CHAPTER 3
PRINCIPAL DESIGN CRITERIA

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3. PRINCIPAL DESIGN CRITERIA

The purpose of Chapter 3 is to provide the principal design criteria utilized in the design of the Waste Control Specialists, LLC (WCS) Consolidated Interim Storage Facility (CISF) and authorized storage systems.

The storage of spent nuclear fuel (SNF) and reactor related Greater-than-Class C (GTCC) waste at the WCS CISF is based on the use of cask systems that have been previously *licensed and/or* certified by the NRC. These cask systems are canister-based storage systems. Table 1-1 provides a listing of the cask systems authorized for use at the WCS CISF.

3.1 Purposes of Installation

The purpose of the WCS CISF is to provide interim storage for pressurized water reactor (PWR) and boiling water reactor (BWR) SNF from commercial nuclear power plants throughout the United States and GTCC waste. The initial phase, Phase 1, is designed to store approximately 470 canisters containing SNF and GTCC waste. The total storage capacity for Phase 1 is limited to 5,000 metric tons of heavy metal (MTHM) for SNF and 510,000 pounds of GTCC waste.

The WCS CISF utilizes dry cask storage systems. These systems store canisters of SNF and GTCC waste inside a storage overpack which provides physical protection, heat removal, radiation shielding, criticality control, and confinement for the safe storage of SNF.

The dry cask storage systems used at the WCS CISF include the NUHOMS®-MP187 Storage System (SNM License 2510), the Standardized NUHOMS® 61BT Storage System and the Standardized NUHOMS® 61BTH Type 1 Storage System (NRC Certificate of Compliance 72-1004), the Advanced Standardized NUHOMS® Storage System (NRC Certificate of Compliance 72-1029), the NAC-MPC Storage System (NRC Certificate of Compliance 72-1025), the NAC-UMS Storage System (NRC Certificate of Compliance 72-1015), and the MAGNASTOR Storage System (NRC Certificate of Compliance 72-1031).

3.1.1 Materials to Be Stored

3.1.1.1 Spent Fuel and Other Radioactive Materials Associated with Fuel Assemblies

The WCS CISF provides interim storage for SNF and GTCC waste loaded in canisterized systems until retrieval of the canisters for transport to a repository or other site. The SNF and GTCC waste is stored in sealed, metallic canisters inside storage overpacks. The canisters contain multiple SNF assemblies and associated hardware or GTCC waste in a dry, inert environment. The WCS Phase 1 CISF is designed to store approximately 470 casks with canisters containing SNF or GTCC waste. The total SNF storage capacity for the WCS CISF is 5,000 MTHM.

All of the types of canisterized SNF that would be stored at the WCS CISF during Phase 1 have previously been approved for storage in one of the six storage overpack systems. The physical, thermal and radiological characteristics for these SNF types are described in detail in the final safety analysis reports (FSAR) for cask storage systems identified in Section 2.1 of the Technical Specifications and listed in Table 1-1.

3.1.1.2 Greater than Class C Waste

The WCS CISF is designed to store up to 231.3 MT (510,000 pounds) of reactor related GTCC waste. GTCC waste containers will contain solid reactor-related waste only, consisting of activated reactor vessel internals and other in-core instrumentation. A description and characterization of the GTCC waste is provided in Appendix H, Section H.3.1.1. There will be no liquid or process GTCC waste stored at the WCS CISF.

The physical, thermal and radiological characteristics of the canisters that would be used to store GTCC waste in a NUHOMS® system are described in the Rancho Seco FSAR, Appendix C [3-18]. GTCC waste stored in NAC systems can be received from the Maine Yankee, Connecticut Yankee, Yankee Rowe, and Zion power plants. For Maine Yankee, the GTCC waste is described in Section 1.3.1.1.2 of the SAR for the NAC-UMS transportation cask, and in Certificate of Compliance No. 9270, Condition 5.(b)(1)(iv) [3-20]. For Connecticut Yankee and Yankee Rowe, the GTCC waste is described in Section 1.2.3.2 of the SAR for the NAC-STC transportation cask and Certificate of Compliance No. 9235, Condition 5.(b)(1)(iii) [3-19]. For Zion, the GTCC waste is described in Section 1.3.2 of the SAR for the NAC-MAGNATRAN, NRC Docket No. 9356 [3-21]. See Appendix H for more details on GTCC waste.

3.1.2 General Operating Functions

3.1.2.1 Transportation and Storage Operations

The WCS CISF is designed to use storage overpacks that use both horizontal (NUHOMS®) and vertical (NAC) storage systems. The major activities at the WCS CISF for horizontal storage systems include the receipt of the MP187 and MP197HB transportation casks, the lifting of MP187 and MP197HB casks onto transfer vehicles, moving the casks to the outdoor storage pad, and placing SNF canisters into the NUHOMS® horizontal concrete storage vaults. The major activities at the WCS CISF for vertical storage systems include the receipt and unloading of transportation casks, the transfer of SNF canisters from transportation casks to the vertical concrete casks, and the transfer and placement of vertical concrete casks on outdoor storage pads.

3.1.2.2 Onsite Generated Waste Processing, Packaging and Storage

The storage overpack systems used at the WCS CISF are designed to confine SNF and GTCC waste within seal-welded canisters. The WCS CISF handles only canisterized SNF and GTCC waste; therefore, the only radioactive wastes are solid wastes generated from residual quantities of radioactive contamination that may be encountered on the surfaces of the transportation casks due to weeping.

As addressed in Section 6.1, this solid waste would be packaged and temporarily stored in a designated radiologically controlled area until the waste is characterized and shipped to a licensed disposal facility.

There are no other systems or facilities for processing, packaging, storing, or transporting any other type of radioactive waste at the WCS CISF. Waste confinement and management requirements are further described in Chapter 6.

3.1.2.3 Utilities

The WCS CISF is supported by utility systems necessary for facility operation. Electrical power is provided for the operation of lights, monitoring equipment, communication systems, security systems, and support equipment. Backup electrical power is provided for essential security and emergency systems. Mechanical utility systems are provided for the facility to provide water, building HVAC systems, fire detection and suppression, compressed air, and sewage handling systems.

3.2 Structural and Mechanical Safety Criteria

This section establishes requirements that satisfy 10 CFR 72.122(b), which identifies the general design criteria that require structures, systems, and components (SSCs) classified as Important-to-Safety (ITS) be designed to accommodate the effects of, and to be compatible with, site characteristics and environmental conditions associated with normal operation of the facility. In addition, appropriate consideration of off-normal and accident conditions must be determined so that SSCs ITS can be designed to withstand the effects of these conditions without impairing their ability to perform their safety functions.

Table 1-2 provides a summary of WCS CISF principal design criteria. The principal design criteria considered for the design of ITS systems and components are defined in the system SARs and compared against the WCS CISF site-specific conditions to demonstrate that the existing designs bound the WCS CISF site conditions. For structural evaluations, specific load values based on these criteria are developed in Chapter 7 and compared against the design basis for each authorized cask system. For thermal evaluations, specific thermal conditions based on these criteria are developed in Chapter 8 and compared against the design basis for each authorized cask system. For shielding, criticality and confinement evaluations, specific conditions based on these criteria are developed in Chapters 9, 10 and 11, respectively, and evaluated against the design basis for each authorized cask system.

The authorized storage systems are designed to provide long-term storage of SNF. 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 SNF 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 Certificates of Compliance or site-specific licenses. Table 3-4 provides the specific references to where SSCs deemed ITS for the storage systems used at the WCS CISF are located.

Loads considered for the WCS CISF are categorized as follows:

Loads	***Normal***	***Off-Normal***	***Accident-Level***
Dead Loads	*X*		
Live Loads	*X*		
Handling Loads	*X*	*X*	
Snow and Ice Loads	*X*		
Wind Loads	*X*		
Internal/External Pressure	*X*	*X*	

Lateral Soil Pressure	*X*	*X*	
Thermal Loads	*X*	*X*	*X*
Explosion Overpressure			*X*
Drop/Tipover			*X*
Accident Pressurization			*X*
Fire			*X*
Tornado Wind/Missiles			*X*
Floods			*X*
Earthquake			*X*

Design criteria for these loads are described in this chapter and are used in the design of all SSCs classified as ITS. The SSCs that are classified as ITS are discussed in Section 3.4.

The NUHOMS® and vertical storage system design criteria are fully described in Appendices A-G. Chapter 12 addresses site specific accident conditions and Table 12-1 provides a cross-walk that points to the appropriate Appendix for each authorized canister/cask system.

3.2.1 Tornado and Wind Loadings

The design of SSCs considers the loads resulting from tornado and extreme wind. The design basis tornado is presented in Table 1-2. Design basis tornado characteristics are based on NRC Regulatory Guide 1.76 [3-2], and NUREG-0800 [3-3].

3.2.1.1 Applicable Design Parameters

The facility, except the cask storage system components, is designed for wind velocities of 90 mph as shown in Figure 6-1 of ASCE-7 [3-24]. The design basis wind is defined as a 3-second gust for Exposure C category.

The cask storage systems are designed to withstand a tornado from Region II as defined by Regulatory Guide 1.76 [3-2]. The design basis tornado characteristics for Region II are listed in Table 1-2.

3.2.1.2 Determination of Forces on Structures

Forces on structures from the design basis wind and the design basis tornado are addressed in the design. The method used to convert wind loading into forces on a structure is in accordance with NUREG-0800 (Section 3.3.1, Wind Loadings, and Section 3.3.2, Tornado Loadings) [3-3].

3.2.1.3 *Ability of Structures to Perform Despite Failure of Structures Not Designed for Tornado Loads*

The WCS CISF is designed so that SSCs not designed for tornado loads do not affect the ability of SSCs that are classified as ITS to perform their intended design functions.

The Cask Handling Building (CHB) is not designed to withstand tornado-generated wind loadings and missiles. It will be governed by administrative controls used to preclude the presence of loaded storage, transportation, or transfer casks inside the CHB during a tornado watch or other inclement weather watches with the potential to lead to winds in excess of those addressed by the International Building Code (IBC), thereby eliminating the potential for structural members of the overhead bridge crane from collapsing onto SNF transportation or storage overpack systems due to these weather events.

3.2.1.4 *Tornado Missiles*

SSCs that are classified as ITS are designed for tornado-generated missiles with the exceptions addressed in Section 3.2.1.3. The loaded storage overpacks are designed to remain stable and to maintain the confinement boundary when subjected to tornado-generated missiles. Tornado-generated missiles are not required to be considered in the design of the canister since the canister is protected by the storage overpack.

Tornado missile load conditions are based on the design basis tornado addressed in Section 3.2.1.1. The evaluation cases required by NUREG-0800, Section 3.5.1.4 [3-3] include at least three objects as potential tornado missiles: a massive high kinetic energy missile which deforms on impact, a rigid missile to test penetration resistance, and a small rigid missile of a size sufficient to just pass through any openings in protective barriers. Tornado missile load cases are established in Table 1-2.

3.2.2 *Water Level (Flood) Design*

The WCS CISF is located in Andrews County, Texas which has a semi-arid climate with approximately 16 inches of rain per year. There are no lake systems or flowing or intermittent streams nearby.

3.2.2.1 *Flood Elevations*

The Probable Maximum Flood (PMF) elevation established in the Floodplain analysis (Chapter 2, Attachment B) is 3488.9 ft msl at the WCS CISF. The elevations of the storage pads vary with the lowest point being 3489 ft msl. The finish floor elevation of the CHB is 3493 ft msl and the finish floor elevation of the Security and Administration Building is 3496 ft msl.

Table 3-1 provides the cross reference to the applicable appendix for each canister/storage overpack for the systems authorized for storage at the WCS CISF. In general, these systems are designed to withstand severe flooding, including full submergence as described in the reference appendices in Table 3-1 for each system. However, the WCS CISF site will remain dry in the event of a flood because the site location and site grade is above the elevation of the PMF from offsite sources as documented in Section 2.4.2.2. The site area is designed to assure adequate drainage for heavy rainfall, including the 100-year event. Therefore, a flood event will not impact SNF and GTCC waste storage or transfer operations.

3.2.2.2 Phenomena Considered in Design Load Calculations

SSCs are not in a floodplain and are above the PMF elevation. Therefore, they are not required to consider flood design loads.

3.2.2.3 Flood Force Application

SSCs are not in a floodplain and are above the PMF elevation. Therefore, they are not required to consider flood design loads.

3.2.2.4 Flood Protection

SSCs are not in a floodplain and are above the PMF elevation. Therefore, they are not required to consider flood design loads.

3.2.3 Seismic Design

The design of SSCs classified as ITS consider loadings based on the WCS CISF design basis ground motion, which was determined by a probabilistic seismic hazard analysis (PSHA) as discussed in Section 2.6 with the exception of the CHB. The CHB seismic design considerations are in accordance with the IBC [3-10]. Probabilistic analysis does not result in the determination of a unique Design Earthquake, such as is the case for a deterministic analysis. Instead, several scenarios and models are used to estimate the likelihood of earthquake ground motions at a site and systematically take into account uncertainties that exist in various hazard parameters. The outcomes are in the form of hazard curves that show the mean annual probabilities or frequencies with which various levels of fault displacement and ground motion are expected to be exceeded.

3.2.3.1 Input Criteria

Andrews County is located within the Southern Great Plains physiographic and tectonic province. As described in Section 2.6, a PSHA was performed to establish the appropriate seismic design basis for the facility. A return period of 10,000 years was determined to be appropriate.

Section 2.6.2 documents the evaluation that demonstrates that the ground surface design response spectrum peak horizontal acceleration for 0.01 seconds is 0.25 g and the vertical is 0.175 g.

To estimate ground motions, four Next Generation of Attenuation (NGA)-West2 ground motion prediction models for the western U.S. (WUS) and the EPRI [3-32] models for the central and eastern U.S. (CEUS) were utilized. For the NGA-West2 models, a time-averaged shear wave velocity (VS) in the top 100 ft (VS30) of 760 m/sec was used. The EPRI [3-32] ground motion models are defined for hard rock or a VS30 of 2,830 m/sec and greater. It is unclear whether the site area should be considered a tectonically active region like the WUS or a stable continental region like the CEUS. It may likely be located in a transition between the WUS and CEUS.

Hence the question arises whether the NGA-West2 ground motion models or the EPRI [3-32] models are more appropriate for the region around the site. Geologic and geophysical data suggests the former but to address the epistemic uncertainty on which models are appropriate, both the NGA-West2 and EPRI [3-32] models were used in the PSHA weighted 0.60 and 0.40, respectively.

