Code exception for the canister in Table B3-1. Included in this table is the leaktight criterion of ANSI N14.5 for the canister.

Appendix A, Section A 3.1, "NAC-UMS System Integrity", of Reference F.11.2, includes limiting condition for operations (LCO) 3.1.1 for canister maximum vacuum drying time, LCO 3.1.2 fir canister vacuum drying pressure, and LCO 3.1.3 for canister helium backfill pressure. These LCOs create a dry, inert, leaktight atmosphere, which contributes to preventing the leakage of radioactive material.

G.11 CONFINEMENT EVALUATION

The MAGNASTOR TSC provides confinement for its radioactive contents in long-term storage. The confinement boundary provided by the TSC is closed by welding, creating a solid barrier to the release of contents in the design basis normal conditions and off-normal or accident events. The welds are visually inspected and nondestructively examined to verify integrity. The figure illustrating the confinement boundary for the NAC-MAGNASTOR is found in Figure 7.1-1 of Reference G.11-1.

The sealed TSC contains a pressurized inert gas (helium). The confinement boundary retains the helium and also prevents the entry of outside air into the TSC in long-term storage. The exclusion of air precludes fuel rod cladding oxidation failures during storage.

The TSC confinement system meets the requirements of 10 CFR 72.24 for protection of the public from release of radioactive material. The design of the TSC allows the recovery of stored spent fuel should it become necessary per the requirements of 10 CFR 72.122. The TSC meets the requirements of 10 CFR 72.122 (h) for protection of the spent fuel contents in long-term storage such that future handling of the contents would not pose an operational safety concern.

The codes and standards for the design, fabrication, and inspection of the canister and confinement boundary are detailed in Reference G.11-2. Specifically, Appendix A, Section 4.2, "Codes and Standards", which states the ASME code, 2001 Edition with Addenda through 2003, Section III, Subsection NB, is the governing Code for the design, material procurement, fabrication, and testing of the canister and Section 4.2.1, "Alternatives to Codes, Standard, and Criteria", which lists the approved alternatives to the ASME Code in Table 2.1-2 in the NAC MAGNASTOR Final Safety Analysis Report (FSAR). In addition, Section 4.1.4, "TSC Confinement Integrity", which states the leaktight criterion for the canister in ANSI N14.5.

Appendix A, Section 3.1, "MAGNASTOR System Integrity", of Reference G.11.2, includes limiting condition for operation (LCO) 3.1.1 for canister maximum vacuum drying time, canister vacuum drying pressure, and canister helium backfill density. These LCOs create a dry, inert, leaktight atmosphere which contributes to preventing the leakage of radioactive material.

RSI NP-9.4

Provide site waste management facilities in Chapter 11, "Confinement Evaluation," and the associated appendices, or other sections of the WCS SAR as appropriate.

See Sections 9.4.1.2, "Pool and waste management facilities," 9.4.2.2, "Pool and waste management facilities," 9.4.4.2, "Pool and waste management facilities," 9.5.3.2, "Pool or waste management facilities", 9.5.4.2, "Pool or waste management facilities," 14.4.2, "Off-Gas Treatment and Ventilation," and 14.5.2, "Off-Gas Treatment and Ventilation," of NUREG-1567. Leakage rate testing described in Quality Plan (QP).10.02 Revision 1, "Post transport package evaluation" could result in possible emissions of radioactive gases; the design of the CISF ventilation, filtration, and off-gas systems that acceptably ensure the confinement of airborne radioactive particulate materials during normal, off-normal, or accident conditions during post transport package evaluation or transportation package unloading in general has not been described.

This information is needed to determine compliance with 10 CFR 72.24, 10 CFR 72.44, 10 CFR 72.122, 10 CFR 72.126, and 10 CFR 72.128.

WCS Response to RSI 9.4:

The probability of releasing radioactive gases during post transport leak testing of transportation casks or the unloading of canisters from the transportation casks is very small. In addition, any release would be minor due to the small volumes of gas involved during the post transportation sampling.

Proposed License Condition 22 requires that a post transport sampling (described in Quality Plan (QP).10.02 Revision 1) be performed prior to removing the transportation cask closure lid. The purpose of the test is to verify that the accessible portion of the canister confinement boundary is intact. In performing this sampling, a very small volume of gas is removed under vacuum through a filter into the sample container from the transportation cask and analyzed. If the sample proves positive, the transportation cask would be handled in the manner described in response to RSI 10.4, submitted on July 20, 2016. No additional ventilation, filtration, and off-gas systems would be required in the Cask Handling Building.

As stated in Chapter 11, Section 11.1 of the WCS SAR, in general, all of the canisters to be stored at the WCS CISF are designed to be leak tight under all normal, off-normal, and accident conditions. The likelihood of releasing radioactive gases during the post transport sampling or during transportation is small because the canisters are seal welded and have been tested to assure compliance with the leak tight standard of ANSI N14.5-1997, or equivalent. The exceptions to this are the FO-, FC-, FF-DSCs that were leak tested to a leakage rate of 10^{-5} std·cm^3/sec. The forces experienced during normal conditions of transport would not be large enough to result in a breach of a canister that could cause a release. The main purpose of the post transportation sampling leak test is to verify that there is no breach in the canister's confinement before a transportation cask's lid is removed.

SAR Impacts:

The response to RSI 10.4, submitted on July 20, 2016, revised WCS SAR Chapter 4, Section 4.1.2.11, *Off-Normal Holding Area*.

1.3.1.3 Transfer Cask or Storage Overpack Carrier System

For NUHOMS® Systems the purpose of this equipment is to transfer the cask out to the Horizontal Storage Module (HSM) and transfer the canister into the HSM or retrieval of same. For vertical systems, the purpose of this equipment is to upright the transportation cask and place it under the Canister Transfer System and to transfer the storage overpack from the transfer station to the storage pad or to return the overpack to the transfer station when the canister is to be shipped off-site. Major components for the NUHOMS® System include the transfer trailer, skid, skid positioning system, HSM/cask restraint system, hydraulic ram and alignment equipment. The major component for the vertical system is a VCT to move the cask from the transfer station to the storage pad.

1.3.1.4 Waste Management Systems

The WCS CISF does not have any major radioactive waste management systems. The only radioactive wastes generated are the result of residual quantities of radioactive contamination on the transportation casks. Solid wastes generated during the decontamination process are disposed of at the WCS FWF.

1.3.1.5 Contingency Plan for Recovery of a Canister From Storage

Canisters containing spent nuclear fuel or Reactor Related GTCC waste are seal welded prior to shipment to the WCS site. If the integrity of the canister seal or containment boundary becomes compromised during storage at the CISF, the canister will be removed from storage and placed into an inerted transportation overpack. Removal of a suspect canister is accomplished by retrieving the overpack containing the canister (vertical systems) or the canister itself (NUHOMS® Systems) from the storage area, transferring the canister to the Cask Handling Building, and loading the canister into an empty transportation cask that has been certified for the canister being removed. The procedures for removing a canister from storage are described in more detail in Chapter 3, Section 3.3.7.1

1.3.1.6 Storage Pad

For the NUHOMS® Systems the basemat and approach slabs are not relied upon to provide any safety function. There are no structural connections or other positive means to transfer shear between the modules and the foundation slab. The HSMs are not connected to the basemat. They resist horizontal forces by friction. Therefore, basemat and approach slabs are considered NITS and are designed, constructed, maintained, and tested as commercial-grade items.

3.3.7.1 Recovering a Canister From Storage

If the integrity of the canister seal or containment boundary becomes compromised during storage, the canister will be removed from storage and placed into a transportation overpack. Prior to removing the canister from storage, WCS will document and notify the NRC of the suspected damage to the canister, and develop an action plan for removing the canister. The action plan will specify and ensure necessary radiological protection, shielding, confinement, monitoring effluents, and protection of the spent fuel cladding to reestablish confinement with the transportation cask.

The process for removing suspect canisters from storage will normally involve the same steps used to transfer the cask to storage, except in reverse order. Procedures for removing canisters from storage are provided for the NUHOMS® and NAC systems in the WCS SAR Appendices Sections A.5.2, B.5.2, C.5.2, D.5.2, E.5.1.3, E.5.2.3, F.5.1.3, and G.5.1.3. WCS will isolate the area and establish measures to control contamination and maintain doses ALARA, in accordance with the action plan, during the transfer to the transportation cask (NUHOMS® Systems) or transfer of the overpack containing the canister (vertical systems) to the Cask Handling Building and transfer the canister from the overpack to the transportation cask. Such measures would include use of moveable shielding, process/engineering controls, air monitoring, direct dose rate monitoring and contamination smear surveys.

The procedure for removing canisters from storage would apply to all of the canisters authorized for storage at the WCS CISF, since the transportation cask for each system provides adequate shielding and containment. The WCS CISF Corrective Action Program would be used to document suspect canisters and removal actions, and to approve any alternative plans that do not involve the storage of suspect canisters in a transportation overpack. WCS will seek NRC approval for alternative plans, as required.

WCS maintains calibrated Canberra® gas flow proportional gross alpha/beta counters, calibrated Perkin & Elmer® Liquid Scintillation Counter, calibrated Ortec® Gamma Spectroscopy counter, Canberra In-Situ Object Counting System (ISOCS), calibrated air monitoring equipment and various calibrated Ludlum hand held instruments (i.e., models 9-3, 12-4, 78, 2360, 2241, 19, and 3) or equivalent equipment to perform all radiological monitoring functions.

RSI 10.3 and Observation 10.2

Provide complete information on the WCS CISF Principal Design Criteria for NAC-MPC, NAC-UMS, and NAC-MAGNASTOR. Include all information that is presented in Tables A.3-1, B.3-1, C.3-1 and D.3-1 noting observation 10.2 of this review below.

This information is needed to determine compliance with 10 CFR 72.120(a), 10 CFR 72.122(a), and 10 CFR 72.122(b).

WCS Response to RSI 10.3 and Observation 10.2:

Tables A.3-1, B.3-1, C.3-1, and D.3-1 have been revised to include the information requested in observation 10.2 (specific SAR references for some of the design parameters).

Also, WCS SAR Appendices Sections E.3, F.3, and G.3 have been revised to reference and include new Tables E.3-1, F.3-1, and G.3-1, respectively. These new tables are consistent with the revised Tables A.3-1, B.3-1, C.3-1, and D.3-1.

WCS SAR Impact:

Section 3 of the WCS SAR Appendices A-D; Tables A.3-1, B.3-1, C.3-1, and D.3-1 have been revised (see attached tables).

Section 3 of the WCS SAR Appendices E-G have been revised (see attached).

Section 3 of the WCS SAR Appendices E-G; Tables E.3-1, F.3-1, and G.3-1 have been added (see attached tables).

Table A.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NUHOMS®-MP187 Design Criteria
Solar Load (Insulation)	Horizontal flat surface insolation 2949.4 BTU/day-ft^2 Curved surface solar insolation	Normal	Horizontal flat surface insolation 2949.4 BTU/day-ft^2 Not Specified
Snow and Ice	Snow 10 psf	Normal (Bounded)	Snow Load 110 psf
Dead Weight	Per design basis for systems listed in Table 1-1	Normal (Same)	See reference [A.3-1]
Internal and External Pressure Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	See reference [A.3-1]
Design Basis Thermal Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	See reference [A.3-1]
Operating Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	See reference [A.3-1]
Live Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Design Load (including snow and ice) 200psf
Radiological Protection	Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 mrem Public lens of eye ≤ 15 mrem	Accident (Same)	Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 Rem Public lens of eye ≤ 15 Rem
Radiological Protection	Public wholebody ≤ 25 mrem/yr[(4)] Public thyroid ≤ 75 mrem/yr[(4)] Public critical organ ≤ 25 mrem/yr[(4)]	Normal (Same)	Public wholebody ≤ 25 mrem/yr[(4)] Public thyroid ≤ 75 mrem/yr[(4)] Public critical organ ≤ 25 mrem/yr[(4)]
Confinement	Per design basis for systems listed in Table 1-1	N/A	See reference [A.3-1]

Section 8.1.1.1 of Volume 1 of

Sections 3.2.2 and 8.1.1.2 of Volume 1 of

Sections 8.1.1.3 and 8.1.1.9 of Volume 1 of

Sections 8.1.1.4, 8.1.1.5, 8.1.1.7 and 8.1.1.8 of Volume 1 of

Section 3.3.2.1 and Appendix B pages 3.3-1 to 3.3.-2

Section 3.3.4 of Volume 1 of

Table A.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NUHOMS®-MP187 Design Criteria
Nuclear Criticality	Per design basis for systems listed in Table 1-1	N/A	~~See~~ reference [A.3-1]
Decommissioning	Minimize potential contamination	Normal (Same)	Minimize potential contamination
Materials Handling and Retrieval Capability	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site	Normal (Same)	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site

Notes

1. "Rancho Seco Independent Spent Fuel Storage Installation Safety Analysis Report" [A.3-1] normal ambient temperature range is 0 - 101°F. Section 8 of this SAR evaluates a normal ambient temperature range of 0 - 110°F.
2. "Rancho Seco Independent Spent Fuel Storage Installation Safety Analysis Report" [A.3-1] maximum off-normal temperature is 117°F. Section 8 of this SAR evaluates a maximum off-normal temperature ~~is~~ of 120°F.
3. 75g Vertical 75g Horizontal and 25g corner is equivalent to 80 inch drop.
4. In accordance with 10 CFR 72.104(3) limits include any other radiation from uranium fuel cycle operations within the region.

(a)

Table B.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	Standardized Advanced NUHOMS® System Design Criteria
Off-Normal Temperature	Minimum temperature 30.1°F Maximum temperature 94.6°F	Off-Normal (Bounded)	Minimum temperature -40.0°F Maximum temperature 120°F(2)
Extreme Temperature	Maximum temperature 113°F	Accident (Bounded)	Maximum temperature 120°F
Solar Load (Insolation)	Horizontal flat surface insolation 2949.4 BTU/day-ft² Curved surface solar insolation	Normal	Horizontal flat surface insolation 2952 BTU/day-ft² Curved surface solar insolation 1474.7 BTU/day-ft²
Snow and Ice	Snow Load 10 psf	Normal (Bounded)	Snow Load 110 psf
Dead Weight	Per design basis for systems listed in Table 1-1	Normal (Same)	See reference [B.3-1]
Internal and External Pressure Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Section 3.1.2.1.3.2 of reference [B.3-1]
Design Basis Thermal Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Section 3.1.2.1.3.3 of reference [B.3-1]
Operating Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Section 3.1.2.2.2 of reference [B.3-1]
Live Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Design Load (including snow and ice) 200psf

Sections 3.1.2.1.3.1, 3.6.1.1.3 and 3.6.2.2.1 of

Table B.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	Standardized Advanced NUHOMS® System Design Criteria
Radiological Protection	Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 Rem Public lens of eye ≤ 15 Rem	Accident (Same)	Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 Rem Public lens of eye ≤ 15 Rem
Radiological Protection	Public wholebody ≤ 25 mrem/yr(4) Public thyroid ≤ 75 mrem/yr(4) Public critical organ ≤ 25 mrem/yr(4)	Normal (Same)	Public wholebody ≤ 25 mrem/yr(4) Public thyroid ≤ 75 mrem/yr(4) Public critical organ ≤ 25 mrem/yr(4)
Confinement	Per design basis for systems listed in Table 1-1	N/A	See reference [B.3-1] (leaktight)
Nuclear Criticality	Per design basis for systems listed in Table 1-1	N/A	See reference [B.3-1]
Decommissioning	Minimize potential contamination	Normal (Same)	Minimize potential contamination
Materials Handling and Retrieval Capability	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site	Normal (Same)	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site

Notes

1. "Advanced NUHOMS® Horizontal Modular Storage System Safety Analysis Report" [B.3-1] normal ambient temperature range is 0 - 104°F. Section 8 of this SAR evaluates a normal ambient temperature range of 0 - 110°F.
2. "Advanced NUHOMS® Horizontal Modular Storage System Safety Analysis Report" [B.3-1] maximum off-normal temperature is 117°F. Section 8 of this SAR evaluates a maximum off-normal temperature is 120°F.
3. 75g Side drop and 25g corner is equivalent to 80 inch drop.
4. In accordance with 10 CFR 72.104(3) limits include any other radiation from uranium fuel cycle operations within the region.

