CHAPTER 3
PRINCIPAL DESIGN CRITERIA

Table of Contents

List of Tables

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 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 Stored Materials

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 a canisters containing SNF or GTCC waste. The total storage capacity for the WCS CISF is 5,000 metric tons of heavy metal (MTHM) and any amount of GTCC waste.

Physical, thermal and radiological characteristics of stored SNF are described in the safety documentation for each cask system listed in Table 1-1. The physical, thermal and radiological characteristics of GTCC canisters are described in the safety documentation for the transportation cask systems listed in Table 1-1.

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

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

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

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

3.2.1 Cask Handling Building and Equipment

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

3.2.2 Storage Systems and Pads

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

3.2.3 Security and Administration Building

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

3.2.4 Receiving Area

The Receiving Area function is summarized in Table 1-3. The Receiving Area is considered NITS and is designed, constructed, maintained, and tested as commercial-grade.

3.3 Design Criteria for WCS CISF ITS Structures, Systems and Components

This section lists the principal criteria utilized in the design of ITS systems and components for the WCS CISF. 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.

3.3.1 Structural

The principal design criteria applicable to the design of ITS systems and components are developed from the WCS CISF site characteristics and are used in the determination of structural loads and load combination analyses. Bounding load values against these criteria are evaluated in Chapter 7.

3.3.1.1 Tornado (Wind Load)

Design Basis Tornado (DBT) parameters are presented in Table 1-2. Design basis tornado characteristics are based on NRC Regulatory Guide 1.76 [3-2] and portions of NUREG-0800 [3-3]. Section 2.3.2.4 discusses observed tornados in the WCS CISF region.

3.3.1.2 Tornado (Missile Spectrum)

Three DBT missiles are defined for use in the WCS CISF design and presented in Table 1-2. The DBT parameters correspond with the parameters for Region II defined by NRC Regulatory Guide l.76 [3-2].

3.3.1.3 Floods

The "bounding" flood at the WCS CISF resulting from the 500-year frequency storm event and the Probable Maximum Precipitation (PMP) results in a flood height of 1.1 inches with a water velocity of 1.7 fps as documented in Section 2.4.2.2.

3.3.1.4 Snow and Ice

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 2.3.2.4.

3.3.1.5 Seismic – Ground Motion

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.

3.3.1.6 Seismic – Surface Faulting

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.

3.3.1.7 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. This reasoning supports a no-ash fall criterion for the design of a WCS CISF as well.

3.3.1.8 Fire and Explosions

The WCS CISF contains no permanent flammable material other than electrical and electronic components within the Cask Handling Building. 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 will be emphasized. All wood scaffolding and cribbing will be 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 Cask Handling Building is controlled. The only sources of flammable liquids in the Cask Handling Building are the locomotive used to move the railcars into and out of the Cask Handling Building, the Cask Transfer System, the Vertical Cask Transporter (VCT) and the transfer vehicle. The locomotive will not be allowed in the building during cask handling operation other than when the transportation casks are ready for transport. The Canister Transfer System and the Vertical Cask Transporter are quantity limited (< 50 gallons) and are described in SAR Section 12.2.1. The transfer vehicle for the NUHOMS® System is also quantity limited (<60 gallons) and will not be in the Cask Handling Building 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 toward the storm drainage system and thus away from the storage overpacks. 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 will be 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 no fixed fire suppression system within the boundaries of the WCS CISF; however, there is a fire detection system in the Cask Handling Building that will be installed to protect the investment in equipment but not to satisfy or imply any regulatory requirement for fire protection.

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.

3.3.2 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 based on these criteria are developed in Chapter 8.

3.3.2.1 Ambient Temperature

Ambient normal, off normal and extreme temperatures are given in Table 1-2. These are documented in Section 2.3.2.1.

3.3.2.2 Solar Load (Insolation)

The Solar Loads are given Table 1-2 and are taken from 10 CFR Part 71 [3-4].

3.3.3 Confinement

Criteria utilized in the confinement design of the cask systems are not based on site-specific confinement criteria. Chapter 6 addresses confinement criteria adopted for each of the canisters authorized for storage at the WCS CISF identified in Table 1-1.

3.3.4 Radiological Protection

Radiation protection shall be provided in accordance with 10 CFR 72.126(a). 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).

- 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).

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, and as necessary to comply with the operating limits imposed by Technical Specifications [3-1].

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.

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 non-radioactive 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 Nuclear Criticality 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.

3.3.6 Decommissioning

The canisters are all licensed for, and will be 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.

3.3.7 Material Handling, Storage, and Retrieval Capability

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) to ensure adequate safety under normal and accident conditions. The following criteria for cask systems shall also be 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. Height values are based on the lifting operations at the WCS CISF. For this event, "designed to withstand" is defined as no impact on ITS functions except the following:

- 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 cask or transportation cask lid during transfer operations.