In addition, a site-specific geotechnical investigation (Chapter 2, Attachment E) was performed to ensure the geological characteristics and soil are stable under earthquake conditions as described in Section 2.6.

There is no surface faulting in the vicinity of the WCS CISF. The closest Quaternary fault is an unnamed fault at the base of the Guadalupe Mountains, listed as fault No. 907 in the USGS database and located approximately 104 miles southwest of the WCS CISF in Guadalupe Mountains National Park in Culberson County, Texas as documented in Section 2.6.3.

3.2.3.2 Design Response Spectra

Based on the PSHA and the inputs of the seismic source model and ground motion models, seismic hazard curves for both firm and hard rock were calculated. The absence of late-Quaternary faulting and the low to moderate rate of background seismicity, even that associated with petroleum recovery activities, results in relatively low seismic hazard at the WCS site. The largest contributor to the hazard at the WCS site is the background seismicity (the Southern Great Plains seismic source zone and Gaussian smoothing).

A site response analysis was performed to estimate the ground motions at the WCS site incorporating the site-specific geology. Using a random vibration theory-based equivalent-linear site response approach, the VS data collected by the University of Texas, Austin, and dynamic material property curves, both the hard rock and firm rock hazard curves from the PSHA were adjusted to the ground surface. The hazard curves were weighted based on the weights assigned to the NGA-West2 and EPRI [3-32] ground motion models and a 10,000 year return period horizontal Uniform Hazard Spectrum (UHS) was calculated. A 10,000-year return period vertical UHS was also calculated using the NRC V/H ratios.

The horizontal and vertical UHS for a return period of 10,000 years represent the recommended DRS for seismic design of the CISF. The DRS peak horizontal acceleration is 0.25 g. Three sets of three-component time histories were developed by spectral matching to the 5%-damped DRS. Also estimated for use in seismic design analyses as a function of depth were strain-compatible shear-wave velocity, density, effective strains, and damping.

3.2.3.3 Design Response Spectra Derivation

The seismic analysis for the CISF swas performed to be consistent with 10 CFR 72.103 [3-23], U.S. Nuclear Regulatory Commission's NUREG- 0800 "Standard Review Plan (SRP) for the Review of Safety Analyses Reports for Nuclear Power Plants: LWR Edition" [3-3] and NUREG/CR-6728 "Technical Basis for Revision of Regulatory Guidance on Design Ground Motions: Hazard- and Risk-Consistent Ground Motion Spectra Guidelines" [3-25].

3.2.3.4 Design Time History

Consistent with NRC requirements, horizontal and vertical DRS for a 10,000 year return period and associated strain-compatible properties were developed and provided for the SSI analysis. Three three-component sets of time histories were developed through spectral matching. A final report was produced that describes and summarizes the above analyses in Chapter 2, Attachment D. All calculations were performed in accordance with AECOM's NQA-1 Program. Detailed calculations are contained in calculation WCS-12-05-200-001 in Chapter 2 Attachment D.

Design time histories are used to verify all required components are considered acceptable. Chapter 7 includes further details.

3.2.3.5 Use of Equivalent Static Loads

Chapter 7 of the SAR details the load analyses used in the seismic design and analysis.

For the Vertical Storage Systems storage pad the soil material properties used are the static properties, equal to or lower than the dynamic soil properties and, therefore, conservative for use in an equivalent static analysis. The soil properties used in the equivalent static analysis for the Vertical Storage System storage pads are given in Appendix C of [3-33] and are listed in Table 7-38.

The design criteria used for the Canister Transfer System (CTS) is specified in ASME NOG-1, Section 4000 [3-26]. All of the load combinations identified in paragraph 4140 have been evaluated. Controlling load combinations have been used to determine component stresses and then are compared to applicable allowable stresses. The sum of simultaneously applied loads (static and dynamic) do not result in stress levels which would cause any permanent deformation, and thus, the CTS fully meets the requirements of ASME NOG-1 [3-26].

CHB structural steel components are analyzed and designed to resist the specified loading combinations in the IBC [3-10]. 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.

Seismic analysis information for the NUHOMS® and Vertical Storage System design criteria are fully described in Appendices A.3, B.3, C.3, D.3, E.3, F.3 and G.3.

3.2.3.6 Critical Damping Values

Critical damping values are in accordance with Regulatory Guide 1.61 [3-27] for a SSE.

3.2.3.7 Basis for Site-Development Analysis

Site-specific vibratory ground motion is determined through evaluation of the seismology, geology, and the seismic and geologic history of the site and surrounding region. This information is contained in the site-specific PSHA (Chapter 2, Attachment D).

3.2.3.8 Soil Supported Structures

The soil supported structures that are analyzed for the CISF design basis ground motion are the ITS Storage Pads and the CTS. The CHB is analyzed based on criteria established by the IBC [3-10].

3.2.3.9 Soil-Structure Interaction

Soil-structure interaction (SSI) is considered in the design of the storage pads and the CTS. The CHB is classified as ITS Category C and is analyzed and designed in accordance with the IBC [3-10]. Under the IBC, analysis of soil-structure interaction is not required for this building. The soil-supported structures requiring SSI are evaluated by considering the properties and effects of the subsurface established during the geotechnical investigation (Chapter 2, Attachment E). Soil boring logs and soil properties of the WCS CISF site are contained in Chapter 2, Attachment E.

3.2.3.10 Seismic-Systems Analysis

3.2.3.10.1 Seismic Analysis Methods

Seismic Analysis for SSCs designated ITS can be found in Chapter 7.

3.2.3.10.2 Natural Frequencies and Response Loads

A modal analysis studies the dynamic properties of structures under vibrational excitation and determines modes of the structure defined by natural frequencies and other factors. Response loads are developed based on the response-spectrum analysis at the appropriate frequencies.

3.2.3.10.3 Procedure Used to Lump Masses

The mass of a system is distributed throughout the actual structure. Lumping mass is an idealized method that concentrates the mass of a system at the nodes of the structure model. The lumped masses at the nodes of a structure are the sums of the actual system mass that can be reasonably attributed to that specific node point represented in the analysis model.

3.2.3.10.4 Methods Used to Couple Soil with Seismic-System Structures

The soil can be represented by discrete springs or a finite element model to represent the soil subgrade.

3.2.3.10.5 Methods Used to Account for Torsional Effects

The storage pads and the CHB are modeled to consider torsional effects due to the eccentricities of the masses.

3.2.3.10.6 Methods for Seismic Analysis of Dams

There are no dams onsite or in the immediate area.

3.2.3.10.7 Methods to Determine Overturning Moments

Stability of the storage overpacks on the storage pads is evaluated to ensure stability. Overturning moments are developed using site-specific seismic design parameters.

3.2.3.10.8 Analysis Procedure for Damping

Critical damping values are developed in accordance with Regulatory Guide 1.61 [3-27].

3.2.3.10.9 Seismic Analysis of Overhead Cranes

The CTS is analyzed for seismic effects in accordance with the requirements of NUREG-0554 [3-29] for single-failure-proof cranes.

The overhead cranes in the CHB are analyzed for the seismic effects in accordance with the requirements in the IBC. Seismic clips are provided on the overhead crane bridge trucks and trolley to limit uplift during a seismic event, thereby eliminating the potential for the bridge or trolley to fall onto loaded SNF casks inside the CHB.

3.2.3.10.10 Seismic Analysis of Specific Safety Features

SSCs classified as ITS meet the requirements of 10 CFR 72.122(b)(2) [3-23], which requires SSCs be designed such that design basis ground motion will not impair the capability to perform their safety functions.

3.2.4 Snow and Ice Loadings

The maximum recorded snowfall in any month near the WCS CISF is less than 14 inches per Table 2-4 and the bounding snow load is 10 psf as documented in Section 2.3.3.4.

3.2.5 Thermal

Thermal design criteria are derived from the WCS CISF site characteristics and include ambient temperature and insolation (solar load). These are used in the determination of thermal conditions to be addressed in the system and component analyses. Specific load values for these criteria are addressed in Chapter 8.

3.2.5.1 Ambient Temperature

Ambient normal, off normal, and extreme temperatures are given in Table 1-2. These are documented in Section 2.3.3.1.

3.2.5.2 Solar Load (Insolation)

The solar loads are given in Table 1-2 and are taken from 10 CFR Part 71 [3-4].

3.2.6 Volcanic Eruption (Ash Fall)

No volcanic ash fall criteria are specified. The probability of a volcanic eruption near the WCS CISF is extremely low, as discussed in Section 2.6.6, such that no specific design considerations are made for ash fall.

3.2.7 Lightning

The design of the SSCs that have the potential to be outdoors and exposed to lightning are designed to withstand the effects of lightning without impairing their capability to perform their safety function. The Security and Administration Building and the CHB are provided lightning protection in accordance with the IBC to protect personnel and equipment. Site light poles and perimeter fences are connected to grounding systems to protect personnel and equipment during the event of lightning strikes.

3.2.8 *Combined Load Criteria*

This design considers all appropriate loads and load combinations required by the applicable SSC design codes. Design loads are determined from normal, off-normal, and accident-level conditions. Design loads are combined to simulate the most adverse load conditions.

3.2.8.1 *NUHOMS® and Vertical Cask Systems*

The NUHOMS® storage systems and the Vertical storage systems are designed to provide long-term storage of SNF. The canister materials are selected to protect against degradation during the storage period, including the application of system specific aging management programs.

3.2.8.2 *Cask Storage Pad Load Combinations*

The storage pads for the Vertical system storage modules are ITS. Load combinations are provided in Section 7.6.1.4.

3.2.8.3 *Canister Transfer System*

The CTS is ITS. Load combinations are in accordance with ASME NOG-1 [3-34].

3.2.8.4 *Cask Handling Building Load Combinations*

The CHB is a structural steel building with metal siding. The building will support two overhead cranes and consider their effects on loading combinations. The design of the structure is in accordance with the IBC. The design will consider load combinations as required by the IBC [3-10]. Section 7.5.3 provides additional information on the CHB design criteria.

3.2.8.5 *Cask Handling Building Foundation*

The foundation for the CHB is a conventional mat foundation of reinforced concrete construction. Loads and load combinations used in the design of the foundations are in accordance with the IBC [3-10]. Load factors and allowable stresses used in the design is in accordance with ACI 318 [3-6].

3.2.8.6 *Cask Handling Building Cranes*

The overhead bridge cranes are classified as Not-Important-to-Safety (NITS) and are designed in accordance with ASME B30.2, "Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist)" [3-30]. The overhead bridge cranes rails are attached to the CHB structure in a manner that provides adequate assurance that the rails will remain attached to the CHB structure. The cranes are procured and designed to follow the loading conditions and combinations established in ASME B30.2 [3-30].

3.3 Safety Protection Systems

3.3.1 General

The WCS CISF is designed for safe storage of the SNF and GTCC waste during normal, off-normal, and accident conditions. The primary components that assure that the safety objectives are met are the storage overpack systems, the cask storage pads, the CHB, the CTS, and the Vertical Cask Transporter (VCT).

The components of the storage overpack systems are the Canister, Storage Overpack, and the Transfer Cask. The major safety functions of the storage system components are as follows:

Canister

The canister shell that provides confinement. The canister shell and basket provide heat transfer capabilities, criticality control and radiation shielding when used in conjunction with the storage overpack or transfer cask.

Storage Overpacks (NUHOMS® HSMs or VCCs)

The storage overpack provides protection to the canister from natural phenomena and environmental conditions. The storage overpack also facilitates heat transfer from the canister and provides radiation shielding.

Transfer Cask (NUHOMS® and Vertical Storage System)

The transfer cask provides physical protection and radiation shielding of the canister during transfer operations.

The primary safety function of the storage pads is to provide a stable and level surface for the storage modules.

The primary safety function of the CTS is to provide single-failure proof lifting capability for canister transfer operations and load/unload operations.

The primary safety function of the Cask Handling Building is to provide protection from building structural members or overhead cranes from falling on transportation equipment or storage overpack systems during seismic or weather events.

3.3.2 Protection by Multiple Confinement Barriers and Systems

This section of the principal design criteria establishes requirements that satisfy 10 CFR 72.122(h) [3-23], which identifies requirements for confinement and ventilation of SNF and GTCC waste during storage.

3.3.2.1 Confinement Barriers and Systems

The primary confinement barrier for SNF and GTCC waste is the canister shell. The canister provides confinement for normal, off-normal, and accident storage conditions when inside the storage overpack or transfer cask.

Criteria utilized in the confinement design of the cask systems are not based on site-specific confinement criteria. Chapter 11 addresses confinement criteria adopted for each of the canisters authorized for storage at the WCS CISF identified in Table 1-1.

3.3.2.2 Ventilation-Offgas

There are no ventilation offgas systems required by the WCS CISF due to the sealed canister.

3.3.3 Protection by Equipment and Instrumentation Selection

3.3.3.1 Equipment

The SSCs that have been identified as ITS are described in Section 3.4. The design criteria for these components are summarized in Table 1-2.

3.3.3.2 Instrumentation

This section of the principal design criteria establishes requirements that satisfy 10 CFR 72.122(i) [3-23], which identifies general design criteria that require instrumentation and control systems be provided to monitor systems that are ITS. The instrumentation and control systems at the WCS CISF are classified as NITS.

Temperature monitors may be installed on HSMs to monitor the air outlet temperatures in place of regular visual inspection for inlet and outlet blockage to ensure the overpack remains operable. Temperature monitors are installed on the VCCs to monitor the air outlet temperatures to ensure the overpack remains operable.

Radiation monitors are utilized during canister transfer operations to verify that occupational exposures are within 10 CFR Part 20 [3-22] limits and during the storage life to ensure that doses to the public are within 10 CFR 72.104 [3-23] limits.

3.3.4 Nuclear Criticality Safety

Storage and transportation cask systems received at the WCS CISF are designed to ensure that the stored materials remain subcritical under normal, off-normal and accident conditions during all WCS CISF operations, transfers and storage. Chapter 10 presents criticality safety criteria and summarizes design features which ensure criticality safety at the WCS CISF. The design of the canisters is such that, under all credible conditions, the highest effective neutron multiplication factor (k_{eff}) remains less than 0.95.

Criteria utilized for criticality safety of the canister/cask systems are not based on site specific criticality safety criteria, therefore no additional criticality evaluations are required specific to this application. Chapter 10 addresses the criticality criteria for each of the canisters authorized for storage at the WCS CISF identified in Table 1-1.