Table C.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria		NUHOMS®-61BT Design Criteria	
Extreme Temperature	Maximum temperature		aximum temperature	125°F
Solar Load (Insolation)	Horizontal fla insolation Curved surfa	/day-ft²	Normal (Same)	rizontal flat surface insolation 2949.4 BTU/day-ft² Curved surface solar insolation 1474.7 BTU/day-ft²
Snow and Ice		10 psf	Normal (Bounded)	Snow Load 110 psf
Dead Weight	Per design basis for systems listed in Table 1-1		Normal (Same)	See reference [C.3-1]
Interna External F Loa		s for systems listed in Table 1-1	Normal (Same)	See reference [C.3-1]
Design Thermal		s for systems listed in Table 1-1	Normal (Same)	See reference [C.3-1]
Operating Loads	Per design basis for systems listed in Table 1-1		Normal (Same)	See reference [C.3-1]
Live Loads	Per design basis for systems listed in Table 1-1		Normal (Same)	Design Load (including snow and ice) 200psf
Radiological Protection	Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 Rem Public lens of eye ≤ 15Rem		Accident (Same)	Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 Rem Public lens of eye ≤ 15 Rem

Sections 8.1.1.4, K.3.2, K.3.6.1.2 and Tables K.2-10 and K.3.2-1 of

Section K.3.6.1.2 and Tables K.2-10, K.3.4-5 and K.4-5 of

Sections K.3.6.1.2, and K.3.6.1.3 of

Sections K.3.6.1.1, K.3.6.1.2, K.3.6.1.4, K.3.6.2.1 and Tables K.2-5 and K.2-10 of

Table C.3-1
Summary of Section K.7 of al Design Criteria
(4 pages)

Design Parameter	WC Section K.6 of a	Condition	NUHOMS®-61BT Design Criteria
Radiological Protection	Public wholebody ≤ 25 mrem/yr(3) Public thyroid ≤ 75 mrem/yr(3) Public critical organ ≤ 25 mrem/yr(3)	Normal (Same)	Public wholebody ≤ 25 mrem/yr(3) Public thyroid ≤ 75 mrem/yr(3) Public critical organ ≤ 25 mrem/yr(3)
Confinement	Per design basis for systems listed in Table 1-1	N/A	See reference [C.3-1]
Nuclear Criticality	Per design basis for systems listed in Table 1-1	N/A	See reference [C.3-1]
Decommissioning	Minimize potential contamination	Normal (Same)	Minimize potential contamination
Materials Handling and Retrieval Capability	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site	Normal (Same)	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site

Notes

1. "Standardized NUHOMS® Horizontal Modular Storage System Safety Analysis Report" [C.3-1] normal ambient temperature range is 0 - 100°F. Section 8 of this SAR evaluates a normal ambient temperature range of 0° - 110°F.
2. 75g Vertical, 75g Horizontal and 25g corner is equivalent to 80 inch drop.
3. In accordance with 10 CFR 72.104(3) limits include any other radiation from uranium fuel cycle operations within the region.

(a)

Table D.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Desig		OMS®-61BTH Type 1 Design Criteria	
Extreme Temperature	Maximum temperature		~~Maximum~~ temperature	125°F
Solar Load (Insolation)	~~Horizontal flat surface~~ /day-ft²	Normal (Same)	Horizontal flat surface insolation	2949.4 BTU/day-ft²
	~~Curved surface solar~~ insolation 1474.7 BTU/day-ft²		Curved surface solar insolation	1474.7 BTU/day-ft²
Snow and Ice	Snow Load 10 psf	Normal (Bounded)	Snow Load	110 psf
Dead	isted in Table 1-1	Normal (Same)	~~See~~ reference [D.3-1]	
Internal and External Pressure Loads	Per design ~~basis for~~ systems listed in Table 1-1	Normal (Same)	~~See~~ reference [D.3-1]	
Design Basis Therm	listed in Table 1-1	Normal (Same)	~~See~~ reference [D.3-1]	
Operating Loads	~~Per design basis for systems~~ listed in Table 1-1	Normal (Same)	~~See~~ reference [D.3-1]	
Live Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Design Load (including snow and ice) 200psf	
Radiological Protection	Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 Rem Public lens of eye ≤ 15 Rem	Accident (Same)	Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 Rem Public lens of eye ≤ 15 Rem	

Sections T.3.2, T.3.6.1.1, T.3.6.1.2, T.3.6.1.3 and Tables T.2-14, T.3.2-1 and T.3.2-2 of

Sections T.3.6.1, T.3.6.2, and Table T.2-14 of

Sections T.3.6.1.1, T.3.6.1.2, T.3.6.1.3, T.3.6.2 and Table T.2-14 of

Sections T.3.6.1.1, T.3.6.1.2, T.3.6.1.3 and Table T.2-14 of

Section T.7 of

Table D.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Section T.6 of

Design Parameter	WCS CISF Design Criteria	Condition	NUHOMS®-61BTH Type 1 Design Criteria
Radiological Protection	Public wholebody ≤ 25 mrem/yr(3) Public thyroid ≤ 75 mrem/yr(3) Public critical organ ≤ 25 mrem/yr(3)	Normal (Same)	Public wholebody ≤ 25 mrem/yr(3) Public thyroid ≤ 75 mrem/yr(3) Public critical organ ≤ 25 mrem/yr(3)
Confinement	Per design basis for systems listed in Table 1-1	N/A	See reference [D.3-1]
Nuclear Criticality	Per design basis for systems listed in Table 1-1	N/A	See reference [D.3-1]
Decommissioning	Minimize potential contamination	Normal (Same)	Minimize potential contamination
Materials Handling and Retrieval Capability	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site	Normal (Same)	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site

Notes

1. "Standardized NUHOMS® Horizontal Modular Storage System Safety Analysis Report" [D.3-1] normal ambient temperature range is 0° - 100°F. Section 8 of this SAR evaluates a normal ambient temperature range of 0° - 110°F.
2. 75g Vertical, 75g Horizontal and 25g corner is equivalent to 80 inch drop.
3. In accordance with 10 CFR 72.104(3) limits include any other radiation from uranium fuel cycle operations within the region.

(a)

E.3 PRINCIPAL DESIGN CRITERIA

The NAC-MPC Cask System principle design criteria for Connecticut Yankee MPC and Yankee Rowe MPC is documented in Chapter 2 of the NAC-MPC Final Safety Analysis Report (FSAR) [Reference E.3-1]. The principle design criteria for the La Crosse MPC is documented in Chapter 2, Appendix 2.A of the NAC-MPC FSAR [Reference E.3-1].

Table E.3-1 provides a comparison of the NAC-MPC Cask System principle design criteria and the Waste Control Specialists, LLC (WCS) Consolidated Interim Storage Facility (CISF) design criteria provided in Table 1-2 which demonstrates that the NAC-MPC Cask System is bounded by the WCS CISF criteria.

Table E.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NAC-MPC Design Criteria
Type of fuel	Commercial, light water reactor spent fuel	Normal (Bounded)	NAC-MPC FSAR Section 2.1
Storage Systems	Transportable canisters and storage overpacks docketed by the NRC	Normal (Bounded)	72-1025 71-9235
Fuel Characteristics	Criteria as specified in previously approved licenses for included systems	Normal (Bounded)	NAC-MPC FSAR Section 2.1
Tornado (Wind Load)	Max translational speed: 40 mph Max rotational speed: 160 mph Max tornado wind speed: 200 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 0.9 psi Rate of pressure drop: 0.4 psi/sec	Accident (Bounded)	**NAC-MPC FSAR Section 2.2.1.1** Max translational speed: 70 mph Max rotational speed: 290 mph Max tornado wind speed: 360 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 3.0 psi Rate of pressure drop: 2.0 psi/sec
Tornado (Missile)	Automobile: 4000 lb, 112 ft/s (76.4 mph) Schedule 40 Pipe: 287 lb, 112 ft/s (76.4 mph) Solid Steel Sphere: 0.147 lb, 23 ft/s (15.7 mph)	Accident (Bounded)	**NAC-MPC FSAR Section 2.2.1.3** Massive Missile: 3960 lb, 126 mph Rigid hardened steel: 275 lb, 126 mph Solid Steel Sphere: 0.15 lb, 126 mph
Floods	Flood height: 1.1 inches (0.0917 ft) Water velocity: 1.7 ft/s	Accident (Bounded)	**NAC-MPC FSAR Section 2.2.2.1** Flood height: 50 ft Water velocity: 15 ft/s

Seismic (Ground Motion)	Site-specific ground-surface uniform hazard response spectra (UHRS) with 1E-4 annual frequency of exceedance (AFE) having peak ground acceleration (PGA) of 0.250 g horizontal and 0.175 g vertical. (Table 1-5 and Figure 1-5)	Accident (Bounded)	**NAC-MPC FSAR Section 2.2.3.1** Yankee-MPC and CY-MPC are designed to 0.25 g horizontal and 0.167 g vertical **NAC-MPC FSAR Section 2.A.2.1.1** MPC-LACBWR is designed to 0.45 g horizontal and 0.3 g vertical **NAC-MPC CoC, Technical Specification B 3.4, Section 3.c)** Alternatively, the design basis earthquake motion of the ISFSI pad maybe limited so that the acceleration g-load resulting from the collision of the two sliding casks remains bounded by the accident condition analyses presented in Chapter 11 of the NAC-MPC FSAR.
Vent Blockage	For MPC Systems: Inlet and outlet vents blocked 24 hrs	Accident (Same)	**Yankee-MPC, NAC-MPC FSAR Section 11.2.8.4** **CY-MPC, NAC-MPC FSAR Section 11.2.8.4** **MPC-LACBWR, NAC-MPC FSAR Section 11.2.8.4** Inlet and outlet vents blocked: 24 hrs
Fire/Explosion	For MPC Systems: Equivalent fire 50 gallons of diesel fuel	Accident (Same)	**NAC-MPC FSAR Section Section 11.2.5** Equivalent fire 50 gallons of diesel fuel
Cask Drop	For MPC Systems: Drop height 6 inches	Accident (Same)	**NAC-MPC FSAR Section Section 11.2.11.2** **NAC-MPC FSAR Section Section 11.A.2.11.2** Drop height 6 inches
Ambient Temperatures	Normal temperature 44.1 – 81.5°F	Normal (Bounded)	**NAC-MPC FSAR Section Section 2.2.6** Average Annual Ambient Temperature 75°F
Off-Normal Temperature	Minimum temperature 30.1°F Maximum temperature 94.6°F	Off-Normal (Bounded)	**NAC-MPC FSAR Section Section 2.2.6** Minimum temperature -40°F Maximum temperature 100°F
Extreme Temperature	Maximum temperature 113°F	Accident (Bounded)	**NAC-MPC FSAR Section Section 2.2.6** Maximum temperature 125°F

Solar Load (Insolation)	Horizontal flat surface insolation 2949.4 BTU/day-ft^2 Curved surface solar insolation 1474.7 BTU/day-ft^2	Normal (Same)	**Yankee-MPC, NAC-MPC FSAR Section 4.4.1.1.2** **CY-MPC, NAC-MPC FSAR Section 4.5.1.1** **MPC-LACBWR, NAC-MPC FSAR Section 4.A.3.1.1** Curved Surface: 1475 Btu/ft^2 for a 24-hour period. Flat Horizontal Surface: 2950 Btu/ft^2 for a 24-hour period.
Snow and Ice	Snow Load 10 psf	Normal (Bounded)	**NAC-MPC FSAR Section Section 2.2.4** 100 psf
Dead Weight	Per design basis for systems listed in Table 1-1	Normal (Same)	Yankee-MPC Canister - NAC-MPC FSAR Section 3.4.4.1.2 Yankee-MPC Storage Cask - NAC-MPC FSAR Section 3.4.4.2.1 CY-MPC Canister - NAC-MPC FSAR Section 3.4.4.3.2 CY-MPC Storage Cask - NAC-MPC FSAR Section 3.4.4.4.1 MPC-LACBWR Concrete Cask - NAC-MPC FSAR Section 3.A.4.4.3.1 MPC-LACBWR Canister - NAC-MPC FSAR Section 3.A.4.4.1.2
Internal and External Pressure Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Yankee-MPC Canister - NAC-MPC FSAR Section 3.4.4.1.3 CY-MPC Canister - NAC-MPC FSAR Section 3.4.4.3.2 MPC-LACBWR Canister - NAC-MPC FSAR Section 3.A.4.4.1.3
Design Basis Thermal Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Yankee-MPC - NAC-MPC FSAR Section 4.4 CY-MPC - NAC-MPC FSAR Section 4.5 MPC-LACBWR - NAC-MPC FSAR Section 4.A
Operating Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	NAC-MPC - NAC-MPC FSAR Section 3.4.4 (Yankee-MPC and CY-MPC) MPC-LACBWR - NAC-MPC FSAR Section 3.A.4.4
Live Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Yankee-MPC Storage Cask - NAC-MPC FSAR Section 3.4.4.2.2 CY-MPC Storage Cask - NAC-MPC FSAR Section 3.4.4.4.2 MPC-LACBWR Concrete Cask - NAC-MPC FSAR Section 3.A.4.4.3.2

Radiological Protection	Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 mrem Public lens of eye ≤ 15 mrem	Accident (Same)	**NAC-MPC FSAR 10.2.2** Public wholebody, organ or skin ≤ 5 Rem
Radiological Protection	Public wholebody ≤ 25 mrem/yr(1) Public thyroid ≤ 75 mrem/yr(1) Public critical organ ≤ 25 mrem/yr(1)	Normal (Same)	**NAC-MPC FSAR Section 10.4** Exposure to the Public ≤ 25 mrem/yr
Confinement	Per design basis for systems listed in Table 1-1	N/A	NAC-MPC FSAR Chapter 7
Nuclear Criticality	Per design basis for systems listed in Table 1-1	N/A	NAC-MPC FSAR Chapter 6
Decommissioning	Minimize potential contamination	Normal (Same)	**Yankee-MPC - NAC-MPC FSAR Section 2.4** **CY-MPC - NAC-MPC FSAR Section 2.4** **MPC-LACBWR - NAC-MPC FSAR Section 2.A.4** Minimize potential contamination
Materials Handling and Retrieval Capability	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site	Normal (Same)	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site

Notes

1. In accordance with 10 CFR 72.104(a)(3) limits include any other radiation from uranium fuel cycle operations within the region.