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

3.3.8 Satisfaction of ALARA Goals

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

The ALARA principles of time, distance and shielding shall be considered throughout the design of the WCS CISF. For tasks requiring access to areas near transportation and storage casks, 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 shall be incorporated into system design.

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

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

3.5 Design Criteria for Other Structures, Systems, and Components Subject to NRC Approval

The classification of structures, systems and components (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.

3.5.1 Important to Physical Protection of Facility and Materials

10 CFR 72, Subpart H 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 as part of this license application. Physical protection design requirements and criteria are described in Section 4.7. SSCs related to Physical Protection of the facility and materials satisfy the applicable requirements of 10 CFR Part 73.

3.5.2 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 318-11 [3-6] for concrete and the AISC Manual of Steel Construction [3-7] for structural steel.

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 International Building Code (IBC) [3-10], National Plumbing Code [3-11], and good work practices.

The design of conventional HVAC systems at the WCS CISF will conform 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 will be 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].

3.6 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] 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 any amount of GTCC waste.

3.6.4 Facility Service Life

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

3.7 Summary of WCS Interim Storage Facility Principle Design Criteria

Table 1-2 provides a listing of principal design criteria for the WCS CISF.

3.8 References

3-1 Proposed SNM-1050, WCS 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, 2006, 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.

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		
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	VCC	
	LACBWR	VCC	
NAC-UMS	Classes 1 thru 5	VCC	Appendix F.3
MAGNASTOR	TSC1 thru TSC4	CC1 thru CC4	Appendix G.3

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

CHAPTER 4
OPERATING SYSTEMS

Table of Contents

List of Tables

4. OPERATING SYSTEMS

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 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 Installation Design

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

4.1.1 Location and Layout of Facility

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

4.1.2 Principle Features

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

4.1.2.1 Site Boundary

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

4.1.2.2 Owner Controlled Area

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

4.1.2.3 Protected Area

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

4.1.2.4 Storage Area and Concrete Storage pads

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

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

4.1.2.5 Cask Handling Building

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

4.1.2.6 Transportation Cask Queuing Areas

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

4.1.2.7 Rail Side Track

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

4.1.2.8 Security and Administration Building

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

4.1.2.9 Receiving Area

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

4.1.2.10 Concrete Cask Staging Area

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

4.1.2.11 Off-Normal Holding Area

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

4.1.2.12 Water Utilities and Fire Protection

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

4.1.2.13 Site Utility Supplies and Systems

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

4.1.2.14 Storage Tanks

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

4.1.2.15 Stacks

There are no stacks at the WCS CISF.

4.1.2.16 Temporary Facilities

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

4.1.3 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 Administration and Security Building.

4.2 Spent Fuel Handling 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 designed to accommodate the systems authorized for use at the storage WCS CISF.

4.2.1 Cask Handling Building

This section describes the Cask Handling Building systems and associated operations. The Cask Handling Building is the primary facility for handling transportation casks and canisters at the WCS CISF and consists of two loading bays for shipping/receiving of transportation casks, and depending whether on the system will be moving the canister/cask to the on-site transfer vehicle for transfer to the storage pad or will be transferring the canister from the transportation cask to the VCC, which is then taken to the storage pad.

The Cask Handling Building loading bays are used to receive and prepare for shipment 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 Cask Handling Building is equipped with a derailleur to prevent inadvertent vehicular impacts. Two 130-ton overhead bridge cranes unload the NUHOMS® transportation cask from their 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 Canister Transfer System. The Canister Transfer System is used to transfer the canister from the NAC transportation cask to the NAC Storage Overpack. The VCT is also used to return the empty NAC transportation casks to the railcar by reversing the process.

4.2.1.1 Cask Off-loading and Loading 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 NUHOMS® MP197HB and MP187 Casks Lift Beam Assembly is used to offload the transportation cask from the railcar to the transfer skid. The transfer vehicle then moves the cask and canister out to the storage pad where the canister is transferred to the HSM. Chapter 5 and applicable appendices provide the procedures for accomplishing the transfers. Equipment is provided for removing or attaching such items as impact limiters, personnel barriers and cask tiedowns from the transportation casks.

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" of the ground. The railcar is removed from the unloading area and the VCT moves the cask to the Canister Transfer System.

4.2.1.2 Cask Carrier System

The cask carrier system for the transportation cask is the VCT. The limit of this operation is removal of the transportation cask from the railcar and the movement of the cask to the Canister Transfer System. The same equipment, VCT, is used to move the loaded VCC to the storage pad.

4.2.1.3 Transfer Preparation System

Transfer preparations follow the placement of the transportation cask and VCC within the Canister Transfer System. 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.