3.3.5 Radiological Protection

This section of the principal design criteria establishes requirements that satisfy 10 CFR 72.126(a) [3-23], which identifies design criteria that requires radiation protection systems be provided to minimize personnel radiation exposure; 10 CFR 72.126(b) [3-23], which identifies design criteria that requires radiological alarm systems be provided in accessible work areas to warn operating personnel of radiation concentrations above given set points; and 10 CFR 72.126(c) [3-23], which identifies design criteria that requires a means for measuring and monitoring radioactive effluents and direct radiation be provided.

In accordance with 10 CFR 20.1101(b) [3-22], and to the extent practicable, WCS CISF procedures and engineering controls are based upon sound radiation protection principles to achieve occupational and public doses that are ALARA.

The ALARA principles of time, distance and shielding are considered throughout the design of the WCS CISF. For tasks requiring access to areas near transportation and storage overpacks, system design is based on minimizing the time spent near the casks.

Special consideration is given to systems located in radiation areas. Design of these systems minimizes the number of components and/or the need for maintenance on these components that pass through radiation areas. Where utility subsystem components must be routed through radiation areas, ALARA design principles are incorporated into system design.

Radiation protection is provided in accordance with 10 CFR 72.126(a) [3-23]. The following design criteria apply.

- *During normal operations and all anticipated occurrences, the annual dose equivalent for any individual located beyond the controlled area shall not exceed 25 mrem to the whole body, 75 mrem to the thyroid or 25 mrem to any other organ, as a result of exposure to planned discharges of radioactive materials (radon and its decay products excepted), to the general WCS CISF environment or to direct radiation from WCS CISF operations.*
- *The dose in any unrestricted area from external sources shall not exceed 2 mrem in any one hour, per 10 CFR 20.1301(a)(2) [3-22].*
- *The maximum individual dose at or beyond the WCS CISF site boundary, resulting from a design-basis accident, shall be less than 5 rem to the whole body or any organ, per the limits set forth in 10 CFR 72.106(b) [3-23].*

The WCS CISF design includes the means to measure and control contamination of areas requiring access, per 10 CFR 72.126(a)(4) [3-23]. Radiation monitoring and surveys are conducted in accordance with 10 CFR 20.1501 [3-22], and as necessary to comply with the operating limits imposed by Technical Specifications [3-1].

Radiological protection provided by confinement barriers and systems are addressed in Section 3.3.2.1.

3.3.5.1 Access Control

The WCS CISF design includes the means to measure and control contamination of areas requiring access, per 10 CFR 72.126(a)(4). Radiation monitoring and surveys are conducted in accordance with 10 CFR 20.1501.

The storage area is defined as a radiation area requiring radiological control, per 10 CFR 72.126(a). The WCS CISF is provided with systems for measuring the direct radiation levels in and around areas containing radioactive materials, per 10 CFR 72.126(c)(2).

Occupational radiation exposure protection for the WCS CISF is provided in accordance with 10 CFR Part 20 requirements.

3.3.5.2 Shielding

The design of WCS CISF, including the cask systems, shield personnel from radiation exposure in accordance with 10 CFR 72.126. Whenever possible, equipment that normally operates in a radioactive environment is designed to allow removal to a nonradioactive environment for maintenance and repair. When this is not possible, the design allows for installation of temporary shielding.

In accordance with 10 CFR 72.106(b), the WCS CISF is designed, constructed and operated to provide shielding and confinement for radioactive materials to limit the maximum individual dose at or beyond the WCS CISF site-controlled area boundary to 1) five rem (to the whole body) and/or 2) the sum of the deep-dose equivalent and the committed dose equivalent to any individual organ or tissue (other than the lens of the eye) of 50 rem and/or 3) the lens dose equivalent may not exceed 0.15 Sv (15 rem) and the shallow dose equivalent to skin or any extremity may not exceed 50 rem; as the result of a design-basis accident.

3.3.5.3 Radiological Alarm Systems

There are no credible events that could result in releases of radioactive effluents from inside the canister or unacceptable increases in direct radiation as is discussed in Chapter 12. Therefore, no radiological alarm systems are needed in storage pad areas. However, area radiation monitors with audible alarms will be provided in the CHB for canister transfer operations.

Continuous air monitors will be provided in the CHB. They are provided as a prudent measure and not required for any identified hazard.

3.3.6 Fire and Explosion Protection

This section of the principal design criteria establishes requirements that satisfy 10 CFR 72.122(c) [3-23], which identifies design criteria that requires SSCs classified as ITS be designed and located so they can continue to perform their safety functions effectively under credible fire and explosion exposure conditions.

The WCS CISF is a low fire load facility. The Protected Area consists of a crushed rock surfaced area (Figure 1-2). Potential vegetation which could increase the fire load will be mitigated through a maintenance program to control any significant growth of vegetation through the crushed rock surface of the Protected Area and the Isolation Zone. Therefore, the surface of the Protected Area is non-combustible.

The WCS CISF contains no permanent flammable material other than some electrical and electronic components within the CHB. The other WCS CISF materials of construction, concrete and steel, can withstand any credible fire hazard. Flammable materials that may be brought into the WCS CISF on a temporary basis include fuel for necessary vehicles and construction materials. Use of non-flammable consumable materials is emphasized. All wood scaffolding and cribbing is treated with fire retardant paint. Any fuel spill within the WCS CISF boundary following storage overpack loading will involve only fuel (the contents of the fuel tanks on the cask moving vehicles, the crane and a few other small vehicles) which has a flash point of over 120° F. Vehicles other than electric or diesel fuel vehicles will not be permitted near loaded canisters or in the storage area where the storage overpacks are stored.

During operations, the amount of flammable liquids that are allowed in the CHB is controlled. The only sources of flammable liquids in the CHB are the locomotive used to move the railcars into and out of the CHB, the CTS, the VCT and the transfer vehicle. The locomotive will not be allowed in the buildingduring cask handling operation other than when the transportation casks are ready for transport. The CTS and the VCT are quantity limited (< 50 gallons) and are described in Section 12.2.1. The transfer vehicle for the NUHOMS® System is also quantity limited (< 60 gallons) and will not be in the CHB during handling of the vertical systems. As the NUHOMS® System is evaluated for fire with 300 gallons of diesel fuel, the quantity of fuel in the transfer vehicle is bounded for NUHOMS® Systems operations.

Due to the positive drainage of the WCS CISF approach slabs, a spill large enough to cause puddling would also tend to drain away from the storage modules. This drainage, coupled with the expected rapid detection of any fire by the fuel transfer personnel, will tend to limit the spread and severity of any fire. In addition, off-site firefighting assistance is available if required. The damage caused by any fire is negligible given the massive nature of the casks. A spill too small to cause puddling would be very difficult to ignite due to the relatively high flash point of diesel fuel and such a small fire would not pose a credible threat to the WCS CISF.

There is a fire suppression system in the CHB that is installed to mitigate the consequences of a fire.

WCS CISF initiated explosions are not considered credible since no explosive materials are present. The effects of externally initiated explosions are bounded by the design basis tornado generated missile load analysis performed for the authorized storage systems.

3.3.7 Material Handling and Storage

This section of the principal design criteria establishes requirements that satisfy 10 CFR 72.128(a) and (b) [3-23], which identify general design criteria that requires SNF storage and handling systems be designed to ensure adequate safety under normal and accident conditions and that radioactive waste treatment facilities be provided.

3.3.7.1 Spent Fuel or High-Level Radioactive Waste Handling and Storage

To meet WCS CISF functional requirements to receive, transfer, store and retrieve canisterized SNF and GTCC waste, the following criteria are established for the WCS CISF design.

Storage and handling systems are designed to allow ready retrieval of the canisters for shipment off-site, and the cask/canister handling systems are designed in accordance with 10 CFR 72.128(a) [3-23] to ensure adequate safety under normal and accident conditions. The following criteria for cask systems are also satisfied.

- *Cask systems are designed and certified to withstand a drop event from heights specified in the Technical Specifications [3-1] for each individual system. WCS CISF operation procedures and limitations ensure casks are within these heights.*
- *Cask systems designed to transfer canisters are designed to withstand the impact of the postulated tornado missiles during transfer operations. For this event, "designed to withstand" is defined as no impact on ITS functions except the following: A partial loss of shielding is allowed to the extent evaluated.*
- *A recovery method for the unlikely loss of confinement event is independent of any bare fuel handling facilities.*
- *Cask systems utilizing vertical transfer must be qualified for a 6-inch drop of the storage overpack or transportation cask lid during transfer operations.*

The CHB cranes and associated cask/canister lifting equipment are designed utilizing the standards identified in the Technical Specifications [3-1].

3.3.7.2 Radioactive Waste Treatment

Radioactive contamination is anticipated to be negligible because SNF and GTCC waste is packaged in sealed canisters. Small volumes of solid radioactive wastes are expected. Waste will be managed in accordance with Section 3.3.7.3.

3.3.7.3 Waste Storage Facilities

As addressed in Section 6.1, solid waste from health physics survey material and dry active waste would be packaged and temporarily stored in a designated radiologically controlled area until the waste is characterized and shipped to a licensed disposal facility.

3.3.8 Industrial and Chemical Safety

Canister transfer operations at the WCS CISF are performed in accordance with Occupational Safety and Health (OSHA) standards.

3.4 Classification of Structures, Components, and Systems

The WCS CISF classifies SSCs as either ITS or NITS. The criteria for selecting the classification of particular SSCs are based on the following definitions:

Important-to-Safety (ITS)

A classification per 10 CFR 72.3 for any SSC whose function is to maintain the conditions required to safely store SNF and GTCC waste, prevent damage to SNF, GTCC waste, or their containers during handling and storage, or provide reasonable assurance that SNF and GTCC waste can be received, handled, packaged, stored, and retrieved without undue risk to the health and safety of the public.

Not-Important-to-Safety (NITS)

A quality classification for items or services that do not have a safety related function and that are not subject to special requirements or NRC imposed regulatory requirements.

SSCs classified as ITS are designed, fabricated, constructed, and tested in accordance with the Quality Assurance (QA) Program referenced in Section 1.4.4.3. Each SSC classified as ITS is given a level of importance based on QA classification categories as detailed in NUREG/CR-6407 [3-31]. The classifications are intended to standardize the QA control applied to activities involving SNF storage systems. Each classification is defined below.

Classification Category A - Critical to Safe Operation

Category A items include SSCs whose failure or malfunction could directly result in a condition adversely affecting public health and safety. The failure of a single item could cause loss of primary containment leading to release of radioactive material, loss of shielding, or unsafe geometry compromising criticality control.

Classification Category B - Major Impact on Safety

Category B items include SSCs whose failure or malfunction could indirectly result in a condition adversely affecting public health and safety. The failure of a Category B item, in conjunction with the failure of an additional item, could result in an unsafe condition.

Classification Category C - Minor Impact on Safety

Category C items include SSCs whose failure or malfunction would not significantly reduce the packaging effectiveness and would not be likely to create a situation adversely affecting public health and safety.

Criteria utilized for criticality safety of the canister/cask systems are not based on site-specific criticality safety criteria, therefore no additional criticality evaluations are required specific to this application. Chapter 10 addresses the criticality criteria for each of the canisters authorized for storage at the WCS CISF identified in Table 1-1.

Table 3-5 describes the Quality Assurance classifications for major SSCs as utilized at the WCS CISF per NUREG/CR-6407 [3-31]. Quality Assurance Classifications for each of the Storage Systems SSCs are addressed in Table 3-4. The canisters are classified as Category A because a failure could lead in loss of primary containment. The Storage Overpacks, CTS, and VCT have been classified as Category B because the failure of these components would require the failure of an additional component to result in an unsafe condition. The Storage Pads for the Vertical Storage System and the CHB have been classified as Category C because the failure of these components would not likely result in an unsafe situation.

All other components are NITS because their failure would not result in an unsafe condition.

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 SNF 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.

3.4.1 Cask Handling Building Quality Classification

The purpose of the CHB and associated lifting equipment is to receive, inspect and prepare for storage, shipments of canisterized SNF and GTCC waste canisters and to provide for cask and rail car light maintenance. The CTS and associated lifting hardware used for stack up and transfer operations for the NAC canisters is located inside the building. The 130-ton overhead crane and associated NUHOMS® MP197HB and MP187 Casks Lift Beam Assembly are 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) is classified as ITS, Category C to meet the requirements of 10 CFR 72.122(b)(2)(ii) [3-23] and to prevent massive building collapse onto cask systems and related ITS SSCs. The overhead crane bridge trucks and trolley seismic clips are ITS. 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. The building will use administrative controls as indicated in Section 3.2.1.3 to manage tornado loads.

3.4.2 *Design Criteria for Other SSCs Not Important-to-Safety*

The classification of SSCs allows the application of design criteria in a graded manner. The system classifies SSCs by function in order to apply the appropriate design criteria. Design criteria for Physical Protection of the facility and materials and NITS buildings and structures are discussed in this section.

The design criteria for SSCs classified as NITS, but that have importance to operations or security, such as back-up power systems, transport vehicles, fire detection and suppression systems, security systems, radiation monitoring systems, and temperature monitoring systems, are addressed in subsequent chapters of this SAR. These SSCs are designed in accordance with their applicable codes and standards.

The WCS CISF radiation monitors are classified as NITS. The radiation monitors are not used to prevent or mitigate any credible accidents. The WCS CISF will utilize several types of radiation monitors including area monitors, thermoluminescent dosimeters (TLD), portable hand held monitors, personnel dosimetry, and portable airborne monitors. The use of several different types of monitors ensures that redundant methods are in place to detect high radiation conditions and provide warning for onsite personnel.

The temperature monitoring system where used is classified as NITS. The purpose of the temperature monitoring system is to provide continuous surveillance of each cask's temperature to ensure proper operation. The temperature monitoring system is designed so that a monitor failure would result in a loss of signal to the monitoring computer. The loss of signal would initiate an alarm informing security personnel of a potential cask temperature problem. Security personnel would then contact operations personnel. In place of temperature monitoring, regular visual inspection for inlet and outlet blockage to ensure that the overpacks remain operable may be implemented.

3.4.2.1 *Important to Physical Protection of Facility and Materials*

10 CFR Part 72, Subpart H [3-23] details requirements for a physical security and safeguards contingency plan, and physical protection design. The detailed physical security plan and a safeguards contingency plan are provided separately. Physical protection design requirements and criteria are described in Section 4.8. SSCs related to physical protection of the facility and materials satisfy the applicable requirements of 10 CFR Part 73.

3.4.2.2 *Conventional Quality*

WCS CISF SSCs not designated as ITS are considered to be of conventional quality. Conventional quality SSCs are designed and constructed in accordance with commercial standards as described below. The design of conventional structures conforms with the requirements of ACI 318 [3-6] for concrete and the AISC Manual of Steel Construction [3-7] for structural steel.