F.3 PRINCIPAL DESIGN CRITERIA

The NAC-UMS Universal Storage System principal design criteria for Maine Yankee is documented in Chapter 2 of the NAC-UMS Final Safety Analysis Report (FSAR) [Reference F.3.2-1].

Table F.3-1 provides a comparison of the NAC-UMS Cask System principle design criteria and the Waste Control Specialists, LLC (WCS) Consolidated Interim Storage Facility (CISF) design criteria provided in Table 1-2 which demonstrates that the NAC-UMS Cask System is bounded by the WCS CISF criteria.

Table F.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NAC-UMS® Design Criteria
Type of fuel	Commercial, light water reactor spent fuel	Normal (Bounded)	WCS CISF SAR Appendix F, Section F.3.2
Storage Systems	Transportable canisters and storage overpacks docketed by the NRC	Normal (Bounded)	72-1015 71-9270
Fuel Characteristics	Criteria as specified in previously approved licenses for included systems	Normal (Bounded)	WCS CISF SAR Appendix F, Section F.3.2
Tornado (Wind Load)	Max translational speed: 40 mph Max rotational speed: 160 mph Max tornado wind speed: 200 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 0.9 psi Rate of pressure drop: 0.4 psi/sec	Accident (Bounded)	**NAC-UMS FSAR Section 2.2.1.1** Max translational speed: 70 mph Max rotational speed: 290 mph Max tornado wind speed: 360 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 3.0 psi Rate of pressure drop: 2.0 psi/sec
Tornado (Missile)	Automobile: 4000 lb, 112 ft/s (76.4 mph) Schedule 40 Pipe: 287 lb, 112 ft/s (76.4 mph) Solid Steel Sphere: 0.147 lb, 23 ft/s (15.7 mph)	Accident (Bounded)	**NAC-UMS FSAR Section 2.2.1.3** Massive Missile: 4000 lb, 126 mph Rigid hardened steel: 280 lb, 126 mph Solid Steel Sphere: 0.15 lb, 126 mph
Floods	Flood height: 1.1 inches (0.0917 ft) Water velocity: 1.7 ft/s	Accident (Bounded)	**NAC-UMS FSAR Section 11.2.9** Flood height: 50 ft Water velocity: 15 ft/s
Seismic (Ground Motion)	Site-specific ground-surface uniform hazard response spectra (UHRS) with 1E-4 annual frequency of exceedance (AFE) having peak ground acceleration (PGA) of 0.250 g horizontal and 0.175 g vertical. (Table 1-5 and Figure 1-5)	Accident (Bounded)	**NAC-UMS FSAR Section 11.2.8** The maximum allowable ground acceleration for the NAC-UMS system is 0.26g horizontal and 0.26g vertical.
Vent Blockage	For UMS Systems: Inlet and outlet vents blocked 24 hrs	Accident (Same)	Inlet and outlet vents blocked: 24 hrs
Fire/Explosion	For UMS Systems: Equivalent fire 50 gallons of diesel fuel	Accident (Same)	**NAC-UMS FSAR Section 11.2.6.1** Equivalent fire 50 gallons of flammable fluid

Cask Drop	For UMS Systems: VCC's Drop height 24 inches	Accident (Same)	**NAC-UMS FSAR Section 11.2.4** VCCs for UMS Systems: Drop height 24 inches
Ambient Temperatures	Normal temperature 44.1 – 81.5°F	Normal (Bounded)	**NAC-UMS FSAR Section 2.2.6** Average Annual Ambient Temperature 76°F
Off-Normal Temperature	Minimum temperature 30.1°F Maximum temperature 94.6°F	Off- Normal (Bounded)	**NAC-UMS FSAR Section 2.2.6** Minimum temperature -40°F Maximum temperature 106°F
Extreme Temperature	Maximum temperature 113°F	Accident (Bounded)	**NAC-UMS FSAR Section 2.2.6** Maximum temperature 133°F
Solar Load (Insolation)	Horizontal flat surface insolation 2949.4 BTU/day-ft^2 Curved surface solar insolation 1474.7 BTU/day-ft^2	Normal (Same)	**NAC-UMS FSAR Section 4.4.1.1** Curved Surface: 1475 Btu/ft2 for a 24-hour period. Flat Horizontal Surface: 2950 Btu/ft2 for a 24-hour period.
Snow and Ice	Snow Load 10 psf	Normal (Bounded)	**NAC-UMS FSAR Section 3.4.4.2.2** 101 psf
Dead Weight	Per design basis for systems listed in Table 1-1	Normal (Same)	Canister - NAC-UMS FSAR Section 3.4.4.1.2 Cask - NAC-UMS FSAR Section 3.4.4.2.1
Internal and External Pressure Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Canister - NAC-UMS FSAR Section 3.4.4.1.3
Design Basis Thermal Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Canister - NAC-UMS FSAR Section 3.4.4.1.1 Cask - NAC-UMS FSAR Section 3.4.4.2.3
Operating Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	NAC-UMS FSAR Section 3.4.4
Live Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Cask - NAC-UMS FSAR Section 3.4.4.2.2
Radiological Protection	Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 mrem Public lens of eye ≤ 15 mrem	Accident (Same)	**NAC-MPC FSAR 10.2.2** Public wholebody, organ or skin ≤ 5 Rem

Radiological Protection	Public wholebody ≤ 25 mrem/yr(1) Public thyroid ≤ 75 mrem/yr(1) Public critical organ ≤ 25 mrem/yr(1)	Normal (Same)	**NAC-MPC FSAR Section 10.4** Exposure to the Public ≤ 25 mrem/yr
Confinement	Per design basis for systems listed in Table 1-1	N/A	NAC-UMS FSAR Chapter 7
Nuclear Criticality	Per design basis for systems listed in Table 1-1	N/A	NAC-UMS FSAR Chapter 6
Decommissioning	Minimize potential contamination	Normal (Same)	Minimize potential contamination
Materials Handling and Retrieval Capability	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site	Normal (Same)	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site

Notes

1. In accordance with 10 CFR 72.104(a)(3) limits include any other radiation from uranium fuel cycle operations within the region.

G.3 PRINCIPAL DESIGN CRITERIA

The MAGNASTOR Cask System principle design criteria for undamaged and damaged PWR fuel is documented in Chapter 2 of the MAGNASTOR Final Safety Analysis Report (FSAR) [Reference G.3-1].

Table G.3-1 provides a comparison of the NAC-MAGNASTOR Cask System principle design criteria and the Waste Control Specialists, LLC (WCS) Consolidated Interim Storage Facility (CISF) design criteria provided in Table 1-2 which demonstrates that the NAC-MAGNASTOR Cask System is bounded by the WCS CISF criteria.

Table G.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	MAGNASTOR® Design Criteria
Type of fuel	Commercial, light water reactor spent fuel	Normal (Bounded)	MAGNASTOR FSAR Section 2.2
Storage Systems	Transportable canisters and storage overpacks docketed by the NRC	Normal (Bounded)	72-1031 71-9356 (Pending)
Fuel Characteristics	Criteria as specified in previously approved licenses for included systems	Normal (Bounded)	MAGNASTOR FSAR Section 2.2
Tornado (Wind Load)	Max translational speed: 40 mph Max rotational speed: 160 mph Max tornado wind speed: 200 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 0.9 psi Rate of pressure drop: 0.4 psi/sec	Accident (Bounded)	**MAGNASTOR FSAR Section 2.3.1.1** Max translational speed: 70 mph Max rotational speed: 290 mph Max tornado wind speed: 360 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 3.0 psi Rate of pressure drop: 2.0 psi/sec
Tornado (Missile)	Automobile: 4000 lb, 112 ft/s (76.4 mph) Schedule 40 Pipe: 287 lb, 112 ft/s (76.4 mph) Solid Steel Sphere: 0.147 lb, 23 ft/s (15.7 mph)	Accident (Bounded)	**MAGNASTOR FSAR Section 2.3.1.3** Massive Missile: 4000 lb, 126 mph Rigid hardened steel: 280 lb, 126 mph Solid Steel Sphere: 0.15 lb, 126 mph
Floods	Flood height: 1.1 inches (0.0917 ft) Water velocity: 1.7 ft/s	Accident (Bounded)	**MAGNASTOR FSAR Section 2.3.2.1** Flood height: 50 ft Water velocity: 15 ft/s
Seismic (Ground Motion)	Site-specific ground-surface uniform hazard response spectra (UHRS) with 1E-4 annual frequency of exceedance (AFE) having peak ground acceleration (PGA) of 0.250 g horizontal and 0.175 g vertical. (Table 1-5 and Figure 1-5)	Accident (Bounded)	**MAGNASTOR FSAR Section 2.3.3** The maximum allowable ground acceleration for the MAGNASTOR system is 0.37g horizontal and 0.25g vertical when the ISFSI pad does not incorporate the use of bollards
Vent Blockage	For MAGNASTOR® Systems: Inlet vents blocked 72 hrs	Accident (Same)	**MAGNASTOR FSAR Section 4.6.3** Inlet vents blocked 72 hrs

Fire/Explosion	For MAGNASTOR® Systems: Equivalent fire 50 gallons of diesel fuel	Accident (Same)	**MAGNASTOR FSAR Section 4.6.2** Equivalent fire 50 gallons of flammable liquid
Cask Drop	For MAGNASTOR® Systems: VCCs Drop height 24 inches	Accident (Same)	**MAGNASTOR FSAR Section 12.2.4** VCCs for MAGNASTOR Systems: Drop height 24 inches
Ambient Temperatures	Normal temperature 44.1 – 81.5°F	Normal (Bounded)	**MAGNASTOR FSAR Section 2.3.6** Normal operations temperature 76°F
Off-Normal Temperature	Minimum temperature 30.1°F Maximum temperature 94.6°F	Off-Normal (Bounded)	**MAGNASTOR FSAR Section 2.3.6** Minimum temperature -40°F Maximum temperature 106°F
Extreme Temperature	Maximum temperature 113°F	Accident (Bounded)	**MAGNASTOR FSAR Section 2.3.6** Maximum temperature 133°F
Solar Load (Insolation)	Horizontal flat surface insolation 2949.4 BTU/day-ft^2 Curved surface solar insolation 1474.7 BTU/day-ft^2	Normal (Same)	**MAGNASTOR FSAR Section 4.4.1.1** Curved Surface: 1475 Btu/ft2 for a 24-hour period. Flat Horizontal Surface: 2950 Btu/ft2 for a 24-hour period.
Snow and Ice	Snow Load 10 psf	Normal (Bounded)	**MAGNASTOR FSAR Section 2.3.4** Snow Load: 100 psf
Dead Weight	Per design basis for systems listed in Table 1-1	Normal (Same)	TSC Dead Load - MAGNASTOR FSAR Section 3.5.1.2 Cask - MAGNASTOR FSAR Section 3.5.3.2
Internal and External Pressure Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	TSC - MAGNASTOR FSAR Section 3.5.1
Design Basis Thermal Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	TSC - MAGNASTOR FSAR Section 3.5.1
Operating Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Cask - MAGNASTOR FSAR Section 3.5.3
Live Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Cask - MAGNASTOR FSAR Section 3.5.3.2

Radiological Protection	Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 mrem Public lens of eye ≤ 15 mrem	Accident (Same)	**MAGNASTOR FSAR Section 2.4.7.2** Public ≤ 5 Rem from any design base accident
Radiological Protection	Public wholebody ≤ 25 mrem/yr(1) Public thyroid ≤ 75 mrem/yr(1) Public critical organ ≤ 25 mrem/yr(1)	Normal (Same)	**MAGNASTOR FSAR Section 2.4.7.2** Public wholebody ≤ 25 mrem/yr
Confinement	Per design basis for systems listed in Table 1-1	N/A	MAGNASTOR FSAR Chapter 7
Nuclear Criticality	Per design basis for systems listed in Table 1-1	N/A	MAGNASTOR FSAR Chapter 6
Decommissioning	Minimize potential contamination	Normal (Same)	**MAGNASTOR FSAR Chapter 15** Minimize potential contamination
Materials Handling and Retrieval Capability	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site	Normal (Same)	**MAGNASTOR FSAR Section 2.4.2** Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site

Notes

1. In accordance with 10 CFR 72.104(a)(3) limits include any other radiation from uranium fuel cycle operations within the region.

Table A.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NUHOMS®-MP187 Design Criteria
Solar Load (Insolation)	Horizontal flat surface insolation 2949.4 BTU/day-ft^2 Curved surface solar insolation 1474.7 BTU/day-ft^2	Normal (Same)	Horizontal flat surface insolation 2949.4 BTU/day-ft^2 Curved surface solar insolation Not Specified
Snow and Ice	Snow Load 10 psf	Normal (Bounded)	Snow Load 110 psf
Dead Weight	Per design basis for systems listed in Table 1-1	Normal (Same)	Section 8.1.1.1 of Volume 1of reference [A.3-1]
Internal and External Pressure Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Sections 3.2.2 and 8.1.1.2 of Volume 1 of reference [A.3-1]
Design Basis Thermal Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Sections 8.1.1.3 and 8.1.1.9 of Volume 1 of reference [A.3-1]
Operating Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Sections 8.1.1.4, 8.1.1.5, 8.1.1.7 and 8.1.1.8 of Volume 1 of reference [A.3-1]
Live Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Design Load (including snow and ice) 200psf
Radiological Protection	Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 mrem Public lens of eye ≤ 15 mrem	Accident (Same)	Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 Rem Public lens of eye ≤ 15 Rem
Radiological Protection	Public wholebody ≤ 25 mrem/yr[(4)] Public thyroid ≤ 75 mrem/yr[(4)] Public critical organ ≤ 25 mrem/yr[(4)]	Normal (Same)	Public wholebody ≤ 25 mrem/yr[(4)] Public thyroid ≤ 75 mrem/yr[(4)] Public critical organ ≤ 25 mrem/yr[(4)]

Table A.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NUHOMS®-MP187 Design Criteria
Confinement	Per design basis for systems listed in Table 1-1	N/A	Section 3.3.2.1 and Appendix B pages 3.3-1 to 3.3-2 of reference [A.3-1]
Nuclear Criticality	Per design basis for systems listed in Table 1-1	N/A	Section 3.3.4 of Volume 1 of reference [A.3-1]
Decommissioning	Minimize potential contamination	Normal (Same)	Minimize potential contamination
Materials Handling and Retrieval Capability	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site	Normal (Same)	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site

Notes

1. "Rancho Seco Independent Spent Fuel Storage Installation Safety Analysis Report" [A.3-1] normal ambient temperature range is 0 - 101°F. Section 8 of this SAR evaluates a normal ambient temperature range of 0 - 110°F.
2. "Rancho Seco Independent Spent Fuel Storage Installation Safety Analysis Report" [A.3-1] maximum off-normal temperature is 117°F. Section 8 of this SAR evaluates a maximum off-normal temperature of 120°F.
3. 75g Vertical 75g Horizontal and 25g corner is equivalent to 80 inch drop.
4. In accordance with 10 CFR 72.104(a)(3) limits include any other radiation from uranium fuel cycle operations within the region.