3.4.2.2.1 Security and Administration Building

The Security and Administration Building is considered NITS and is designed, constructed, maintained, and tested as commercial-grade. The function of the building is summarized in Table 1-3.

3.4.2.2.2 Receiving Area

The receiving area is considered NITS and is designed, constructed, maintained, and tested as commercial-grade. The function of the area is summarized in Table 1-3.

3.4.2.2.3 Storage Pad for NUHOMS® Storage Modules

The Storage Pad for the NUHOMS® Storage Modules is considered NITS and is designed, constructed, maintained, and tested as commercial-grade.

3.4.2.2.4 Design and Construction Standards

SSCs important to fire protection will comply with the design requirements of applicable National Fire Protection Association (NFPA) codes. Protection of personnel is also ensured in accordance with NFPA 101 [3-8]. The design and installation of piping systems at the WCS CISF pertaining to water, compressed air, oil and sewer services will conform to the requirements of the American Society of Mechanical Engineers/American National Standards Institute (ASME/ANSI) B31.1-2104 Code [3-9]. This code invokes appropriate American Society for Testing and Materials (ASTM) Standards, American Welding Society (AWS) Standards, and American Water Works Association (AWWA) Standards. Additionally, the design and installation of piping systems located inside buildings (including vent and drainage systems) will conform to the applicable IBC [3-10], National Plumbing Code [3-11], and good work practices.

The design of conventional HVAC systems at the WCS CISF conforms to the design criteria contained in applicable American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE), Air-conditioning and Refrigeration Institute (ARI), and NFPA standards, which are selected to satisfy building heating, ventilation, and cooling load requirements.

The design of conventional electrical systems will conform to ANSI/NFPA 70e-2012, National Electric Code [3-12], ANSI C2-2012 National Electric Safety Code [3-13], NEMA Standards and applicable state, county, municipal and other local regulations, building and zoning codes. The switchyard and electrical distribution designs will conform to Institute for Electrical and Electronic Engineers (IEEE) Standard 141-1993, IEEE Recommended Practice for Electric Power Distribution and Industrial Plants [3-14]; IEEE 142-1991, Recommended Practice for Grounding of Industrial and Commercial Power Systems [3-15]; and IEEE 80-1991, Guide for Safety in Substation Grounding [3-16]. Lightning protection for all structures will comply with NFPA 780-2011, Lightning Protection Code [3-17].

3.5 Decommissioning Considerations

This section of the principal design criteria satisfies 10 CFR 72.130, which requires provisions be made to facilitate decontamination of structures and equipment, minimize the quantity of radioactive wastes and contaminated equipment, and facilitate the removal of radioactive wastes and contaminated materials.

The canisters are all licensed for, and are maintained for, off-site transportation. The loaded canisters will be shipped to a Department of Energy (DOE) facility when DOE is ready to take the fuel. Because of the minimal contamination of the outer surface of the canister, no contamination is expected on any WCS CISF equipment or on the internal passages or other surfaces of the storage overpacks. The storage overpacks may become slightly radioactive due to neutron activation. If necessary, the storage overpacks will remain at the WCS CISF until they can be dismantled and disposed of using commercial demolition and disposal techniques.

The design and function of the WCS CISF facilitates decommissioning activities and maintains radiation exposures ALARA during all decommissioning and decontamination activities.

Further decommissioning considerations are addressed in Appendix B of the WCS CISF License Application, "Preliminary Decommissioning Plan."

3.6 Performance Requirements

The function of the WCS CISF is to store canisterized SNF and GTCC waste resulting from commercial nuclear activities in an NRC-approved storage facility, until removal from the WCS CISF for disposal in a repository or other site as directed by the DOE. This section provides principal performance requirements imposed upon the design to ensure the facility can function as required.

3.6.1 Receipt Rate Capability

The WCS CISF has the capability to receive SNF at the rates (MTHM/year) listed in Table 3-2. The WCS CISF has the capability to receive casks and canisters containing commercial SNF at the annual rates (casks/year) specified in Table 3-3.

3.6.2 SNF and GTCC Waste Receiving Mode

The WCS CISF is designed to receive, handle, transfer, store and ship SNF and GTCC waste contained in canisters in Section 2.1 of the Technical Specifications [3-1] and Table 1-1 via rail in the transportation casks identified in Sections 1.6.1.1 and 1.6.2.1.

3.6.3 Storage Capacity

Phase 1 of the WCS CISF has a SNF storage capacity of 5,000 MTHM with an ultimate capacity of 40,000 MTHM at full build out and 231.3 MT (510,000 pounds) of GTCC waste.

3.6.4 Facility Service Life

The WCS CISF is initially licensed for 40 years with the option for renewals for time periods allowable by regulation.

3.7 Summary of WCS Interim Storage Facility Principal Design Criteria

A summary of principal design criteria is shown in Table 1-2. The table summarizes design parameters developed in this chapter, including the SNF stored at the WCS CISF site, and structural, thermal, radiation protection/shielding, criticality, and confinement design of the SSCs that are ITS.

3.8 References

3-1 Proposed SNM-1050, WCS *Consolidated* Interim Storage Facility Technical Specifications, Amendment 0.

3-2 Reg Guide 1.76, "Design-Basis Tornado And Tornado Missiles For Nuclear Power Plants," Revision 1, March 2007.

3-3 NUREG-0800, Standard Review Plan, Section 3.3.1 "Wind Loading", 3.3.2 "Tornado Loads" and Section 3.5.1.4 "Missiles Generated by Tornado and Extreme Winds", Rev 3, March 2007.

3-4 Title 10, Code of Federal Regulations, Part 71, "Packaging and Transportation of Radioactive Material."

3-5 Not Used.

3-6 ACI 318, "Building Code Requirements for Structural Concrete and Commentary," American Concrete Institute, 2011.

3-7 American Institute of Steel Construction, AISC Manual of Steel Construction, 14th Edition.

3-8 NFPA 101 (2015 Edition), National Fire Protection Association.

3-9 ASME/ANSI B31.1, American Society of Mechanical Engineers/American National Standards Institute.

3-10 IBC, 2006, International Building Code.

3-11 NPC, *2009*, National Plumbing Code.

3-12 ANSI/NFPA 70e-2012, National Electric Code.

3-13 ANSI C1-212, National Electric Safety Code.

3-14 IEEE 141-1993, Institute for Electrical and Electronic Engineers.

3-15 IEEE 142-1991, Recommended Practice for Grounding of Industrial and Commercial Power System.

3-16 IEEE 80-1991, Guide for Safety in Substation Grounding.

3-17 NFPA 780-2011, Lightning Protection Code.

3-18 "Rancho Seco Independent Spent Fuel Storage Installation, Final Safety Analysis Report, Volume I, ISFSI System," NRC Docket No. 72-11, Revision 4.

3-19 NAC International, "NAC-STC, NAC Storage Transport Cask Safety Analysis Report," Revision 17, CoC 9235 Revision 13, USNRC Docket Number 71-9235.

3-20 NAC International, "Safety Analysis Report for the UMS® Universal Transport Cask," Revision 2, CoC 9270 Revision 4, USNRC Docket Number 71-9270.

3-21 NAC International, "Safety Analysis Report for the MAGNATRAN Transport Cask," Revisions 12A, 14A, 15A, and 16A, USNRC Docket Number 71-9356.

3-22 *Title 10, Code of Federal Regulations, Part 20, "Standards for Protection Against Radiation."*

3-23 *Title 10, Code of Federal Regulations, Part 72, "License Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater than Class C Waste."*

3-24 *ASCE-7 (formerly ANSI A58.1), Minimum Design Loads for Buildings and Other Structures, American Society of Civil Engineers, 1995.*

3-25 *McGuire, R.K., Silva, W.J. and Constantino, C.J., 2001, Technical basis for revision of regulatory guidance on design ground motions: Hazard- and risk-consistent ground motion spectra guidelines, U.S. Nuclear Regulatory Commission NUREG/CR-6728.*

3-26 *ASME NOG-1, Rules for Construction of Overhead and Gantry cranes (Top Running Bridge, Multiple Bridge), 1989.*

3-27 *Regulatory Guide 1.61, Damping Values For Seismic Design of Nuclear Power Plants, U.S. Nuclear Regulatory Commission, October 1973.*

3-28 *ASCE-4, Seismic Analysis of Safety-Related Nuclear Structures and Commentary on Standard for Seismic Analysis of Safety-Related Nuclear Structures, American Society of Civil Engineers, 1986.*

3-29 *NUREG-0554, Single-Failure-Proof Cranes for Nuclear Power Plants, U.S. Nuclear Regulatory Commission, 1979.*

3-30 *ASME B30.2-2005 Overhead and Gantry Cranes.*

3-31 *NUREG/CR-6407, (INEL-95/0551), Classification of Transportation Packaging and Dry Spent Fuel Storage System Components According to Importance to Safety, 1996.*

3-32 *Electric Power Research Institute (EPRI), 2013, Ground motion model (GMM) review project, Final Report.*

3-33 *Geoservices, LLC, Project No. 31-151247, "Report of Geotechnical Exploration: Consolidated Interim Storage Facility (CISF) Andrews, Texas," August 20, 2015.*

3-34 *ASME NOG-1-2010, "Rules for Construction of Overhead Gantry Cranes (Top Running Bridge, Multiple Girder)," The American Society of Mechanical Engineers, 2010.*

Table 3-1
Physical Design Characteristics of Storage Systems at the WCS CISF

Cask System	Canister	Overpack	Appendix
NUHOMS®-MP187 Cask System	FO-DSC	HSM (Model 80)	Appendix A.3
	FC-DSC		
	FF-DSC		
	GTCC Canister		
Standardized Advanced NUHOMS® System	NUHOMS® 24PT1	AHSM	Appendix B.3
Standardized NUHOMS® System	NUHOMS® 61BT	HSM Model 102	Appendix C.3
	NUHOMS® 61BTH Type 1		Appendix D.3
NAC-MPC	Yankee Class	**VCC**	Appendix E.3
	Connecticut Yankee		
	LACBWR		
	GTCC-Canister-CY		
	GTCC-Canister-YR		
NAC-UMS	Classes 1 through 5	VCC	Appendix F.3
	GTCC-Canister-MY		
MAGNASTOR	TSC1 through TSC4	CC1 through CC4	Appendix G.3
	GTCC-Canister-ZN		

Table 3-2
WCS CISF Receipt
Rate Capability

Year	SNF (MTHM/year)
1	1,000
2+	2,000

Table 3-3
WCS CISF Receipt
Rate Capability
(Casks)

Year	Rail Casks
1	100
2+	200

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 Table 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*

Table 3-5
Quality Assurance Classification of Structures, Systems, and Components as Utilized at the WCS CISF

Important-To-Safety	***Not Important-To-Safety***
Classification Category A	*Facility Infrastructure*
SNF Canister	*Security and Administration Building*
	Storage Pads (NUHOMS® Storage Overpacks)
Classification Category B	*Overhead Building Cranes*
Storage Overpacks	*Overhead Building Crane Lifting Devices*
Canister Transfer System	*Security Cameras*
Vertical Cask Transporter	*Security Alarm Systems*
	Electrical Power
	Backup Electric Power (Generators)
Classification Category C	*Facility Lighting*
Storage Pads (Vertical Concrete Storage overpacks)	*NUHOMS® Cask Transfer Trailer*
Cask Handling Building	*Radiation Monitors*
	Temperature Monitoring System
	Communication System
	Fire Protection System
	Potable Water System
	Sanitary Waste/Septic Systems
	Facility Roads
	Railroad Line Components
	Associated Support Equipment

Note: Quality Assurance Classifications for each of the Storage Systems SSCs are addressed in Table 3-4.

CHAPTER 4
FACILITY DESIGN

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4. *FACILITY DESIGN*

Chapter 4 describes the main operating functions of the Waste Control Specialists LLC (WCS) Consolidated Interim Storage Facility (CISF) and the systems needed to perform these functions. The chapter follows the guidance of NUREG-1567 [4-1]; and also, includes a description of the WCS CISF layout and principal features in accordance with Regulatory Guide 3.48 [4-2]. General arrangements of the Cask Handling Building *(CHB)* are presented in this chapter. The major systems necessary for handling canisterized spent nuclear fuel (SNF) and Greater-than-Class C (GTCC) waste and the supporting auxiliary systems are described.

4.1 Summary Description

This section provides a description of the WCS CISF layout and design and description of the systems needed to perform the main operating functions for the WCS CISF based on the principal design criteria provided in Chapter 3. The description of structures, systems, and components (SSCs) discussed in this chapter focus primarily on SSCs that perform an important-to-safety (ITS) function. SSCs that are ITS are identified in Table 3-5.

Storage System Components

The storage systems used at the WCS CISF for storage of containerized SNF and GTCC waste are identified in Table 1-1 and have been approved by the NRC for spent nuclear fuel. The NUHOMS® MP187 GTCC waste canister is currently included in a specific license for storage and is also certified by the NRC for transport under 10 CFR Part 71. The GTCC waste canisters for the NAC systems are certified by the NRC for transport under 10 CFR Part 71.

The quality classification for each SSC associated with a given storage system is identified in the corresponding cask SAR incorporated by reference. Table 3-4 provides a list of the storage system components used at the WCS CISF and provides a reference to the quality classification in the corresponding approved SAR for each component.

The principal design criteria for the WCS CISF are listed in Table 1-2. Table 1-4 provides locations for specific design criteria information for each storage system used in conjunction with the WCS CISF. This table provides a reference to the appropriate Appendix Section of this SAR for each Cask System as well as the corresponding approved SAR for each system.

4.1.1 Location and Layout of Installation

The WCS CISF is located in Andrews County, Texas near the Texas and New Mexico state line. The WCS CISF *is* to the north and adjacent to the existing WCS facilities. The entrance *to* the WCS CISF is located approximately 1.5 miles north of the existing entrance to WCS on Texas State Highway 176. Figure 1-1 *shows* the location of the WCS CISF *in relation to existing WCS facilities, structures, rail lines, and the Texas New Mexico state line*.

The WCS CISF is served by an existing rail spur off of the Texas and New Mexico Railway that originates at Eunice, NM and terminates at the WCS facilities. The Texas and New Mexico Railway passes approximately five miles west of the WCS CISF and provides freight service from a connection with the Union Pacific at Monahans, TX to Lovington, NM (approximately 105 miles of track). Primary traffic on the Texas and New Mexico Railway consists of oilfield commodities, aggregates, chemicals, scrap metal, hydrochloric acid, and hazardous waste.