Table B.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	Standardized Advanced NUHOMS® System Design Criteria
Off-Normal Temperature	Minimum temperature 30.1°F Maximum temperature 94.6°F	Off-Normal (Bounded)	Minimum temperature -40.0°F Maximum temperature 120°F(2)
Extreme Temperature	Maximum temperature 113°F	Accident (Bounded)	Maximum temperature 120°F
Solar Load (Insolation)	Horizontal flat surface insolation 2949.4 BTU/day-ft^2 Curved surface solar insolation 1474.7 BTU/day-ft^2	Normal (Same)	Horizontal flat surface insolation 2952 BTU/day-ft^2 Curved surface solar insolation 1474.7 BTU/day-ft^2
Snow and Ice	Snow Load 10 psf	Normal (Bounded)	Snow Load 110 psf
Dead Weight	Per design basis for systems listed in Table 1-1	Normal (Same)	Sections 3.1.2.1.3.1, 3.6.1.1.3 and 3.6.2.2.1 of reference [B.3-1]
Internal and External Pressure Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Section 3.1.2.1.3.2 of reference [B.3-1]
Design Basis Thermal Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Section 3.1.2.1.3.3 of reference [B.3-1]
Operating Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Section 3.1.2.2.2 of reference [B.3-1]
Live Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Design Load (including snow and ice) 200psf

Table B.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	Standardized Advanced NUHOMS® System Design Criteria
Radiological Protection	Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 Rem Public lens of eye ≤ 15 Rem	Accident (Same)	Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 Rem Public lens of eye ≤ 15 Rem
Radiological Protection	Public wholebody ≤ 25 mrem/yr(4) Public thyroid ≤ 75 mrem/yr(4) Public critical organ ≤ 25 mrem/yr(4)	Normal (Same)	Public wholebody ≤ 25 mrem/yr(4) Public thyroid ≤ 75 mrem/yr(4) Public critical organ ≤ 25 mrem/yr(4)
Confinement	Per design basis for systems listed in Table 1-1	N/A	Section 7 of reference [B.3-1] (leaktight)
Nuclear Criticality	Per design basis for systems listed in Table 1-1	N/A	Section 6 of reference [B.3-1]
Decommissioning	Minimize potential contamination	Normal (Same)	Minimize potential contamination
Materials Handling and Retrieval Capability	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site	Normal (Same)	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site

Notes

1. "Advanced NUHOMS® Horizontal Modular Storage System Safety Analysis Report" [B.3-1] normal ambient temperature range is 0 - 104°F. Section 8 of this SAR evaluates a normal ambient temperature range of 0 - 110°F.
2. "Advanced NUHOMS® Horizontal Modular Storage System Safety Analysis Report" [B.3-1] maximum off-normal temperature is 117°F. Section 8 of this SAR evaluates a maximum off-normal temperature of 120°F.
3. 75g Side drop and 25g corner is equivalent to 80 inch drop.
4. In accordance with 10 CFR 72.104(a)(3) limits include any other radiation from uranium fuel cycle operations within the region.

Table C.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NUHOMS®-61BT Design Criteria
Extreme Temperature	Maximum temperature 113°F	Accident (Bounded)	Maximum temperature 125°F
Solar Load (Insolation)	Horizontal flat surface insolation 2949.4 BTU/day-ft^2 Curved surface solar insolation 1474.7 BTU/day-ft^2	Normal (Same)	Horizontal flat surface insolation 2949.4 BTU/day-ft^2 Curved surface solar insolation 1474.7 BTU/day-ft^2
Snow and Ice	Snow Load 10 psf	Normal (Bounded)	Snow Load 110 psf
Dead Weight	Per design basis for systems listed in Table 1-1	Normal (Same)	Sections 8.1.1.4, K.3.2, K.3.6.1.2 and Tables K.2-10 and K.3.2-1 of reference [C.3-1]
Internal and External Pressure Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Section K.3.6.1.2 and Tables K.2-10, K.3.4-5 and K.4-5 of reference [C.3-1]
Design Basis Thermal Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Sections K.3.6.1.2 and K.3.6.1.3 of reference [C.3-1]
Operating Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Sections K.3.6.1.1, K.3.6.1.2, K3.6.1.4, K.3.6.2.1 and Tables K.2-5 and K.2-10 of reference [C.3-1]
Live Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Design Load (including snow and ice) 200psf
Radiological Protection	Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 Rem Public lens of eye ≤ 15Rem	Accident (Same)	Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 Rem Public lens of eye ≤ 15 Rem

Table C.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NUHOMS®-61BT Design Criteria
Radiological Protection	Public wholebody ≤ 25 mrem/yr[3] Public thyroid ≤ 75 mrem/yr[3] Public critical organ ≤ 25 mrem/yr[3]	Normal (Same)	Public wholebody ≤ 25 mrem/yr[3] Public thyroid ≤ 75 mrem/yr[3] Public critical organ ≤ 25 mrem/yr[3]
Confinement	Per design basis for systems listed in Table 1-1	N/A	Section K.7 of reference [C.3-1]
Nuclear Criticality	Per design basis for systems listed in Table 1-1	N/A	Section K.6 of reference [C.3-1]
Decommissioning	Minimize potential contamination	Normal (Same)	Minimize potential contamination
Materials Handling and Retrieval Capability	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site	Normal (Same)	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site

Notes

1. "Standardized NUHOMS® Horizontal Modular Storage System Safety Analysis Report" [C.3-1] normal ambient temperature range is 0 - 100°F. Section 8 of this SAR evaluates a normal ambient temperature range of 0° - 110°F.
2. 75g Vertical, 75g Horizontal and 25g corner is equivalent to 80 inch drop.
3. In accordance with 10 CFR 72.104(a)(3) limits include any other radiation from uranium fuel cycle operations within the region.

Table D.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NUHOMS®-61BTH Type 1 Design Criteria
Extreme Temperature	Maximum temperature 113°F	Accident (Bounded)	Maximum temperature 125°F
Solar Load (Insolation)	Horizontal flat surface insolation 2949.4 BTU/day-ft^2 Curved surface solar insolation 1474.7 BTU/day-ft^2	Normal (Same)	Horizontal flat surface insolation 2949.4 BTU/day-ft^2 Curved surface solar insolation 1474.7 BTU/day-ft^2
Snow and Ice	Snow Load 10 psf	Normal (Bounded)	Snow Load 110 psf
Dead Weight	Per design basis for systems listed in Table 1-1	Normal (Same)	Sections T.3.2, T.3.6.1.1, T.3.6.1.2, T.3.6.1.3 and Tables T.2-14, T.3.2-1 and T.3.2-2 of reference [D.3-1]
Internal and External Pressure Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Sections T.3.6.1, T.3.6.2, and Table T.2-14 of reference [D.3-1]
Design Basis Thermal Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Sections T.3.6.1.1, T.3.6.1.2, T.3.6.1.3, T.3.6.2 and Table T.2-14 of reference [D.3-1]
Operating Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Sections T.3.6.1.1, T.3.6.1.2, T.3.6.1.3 and Table T.2-14 of reference [D.3-1]
Live Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Design Load (including snow and ice) 200psf
Radiological Protection	Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 Rem Public lens of eye ≤ 15 Rem	Accident (Same)	Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 Rem Public lens of eye ≤ 15 Rem

Table D.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NUHOMS®-61BTH Type 1 Design Criteria
Radiological Protection	Public wholebody ≤ 25 mrem/yr(3) Public thyroid ≤ 75 mrem/yr(3) Public critical organ ≤ 25 mrem/yr(3)	Normal (Same)	Public wholebody ≤ 25 mrem/yr(3) Public thyroid ≤ 75 mrem/yr(3) Public critical organ ≤ 25 mrem/yr(3)
Confinement	Per design basis for systems listed in Table 1-1	N/A	Section T.7 of reference [D.3-1]
Nuclear Criticality	Per design basis for systems listed in Table 1-1	N/A	Section T.6 of reference [D.3-1]
Decommissioning	Minimize potential contamination	Normal (Same)	Minimize potential contamination
Materials Handling and Retrieval Capability	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site	Normal (Same)	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site

Notes

1. "Standardized NUHOMS® Horizontal Modular Storage System Safety Analysis Report" [D.3-1] normal ambient temperature range is 0° - 100°F. Section 8 of this SAR evaluates a normal ambient temperature range of 0° - 110°F.
2. 75g Vertical, 75g Horizontal and 25g corner is equivalent to 80 inch drop.
3. In accordance with 10 CFR 72.104(a)(3) limits include any other radiation from uranium fuel cycle operations within the region.

E.3 PRINCIPAL DESIGN CRITERIA

The NAC-MPC Cask System principle design criteria for Connecticut Yankee MPC and Yankee Rowe MPC is documented in Chapter 2 of the NAC-MPC Final Safety Analysis Report (FSAR) [Reference E.3-1]. The principle design criteria for the La Crosse MPC is documented in Chapter 2, Appendix 2.A of the NAC-MPC FSAR [Reference E.3-1]. Table E.3-1 provides a comparison of the NAC-MPC Cask System principle design criteria and the Waste Control Specialists LLC (WCS) Consolidated Interim Storage Facility (CISF) design that the NAC-MPC Cask System is bounded by the WCS CSIF criteria. The principle design criteria for the La Crosse MPC is documented in Chapter 2, Appendix 2.A of the NAC-MPC FSAR [Reference E.3-1].

Table E.3-1
Summary of WCS CISF Principal Design Criteria
(5 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NAC-MPC Design Criteria
Type of fuel	Commercial, light water reactor spent fuel	Normal (Bounded)	NAC-MPC FSAR Section 2.1
Storage Systems	Transportable canisters and storage overpacks docketed by the NRC	Normal (Bounded)	72-1025 71-9235
Fuel Characteristics	Criteria as specified in previously approved licenses for included systems	Normal (Bounded)	NAC-MPC FSAR Section 2.1
Tornado (Wind Load)	Max translational speed: 40 mph Max rotational speed: 160 mph Max tornado wind speed: 200 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 0.9 psi Rate of pressure drop: 0.4 psi/sec	Accident (Bounded)	**NAC-MPC FSAR Section 2.2.1.1** Max translational speed: 70 mph Max rotational speed: 290 mph Max tornado wind speed: 360 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 3.0 psi Rate of pressure drop: 2.0 psi/sec
Tornado (Missile)	Automobile: 4000 lb, 112 ft/s (76.4 mph) Schedule 40 Pipe: 287 lb, 112 ft/s (76.4 mph) Solid Steel Sphere: 0.147 lb, 23 ft/s (15.7 mph)	Accident (Bounded)	**NAC-MPC FSAR Section 2.2.1.3** Massive Missile: 3960 lb, 126 mph Rigid hardened steel: 275 lb, 126 mph Solid Steel Sphere: 0.15 lb, 126 mph
Floods	Flood height: 1.1 inches (0.0917 ft) Water velocity: 1.7 ft/s	Accident (Bounded)	**NAC-MPC FSAR Section 2.2.2.1** Flood height: 50 ft Water velocity: 15 ft/s

Table E.3-1
Summary of WCS CISF Principal Design Criteria
(5 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NAC-MPC Design Criteria
Seismic (Ground Motion)	Site-specific ground-surface uniform hazard response spectra (UHRS) with 1E-4 annual frequency of exceedance (AFE) having peak ground acceleration (PGA) of 0.250 g horizontal and 0.175 g vertical. (Table 1-5 and Figure 1-5)	Accident (Bounded)	**NAC-MPC FSAR Section 2.2.3.1** Yankee-MPC and CY-MPC are designed to 0.25 g horizontal and 0.167 g vertical **NAC-MPC FSAR Section 2.A.2.1.1** MPC-LACBWR is designed to 0.45 g horizontal and 0.3 g vertical **NAC-MPC CoC, Technical Specification B 3.4, Section 3.c)** Alternatively, the design basis earthquake motion of the ISFSI pad maybe limited so that the acceleration g-load resulting from the collision of the two sliding casks remains bounded by the accident condition analyses presented in Chapter 11 of the NAC-MPC FSAR.
Vent Blockage	For MPC Systems: Inlet and outlet vents blocked 24 hrs	Accident (Same)	**Yankee-MPC, NAC-MPC FSAR Section 11.2.8.4** **CY-MPC, NAC-MPC FSAR Section 11.2.8.4** **MPC-LACBWR, NAC-MPC FSAR Section 11.2.8.4** Inlet and outlet vents blocked: 24 hrs
Fire/Explosion	For MPC Systems: Equivalent fire 50 gallons of diesel fuel	Accident (Same)	**NAC-MPC FSAR Section Section 11.2.5** Equivalent fire 50 gallons of diesel fuel
Cask Drop	For MPC Systems: Drop height 6 inches	Accident (Same)	**NAC-MPC FSAR Section Section 11.2.11.2** **NAC-MPC FSAR Section Section 11.A.2.11.2** Drop height 6 inches
Ambient Temperatures	Normal temperature 44.1 – 81.5°F	Normal (Bounded)	**NAC-MPC FSAR Section Section 2.2.6** Average Annual Ambient Temperature 75°F