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 *and 231.3 MT (510,000 pounds) of GTCC waste.* 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 *(CTS)* for vertical systems; or directly to a transfer vehicle, for the horizontal systems. For the vertical systems, the *CTS* 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-*3* shows the WCS CISF layout.

The principal features of the WCS CISF are the Storage Area and Storage Pads, shown on Figure 1-3, the CHB, shown on Figure 1-7, and the Security and Administration Building shown on Figure 1-9. The Storage Pads, the CHB, and the Security and Administration Building are located within the Protected Area (PA). The CHB receives transportation casks as they arrive by rail. For horizontal storage systems, the building overhead crane unloads transportation casks and loads the cask onto a transfer trailer which takes the cask to the storage pads. For vertical storage systems, the building houses the CTS which transfers the canister from the transportation cask to the storage overpack that is then moved to the appropriate Storage Pad. The Security and Administration Building is the access point for personnel to the PA and holds offices and equipment for security, administrative, and health physics personnel.

The PA is approximately 36 acres within the Owner Controlled Area (OCA) which includes the concrete storage pads, storage overpacks, CHB, 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. Figure 1-2 shows the fence boundaries in relation to the components of the CISF.

The facility layout and location is designed to be accessible by on-site and off-site emergency services in accordance with 10 CFR 72.122(g). The facility is accessible from Texas State Highway 176 by on-site roads maintained for use by highway and heavy vehicles. Roads within the facility that provide access to SSCs that are ITS have sufficient width and functionality to accommodate vehicles and equipment associated with emergency services.

The WCS CISF SSCs that are ITS are completely independent and not shared with other existing WCS facilities. While some SSCs will be shared, such as the counting laboratories referenced in Section 9.5.2, these are not classified as ITS.

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 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.

The OCA establishes a minimum distance of 200 meters from storage and handling operations of SNF and GTCC waste to the nearest controlled boundary in accordance with 10 CFR 72.106 [4-5]. This boundary encompasses the 155 acres referenced in Section 4.1.2.1.

4.1.2.3 Site Utility Supplies and Systems

Utility systems for the WCS CISF are limited to basic services. The SSCs classified as ITS do not require utility services to maintain their safety function. Therefore, utility services and systems at the facility are not required to be classified as ITS and do not need to include redundant capabilities as otherwise would be required by 10 CFR 72.122(k).

Existing WCS site electrical service exists at the WCS CISF location. This infrastructure will be upgraded to accommodate the WCS CISF needs. Electric power is provided to the WCS CISF for lighting, general utilities, security system, and overhead cranes. Although the CTS is ITS, its safety function does not rely on electric power. A standby diesel-generator provides backup power for the security system, emergency lighting loads, storage overpack temperature monitoring system, and communication systems.

Potable water will be supplied to the WCS CISF from the existing WCS potable water system. The WCS CISF potable 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.

Storage tanks are used in a limited capacity. The WCS CISF will have an above ground holding tank at the Security and Administration Building.

4.1.2.4 Storage Facilities

There are no significant storage facilities such as holding ponds, fuel storage tanks, or other items required to maintain ITS functions at the facility. As mentioned in Section 4.1.2.3, there will be a sanitary/septic holding tank (or tanks) at the Security and Administration Building with a total capacity less than 10,000 gallons. Fuel tanks are not located at the WCS CISF and are discussed in the Offsite Accident Analysis in Section 12.2.2.

4.1.2.5 Stacks

There are no stacks at the WCS CISF.

4.2 Storage Structures

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 (*24HSM* Model 80s, 20 AHSMs and *104HSM* 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).

The storage SSCs are used to store canisters at the WCS CISF. The storage SSCs consist of Cask Systems and Storage Pads. The storage SSCs are designed to withstand the effects of site environmental conditions, natural phenomena, and accidents in accordance with 10 CFR 72.122(b) and 10 CFR 72.128(a).

Storage Systems

Six storage systems were evaluated for use in the WCS CISF Storage Area. These storage 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 storage systems are discussed and drawings are provided or incorporated by reference.

The methodologies used for analysis of tornado, earthquake, fire, explosion, and differential subsidence effects have been previously reviewed and approved by the NRC and are described in the corresponding SAR for each storage system at the WCS CISF. These analyses are incorporated by reference into the WCS CISF SAR as shown in Table 1-4.

Storage Pads

SNF is placed in storage overpacks located on concrete pads in the Storage Area shown on Figure 1-3. 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.

Concrete pad thickness and steel reinforcing depends on the 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 Sections 7.6.1 and 7.6.5.

Six storage systems were evaluated for storage in the WCS CISF Storage Area. These six storage systems are divided into two categories: Vertical Concrete Cask (VCC) Systems and NUHOMS® Horizontal Storage Modules (HSM). These storage 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 pads structures are discussed. Two Storage Pad designs have been created to accommodate the two categories of storage systems.

4.2.1 Structural Specifications for Storage Pads

The WCS CISF storage pads for VCCs are conventional cast-in-place reinforced concrete mat foundation structures. The pads are designed for normal operating loads, severe environmental loads and extreme environmental loads as referenced by NUREG-1567 [4-10]. Design information for the storage pads for VCCs is contained in Section 7.6.1. The storage pads for VCCs are classified as ITS.

The WCS CISF storage pads for NUHOMS® HSMs are a commercial grade reinforced concrete surface structure that is classified as not-important-to-safety (NITS). The storage pad consists of a 36 inch thick reinforced concrete basemat structure. Additional information about the storage pads for HSMs is contained in Section 7.6.5.

4.2.2 Storage Pad Layout

4.2.2.1 Storage Pad Plans and Sections

Figure 1-3 shows the locations of the concrete storage pads. Concrete storage pad plan, cross section, and details for the VCC storage pads are shown in Drawing NAC004-C-002, Rev. 0, "ISFSI Pad Licensing Design Structural Concrete Plan, Sections, and Details" [4-11]. Plan, cross section, and details for the HSM storage pads are shown in Figure 7-53.

4.2.2.2 Confinement Features

The storage pads are not counted on for any confinement features.

4.2.3 Storage Pad Description

The WCS CISF storage pads are conventional cast-in-place reinforced concrete mat foundation structures.

4.2.3.1 Storage Pad Function

The function of the storage pads is to provide a level and stable surface for placement and storage of storage overpacks.

4.2.3.2 Storage Pad Components

The components of the storage pads consist of the materials of construction as specified in Section 7.6.

4.2.3.3 Design Bases and Safety Assurance

Analysis and design of storage pads is provided and described in Section 7.6.

4.3 *Auxiliary Systems*

4.3.1 *Ventilation and Offgas Systems*

The storage systems use a sealed canister and do not require an offgas system or ventilation. No canisters will be opened at the WCS CISF.

4.3.2 *Electrical Systems*

4.3.2.1 *Major Components and Operating Characteristics*

Site power currently exists at the WCS CISF. The existing overhead power lines will be upgraded to provide the necessary service. Site power will enter the WCS CISF at the Security and Administration Building and be distributed to the rest of the WCS CISF from that point through an underground distribution system. A backup diesel generator system at the Security and Administration Building will supply emergency power to essential systems (security system) in case of a power failure.

WCS CISF electrical systems will provide power for operation of the two buildings (CHB and Security and Administration Building). The remaining electrical systems are those used for site security and lighting requirements.

Emergency backup power is provided at the WCS CISF by a diesel-generator system. Emergency backup power will be limited to the security systems, communication systems, emergency lighting, and applicable temperature monitoring systems.

The emergency backup power system will consist of a diesel generator, Uninterruptible Power Source (UPS), starting batteries, fuel supply, and auxiliary system components. The system will be designed and installed to comply with the requirements of IEEE 692 [4-6]. The backup power system is located at the Security and Administration Building within the PA.

4.3.2.2 *Safety Considerations and Controls*

The emergency backup power system will be designed to automatically switch to battery power in the event of loss of power to the WCS CISF. Batteries will provide power to the site for the brief period it takes the diesel generator to start and begin producing power at design capacity. At this point the diesel generator will take over supplying power to the facility.

SSCs at the facility that have a potential for being struck by lightning, such as the CHB or light poles, are grounded to ensure that the current from a lightning strike is conducted to ground per the National Electric Code (NEC) [4-7].

4.3.3 *Air Supply Systems*

An air supply system is provided at the WCS CISF in the CHB for the use of tools and small equipment. The CTS has an air operated hoist and is discussed in Sections 7.5.1, 7.5.1.2, and 7.5.1.7.

4.3.4 *Steam Supply and Distribution System*

A steam supply system is not needed or provided at the WCS CISF.

4.3.5 *Water Supply System*

Water is supplied to the WCS CISF by the existing potable water system at WCS. The water supply system is provided for normal facility services and operation and maintenance functions. Water will be supplied to the Security and Administration Building and CHB using underground pipes from the WCS Facility Potable Water System. There are no safety related SSCs classified as being ITS that require water for operation.

4.3.6 *Sewage Treatment System*

All wastewater from the WCS CISF will be drained or pumped into above ground holding tanks for removal to an off-site publicly owned treatment works (POTW). *The sanitary drainage system will be provided at the WCS CISF in accordance with the applicable codes referenced in Section 3.4.2.2.4.*

The only sanitary drainage system at the WCS CISF will be at the Security and Administration Building. The system will utilize a septic tank and a holding tank system with no drain field. The septic tank and holding tank will be located near the Security and Administration Building. The holding tank (or tanks) are expected to have a total combined volume of less than 10,000 gallons and will be pumped for off-site treatment as required.

4.3.7 *Communications and Alarm Systems*

The WCS CISF will utilize a variety of communications and alarm systems with redundancy provided for emergency communication situations.

A telephone system will be installed at the WCS CISF. This system will have access to other WCS facilities outside of the WCS CISF and outside lines. The telephone service will be used to provide normal communication to and from the site and emergency communications with local authorities.

A Public Address System will be installed at the WCS CISF. This system allows emergency messages and alarms to be broadcast for all personnel in the WCS CISF boundary to hear. In the event of an emergency, facility personnel and visitors on site are notified by an announcement over the Public Address System. Offsite emergency response personnel are notified by means of personal cell phones and/or using the notification list of telephone numbers located in the Emergency Plan implementing procedures. Alarms at the WCS CISF are only used on area radiation monitors to notify nearby personnel of doses that exceed the alarm setpoint.

A wireless radio system will be used at the WCS CISF for standard communication needs. Portable two-way radios are used by security personnel to maintain continuous communications with the Security and Administration Building while on patrol.

4.3.8 *Fire Protection System*

4.3.8.1 *Design Basis*

Fires that could affect SSCs classified as ITS are likely to result from diesel fuel sources originating from the VCT, Transfer Trailer/Truck, CTS auxiliary power unit or the Rail Locomotive. SSCs affected include the storage overpacks in the storage area and the shipping and storage system components and cranes in the CHB. Scenarios have been evaluated for a fire in each location considering fire location, intensity, and duration. The storage overpack accident analysis is referenced in Table 12-1. The CTS is evaluated in Section 12.2.1 and the controls instituted in the CHB are discussed in Section 7.5.3.8. The analysis determined that the fires will not compromise the safety provisions of the SSCs. No other major fire fuel sources are located in areas near SSCs classified as ITS.

4.3.8.2 *System Description*

Cask Handling Building

The CHB will be designed with a fire protection system. Fire protection will be in accordance with the requirements of the NFPA [4-9] and the IBC [4-8].

Security and Administration Building

The Security and Administration Building fire protection provisions will be designed in accordance with the requirements of the IBC [4-8] and NFPA [4-9] as applicable.

Fire detection systems are located in both the facility buildings. The detectors within each building are connected to a central alarm panel located in the Security and Administration Building. Alarms will sound within both the building where the detector is located and the central alarm panel.

4.3.8.3 *System Evaluation*

An evaluation of potential fires affecting SSCs classified as ITS is addressed in Section 4.3.8.1. The referenced analysis concludes that the postulated fires will not preclude the ability of SSCs from performing their safety related function.

WCS will perform a Fire Hazards Analysis (FHA) prior to detailed design of the facility. Based on evaluations referenced in Section 4.3.8.1, the FHA will demonstrate that the WCS CISF is sufficiently protected against the effects of major fires. This conclusion is based on the low fire loading, fire detection and suppresion systems, and compliance with the requirement of the IBC and applicable NFPA standards.

4.3.8.4 *Inspection and Testing Requirements*

Inspection and preoperational testing of the fire detection and fire suppression systems will be performed in accordance with the requirements of Section 13.2.2.1. Preoperational and periodic inspection and testing will be performed in accordance with NFPA 25 [4-12].

4.3.8.5 *Personnel Qualification and Training*

Training and qualification requirements for the testing, inspection, and operation of the fire systems will be in accordance with the requirements of NFPA 25 [4-12].

4.3.9 *Maintenance System*

4.3.9.1 *Major Components and Operating Characteristics*

No special maintenance techniques are necessary that would require a safety analysis. There is preventative maintenance performed on a regular basis on the CTS, transfer equipment and transportation casks. Maintenance of these SSCs, which are classified as ITS, ensure that they are safe and reliable throughout the life of the WCS CISF per 10 CFR 72.122(f).

The storage systems at the WCS CISF have minor maintenance requirements due to their passive design and function. Periodic inspection and maintenance to keep the storage overpack air vents unobstructed is required to meet the requirements given in the Technical Specifications [4-3]. Other components at the WCS CISF that require routine periodic maintenance include the overhead bridge crane, fire suppression system located in the CHB, the rail cars, the cask transporters, the backup diesel generator, and the temperature monitoring equipment.

4.3.9.2 *Safety Considerations and Controls*

Preventive and routine maintenance activities are scheduled and established to ensure that SSCs are being maintained according to equipment manufacturer's recommended standards. WCS CISF procedures prevent maintenance activities of equipment in the CHB when overpacks loaded with canisters are in the building to minimize personnel radiation doses. Maintenance activities at the storage area will be monitored and controlled by WCS CISF procedures to ensure that inspections and maintenance work is performed ALARA.

4.3.10 *Cold Chemical Systems*

There are no cold chemical systems at the WCS CISF.

4.3.11 *Air Sampling Systems*

Air monitoring is described in Section 5.6.4.

4.3.12 *Gas Utilities*

There is no propane or natural gas at the WCS CISF. There are existing propane tanks at the existing WCS facilities. These are discussed in Section 12.2.2.

4.3.13 *Fueling of on-site vehicles used at the WCS CISF*

Fueling of on-site vehicles including the Rail Locomotive will occur from existing WCS LLRW and TSDF fuel tanks. As stated in SAR Section 12.2.2, diesel fuel oil storage tanks are located outside the PA at the WCS LLRW and TSDF Facilities. The closest Diesel Fuel storage tank is approximately 3,500 feet from the WCS CISF. The station tank will be supplied with fuel from a bulk fuel service. A fuel truck may be used to provide fuel to some onsite components at the CHB such as the CTS auxiliary power supply fuel tank and the VCT if necessary. This activity is administratively controlled so that the fuel truck is at the CHB only when loaded canisters are not in the building.

4.3.14 *Radiation Monitoring Systems*

Occupational radiation dose at the WCS CISF is measured by optically stimulated luminescence (OSL) dosimetry devices for beta and photon radiation, along with CR-39 dosimetry devices for fast and thermal neutron monitoring. Monitoring will cover the PA and the OCA to ensure the dose is within 10 CFR 20.1301 and 10 CFR 72.104 limits.

4.3.15 *Control Room and Control Area*

The WCS CISF is a passive installation, with no need for operator actions. No control room is needed for normal operations; however, the instrumentation used to monitor storage overpack temperatures have readouts in the Security and Administration Building.

4.3.16 *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 reinforced concrete floors and foundations. The building is NITS 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.

The Security and Administration Building as well as the CHB will utilize commercial grade HVAC systems and ductwork. The Security and Administration Building HVAC will be used for employee comfort and equipment protection.

4.3.17 Operation Support Systems

The storage overpacks have thermal monitoring capabilities as described in the Technical Specifications [4-3] applicable to each system. Table 4-1 provides a cross reference to the applicable appendix and section for each canister/storage overpack where the individual storage overpack thermal monitoring systems are discussed.

4.3.18 Temporary Facilities

Additional security positions and receiving and inspection areas will be used and located as needed.

4.4 *Decontamination Systems*

4.4.1 *Equipment Decontamination*

The WCS CISF handles only canisterized SNF and GTCC waste; therefore, the only radioactive wastes are solid wastes generated from residual quantities of radioactive contamination that may be encountered on the surfaces of the transportation casks due to weeping.

The potential for radionuclide contamination of the outside surface of the canisters is minimized by using design concepts for each of the canisters identified in Table 1-1 that preclude intrusion of spent fuel pool water into the annular gap between the transfer cask and the canister while they are submerged in the pool water at the originating nuclear power plants.

The transportation cask externals are also surveyed and decontaminated, as necessary, before the cask leaves the originating site for transport to the WCS CISF. Radioactive wastes generated during the canister and transportation cask loading operations are processed at the originating site.

After a transportation cask arrives at the WCS CISF, if the outer surface of the transportation cask is found to be contaminated, decontamination methods would be conducted using dry decontamination methods only resulting in the generation of Dry Active Wastes (DAW). The DAW that may be generated would consist of anti-contamination garments, rags, and associated health physics material. This solid waste would be packaged and temporarily stored in a designated radiologically controlled area until the waste is characterized and shipped to a licensed disposal facility. Section 6.1 addresses onsite waste sources.

4.4.1.1 *Major Components and Operating Characteristics*

The WCS CISF is designed as a "start-clean/stay-clean" facility. The spent fuel storage canisters are sealed by welding at the originating nuclear power plants to preclude any leakage of radionuclides. As a result of the "start-clean/stay-clean" operational design, incidental radioactive waste volumes generated by the WCS CISF operations are reduced to the extent practicable, in compliance with 10 CFR 72.24(f) and 10 CFR 72.128(a)(5).

4.4.1.2 *Safety Considerations and Controls*

Operation of receipt, transfer, and storage operations is governed by the WCS CISF radiation protection program in accordance with the requirements of 10 CFR Part 20. ALARA (as low as reasonably achievable) principles are incorporated into the radiation protection program to maintain exposure to radiation as far below the dose limits of Part 20 as is practical, consistent with the purpose for which the licensed activity is undertaken.

4.4.2 *Personnel Decontamination*

Under normal operation of the WCS CISF, contamination of personnel is not anticipated to occur. Any decontamination of personnel will be conducted using methods that produce only dry solid waste.

4.5 Transportation Casks and Associated Components

Transportation casks are used to transport the canisters from the originating sites to the WCS CISF. The transportation casks are designed in accordance with 10 CFR Part 71 to protect the canisters from the effects of environmental conditions, natural phenomena, and accidents.

The transportation casks are shipped by rail to and from the WCS CISF with impact limiters, a shipping cradle, and tie downs. At the WCS CISF, the transportation cask is unloaded from the rail car inside the CHB and, depending on the Cask System, moved to the CTS where the transportation cask is opened and the canister is removed or transferred to the Storage Pad where the canister is removed. After the canister is unloaded, the transportation cask is resealed and shipped off site.

Transportation casks used at the WCS CISF are referenced in Sections 1.6.1.1 and 1.6.2.1. The additional components discussed in this section include:

- *Transportation Cask repair and maintenance*
- *Rail Side Track*
- *Transportation Cask Queuing Areas*
- *Receiving Area*
- *Temporary Isolation Areas*

4.5.1 Transportation Cask Repair and Maintenance Activities

If visual inspections reveal the need for repairs or maintenance, these activities will be performed either *at the WCS CISF* or in another appropriate location, based on the nature of the work to be performed. Radiation protection personnel will provide input and monitor these activities. Work will be performed under the NRC approved WCS CISF Quality Assurance Program Description [*4-4*] in accordance with written procedures that meet the transportation license requirements under 10 CFR Part 71.

If transportation cask repair or maintenance activities are necessary, the designated location for them to be conducted is in a section of the CHB as shown on Figure 1-7 or at a vendor designated location. Special contamination control measures are not required because the SNF or GTCC waste is contained within a sealed canister.

The following describes the types of repair and maintenance activities that will be performed at the *CHB* on the transportation casks transporting canisters to the WCS CISF. Maintenance activities are limited primarily to those needed to support routine use of transportation casks. Those maintenance activities are required in the transportation certificates, which reference Chapter 8 of the Transportation Cask SAR*s*. The only expected radiological hazards would be from surface contamination on the outsides of the casks due to weeping from the cask surfaces that were exposed to contaminated *SNF* pool water. Prior to performing any maintenance activities, health physics personnel will survey the casks as required and incorporate the appropriate restrictions and controls to be observed during the planned maintenance activity.

The maintenance activities carried out at the *CHB* include:

- Leak Tests
- Fastener Inspections and Replacement
- Impact Limiter Inspections
- Seal Areas and Groove Inspections
- Trunnion Inspections
- Rupture Disk and Gasket Inspections

Maintenance activities *are* conducted in accordance with the WCS Quality Assurance Program Description (QAPD). These maintenance activities *will be* performed at the WCS CISF, which is licensed under 10 CFR Part 72. A high level description of the types of maintenance activities listed above is provided below.

Leak Tests

When containment boundary seals are replaced, the seals are leak tested to show a leak rate less than the requirements listed in Chapter 8, Acceptance Tests and Maintenance Program of the applicable transportation cask SAR.

Fastener Inspections and Replacement

Vent/Test/Drain Port, impact limiter attachment, cask top closure plate, and ram closure plate fasteners, etc. are inspected for deformed or stripped threads. Damaged parts are documented with a non-conformance report and evaluated for continued use and replacement as required.

Impact Limiter Inspections

Visual examinations and inspections of the impact limiters, including any attachment mechanisms used are performed looking for damage or excessive wear. Damaged parts are documented with a non-conformance report and evaluated for continued use, replaced or repaired as required. In addition, the impact limiters are inspected to verify that a significant amount of water has not been absorbed and that degradation of the energy absorbing material has not occurred. These inspections are performed by weighing the impact limiter and visual examination of the impact limiters and welds. Evidence of weld cracking or other damage which could result in water in-leakage is documented and dispositioned with a non-conformance report.

Seal Areas and Groove Inspections

Sealing surfaces and O-ring grooves are inspected when the seals are replaced for damaging burrs or scratches or as otherwise required. Damaged parts are documented in a non-conformance report and evaluated for continued use or repair.

Trunnion Inspections

The trunnion and trunnion sockets are inspected for excessive wear, galling or distortion. Dimensional testing, visual inspection and nondestructive examination of accessible critical areas of the trunnions including the bearing surfaces are performed. A non-conformance is generated to document and disposition any excessive wear, galling or distortion that is observed.

Rupture Disk and Gasket Inspections

Some transport*ation* casks contain a neutron shield or other rupture disks which require visual inspection to verify no evidence of damage. Evidence of damage is documented in a non-conformance report for disposition.

4.5.2 Rail Side Track

A rail side track will depart from the existing WCS rail loop and extend north and to the east into the PA and the CHB. There is sufficient rail length for 10 rail cars to be inside the PA before proceeding to the CHB. Unloaded rail cars will exit the CHB and continue east on the rail sidetrack which will connect back into the existing WCS rail loop. Figure 1-1 shows the WCS Site, Existing Rail Loop, and the new WCS CISF Side Track.

4.5.3 Transportation Cask Queuing Areas

The rail side track that brings rail cars to the CHB has queuing length of approximately 1,000 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 CHB and outside of the PA.

In addition to the main side track, there is an additional parallel storage rail line that departs the new sidetrack to inside the PA. This line terminates near the eastern edge of the PA. This provides approximately 800 feet of additional track length inside the PA for rail car storage and staging. Figure 1-3 shows the main side track as well as the parallel storage rail line.

4.5.4 Receiving Area

When the transportation cask arrives at the WCS CISF, the transportation cask and cradle are visually inspected for damage prior to entry into the OCA. The receiving area is shown on Figures 1-2 and 1-3.

4.5.5 Temporary Isolation Areas

Transportation 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 inspection, WCS will isolate the rail car or move the rail car to the CHB and establish appropriate radiological controls. WCS will document the damage, notify the NRC of the condition and develop a corrective action plan. WCS will evaluate the use of movable shielding to protect personnel from radiation exposure while the damaged cask is on site.

If initial radiological surveys do not prevent further receipt inspection, WCS will move the transportation cask to the CHB. WCS will assess the safety features of the transportation cask including seal leak testing and cask sipping analysis for indications that the canister integrity is intact. If WCS concludes that the transportation cask is capable of performing its intended safety functions, WCS will proceed with the receipt as per established procedure.

If the assessment indicates that the transportation cask integrity is not intact, WCS will ensure the cask continues to be isolated, document the damage, notify the NRC of the condition and develop a corrective action plan. WCS will establish measures to ensure control for contamination and maintain doses ALARA.

WCS will utilize swipes and air samples that will be processed on WCS calibrated Canberra® gas flow proportional gross alpha/beta counters, WCS calibrated Perkin & Elmer® Liquid Scintillation Counters, and WCS calibrated Ortec® Gamma Spectroscopy counters or equivalent equipment. Sipping analysis will be performed on a calibrated gas chromatograph or equivalent equipment.

4.6 Cathodic Protection

There are no cathodic protection systems required or provided at the WCS CISF. Underground piping used for the water supply and septic systems consists of nonmetallic piping. Underground conduit consists of non-metallic conduit encased in concrete duct banks.

4.7 Canister Handling Operation Systems

This section identifies the WCS CISF canister handling systems. Information is presented regarding system function, major components, design bases and design features, and associated safety features. The canister handling systems are design to accommodate the systems authorized for use at the WCS CISF.

The canister handling operation systems serve to transfer the canisters from the transportation cask to the storage overpack. During transfer operations, the SNF or GTCC waste remains confined within the sealed canister at all times.

The canister handling operation systems used to handle SNF and GTCC waste canisters at the WCS CISF include the following:

- *Cask Handling Building*
- *Overhead Bridge Cranes*
- *NUHOMS® Transfer System*
- *NAC Cask Transfer System*
- *Vertical Cask Transporter*

The canister handling systems are designed to ensure adequate safety and to withstand the effects of site environmental conditions, natural phenomena, and accidents in accordance with 10 CFR 72.122(b) and 10 CFR 72.128(a).

10 CFR 72.122(l) requires that the storage systems be designed to allow ready retrieval of SNF for further processing or disposal. The storage systems used at the WCS CISF are designed to allow retrieval of SNF or GTCC waste canisters for further processing or disposal.

Chapter 5 addresses cask handling operations required for transportation of the canisters offsite.

Each of the canister handling systems is described in the following sections. Figures are provided to illustrate the major components of the systems and their function.

4.7.1 Cask Handling Building

Transfer of each canister from the rail car to the transfer vehicle or VCT occurs inside the CHB. The CHB 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 VCCs, the CTS and VCT are used to transfer the canister from the transportation cask to a VCC that is then moved to the Storage Area. Figures 1-7 and 1-8 show the CHB layout and elevation section. The CHB 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 CHB loading bays are used to receive and prepare for shipment of all transportation casks arriving at and departing from the WCS CISF. Rail shipments of transportation casks enter the loading bays through rollup doors. Two rail/truck lanes are provided in this area to meet the expected WCS CISF throughput requirements. The rail line serving the CHB is equipped with a derail device to prevent inadvertent vehicular impacts. Two 130-ton overhead bridge cranes unload the NUHOMS® transportation cask from its transfer vehicle after appropriate contamination surveys and decontamination activities (if necessary) and place the transportation cask onto the on-site transfer vehicle. Empty NUHOMS® transportation casks are returned to the transfer vehicle and shipped, reversing the process. The VCT is used to unload the NAC transportation casks from their railcar, upright the cask and place it under the CTS. The CTS is used to transfer the canister from the NAC transportation cask to the VCC. The VCT is also used to return the empty NAC transportation casks to the railcar by reversing the process.

The CHB is commercially designed and fabricated steel framed structure with metal siding designed to support two commercial overhead cranes. The CHB is classified as ITS, Category C. Section 7.5.3 provides additional information about the building.

There are several doors in the building to allow access by railroad cars and transfer vehicles. Roll-up or sliding doors will be provided to minimize the potential for rain and snow that may blow into the building. No floor drains are located in the CHB to preclude the possibility of contamination entering a sanitary waste system. If there is any water collected in the building, it will be sampled to ensure no contamination is present and then pumped for discharge.

4.7.1.1 Design Specifications

The CHB structure is designed to withstand snow, rain, and wind loads in accordance with the IBC [4-8]. Administrative controls will be used to preclude the presence of loaded storage, transportation, or transfer casks inside the CHB during a tornado watch or other inclement weather watches with the potential to lead to winds in excess of those addressed by IBC, thereby eliminating the potential for structural members or the overhead bridge crane from collapsing onto loaded transportation casks, transfer casks or storage overpacks due to these weather events. Section 7.5.3.2 describes the design specifications for the CHB.