Table E.3-1
Summary of WCS CISF Principal Design Criteria
(5 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NAC-MPC Design Criteria
Off-Normal Temperature	Minimum temperature 30.1°F Maximum temperature 94.6°F	Off-Normal (Bounded)	**NAC-MPC FSAR Section Section 2.2.6** Minimum temperature -40°F Maximum temperature 100°F
Extreme Temperature	Maximum temperature 113°F	Accident (Bounded)	**NAC-MPC FSAR Section Section 2.2.6** Maximum temperature 125°F
Solar Load (Insolation)	Horizontal flat surface insolation 2949.4 BTU/day-ft^2 Curved surface solar insolation 1474.7 BTU/day-ft^2	Normal (Same)	**Yankee-MPC, NAC-MPC FSAR Section 4.4.1.1.2** **CY-MPC, NAC-MPC FSAR Section 4.5.1.1** **MPC-LACBWR, NAC-MPC FSAR Section 4.A.3.1.1** Curved Surface: 1475 Btu/ft^2 for a 24-hour period. Flat Horizontal Surface: 2950 Btu/ft^2 for a 24-hour period.
Snow and Ice	Snow Load 10 psf	Normal (Bounded)	**NAC-MPC FSAR Section Section 2.2.4** 100 psf
Dead Weight	Per design basis for systems listed in Table 1-1	Normal (Same)	Yankee-MPC Canister - NAC-MPC FSAR Section 3.4.4.1.2 Yankee-MPC Storage Cask - NAC-MPC FSAR Section 3.4.4.2.1 CY-MPC Canister - NAC-MPC FSAR Section 3.4.4.3.2 CY-MPC Storage Cask - NAC-MPC FSAR Section 3.4.4.4.1 MPC-LACBWR Concrete Cask - NAC-MPC FSAR Section 3.A.4.4.3.1 MPC-LACBWR Canister - NAC-MPC FSAR Section 3.A.4.4.1.2

Table E.3-1
Summary of WCS CISF Principal Design Criteria
(5 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NAC-MPC Design Criteria
Internal and External Pressure Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Yankee-MPC Canister - NAC-MPC FSAR Section 3.4.4.1.3 CY-MPC Canister - NAC-MPC FSAR Section 3.4.4.3.2 MPC-LACBWR Canister - NAC-MPC FSAR Section 3.A.4.4.1.3
Design Basis Thermal Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Yankee-MPC - NAC-MPC FSAR Section 4.4 CY-MPC - NAC-MPC FSAR Section 4.5 MPC-LACBWR - NAC-MPC FSAR Section 4.A
Operating Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	NAC-MPC - NAC-MPC FSAR Section 3.4.4 (Yankee-MPC and CY-MPC) MPC-LACBWR - NAC-MPC FSAR Section 3.A.4.4
Live Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Yankee-MPC Storage Cask - NAC-MPC FSAR Section 3.4.4.2.2 CY-MPC Storage Cask - NAC-MPC FSAR Section 3.4.4.4.2 MPC-LACBWR Concrete Cask - NAC-MPC FSAR Section 3.A.4.4.3.2
Radiological Protection	Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 mrem Public lens of eye ≤ 15 mrem	Accident (Same)	**NAC-MPC FSAR 10.2.2** Public wholebody, organ or skin ≤ 5 Rem

Table E.3-1
Summary of WCS CISF Principal Design Criteria
(5 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NAC-MPC Design Criteria
Radiological Protection	Public wholebody ≤ 25 mrem/yr(1) Public thyroid ≤ 75 mrem/yr(1) Public critical organ ≤ 25 mrem/yr(1)	Normal (Same)	**NAC-MPC FSAR Section 10.4** Exposure to the Public ≤ 25 mrem/yr
Confinement	Per design basis for systems listed in Table 1-1	N/A	NAC-MPC FSAR Chapter 7
Nuclear Criticality	Per design basis for systems listed in Table 1-1	N/A	NAC-MPC FSAR Chapter 6
Decommissioning	Minimize potential contamination	Normal (Same)	**Yankee-MPC - NAC-MPC FSAR Section 2.4** **CY-MPC - NAC-MPC FSAR Section 2.4** **MPC-LACBWR - NAC-MPC FSAR Section 2.A.4** Minimize potential contamination
Materials Handling and Retrieval Capability	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site	Normal (Same)	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site

Note
1. In accordance with 10 CFR 72.104(a)(3) limits include any other radiation from uranium fuel cycle operations within the region.

F.3 PRINCIPAL DESIGN CRITERIA

The NAC-UMS Universal Storage System principal design criteria for Maine Yankee is documented in Chapter 2 of the NAC-UMS Final Safety Analysis Report (FSAR) [Reference F.3.2-1]. Table F.3-1 provides a comparison of the NAC UMS Cask System principle design criteria and the Waste Control Specialists LLC (WCS) Consolidated Interim Storage Facility (CISF) design criteria provided in Table 1-2 which demonstrates that the NAC-UMS Cask System is bounded by the WCS CISF criteria.

Table F.3-1
Summary of WCS CISF Principal Design Criteria
(5 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NAC-UMS® Design Criteria
Type of fuel	Commercial, light water reactor spent fuel	Normal (Bounded)	WCS CISF SAR Appendix F, Section F.3.2
Storage Systems	Transportable canisters and storage overpacks docketed by the NRC	Normal (Bounded)	72-1015 71-9270
Fuel Characteristics	Criteria as specified in previously approved licenses for included systems	Normal (Bounded)	WCS CISF SAR Appendix F, Section F.3.2
Tornado (Wind Load)	Max translational speed: 40 mph Max rotational speed: 160 mph Max tornado wind speed: 200 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 0.9 psi Rate of pressure drop: 0.4 psi/sec	Accident (Bounded)	NAC-UMS FSAR Section 2.2.1.1 Max translational speed: 70 mph Max rotational speed: 290 mph Max tornado wind speed: 360 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 3.0 psi Rate of pressure drop: 2.0 psi/sec
Tornado (Missile)	Automobile: 4000 lb, 112 ft/s (76.4 mph) Schedule 40 Pipe: 287 lb, 112 ft/s (76.4 mph) Solid Steel Sphere: 0.147 lb, 23 ft/s (15.7 mph)	Accident (Bounded)	NAC-UMS FSAR Section 2.2.1.3 Massive Missile: 4000 lb, 126 mph Rigid hardened steel: 280 lb, 126 mph Solid Steel Sphere: 0.15 lb, 126 mph

Table F.3-1
Summary of WCS CISF Principal Design Criteria
(5 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NAC-UMS® Design Criteria
Floods	Flood height: 1.1 inches (0.0917 ft) Water velocity: 1.7 ft/s	Accident (Bounded)	NAC-UMS FSAR Section 11.2.9 Flood height: 50 ft Water velocity: 15 ft/s
Seismic (Ground Motion)	Site-specific ground-surface uniform hazard response spectra (UHRS) with 1E-4 annual frequency of exceedance (AFE) having peak ground acceleration (PGA) of 0.250 g horizontal and 0.175 g vertical. (Table 1-5 and Figure 1-5)	Accident (Bounded)	NAC-UMS FSAR Section 11.2.8 The maximum allowable ground acceleration for the NAC-UMS system is 0.26g horizontal and 0.26g vertical.
Vent Blockage	For UMS Systems: Inlet and outlet vents blocked 24 hrs	Accident (Same)	Inlet and outlet vents blocked: 24 hrs
Fire/Explosion	For UMS Systems: Equivalent fire 50 gallons of diesel fuel	Accident (Same)	NAC-UMS FSAR Section 11.2.6.1 Equivalent fire 50 gallons of flammable fluid
Cask Drop	For UMS Systems: VCC's Drop height 24 inches	Accident (Same)	NAC-UMS FSAR Section 11.2.4 VCCs for UMS Systems: Drop height 24 inches

Table F.3-1
Summary of WCS CISF Principal Design Criteria
(5 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NAC-UMS® Design Criteria
Ambient Temperatures	Normal temperature 44.1 – 81.5°F	Normal (Bounded)	NAC-UMS FSAR Section 2.2.6 Average Annual Ambient Temperature 76°F
Off-Normal Temperature	Minimum temperature 30.1°F Maximum temperature 94.6°F	Off-Normal (Bounded)	NAC-UMS FSAR Section 2.2.6 Minimum temperature -40°F Maximum temperature 106°F
Extreme Temperature	Maximum temperature 113°F	Accident (Bounded)	NAC-UMS FSAR Section 2.2.6 Maximum temperature 133°F
Solar Load (Insolation)	Horizontal flat surface insolation 2949.4 BTU/day-ft^2 Curved surface solar insolation 1474.7 BTU/day-ft^2	Normal (Same)	NAC-UMS FSAR Section 4.4.1.1 Curved Surface: 1475 Btu/ft2 for a 24-hour period. Flat Horizontal Surface: 2950 Btu/ft2 for a 24-hour period.
Snow and Ice	Snow Load 10 psf	Normal (Bounded)	NAC-UMS FSAR Section 3.4.4.2.2 101 psf
Dead Weight	Per design basis for systems listed in Table 1-1	Normal (Same)	Canister - NAC-UMS FSAR Section 3.4.4.1.2 Cask - NAC-UMS FSAR Section 3.4.4.2.1

Table F.3-1
Summary of WCS CISF Principal Design Criteria
(5 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NAC-UMS® Design Criteria
Internal and External Pressure Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Canister - NAC-UMS FSAR Section 3.4.4.1.3
Design Basis Thermal Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Canister - NAC-UMS FSAR Section 3.4.4.1.1 Cask - NAC-UMS FSAR Section 3.4.4.2.3
Operating Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	NAC-UMS FSAR Section 3.4.4
Live Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Cask - NAC-UMS FSAR Section 3.4.4.2.2
Radiological Protection	Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 mrem Public lens of eye ≤ 15 mrem	Accident (Same)	NAC-MPC FSAR 10.2.2 Public wholebody, organ or skin ≤ 5 Rem

Table F.3-1
Summary of WCS CISF Principal Design Criteria
(5 pages)

Design Parameter	WCS CISF Design Criteria	Condition	NAC-UMS® Design Criteria
Radiological Protection	Public wholebody ≤ 25 mrem/yr(1) Public thyroid ≤ 75 mrem/yr(1) Public critical organ ≤ 25 mrem/yr(1)	Normal (Same)	NAC-MPC FSAR Section 10.4 Exposure to the Public ≤ 25 mrem/yr
Confinement	Per design basis for systems listed in Table 1-1	N/A	NAC-UMS FSAR Chapter 7
Nuclear Criticality	Per design basis for systems listed in Table 1-1	N/A	NAC-UMS FSAR Chapter 6
Decommissioning	Minimize potential contamination	Normal (Same)	Minimize potential contamination
Materials Handling and Retrieval Capability	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site	Normal (Same)	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site

Note
1. In accordance with 10 CFR 72.104(a)(3) limits include any other radiation from uranium fuel cycle operations within the region

G.3 PRINCIPAL DESIGN CRITERIA

The MAGNASTOR Cask System principle design criteria for undamaged and damaged PWR fuel is documented in Chapter 2 of the MAGNASTOR Final Safety Analysis Report (FSAR) [Reference G.3-1]. Table G.3-1 provides a comparison of the NAC-MAGNASTOR Cask System principle design criteria and Waste Control Specialists LLC (WCS) Consolidated Interim Storage Facility (CISF) design criteria provided in Table 1-2 which demonstrates that the NAC-MAGNASTOR Cask System is bounded by the WCS CISF criteria.

Table G.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	MAGNASTOR® Design Criteria
Type of fuel	Commercial, light water reactor spent fuel	Normal (Bounded)	MAGNASTOR FSAR Section 2.2
Storage Systems	Transportable canisters and storage overpacks docketed by the NRC	Normal (Bounded)	72-1031 71-9356 (Pending)
Fuel Characteristics	Criteria as specified in previously approved licenses for included systems	Normal (Bounded)	MAGNASTOR FSAR Section 2.2
Tornado (Wind Load)	Max translational speed: 40 mph Max rotational speed: 160 mph Max tornado wind speed: 200 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 0.9 psi Rate of pressure drop: 0.4 psi/sec	Accident (Bounded)	**MAGNASTOR FSAR Section 2.3.1.1** Max translational speed: 70 mph Max rotational speed: 290 mph Max tornado wind speed: 360 mph Radius of max rotational speed: 150 ft Tornado pressure drop: 3.0 psi Rate of pressure drop: 2.0 psi/sec
Tornado (Missile)	Automobile: 4000 lb, 112 ft/s (76.4 mph) Schedule 40 Pipe: 287 lb, 112 ft/s (76.4 mph) Solid Steel Sphere: 0.147 lb, 23 ft/s (15.7 mph)	Accident (Bounded)	**MAGNASTOR FSAR Section 2.3.1.3** Massive Missile: 4000 lb, 126 mph Rigid hardened steel: 280 lb, 126 mph Solid Steel Sphere: 0.15 lb, 126 mph
Floods	Flood height: 1.1 inches (0.0917 ft) Water velocity: 1.7 ft/s	Accident (Bounded)	**MAGNASTOR FSAR Section 2.3.2.1** Flood height: 50 ft Water velocity: 15 ft/s

Table G.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	MAGNASTOR® Design Criteria
Seismic (Ground Motion)	Site-specific ground-surface uniform hazard response spectra (UHRS) with 1E-4 annual frequency of exceedance (AFE) having peak ground acceleration (PGA) of 0.250 g horizontal and 0.175 g vertical. (Table 1-5 and Figure 1-5)	Accident (Bounded)	**MAGNASTOR FSAR Section 2.3.3** The maximum allowable ground acceleration for the MAGNASTOR system is 0.37g horizontal and 0.25g vertical when the ISFSI pad does not incorporate the use of bollards
Vent Blockage	For MAGNASTOR® Systems: Inlet vents blocked 72 hrs	Accident (Same)	**MAGNASTOR FSAR Section 4.6.3** Inlet vents blocked 72 hrs
Fire/Explosion	For MAGNASTOR® Systems: Equivalent fire 50 gallons of diesel fuel	Accident (Same)	**MAGNASTOR FSAR Section 4.6.2** Equivalent fire 50 gallons of flammable liquid
Cask Drop	For MAGNASTOR® Systems: VCCs Drop height 24 inches	Accident (Same)	**MAGNASTOR FSAR Section 12.2.4** VCCs for MAGNASTOR Systems: Drop height 24 inches
Ambient Temperatures	Normal temperature 44.1 – 81.5°F	Normal (Bounded)	**MAGNASTOR FSAR Section 2.3.6** Normal operations temperature 76°F
Off-Normal Temperature	Minimum temperature 30.1°F Maximum temperature 94.6°F	Off-Normal (Bounded)	**MAGNASTOR FSAR Section 2.3.6** Minimum temperature -40°F Maximum temperature 106°F
Extreme Temperature	Maximum temperature 113°F	Accident (Bounded)	**MAGNASTOR FSAR Section 2.3.6** Maximum temperature 133°F
Solar Load (Insolation)	Horizontal flat surface insolation 2949.4 BTU/day-ft^2 Curved surface solar insolation 1474.7 BTU/day-ft^2	Normal (Same)	**MAGNASTOR FSAR Section 4.4.1.1** Curved Surface: 1475 Btu/ft2 for a 24-hour period. Flat Horizontal Surface: 2950 Btu/ft2 for a 24-hour period.

Table G.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	MAGNASTOR® Design Criteria
Snow and Ice	Snow Load 10 psf	Normal (Bounded)	**MAGNASTOR FSAR Section 2.3.4** Snow Load: 100 psf
Dead Weight	Per design basis for systems listed in Table 1-1	Normal (Same)	TSC Dead Load - MAGNASTOR FSAR Section 3.5.1.2 Cask - MAGNASTOR FSAR Section 3.5.3.2
Internal and External Pressure Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	TSC - MAGNASTOR FSAR Section 3.5.1
Design Basis Thermal Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	TSC - MAGNASTOR FSAR Section 3.5.1
Operating Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Cask - MAGNASTOR FSAR Section 3.5.3
Live Loads	Per design basis for systems listed in Table 1-1	Normal (Same)	Cask - MAGNASTOR FSAR Section 3.5.3.2
Radiological Protection	Public wholebody ≤ 5 Rem Public deep dose plus individual organ or tissue ≤ 50 Rem Public shallow dose to skin or extremities ≤ 50 mrem Public lens of eye ≤ 15 mrem	Accident (Same)	**MAGNASTOR FSAR Section 2.4.7.2** Public ≤ 5 Rem from any design base accident
Radiological Protection	Public wholebody ≤ 25 mrem/yr(1) Public thyroid ≤ 75 mrem/yr(1) Public critical organ ≤ 25 mrem/yr(1)	Normal (Same)	**MAGNASTOR FSAR Section 2.4.7.2** Public wholebody ≤ 25 mrem/yr
Confinement	Per design basis for systems listed in Table 1-1	N/A	MAGNASTOR FSAR Chapter 7

Table G.3-1
Summary of WCS CISF Principal Design Criteria
(4 pages)

Design Parameter	WCS CISF Design Criteria	Condition	MAGNASTOR® Design Criteria
Nuclear Criticality	Per design basis for systems listed in Table 1-1	N/A	MAGNASTOR FSAR Chapter 6
Decommissioning	Minimize potential contamination	Normal (Same)	**MAGNASTOR FSAR Chapter 15** Minimize potential contamination
Materials Handling and Retrieval Capability	Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site	Normal (Same)	**MAGNASTOR FSAR Section 2.4.2** Cask/canister handling system prevent breach of confinement boundary under all conditions Storage system allows ready retrieval of canister for shipment off-site

Note

1. In accordance with 10 CFR 72.104(a)(3) limits include any other radiation from uranium fuel cycle operations within the region.

RSI NP-10.1

Provide sufficient information on the process and actions taken including additional monitoring that may be necessary for Off-Normal Recovery described in SAR Section 1.3.1.5. Include a description of equipment procedures and monitoring systems for components important to safety that ensure radiological protection, shielding, confinement, monitoring effluents, and protection of the spent fuel cladding.

This information is needed to determine compliance with 10 CFR 72.122(h)(1), 10 CFR 72.126(a), 10 CFR 72.126(b), 10 CFR 72.126(c), and 10 CFR 72.128(a).

WCS Response to RSI 10.1

WCS has renamed Section 1.3.1.5 of the WCS SAR as "Contingency Plan for Recovery of a Canister from Storage." WCS also modified the content of Section 1.3.1.5 to provide a high level discussion of the plan to be used in recovering a canister from storage and to point to a new section of the SAR providing further details on procedures for recovering a canister from storage. The new section is located in Chapter 3, Section 3.3.7, Material Handling, Storage and Retrieval Capability, and is titled "3.3.7.1 Recovering a Canister from Storage." Section 3.3.7.1 includes a description of equipment, procedures, and monitoring systems for components important-to-safety ensuring radiological protection, shielding, confinement, monitoring effluents, and protection of the spent fuel cladding.

WCS SAR Impact:

WCS SAR Chapter 1, Section 1.3.1.5 has been revised:

~~1.3.1.5 Off-Normal Recovery System~~

~~Recovery operations during off-normal conditions are provided by the WCS CISF, as necessary. Canisters that contain spent nuclear fuel and GTCC waste are sealed prior to shipment to the WCS site. Recovery of a suspect canister is accomplished by retrieving the overpack containing the suspect canister (vertical systems) or the canister itself (NUHOMS® systems) from the storage area and placing the canister into an empty transportation cask. This procedure applies to all of the canisters authorized for storage at the WCS CISF, since the transportation cask for each system provides confinement barriers that isolate any materials leaking from a canister this configuration can be considered safe storage until necessary actions are developed, approved by the US NRC and implemented to address the specific conditions. The WCS CISF Corrective Action Program is used to document suspect canisters and recovery actions.~~

1.3.1.5 Contingency Plan for Recovery of a Canister from Storage

Canisters containing spent nuclear fuel or Reactor Related GTCC waste are seal welded prior to shipment to the WCS site. If the integrity of the canister seal or containment boundary becomes compromised during storage at the CISF, the canister will be removed from storage and placed into an inerted transportation overpack. Removal of a suspect canister is accomplished by retrieving the overpack containing the canister (vertical systems) or the canister itself (NUHOMS® Systems) from the storage area, transferring the canister to the Cask

Handling Building, and loading the canister into an empty transportation cask that has been certified for the canister being removed. The procedures for removing a canister from storage are described in more detail in Chapter 3, Section 3.3.7.1.

New Section in Chapter 3, after Section 3.3.7 has been added to WCS SAR:

3.3.7.1 Recovering a Canister from Storage

If the integrity of the canister seal or containment boundary becomes compromised during storage, the canister will be removed from storage and placed into a transportation overpack. Prior to removing the canister from storage, WCS will document and notify the NRC of the suspected damage to the canister, and develop an action plan for removing the canister. The action plan will specify ~~consider and ensure~~ necessary radiological protection, shielding, confinement, monitoring effluents, and protection of the spent fuel cladding to reestablish confinement with the transportation cask.

The process for removing suspect canisters from storage will normally involve the same steps used to transfer the cask to storage, except in reverse order. Procedures for removing canisters from storage are provided for the NUHOMS® and NAC Systems in the WCS SAR Appendices Sections A.5.2, B.5.2, C.5.2, D.5.2, E.5.1.3, E.5.2.3, F.5.1.3, and G.5.1.3. WCS will isolate the area and establish measures to control contamination and maintain doses ALARA, in accordance with the action plan, during the transfer to the transportation cask (NUHOMS® Systems) or transfer of the overpack containing the canister (vertical systems) to the Cask Handling Building and transfer the canister from the overpack to the transportation cask. Such measures would include use of movable shielding, process/engineering controls, air monitoring, direct dose rate monitoring and contamination smear surveys.

This procedure for removing canisters from storage would apply to all of the canisters authorized for storage at the WCS CISF, since the transportation cask for each system provides adequate shielding and containment. The WCS CISF Corrective Action Program would be used to document suspect canisters and removal actions, and to approve any alternative plans that do not involve the storage of suspect canisters in a transportation overpack. WCS will seek NRC approval for alternative plans, as required.

WCS maintains calibrated Canberra® gas flow proportional gross alpha/beta counters, calibrated Perkin & Elmer® Liquid Scintillation Counter, calibrated Ortec® Gamma Spectroscopy counter, Canberra In-Situ Object Counting System (ISOCS), calibrated air monitoring equipment and various calibrated Ludlum hand held instruments (i.e. models 9-3, 12-4, 78, 2360, 2241, 19, and 3) or equivalent equipment to perform all radiological monitoring functions.

RSI NP-11.1

Provide, in the emergency plan, a description of each type of radioactive material accident for which actions may be needed to prevent or minimize exposure from radiation and/or radioactive materials to onsite personnel. Include in the descriptions the means of mitigating the consequences for each type of accident, including those provided to protect workers onsite and the program for maintaining the equipment. The accidents to be analyzed should be the accidents described in the FSARs for the casks to be stored at the CISF, or the accidents described in the CISF SAR, if those accidents bound the accidents described in the cask's FSARs.

Consolidated Emergency Response Plan (CERP) Section 2.1, "Description of Postulated Accidents," is not consistent with Chapter 12, "Accident Analysis," of the CISF SAR, which contain analyses specific to dry cask storage. Specifically, the CERP only addresses accidents and unusual operational conditions that could occur during the operation of the low level radioactive waste and mixed waste storage and processing component of the site but the SAR Section B.12.2.2 describes a cask drop accident.

Spent Fuel Project Office Interim Staff Guidance 16, Emergency Planning, 3.3, Types of Accidents states in part:

> The emergency plan should identify and describe each type of radioactive material accident for which actions may be needed to prevent or minimize exposure from radiation and/or radioactive materials to onsite personnel for an ISFSI…

This information is needed to determine compliance with 10 CFR 72.32(a)(2) and 10 CFR 72.32(a)(5).

WCS Response to RSI 11.1:

WCS has reviewed Chapter 12 of the WCS CISF SAR and the associated FSARs for the six approved cask systems for the WCS CISF and has updated the WCS Consolidated Emergency Response Plan (CERP) to identify those accidents with potential consequences that require an emergency response. Those accidents are consistent with the postulated accident conditions discussed in Chapter 12 of the WCS CISF SAR.

WCS Consolidated Emergency Response Plan Impacts:

2.1 Description of Postulated Accidents

Accidents and unusual operational conditions could occur during the operation of the WCS facilities. ~~low-level radioactive waste and mixed waste storage and processing component of the site.~~ The operations and physical characteristics of the operating facilities were evaluated to define accidents that could potentially result in on-site or off-site exposures to the general public. Potential accidents could involve rupture of a waste container or process confinement and subsequent release of a portion of the radioactive waste material. A fire could consume a waste package and release a portion of the contained radioactive waste. Natural events such as floods or tornadoes could disperse radioactive material to off-site locations where public exposure is possible.

The postulated accident scenarios for the WCS facilities that could result in the implementation of the ERP includes a transportation accident within the facility (with fire), cask drop accidents during transfer, a failure of a ventilation system utilized for radioactive or hazardous particulate filtration, blockage of storage cask Air Inlets/Outlets, a fire within one of the storage, staging or processing areas, earthquakes, lightning, flood, and a tornado. Each of the scenarios has been assessed to determine the environmental impact.

Fire scenarios produce greater consequences than other containment failure events because fire offers an increased off-site transport potential. Fire generates heat and combustion gases that may destroy or stress the material and/or the substrate upon which the radioactive materials may be deposited, compromise barriers and/or pressurize containers/enclosures that may lead to the airborne release of contained materials. Mass flux and vapors from the fire suspend material in air. This material mixes with general convection currents that provide transport for particulate materials.

The primary exposure pathways to workers and the public are through inhalation and direct external exposure. The dose from external exposure is much less than dose from inhalation exposures outside of the facility structures, therefore, protective actions are typically based on inhalation exposures.

Secondary emergencies that may result from the onset of the primary condition include medical emergencies, personal injury accidents and property damage accidents. A power failure will not constitute an emergency requiring implementation of the ERP, unless it causes an increased threat of fire or release to the environment. There are no postulated accidents that could lead to a release of radioactive material in quantities that would trigger an Eevent classification, per Table A in Section 3.

Potential emergencies that could occur at the facility are similar to those that can occur at any industrial facility operation. These include the following:

2.1.1 Fire

- Could cause release of toxic fumes and/or radioactive particulates
- Could spread and possibly ignite materials at other buildings on-site or cause heat induced explosions
- Could produce contaminated runoff from fighting fires with extinguishing chemicals or water
- Cause injury to personnel
- Could cause damage to the physical structures of the facility
- Could cause spalling of concrete in the storage overpack and increase in CISF general area dose rate

- Could cause damage to Neutron Shield and increase in CISF general area dose rates

2.1.2 Explosion

- Could cause a safety hazard from flying fragments or shock waves
- Could ignite other hazardous waste at the facility
- Could damage other containers or tanks at the facility that would result in release of toxic and/or radioactive material
- Could cause injury to personnel
- Could cause spalling of concrete in the storage overpack and increase in CISF general area dose rate
- Could cause damage to Neutron Shield and increase in CISF general area dose rates

2.1.3 Material Release (not applicable to WCS CISF)

- Could result in the release of flammable liquids or vapors capable of causing a fire or gas explosion
- Could cause the release of toxic and/or radioactive contaminated liquids or fumes
- Could result in contamination of surface or ground water and/or soil
- Could cause injury to personnel

2.1.4 Accident (vehicle or equipment)

- Could cause fire, explosion or spill
- Could cause mixing of incompatible chemicals
- Could cause release of toxic and/or radioactive materials
- Could cause injury to personnel
- Could cause damage to Neutron Shield and increase in CISF general area dose rates
- Could cause damage to the storage overpack and increase in general area dose rates

2.1.5 Natural Events (tornados, lightning, earthquakes, floods, etc.)

- Could cause a safety hazard from flying debris
- Could cause damage to the physical structures at the facility
- Could indirectly cause fires, releases and other consequences
- Could directly cause injury to personnel
- Could cause damage to Neutron Shield and increase in CISF general area dose rates

- Could cause damage to the storage overpack and increase in general area dose rates
- Could cause blockage of Air inlet/outlet blockage

2.1.6 Blockage of Air Inlets/Outlets (applicable to WCS CISF)

- Could cause storage cask heat removal systems to become inoperable
- Fully blocked vents could cause cladding accident temperature limit to be exceeded and could cause damage to the storage overpack

2.1.7 Cask Drop Accident/ Vertical Concrete Overpack Tipover (applicable to WCS CISF)

- Could cause damage to Neutron Shield and increase in CISF general area dose rates
- Could cause increased dose rates from bottom of the overpack

2.0 TYPES OF ACCIDENTS

Information that was used to develop potential operational failures leading to potential accidents is found in the site's documents that serve as its basis of operations. These documents include the licenses, permits, authorizations and hazard analysis performed on systems and or operations. Hazards analysis will be conducted for new systems /operations and any new or unique hazardous or radioactive material inventories. These data will be used to formulate accident scenarios that, through human or equipment failures, may lead to previously unevaluated accident types. The Incident Commander (IC) then prepares various protective action scenarios that serve as the baseline emergency management response actions incorporating the appropriate response equipment, on-site emergency response, off-site support and notifications.

2.1 Description of Postulated Accidents

Accidents and unusual operational conditions could occur during the operation of the WCS facilities. The operations and physical characteristics of the operating facilities were evaluated to define accidents that could potentially result in on-site or off-site exposures to the general public. Potential accidents could involve rupture of a waste container or process confinement and subsequent release of a portion of the radioactive waste material. A fire could consume a waste package and release a portion of the contained radioactive waste. Natural events such as floods or tornadoes could disperse radioactive material to off-site locations where public exposure is possible.

The postulated accident scenarios for the WCS facilities that could result in the implementation of the ERP includes a transportation accident within the facility (with fire), cask drop accidents during CISF transfer, a failure of a ventilation system utilized for radioactive or hazardous particulate filtration, blockage of storage cask Air Inlets/Outlets, a fire within one of the storage, staging or processing areas, earthquakes, lightning, flood, and a tornado. Each of the scenarios has been assessed to determine the environmental impact.