4.7.1.2 Plans and Sections

The CHB is shown in Figures 1-7 and 1-8.

4.7.1.3 Confinement Features

The CHB is not counted on to provide confinement for SNF or GTCC waste.

4.7.1.4 Function

The CHB facilitates cask handling operations at the WCS CISF. Those operations are described in more detail in Chapter 5. The functions of the CHB include: loading and unloading transportation casks from rail cars; general weather protection for the handling operations; a location for the CTS; support structure for overhead cranes; staging area for storage overpacks; and storage and staging for other transfer and shipping equipment. The CHB is not counted on to provide shielding or confinement.

4.7.1.5 Components

The major components that comprise the CHB are two 130 ton overhead bridge cranes. Minor components include a compressed air supply system for tools as discussed in Section 4.3.3 and the CHB will have a standard commercial HVAC system in the Utility and Storage room area of the building. The larger building will not be heated or cooled. Ventilation will be commercial grade equipment and materials.

In addition to components that are part of the CHB, all or parts of the transfer systems will operate within the building. Six storage systems were evaluated for storage in the WCS CISF Storage Area. These storage systems use various cask transfer systems. These transfer systems are described in Sections 4.7.3 and 4.7.4. 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.

4.7.1.6 Design Bases and Safety Assurance

The CHB is classified as being ITS. The design bases for the CHB are described in Section 7.5.3.

4.7.2 *Overhead Bridge Cranes*

The CHB houses two 130 ton overhead bridge cranes. These cranes are classified as NITS. The cranes are provided for the purpose of loading and unloading NUHOMS® transportation casks off or on the rail car and to or from the Transfer Trailer. The cranes will be administratively controlled so that they do not lift the NUHOMS® casks above their analyzed drop height. Section 7.5.3.1 provides additional information on the overhead bridge cranes. The NUHOMS® casks will be lifted by the crane utilizing the WCS Lift Beam Assembly, which is referenced in Section 4.10.

4.7.3 *NUHOMS® Transfer System*

For the NUHOMS® Systems, the transportation cask containing the loaded canister is received in the loading bay. After the cask has been received, including removal of the personnel barrier and impact limiters, the WCS Lift Beam Assembly is used to offload the transportation cask from the railcar to the transfer skid. The WCS Lift Beam Assembly is shown in drawing WCS01-2100 (referenced in Section 4.10). The transfer vehicle then moves the cask and canister out to the storage pad where the canister is transferred to the HSM. Equipment is provided for removing or attaching such items as impact limiters, personnel barriers and cask tie downs from the transportation casks. The NUHOMS® Transfer Equipment is shown in Figure 4-1 through Figure 4-3. Section 5.1.3.1.1 describes the transfer process for the NUHOMS® system.

4.7.4 *NAC Cask Transfer System*

For the NAC Systems, the transportation cask containing the loaded canister is also received in the loading bay. After the transportation cask has been received, including removal of the impact limiters, the VCT is driven over, essentially straddling the railcar, and is positioned to engage the transportation cask upper trunnions. The VCT then raises and moves towards the rear of the cask to raise and lift the transportation cask from the railcar. The VCT then lowers the transportation cask to 3-6" off the ground. The railcar is removed from the unloading area and the VCT moves the cask to the CTS. The VCT is shown in Figure 4-4.

Transfer preparations follow the placement of the transportation cask and VCCs within the CTS. Unloading operations for the transportation cask follow SAR requirements, which leaves the transportation cask in a state of readiness for content removal. The VCC is prepared for loading in accordance with SAR requirements, leaving it in readiness for the transfer operation. These operations do not require a "system", but will require lifting equipment in the area for handling the equipment indicated.

There is an area inside the CHB for VCC staging for VCCs awaiting loading via the CTS. Additional staging areas are available outside the security boundaries of the WCS CISF.

The CTS is used to remove the canistered contents from the transportation cask to the VCC. When a transportation cask is removed from the railcar, it is positioned within the CTS. Additionally, a VCC is also positioned within the CTS. Both the transportation cask and VCC are each fitted with a transfer adapter. The CTS is pre-rigged with the transfer cask for the system being transferred (e.g., NAC-MPC, NAC-UMS, NAC-MAGNASTOR) that is designed to interface with the transportation and storage configurations in the CTS.

The CTS is used to transfer the canister from the transportation casks into the storage overpacks. The CTS is essentially a hydraulic gantry crane with a dedicated transfer cask. Figure 7-1 is a rendering of the CTS. Section 7.5.1 provides information on the CTS.

There are no further preparations of the storage system after loading within the CTS. Following placement of the canister into the VCC, the VCC lid is placed in accordance with the SAR and the storage overpack is ready for placement on the storage pad in the Storage Area. Section 5.1.3.1.2 describes the transfer process for the NAC System.

4.7.4.1 Vertical Cask Transporter

The VCT is the component used to lift, stabilize and move both the transportation cask and the VCC storage overpacks during loading operations at the WCS CISF. The limit of this operation is removal of the transportation cask from the railcar and the movement of the cask to the CTS. The VCT is also used to move the loaded VCC to the storage pad. Section 7.5.2 provides a description of the VCT.

4.7.4.2 Plans and Sections

The VCT is shown in Figure 4-4.

4.7.4.3 Function

The function of the cask transporter is to enable transfer of the loaded storage overpack between the CHB and the concrete storage pads.

4.7.4.4 Components

The VCT is the component used to lift, stabilize and move both the transportation cask and the VCC storage overpacks during loading operations at the WCS CISF. The VCT components are described in Section 7.5.2.

4.7.4.5 Design Bases and Safety Assurance

The VCT design bases and safety assurance is described in Section 7.5 and Section 7.5.2.

4.8 Physical Protection

4.8.1 Introduction

WCS will use multiple technologies, physical barriers, and an armed security force to protect WCS personnel. All safeguard information associated with SNF and GTCC waste inventory, security, and transportation will be protected inside the WCS CISF PA. The WCS CISF is subject to the requirements in the Physical Security Plan for the site.

4.8.2 Security System Functions

WCS will have multiple security technologies controlling access, assisting with personnel identification, intrusion detection, alarm assessment, and threat delay. These systems will employ line monitoring, redundant power, and networking. All systems will feed into a user station. A backup user station will be available in the event the primary station is not available.

4.8.3 Physical Protection Plan Components

The Physical Security Plan will include the general security posture, an overview of the security features, guard force requirements, responses to alarms, and other security functions.

4.8.3.1 General Performance Objectives

The general performance objectives of WCS security are to detect, assess and respond to alarms, prevent introduction of prohibited items, and control access to the PA.

4.8.3.2 Security Organization

The security organization will consist of security officers, an assistant officer-in-charge and/or an officer-in-charge on each shift. All uniformed security officers, assistant supervisors, and supervisors will report to a security manager assigned to the WCS CISF. The WCS Facility Security Officer will have responsibility over all WCS CISF security personnel, programs and systems.

4.8.3.3 Physical Barrier System

The WCS CISF will use a fence posted with signage at the OCA boundary, a nuisance fence just outside of the PA fence and the PA fence inside of the nuisance fence.

4.8.3.4 Access Control Subsystems and Procedures

WCS will control unescorted access to the WCS CISF. Only individuals meeting the unescorted access requirements pursuant to 10 CFR Part 73 will be given this access type. The WCS CISF will use dual authentication identity verification before unescorted access is granted at the WCS CISF. Procedures will define the WCS CISF clearance practices and security practices for ensuring that only individuals approved for unescorted access are able to gain unescorted access to the WCS CISF.

4.8.3.5 Detection, Surveillance and Alarm Subsystems

The WCS CISF will use outward looking cameras and lighting for early detection and assessment of potential intruders and additional cameras to view the PA to assess areas of alarm from the intrusion detection systems. Alarms will communicate to alarm stations where posted security force employees will receive alarm signals.

4.8.3.6 Communication Subsystems

WCS will use wired and wireless communication devices to communicate between stationary posts, mobile posts and off-site resources.

4.8.3.7 Test and Maintenance Program

The WCS CISF will contract technology and equipment maintenance. WCS Security will follow developed security procedures for equipment and alarm testing.

4.8.3.8 Contingency Response Plans and Procedures

The WCS CISF will work to operational procedures and a contingency plan addressing required actions for events including but not limited to intrusion, equipment failure, and natural disasters.

4.9 References

4-1 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.

4-2 NRC Regulatory Guide 3.48, "Standard Format And Content For The Safety Analysis Report For An Independent Spent Fuel Storage Installation Or Monitored Retrievable Storage Installation (Dry Storage)," Rev 1.

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

4-4 "Quality Assurance Program for Consolidated Interim Spent Fuel Storage Facility and the Packaging and Transport of Radioactive Materials," QAPD-400, Revision *2*.

4-5 Title 10, Code of Federal Regulations, Part 72, "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater Than Class C Waste."

4-6 IEEE 692, 2013, Institute of Electrical and Electronics Engineers, "Criteria for Security Systems for Nuclear Power Generating Stations".)

4-7 NFPA 70, 2016, National Fire Protection Association, "National Electric Code"

4-8 IBC, 2009, International Building Code.

4-9 NFPA 101, 2015, National Fire Protection Association, "Life Safety Code."

4-10 Not Used.

4-11 Drawing NAC004-C-002, Rev. 0, "ISFSI Pad Licensing Design Structural Concrete Plan, Sections, and Details."

4-12 NFPA 25. 2014, National Fire Protection Association, "Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems

4.10 Supplemental Data Drawings

The following drawing is enclosed as noted below:

1. *"WCS Lift Beam Assembly (three sheets)," WCS01-2100, Revision 0 (Included at the end of this Section).*

PROPRIETARY AND SECURITY RELATED INFORMATION WITHHELD UNDER 10 CFR 2.390

REVISION	DESCRIPTION	DATE
0	INITIAL ISSUE	4/14/16

AREVA

PROJECT: PROJECT

WCS LIFT BEAM ASSEMBLY

DRAWING NO. WCS01-2100 | SCALE SHOWN | SHEET 1 OF 3

DRAWING NO. WCS01-2100 SHEET 1 OF 3

PROPRIETARY AND SECURITY RELATED INFORMATION WITHHELD UNDER 10 CFR 2.390

DRAWING NO.	SHEET	REVISION
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PROPRIETARY AND SECURITY RELATED INFORMATION WITHHELD UNDER 10 CFR 2.390

DRAWING NO. WCS01-2100 SHEET 3 OF 3

DRAWING NO.	SHEET	REVISION
WCS01-2100	3 OF 3	0

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 are listed in Section A.4.6)*
	FC-DSC		
	FF-DSC		
	GTCC Canister		
Standardized Advanced NUHOMS® System	NUHOMS® 24PT1	AHSM	Appendix B.4 *(Drawings are listed in Section B.4.6)*
Standardized NUHOMS® System	NUHOMS® 61BT	HSM Model 102	Appendix C.4 *(Drawings are listed in Section C.4.6)*
	NUHOMS® 61BTH Type 1		Appendix D.4 *(Drawings are listed in Section D.4.6)*
NAC-MPC	Yankee Class	VCC	Appendix E.4 *(Drawings are listed in Section E.4.4)*
	Connecticut Yankee		
	LACBWR		
	GTCC-Canister-CY		
	GTCC-Canister-YR		
NAC-UMS	Classes 1 through 5	VCC	Appendix F.4 *(Drawings are listed in Section F.4.3)*
	GTCC-Canister-MY		
MAGNASTOR	TSC1 through TSC4	CC1 through CC4	Appendix G.4 *(Drawings are listed in Section G.4.3)*
	GTCC-Canister-ZN		

Table 4-2
WCS CISF Compliance with General Design Criteria
(10 CFR 72, Subpart F)
(5 Sheets)

10 CFR 72 Requirement	***Requirement Summary***	***SAR Section Where Compliance Is Demonstrated***
72.122(a) *Quality standards*	*Structures, systems, and components Important to Safety must be designed, fabricated, erected, and tested to quality standards commensurate with the importance to safety of the function to be performed.*	• *Section 3.4 provides the QA classifications for SSCs Important to Safety.* • *Chapter 4 describes the design of SSCs Important to Safety.* • *Section 13.2 describes the Preoperational Test Plan.* • *QAPD 400 Revision 1 describes the QA procedures requirements and shows that the QA Program is in accordance with 10 CFR 72.140.*
72.122(b) *Protection against environmental conditions and natural phenomena*	*Structures, systems, and components Important to Safety must be designed to accommodate the effects of, and to be compatible with, site characteristics and environmental conditions and to withstand postulated accidents.*	• *Sections 3.2 and 3.2.3 provide requirements for environmental and site design criteria for SSCs Important to Safety.* • *Sections 4.2 and 4.7 describe the design to mitigate environmental effects.* • *Chapter 12 demonstrates the capability of SSCs Important to Safety to withstand postulated accidents.*
72.122(c) *Protection against fires and explosions*	*Structures, systems, and components Important to Safety must be designed and located so that they can continue to perform their safety functions under credible fire and explosion exposure conditions.*	• *Section 3.3.6 provides fire and explosion protection requirements.* • *Sections 4.3.8 and 7.5.3 describe the design that provides fire and explosion protection.* • *Sections 4.3.8 and Tables A.3-1, B.3-1, C.3-1, D.3-1, E.3-1, F.3-1 and G.3-1 show the capability of SSCs ITS to withstand postulated fire and explosion accidents.*
72.122(d) *Sharing of structures, systems, and components*	*Structures, systems, and components Important to Safety must not be shared between the WCS CISF and other facilities unless it is shown that such sharing will not impair the capability of either facility to perform its safety functions.*	• *Section 4.1.2 verifies that the WCS CISF does not share SSCs ITS with other facilities.*

Table 4-2
WCS CISF Compliance with General Design Criteria
(10 CFR 72, Subpart F)
(5 Sheets)

10 CFR 72 Requirement	***Requirement Summary***	***SAR Section Where Compliance Is Demonstrated***
72.122(e) Proximity of sites	*An ISFSI located near other nuclear facilities must be designed and operated to ensure that the cumulative effects of their combined operations will not constitute an unreasonable risk to the health and safety of the public.*	• *Section 9.4.3.3 evaluates the radiological impacts attributable to WCS's present operations, those from the National Enrichment Facility, and radiation doses estimated for storing up to 40,000 MTHM of SNF at the CISF.*
72.122(f) Testing and maintenance of systems and components	*Systems and components that are Important to Safety must be designed to permit inspection, maintenance, and testing.*	• *Section 4.3.9 describes the capability of SSC's to permit inspection, maintenance, and testing.*
72.122(g) Emergency capability	*Structures, systems, and components Important to Safety must be designed for emergencies. The design must provide for accessibility to the equipment of onsite and available offsite emergency facilities and services.*	• *Section 4.1.2 specifies that the WCS CISF is designed for accessibility.* • *Section 13.5 summarizes the Emergency Plan for the WCS CISF.*