Fire scenarios produce greater consequences than other containment failure events because fire offers an increased off-site transport potential. Fire generates heat and combustion gases that may destroy or stress the material and/or the substrate upon which the radioactive materials may be deposited, compromise barriers and/or pressurize containers/enclosures that may lead to the airborne release of contained materials. Mass flux and vapors from the fire suspend material in air. This material mixes with general convection currents that provide transport for particulate materials.

The primary exposure pathways to workers and the public are through inhalation and direct external exposure. The dose from external exposure is much less than dose from inhalation exposures outside of the facility structures, therefore, protective actions are typically based on inhalation exposures.

Secondary emergencies that may result from the onset of the primary condition include medical emergencies, personal injury accidents and property damage accidents. A power failure will not constitute an emergency requiring implementation of the ERP, unless it causes an increased threat of fire or release to the environment. There are no postulated accidents that could lead to a release of radioactive material in quantities that would trigger an event classification, per Table A in Section 3.

Potential emergencies that could occur at the facility are similar to those that can occur at any industrial facility operation. These include the following:

2.1.1 Fire

- Could cause release of toxic fumes and/or radioactive particulates
- Could spread and possibly ignite materials at other buildings on-site or cause heat induced explosions
- Could produce contaminated runoff from fighting fires with extinguishing chemicals or water
- Cause injury to personnel
- Could cause damage to the physical structures of the facility
- Could cause spalling of concrete in the storage overpack and increase in CISF general area dose rate
- Could cause damage to Neutron Shield and increase in CISF general area dose rates

2.1.2 Explosion

- Could cause a safety hazard from flying fragments or shock waves
- Could ignite other hazardous waste at the facility
- Could damage other containers or tanks at the facility that would result in release of toxic and/or radioactive material
- Could cause injury to personnel
- Could cause spalling of concrete in the storage overpack and increase in CISF general area dose rate
- Could cause damage to Neutron Shield and increase in CISF general area dose rates

2.1.3 Material Release(not applicable to WCS CISF)

- Could result in the release of flammable liquids or vapors capable of causing a fire or gas explosion
- Could cause the release of toxic and/or radioactive contaminated liquids or fumes
- Could result in contamination of surface or ground water and/or soil
- Could cause injury to personnel

2.1.4 Accident (vehicle or equipment)

- Could cause fire, explosion or spill
- Could cause mixing of incompatible chemicals
- Could cause release of toxic and/or radioactive materials
- Could cause injury to personnel

- Could cause damage to Neutron Shield and increase in CISF general area dose rates
- Could cause damage to the storage overpack and increase in general area dose rates

2.1.5 Natural Events (tornados, lightning, earthquakes, floods,etc.)

- Could cause a safety hazard from flying debris
- Could cause damage to the physical structures at the facility
- Could indirectly cause fires, releases and other consequences
- Could directly cause injury to personnel
- Could cause damage to Neutron Shield and increase in CISF General Area dose rates
- Could cause damage to the storage overpack and increase in General Area dose rates
- Could cause blockage of Air inlet/blockage

2.1.6 Blockage of Air Inlets/Outlets (applicable to WCS CISF)

- Could cause heat removal systems to become inoperable (if not cleared within 40 hours)
- Fully blocked vents could cause cladding accident temperature limit to be exceeded and could cause damage to the storage overpack (if not cleared within 40 hours)

2.1.7 Cask Drop Accident/ Vertical Concrete Overpack Tipover

- Could cause damage to Neutron Shield and increase in CISF general area dose rates
- Could cause increased dose rates in CISF general area from bottom of the Overpack

The hazards are documented by the pre-acceptance procedures as developed from the customer data and sample analysis or initial waste screening for any particular waste handled by the facilities. Potential adverse human health effects from any substances released in an emergency are summarized below:

Radioactive materials – The primary dangers are external exposures or internal exposures from ingestion or inhalation of radioactive particles or gases. All types of radioactive emitters are accepted and are stored in containers that limit the potential for involvement and release for most types of accidents.

Ignitable substances - The primary dangers are those associated either with burns or with injuries due to the concussive forces of possible detonation upon ignition. The RCRA Part B permitted facilities accept all types of hazardous materials including highly ignitable wastes. WCS does not store ignitable liquid wastes in bulk. All ignitable liquids and solids are either stored in drums and placed in the Container Storage Building (CSB) or contained in roll-off bins, tank trucks or vans. There is a diked 4000-gallon gasoline tank and bulk liquefied petroleum gas tanks for vehicular use on the facility.

Toxic substances - Adverse health effects (whether acute or chronic) may include injury to the skin, the eyes, the mucous membranes, the respiratory system, the

RSI NP-11.2 (Observations 11.3 and 11.5 are also addressed in this RSI response)

Provide justification for the inconsistencies between the description of the emergency plan in Chapter 11 of the license application, Chapter 13.5 of the CISF SAR and the CERP submitted as part of the license application.

The license application, Chapter 11, "Emergency Plan," states, [t]here is a single emergency classification level for events at the CISF, the Alert classification and Chapter 13.5 of the CISF SAR states that there is a single emergency classification level (Alert) for events at the WCS CISF. However, this in inconsistent with the CERP, as follows:

a. CERP Section 3.1, "Classifications of Accidents," states, [e]emergencies are classified as an Alert or Site Area Emergency; and

b. CERP Table B, "CISF Malfunction Initiating Condition Matrix," provides initiating conditions for a Notice of Unusual Event and Alert classifications.

This information is needed to determine compliance with 10 CFR 72.32(a)(6).

WCS response to RSI 11.2:

There are two emergency classification levels in the CERP, which are based on the worst-case consequences of potential accidents for all the WCS owned facilities. These classification levels are defined in CERP Section 3.1, Table A, *Emergency Classification.*

The Alert is defined as: an incident that led or could lead to a release to the environment of radioactive or hazardous material, but the release is not expected to require a response by an off-site organization to protect persons off-site.

The Site Area Emergency is defined as: an incident that led or could lead to a significant release to the environment of radioactive or other hazardous material and that could require a response by an off-site organization to protect persons off-site.

The two classification levels (Alert and Site Area Emergency) are consistent with Regulatory Guide 3.67 and 10 CFR 72.32(a)(2). The CERP does not require a third emergency classification level. Accordingly, WCS has deleted Table B *CISF Malfunction Initiating Condition Matrix*, from the CERP.

Evaluation of the consequences of credible and hypothetical accidents postulated to occur at the WCS CISF determined that releases of radioactivity would not require response by an off-site organization to protect persons beyond the boundary of the WCS CISF owner-controlled area. Therefore, events at the CISF could be classified as an Alert, but not a Site Area Emergency. The Site Area Emergency is applicable only to the other WCS non-CISF licensed facilities.

MOUs were included with the Emergency Response Plan submitted as part of the overall license application. Those MOUs were submitted to the LLEAs and signed agreements are expected. WCS currently has fully executed MOUs with the same LLEAs in support of the existing operating facilities in the site.

Pursuant to 10 CFR 72.32(a)(14), WCS disturbed the draft CERP and MOUs to the off-site response organizations for review on January 29, 2016 and no comments have been received.

License Application Impacts:

The WCS CISF License Application Chapter 11, Emergency Plan Page 11-1 has been updated:

Evaluation of the consequences of credible and hypothetical accidents postulated to occur at the WCS CISF determined that releases of radioactivity would not require response by an off-site organization to protect persons beyond the boundary of the WCS CISF owner-controlled area, resulting in an Alert as the single emergency classification level for events occurring at the CISF.~~, the Alert classification.~~

This is based on worst-case consequences of potential accidents at the CISF and the guidance of NUREG-1567, and is consistent with NUREG-1140, which concluded that the worst-case postulated accident involving a CISF has insignificant consequences to the public health and safety.

~~The comments and WCS' resolutions are provided with this LA.~~

SAR Impacts:

WCS SAR Chapter 13, Section 13.5 has been updated:

13.5 Emergency Response Planning

A~~n~~ Consolidated Emergency Response Plan (~~ERP~~CERP) has been prepared for the WCS CISF with an outline and content that complies with the requirements of 10 CFR 72.32(a). The ~~WCS CISF ERP~~CERP applies specifically to emergencies that could occur at the WCS CISF as well as other WCS operated facilities.

All accidents and off-normal events evaluated in Chapter 12 of this SAR were considered in the planning basis for development of the ~~WCS CISF ERP~~CERP. The planning basis includes credible events as well as hypothetical accidents whose occurrence is not considered credible, so as not to limit the scope of Emergency Response Planning. Evaluation of the consequences of credible and hypothetical accidents postulated to occur at the WCS CISF determined that releases of radioactivity would not require response by an off-site organization to protect persons beyond the boundary of the WCS CISF owner-controlled area. Therefore, there is a single emergency classification level for events at the WCS CISF, the Alert classification, which is based on the worst-case consequences of potential accidents which are postulated to occur at the WCS CISF.

Should an off-normal event or accident occur, the ~~WCS CISF ERP~~CERP requires personnel stationed at the WCS CISF to notify appropriate emergency response personnel and the Incident Commander (IC) or designee immediately. The emergency response personnel are

then responsible for ~~classifying the event in accordance with classification procedures~~responding to the event in ~~the~~ accordance with the ~~WCS CISF ERP~~CERP and notifying the ~~NRC and local~~appropriate authorities, as stated in the ~~WCS CISF ERP~~CERP. The emergency response personnel are also responsible for calling out trained ~~personnel, as necessary, who~~personnel to assemble at the WCS CISF ~~to take actions~~ to mitigate the consequences of the emergency at the direction of the Incident Commander (IC), assess radiation and radioactivity levels in the vicinity of the WCS CISF, and return the WCS CISF to a safe and stable condition. The design of the WCS CISF provides for accessibility to equipment on-site and availability of off-site emergency facilities and services in accordance with 10 CFR 72.122(g). WCS has a central Emergency Operations Center (EOC) from which management and support personnel carry out coordinated emergency response activities. The EOC is the location having appropriate communications and informational materials to carry out the assigned emergency response mission. The primary EOC is the Executive Conference Room located in the southern section of the main administrative building within the boundaries of the existing facility. The secondary EOC is the LLRW Administration Building, also within the existing facility boundary.

The ~~ERP~~CERP identifies Incident Commanders (ICs) who train to coordinate the response of the Emergency Response Organization (ERO) to an emergency event. These personnel may not always be present at the facility when an event occurs. One of the ICs designated in the ~~ERP~~CERP is always on-call. If the on-call IC is not at the facility, then he / she is available to those individuals present at the facility through communication devices or other means. Depending upon the nature of the event, the on-call IC may designate certain duties to those present at the facility by phone or electronic communication. The IC assumes responsibilities for declaring an Alert, as appropriate, and activation of the ERO, as well as communicating with on-site emergency response personnel and appraising them of the situation at the WCS CISF. The ~~ERP~~CERP identifies responsibilities and staffing of the on-site ERO and for requesting off-site assistance. Members of the ERO will be trained on how to respond to various emergencies at the WCS CISF, as established in the ~~ERP~~CERP.

Off-site assistance may be requested as necessary from both the Andrews County Volunteer Fire Department, located 32 miles from the WCS CISF, and the Eunice, New Mexico Volunteer Fire Department, located 6 miles from the WCS CISF. Both departments have signed agreements to assist the WCS ERO in the control of major emergencies are both equipped to respond to structural fires, oil well fires and chemical tank explosions. The City of Andrews Police Department provides ambulance service for Andrews County and has agreed to provide emergency medical assistance and evacuation for the WCS CISF. Additional ambulance service is available through the Eunice Fire and Rescue Service, which has also agreed to provide emergency medical care to the facility. For off-site medical care, Carlsbad Medical Center, located in Carlsbad, New Mexico is the first choice for incidents involving radiologically contaminated individuals unless life-threatening injuries are present, in which case they would

take precedence and treatment would be sought at Lea Regional Medical Center or Permian Regional Medical Center. Lea Regional Medical Center is located 25 miles to the northwest in Hobbs, New Mexico. The hospital is fully equipped to handle most types of emergencies and has a life flight helicopter available. The hospital has received training from the Waste Isolation Pilot Plants (WIPP) personnel on the handling of injury victims in the event of contamination with radioactive materials. Permian Regional Medical Center is located approximately 32 miles to the east in Andrews, Texas. The hospital is fully equipped to handle most types of emergencies. WCS also has agreements with the Andrews County Sherriff's Office and the Eunice Police Department to provide law enforcement services should they be needed at the facility. Other off-site assistance may be requested from industry or the NRC, as specified in the ~~ERP~~CERP.

The ~~ERP~~CERP was submitted to the following organizations for their review and comment in accordance with 10 CFR 72.32(a)(14):

- Andrews, Texas Police Department
- Andrews County Sherriff's Office
- Carlsbad Medical Center
- City of Andrews, Texas
- Eunice, New Mexico Fire and Rescue
- Eunice, New Mexico Police Department
- Lea Regional Medical Center
- Permian Regional Medical Center

The MOUs are included as Appendix D in the CERP. ~~Comments received from off-site response agencies are included as an attachment to the Emergency Response Plan.~~

The ~~ERP~~CERP does not cover actions to be taken for security related events at the WCS CISF. These actions will be governed by the WCS CISF Safeguards Contingency Plan.

WCS CERP Impacts:

WCS CERP has been updated:

WCS has removed Table B *CISF Malfunction Initiating Condition Matrix*, from the CERP.

CHAPTER 11

EMERGENCY PLAN

The Emergency Plan (EP) has been prepared to establish the procedures and practices for management control over unplanned or emergency events that may occur at the CISF, and to meet the requirements of 10 CFR 72.32(a).

Evaluation of the consequences of credible and hypothetical accidents postulated to occur at the WCS CISF determined that releases of radioactivity would not require response by an off-site organization to protect persons beyond the boundary of the WCS CISF owner-controlled area, resulting in an Alert as the single emergency classification level for events occurring at the CISF. This is based on worst-case consequences of potential accidents at the CISF and the guidance of NUREG-1567, and is consistent with NUREG-1140, which concluded that the worst-case postulated accident involving a CISF has insignificant consequences to the public health and safety.

13.5 Emergency Response Planning

A Consolidated Emergency Response Plan (CERP) has been prepared for the WCS CISF with an outline and content that complies with the requirements of 10 CFR 72.32(a). The CERP applies specifically to emergencies that could occur at the WCS CISF.

All accidents and off-normal events evaluated in Chapter 12 of this SAR were considered in the planning basis for development of the CERP. The planning basis includes credible events as well as hypothetical accidents whose occurrence is not considered credible, so as not to limit the scope of Emergency Response Planning. Evaluation of the consequences of credible and hypothetical accidents postulated to occur at the WCS CISF determined that releases of radioactivity would not require response by an off-site organization to protect persons beyond the boundary of the WCS CISF owner-controlled area. There is a single emergency classification level for events at the WCS CISF, the Alert classification, which is based on the worst-case consequences of potential accidents which are postulated to occur at the WCS CISF.