Table 4-2
WCS CISF Compliance with General Design Criteria
(10 CFR 72, Subpart F)
(5 Sheets)

10 CFR 72 Requirement	***Requirement Summary***	***SAR Section Where Compliance Is Demonstrated***
72.122(h) Confinement barriers and systems	*The spent fuel cladding must be protected during storage against degradation that leads to gross ruptures or the fuel must be otherwise confined. Ventilation systems must be provided to ensure the confinement of airborne radioactive particulate materials during normal or off-normal conditions. Storage confinement systems must have the capability for continuous monitoring to maintain safe storage conditions.*	• *Chapter 11 provides the requirements to ensure confinement of the spent fuel.* • *Section 11.1 describes the confinement design features.* • *Chapter 12 (accident analysis) shows that there is no loss of confinement during an accident.* • *Section 11.5 shows that the fuel cladding is protected.* • *Section 9.3.5 describes the area radiation and airborne radioactivity monitoring system.*
72.122(i) Instrumentation and control systems	*Instrumentation and control systems must be provided to monitor systems that are Important to Safety over anticipated ranges for normal operation and off-normal operation.*	• *Section 5.4 provides the requirements to monitor systems Important to Safety.* • *Section 5.4.1 describes the instrumentation and control systems.*
72.122(j) Control room or control area	*A control room or control area, if appropriate, must be designed to permit occupancy and actions to be taken to monitor the WCS CISF safely under normal conditions, and to provide safe control of the WCS CISF under off-normal or accident conditions.*	• *Sections 4.3.15 and 5.5 show that a control room/area is not required.* • *Section 4.3.17 describes the operational systems that ensure safe conditions during cask storage and canister transfer.* • *Chapter 5 defines the operational controls and limits to be used for the WCS CISF.*

Table 4-2
WCS CISF Compliance with General Design Criteria
(10 CFR 72, Subpart F)
(5 Sheets)

10 CFR 72 Requirement	***Requirement Summary***	***SAR Section Where Compliance Is Demonstrated***
72.122(k) *Utility or other services*	*Each utility service system must be designed to meet emergency conditions. The design of utility services and distribution systems that are Important to Safety must include redundant systems to the extent necessary to maintain, with adequate capacity, the ability to perform safety functions assuming a single failure.*	• *Section 4.1.2.3 and 4.3 verify that the WCS CISF does not rely on utility systems to ensure the safe operation of the facility.*
72.122(l) *Retrievability*	*Storage systems must be designed to allow ready retrieval of spent fuel and reactor-related GTCC waste for further processing or disposal.*	• *Section 4.7 explains that the WCS CISF provides the retrievability capability.*
72.124(a) *Design for criticality safety*	*Spent fuel handling, packaging, transfer, and storage systems must be designed to be maintained subcritical.*	• *Section 3.3.4 and Chapter 10 provides the requirements to ensure subcriticality is maintained.* • *Section 10.1 describes the criticality safety design.*
72.124(b) *Methods of criticality control*	*When practicable, the design of an ISFSI must be based on favorable geometry; permanently fixed neutron absorbing materials (poisons), or both.*	• *Chapter 10 provides the requirements for the means of subcriticality control and describes the components that maintain subcritical conditions.*
72.124(c) *Criticality monitoring*	*A criticality monitoring system shall be maintained in each area where special nuclear material is handled, used, or stored which will energize clearly audible alarm signals if accidental criticality occurs.*	• *Section 10.1.2 describes why criticality monitoring is not applicable for dry storage systems where the spent fuel is packaged in its stored configuration.*

Table 4-2
WCS CISF Compliance with General Design Criteria
(10 CFR 72, Subpart F)
(5 Sheets)

10 CFR 72 Requirement	***Requirement Summary***	***SAR Section Where Compliance Is Demonstrated***
72.126(a) *Exposure control*	*Radiation protection systems must be provided for all areas and operations where onsite personnel may be exposed to radiation or airborne radioactive materials.*	• *Section 3.3.5 provides the radiological protection design criteria.* • *Section 9.3 describes the components that provide shielding for exposure control.* • *Sections 9.1 describes the program features for ensuring that occupational exposures are ALARA.*
72.126(b) *Radiological alarm systems*	*Radiological alarm systems must be provided in accessible work areas as appropriate to warn operating personnel of radiation and airborne radioactive material concentrations above a given setpoint and of concentrations of radioactive material in effluents above control limits.*	• *Section 11.2 concludes that no confinement monitoring is required for any of the canisters stored at the WCS CISF because all canisters include welded closures.* • *Section 9.5 describes the radiation protection program during operations including radiological monitoring.*
72.126(c) *Effluent and direct radiation monitoring*	*As appropriate for the handling and storage system, a means to measure effluents must be provided.* *Areas containing radioactive materials must be provided with systems for measuring the direct radiation levels in and around these areas.*	• *Operation of the WCS CISF is not expected to result in radioactive contamination of any effluents (Chapter 6).* • *Section 9.5 describes the radiation protection program during operations including radiological monitoring.*
72.126(d) *Effluent control*	*The ISFSI must be designed to provide means to limit to ALARA levels the release of radioactive materials in effluents during normal operations; and control the release of radioactive materials under accident conditions.*	• *Section 6.5 describes why effluent control is not applicable at the WCS CISF and demonstrates that the dose limits specified in 72.104 are met.*

Table 4-2
WCS CISF Compliance with General Design Criteria
(10 CFR 72, Subpart F)
(5 Sheets)

10 CFR 72 Requirement	***Requirement Summary***	***SAR Section Where Compliance Is Demonstrated***
72.128(a) *Spent fuel storage and handling systems*	*Spent fuel storage, reactor-related GTCC waste storage and other systems that might contain or handle radioactive materials associated with spent fuel or reactor-related GTCC waste, must be designed to ensure adequate safety under normal and accident conditions.*	• *Chapters 8, 9, and 11 describe the design features of the storage and handling systems to provide adequate shielding, confinement, and heat removal capability.*
72.128(b) *Waste treatment*	*Radioactive waste treatment facilities must be provided.*	• *Chapter 6 addresses the generation and treatment of radioactive wastes.*
72.130 *Criteria for decommissioning*	*The ISFSI must be designed for decommissioning.*	• *Section 13.6 provides the requirements for decommissioning the site.* • *Section 13.6.3 describes the design considerations to facilitate decommissioning.* • *The Decommissioning Plan (License Application, Appendix B) presents an overall description of the decommissioning requirements.*

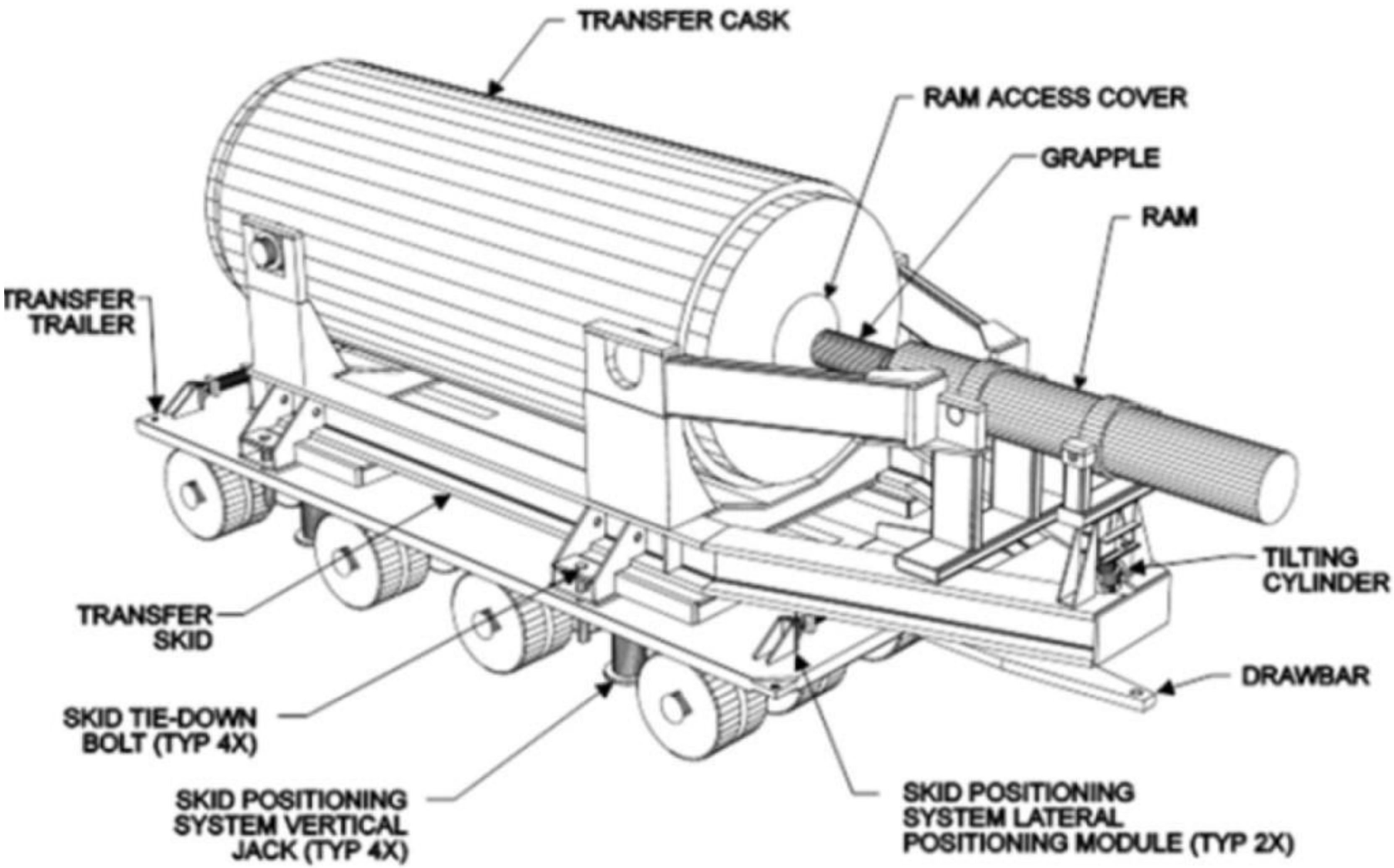

Figure 4-1
NUHOMS® Transfer System

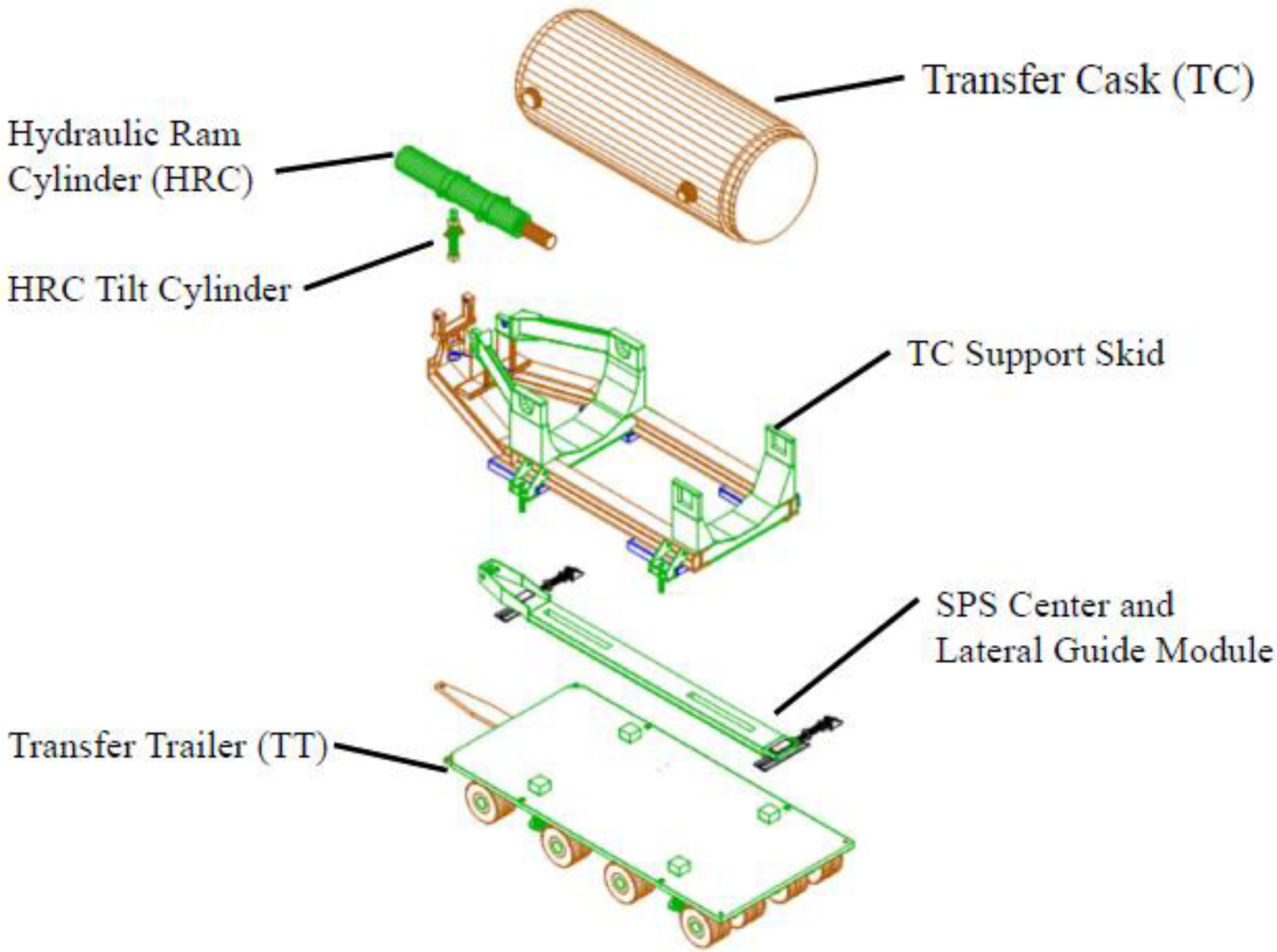

Figure 4-2
Exploded View of Transfer Components

Figure 4-3
Assembled Transfer Trailer

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