Should an off-normal event or accident occur, the CERP requires personnel stationed at the WCS CISF to notify appropriate emergency response personnel and the Incident Commander (IC) or designee immediately. The emergency response personnel are then responsible for responding to the event in accordance with the CERP and notifying the appropriate authorities, as stated in the CERP. The emergency response personnel are also responsible for calling out trained personnel to assemble at the WCS CISF to mitigate the consequences of the emergency at the direction of the Incident Commander (IC), assess radiation and radioactivity levels in the vicinity of the WCS CISF, and return the WCS CISF to a safe and stable condition. The design of the WCS CISF provides for accessibility to equipment on-site and availability of off-site emergency facilities and services in accordance with 10 CFR 72.122(g). WCS has a central Emergency Operations Center (EOC) from which management and support personnel carry out coordinated emergency response activities. The EOC is the location having appropriate communications and informational materials to carry out the assigned emergency response mission. The primary EOC is the Executive Conference Room located in the southern section of the main administrative building within the boundaries of the existing facility. The secondary EOC is the LLRW Administration Building, also within the existing facility boundary.

The CERP identifies Incident Commanders (ICs) who train to coordinate the response of the Emergency Response Organization (ERO) to an emergency event. These personnel may not always be present at the facility when an event occurs. One of the ICs designated in the CERP is always on-call. If the on-call IC is not at the facility, then he / she is available to those individuals present at the facility through communication devices or other means. Depending upon the nature of the event, the on-call IC may designate certain duties to those present at the facility by phone or electronic communication. The IC assumes responsibilities for declaring an Alert, as appropriate, and activation of the ERO, as well as communicating with on-site emergency response personnel and apprising them of the situation at the WCS CISF. The CERP identifies responsibilities and staffing of the on-site ERO and for requesting off-site assistance. Members of the ERO will be trained on how to respond to various emergencies at the WCS CISF, as established in the CERP.

Off-site assistance may be requested as necessary from both the Andrews County Volunteer Fire Department, located 32 miles from the WCS CISF, and the Eunice, New Mexico Volunteer Fire Department, located 6 miles from the WCS CISF. Both departments have signed agreements to assist the WCS ERO in the control of major emergencies are both equipped to respond to structural fires, oil well fires and chemical tank explosions. The City of Andrews Police Department provides ambulance service for Andrews County and has agreed to provide emergency medical assistance and evacuation for the WCS CISF. Additional ambulance service is available through the Eunice Fire and Rescue Service, which has also agreed to provide emergency medical care to the facility. For off-site medical care, Carlsbad Medical Center, located in Carlsbad, New Mexico is the first choice for incidents involving radiologically contaminated individuals unless life-threatening injuries are present, in which case they would take precedence and treatment would be sought at Lea Regional Medical Center or Permian Regional Medical Center. Lea Regional Medical Center is located 25 miles to the northwest in Hobbs, New Mexico. The hospital is fully equipped to handle most types of emergencies and has a life flight helicopter available. The hospital has received training from the Waste Isolation Pilot Plants (WIPP) personnel on the handling of injury victims in the event of contamination with radioactive materials. Permian Regional Medical Center is located approximately 32 miles to the east in Andrews, Texas. The hospital is fully equipped to handle most types of emergencies. WCS also has agreements with the Andrews County Sherriff's Office and the Eunice Police Department to provide law enforcement services should they be needed at the facility. Other off-site assistance may be requested from industry or the NRC, as specified in the CERP.

The CERP was submitted to the following organizations for their review and comment in accordance with 10 CFR 72.32(a)(14):

- Andrews, Texas Police Department
- Andrews County Sherriff's Office
- Carlsbad Medical Center
- City of Andrews, Texas
- Eunice, New Mexico Fire and Rescue
- Eunice, New Mexico Police Department
- Lea Regional Medical Center
- Permian Regional Medical Center

The MOUs are included as Appendix D in the CERP.

The CERP does not cover actions to be taken for security related events at the WCS CISF. These actions will be governed by the WCS CISF Safeguards Contingency Plan.

RSI NP-17.1

Provide Technical Specifications for design features of the Cask Transfer System (CTS) and Vertical Cask Transporter (VCT) that will have a significant effect on safety if altered or modified.

The proposed design of the CTS and VCT described in Section 7.5 of the WCS CISF SAR identified these items as important to safety. Proposed Technical Specification (TS) 4.4.1, "Lifting," included the following statement:

The CTS and VCT lifting devices shall be designed, fabricated, tested, inspected, and maintained in accordance with the guidelines of NUREG-0612 with the following clarifications:

- The CTS cranes shall be classified as Type 1 cranes in accordance with ASME NOG.1, 1995. Allowable stresses used in the crane designs shall be in accordance with ASME NOG.1. These cranes shall be of single-failure-proof design and meet the requirements of NUREG-0554, "Single-Failure-Proof Cranes for Nuclear Power Plants," May 1970 and NUREG-0612.

- The VCT with CANISTER lifting devices used with the CTS shall be designed, fabricated, operated, tested, inspected and maintained in accordance with NUREG-0612, Section 5.1

The staff determined the proposed design of the CTS and VCT described in Section 7.5 of the WCS CISF SAR are not consistent with these clarifications because neither the CTS nor the VCT include an overhead crane with multiple girders and a top-running trolley, which is the crane design specified in NUREG -0554, ASME NOG.1, and crane design and inspection standards referenced in NUREG-0612. Provide a revision to TS 4.4.1 that accurately reflects the important to safety design features of the CTS and VCT and that satisfies the intent of NUREG-0612 guidelines for safe handling of heavy loads with the potential to damage irradiated fuel.

WCS Response to RSI 17.1:

The Consolidated Interim Storage Facility (CISF) at Waste Control Specialists (WCS) will use both a Vertical Cask Transporter (VCT) and a Canister Transfer System (CTS) in support of unloading transportation casks and transferring canistered spent fuel from the transportation casks into the storage casks as designated by the licenses for each of NAC's technologies. At WCS, in lieu of a formal 10 CFR 50 heavy loads program, the VCT and CTS are independently designed and analyzed to meet the guidance of NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants."

Note that the VCT is also used to transport the loaded Vertical Concrete Casks (VCC), which are heavier than the transportation casks, however, the loaded VCC configurations (UMS, MPC and MAGNASTOR) are analyzed for drops which exceed the prescribed transfer height for handling the loaded VCC. As such, NUREG-0612 guidance is maintained. Load rating the VCT

for handling the VCC lifts (180 tons) provides increased factors of safety for the handling of the bounding transportation casks (149 tons).

The basis for adopting NUREG-0612 as design guidance for both the VCT and CTS is "To provide adequate measures to minimize the occurrence of the principal causes of load handling accidents and to provide an adequate level of defense-in-depth for handling heavy loads near spent fuel and safe shutdown systems."

Understanding the WCS facility will not have safe shutdown equipment or spent fuel pools, it is still recognized that the canisters loaded with spent fuel must be safely and securely handled thereby protecting the spent fuel from damage and protecting the site and surrounding areas from any potential radiological impacts.

NUREG-0612, Section 5 provides the general guidelines for controlling heavy loads and specifically Section 5.1.6 provides guidance in establishing the criteria for single-failure-proof handling through the use of redundant load paths or increased factors of safety. NUREG-0612 also points to NUREG-0554, "Single-Failure-Proof Cranes for Nuclear Power Plants", to provide guidance on design, fabrication, installation, and testing of new cranes that are of a high reliability design. For the CTS, NAC has used applicable portions of ASME NOG-1 as guidance for the hydraulic gantry crane and bridge components.

As stated in Regulatory Issue Summary (RIS) 2005-25, Supplement 1, "...the application of the criteria for Type 1 cranes from ASME NOG-1, 'Rules for Construction of Overhead and Gantry Cranes,' to the design of new overhead heavy load handling systems is an acceptable method for satisfying the guidelines of NUREG-0554, 'Single-Failure-Proof Cranes for Nuclear Power Plants.'"

Additionally, from NUREG-0800, Revision 1, Section 9.1.5, "Overhead Heavy Load Handling Systems", Section I.4.C, "The probability for a load drop is minimized by an overhead handling system designed to comply with the guidelines of NUREG-0554 and lifting devices that comply with American National Standards Institute (ANSI) N14.6 or an alternative based on American Society of Mechanical Engineers (ASME) B30.9. An overhead handling system that complies with ASME NOG-1 criteria for Type 1 cranes is an acceptable method for compliance with the NUREG-0554 guidelines."

CTS components not within the scope of ASME NOG-1, such as the lift links, shackles, slings, transfer cask lift plates, chain hoist and canister lift adapter, invoke applicable ASME B30 Standards and are designed with twice the required factors of safety. Special lifting devices, per ANSI N14.6, have factors of safety of at least six on material yield strength and at least ten on material ultimate strength.

As both the VCT and CTS are essentially longitudinally moving jacking towers, and not electric overhead traveling cranes, as described in NUREG-0612 and NUREG-0554, their component parts must be addressed individually, with regard to the applicable criteria of USNRC regulatory guides and nuclear & non-nuclear industry standards, for the purpose of confirming single-failure-proof handling capability of the overall systems. Additional details on how the specific

design standards are applied to individual system components can be found in the response to RSI 5.5.

WCS Proposed Technical Specification Impact:

Proposed Technical Specification 4.4.1 is being revised as follows to specify which standard is being applied to particular components.

Lifting of a loaded TRANSPORATION CASK, TRANSFER CASK, or VCC with an NAC-MPC, NAC-UMS or MAGNASTOR CANISTER shall be performed with the CTS in accordance with guidelines of NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants," July 1980. The CTS and VCT lifting devices shall be designed, fabricated, operated, tested, inspected, and maintained in accordance with the guidelines of NUREG-0612 with the following clarifications:

- The CTS cranes shall be classified as Type 1 cranes in accordance with ASME NOG-1, 1995. Allowable stresses used in the crane designs shall be in accordance with ASME NOG-1. These cranes shall be of single-failure-proof design and meet the ~~requirements~~ applicable guidelines of NUREG-0554, "Single-Failure-Proof Cranes for Nuclear Power Plants," May 1970 and NUREG-0612. In addition, the CTS shall be designed, fabricated, operated, tested, inspected, and maintained in accordance with the guidelines of NUREG-0612. The specific applicable standard being applied to each primary gantry system component is as follows:

    - Hydraulic Locking Telescoping Boom Gantry Leg Assemblies on Self Propelled Dollies – ASME B30.1
    - Lift Beams (spanning the Telescoping Gantry Leg Assemblies) – ASME NOG-1
    - Trolley Beam (spanning the Lift Beams & also mounted on Self Propelled Dollies) – ASME NOG-1
    - Standard Lift Links – ASME B30.26
    - Standard Shackles – ASME B30.26
    - Standard Slings – ASME B30.9
    - Transfer Cask Lift Plates – ANSI N14.6
    - Air Operated Chain Hoist (suspended from Trolley Beam) – ASME NUM-1 Qualified with Rated Load per ASME HST-5
    - Canister Lift Adapter (which mates with canister) – ANSI N14.6

- The VCT with CANISTER lifting devices used with the CTS shall be designed, fabricated, operated, tested, inspected, and maintained in accordance with the guidance of NUREG-0612, Section 5.1. The specific applicable standard being applied to each primary VCT is as follows:

    - Hydraulic Locking Telescoping Boom Assemblies – ASME B30.1

- Lift Beam(s) (spanning the Telescoping Boom Assemblies) – ANSI N14.6
- Cask Lift Links – ANSI N14.6

4.0 Design Features (continued)

4.3 Storage Area Design Features

The following storage location design features and parameters shall be implemented at the WCS CISF.

4.3.1 Storage Configuration

HSMs are placed together in single rows or back-to-back arrays. An end shield wall is placed on the outside end of any loaded outside HSM. A rear shield wall is placed on the rear of any single row loaded HSM.

The VCCs for NAC-MPC, NAC-UMS, and MAGNASTOR Systems shall meet the minimum center-to-center spacing requirements presented in the SAR.

4.3.2 Concrete Storage Pad Properties to Limit CANISTER Gravitational Loadings Due to Postulated Drops

The STCs with NUHOMS® CANISTERs have been evaluated for drops of up to 80 inches onto a reinforced concrete storage pad.

For concrete storage pads loaded with NAC-MPC, NAC-UMS, and/or MAGNASTOR VCC systems, the storage pad shall meet the concrete storage pad properties presented in CoC No. 1025, Section B 3.4, CoC No. 1015, Section B 3.4, and CoC No. 1031, Sections 4.3.1 and 5.4.

4.4 Cask Receipt and CTS

4.4.1 Lifting

Vertical lifting of the STC with a NUHOMS® CANISTER is not allowed. Horizontal lifting of the TRANSPORTATION CASK or TRANSFER CASK with an NAC-MPC, NAC-UMS or MAGNASTOR CANISTER is not allowed.

Lifting of a loaded TRANSPORTATION CASK, TRANSFER CASK, or VCC with an NAC-MPC, NAC-UMS or MAGNASTOR CANISTER shall be performed with the CTS in accordance with the guidelines of NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants," July 1980. The CTS and VCT lifting devices shall be designed, fabricated, operated, tested, inspected, and maintained in accordance with the guidelines of NUREG-0612 with the following clarifications.

- The CTS cranes shall be classified as Type 1 cranes in accordance with ASME NOG-1, 1995. Allowable stresses used in the crane designs shall be in accordance with ASME NOG-1. These cranes shall be of single-failure-proof design and meet the applicable guidelines of NUREG-0554, "Single-Failure-Proof Cranes for Nuclear Power Plants," May 1970 and NUREG-0612. In addition, the CTS shall be designed, fabricated, operated, tested, inspected, and maintained in accordance with the guidelines of NUREG-0612. The specific applicable standard being applied to each primary gantry system component is as follows:
    - Hydraulic Locking Telescoping Boom Gantry Leg Assemblies on Self Propelled Dollies-ASME B30.1
    - Lift Beans (spanning the Telescoping Gantry Leg Assemblies) – ASME NOG-1

- Trolley Beam (spanning the Lift Beams & also mounted on Self Propelled Dollies) – ASME NOG-1
- Standard Lift Links – ASME B30.26
- Standard Shackles – ASME B30.26
- Standard Slings – ASME B30.9
- Transfer Cask Lift Plates – ANSI N14.6
- Air Operated Chain Hoist (suspended from Trolley Beam) – ASME NUM-1 Qualified with Rated Load per ASME HST-5
- Canister Lift Adapter (which mates with canister) – ANSI N14.6

- The VCT with CANISTER lifting devices used with the CTS shall be designed, fabricated, operated, tested, inspected and maintained in accordance with the guidance of NUREG-0612, Section 5.3. The specific applicable standard being applied to each primary VCT is as follows:
  - Hydraulic Locking Telescoping Boom Assemblies – ASME B30.1
  - Lift Beam(s) (spanning the Telescoping Boom Assemblies) – ANSI N14.6
  - Cask Lift Links - ANSI N14.6