4.2.1.4 Canister Transfer System

The Canister Transfer System 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 Canister Transfer System. Additionally, a VCC is also positioned within the Canister Transfer System. Both the transportation cask and VCC are each fitted with a transfer adapter. The Canister Transfer System 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 Canister Transfer System.

4.2.1.5 Storage Mode Preparations Systems

There are no further preparations of the storage system after loading within the Canister Transfer System. Following placement of the canister into the VCC, the VCC lid is placed in accordance with the SAR and the cask is ready for placement on the storage pad in the Storage Area.

4.2.2 Storage Area

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

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

4.2.2.1 Concrete Pad Structures

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

4.2.2.2 Cask Storage Systems

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

4.2.2.3 Cask Transfer Systems

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

4.3 Other Operating Systems

4.3.1 Heating, Ventilation and Air Conditioning (HVAC) Systems

The Security and Administration Building as well as the Cask Handling Building will utilize commercial grade HVAC systems and ductwork.

4.3.1.1 Cask Handling Building HVAC System

The Cask Handling Building will have a standard commercial HVAC system in the office and break room area of the building. The larger building will not be heated or cooled. Ventilation will be commercial grade equipment and materials.

4.3.1.2 Security and Administration Building HVAC System

The Security and Administration Building HVAC system will be a standard commercial system used for employee comfort and equipment protection.

4.3.2 Electrical System

4.3.2.1 Site Electrical Power Distribution System

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.

4.3.2.2 Facility Electrical Systems

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

4.3.3 Compressed Air Supply Systems

Compressed air use at the WCS CISF will be limited to the Cask Handling Building.

The Cask Handling Building will have a compressed air system for the use of tools and small equipment.

4.3.4 Water Supply Systems

Water is supplied to WCS CISF by the existing potable water system at WCS.

4.3.5 Wastewater Systems

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).

4.3.6 Communication and Alarm Systems

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

4.3.6.1 Telephone System

A telephone system will be installed at the WCS CISF. This system will have access to the other WCS facilities outside the WCS CISF and outside lines.

4.3.6.2 Public Address System

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.

4.3.6.3 Radio System

A wireless radio system will be used at the WCS CISF for standard communication needs.

4.3.7 Fire Protection

Fire protection will be in accordance with requirements of the National Fire Protection Association (NFPA).

4.3.8 Maintenance Systems

No special maintenance techniques are necessary that would require a safety analysis.

There is preventative maintenance performed on a regular basis on the overhead transfer crane, transfer equipment and shipping casks. Maintenance of these SSCs, which are classified as important-to-safety (ITS), ensure that they are safe and reliable throughout the life of the WCS CISF per 10 CFR 72.122(f).

4.3.9 Cold Chemical Systems

There will be no cold chemical systems at the WCS CISF.

4.3.10 Radiation Monitoring Systems

Radiation dose at the WCS CISF is measured by optically stimulated luminescence monitoring and monitoring will cover the PA and the OCA to ensure the dose is within 10 CFR 20.1301 and 10 CFR 72.104 limits.

4.4 Operation Support Systems

The section below describes surveillance and monitoring system requirements for the storage overpacks. The storage overpacks have optional thermal monitoring capabilities as described in the Technical Specifications [4-3] applicable to each system.

4.4.1 Storage Overpack Thermal Monitoring 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.

4.5 Analytical Sampling

No sampling is required for the safe operation of the WCS CISF or to ensure that operations are within prescribed limits. The cask system designs preclude the release of effluents generated during interim storage for normal, off-normal and accident conditions. Since the sampling is not required for nuclear safety of the WCS CISF, it is not subject to ITS. While not required, it is prudent to establish a monitoring system for surface water runoff as an additional step in the radiation control process. Since the surface water drainage paths are normally dry, it is not possible to monitor runoff in a continuous or batch mode basis. Instead, quarterly soil sampling coupled with weekly/monthly radiological surveys on the casks and storage pad will be conducted.

There are no connections to municipal sewer systems. On-site sewage would be routed to holding tanks which are periodically pumped and sent offsite for disposal in a publically operated treatment facility. Each holding tank would be periodically sampled (prior to pumping) and analyzed for applicable radionuclides.

4.5.1 Liquid Radioactive Waste Sampling

No sampling is required for the safe operation of the WCS CISF.

4.5.2 Solid Radwaste Sampling

No sampling is required for the safe operation of the WCS CISF.

4.5.3 Gaseous Radioactive Waste Sampling

No sampling is required for the safe operation of the WCS CISF.

4.6 Transportation Cask Repair and Maintenance

If visual inspections reveal the need for repairs or maintenance, these activities will be performed either in situ 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.

4.7 Physical Protection

4.7.1 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.

4.7.2 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.

4.7.3 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.

4.7.3.1 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.

4.7.3.2 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.

4.7.3.3 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.

4.7.3.4 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.

4.7.3.5 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.

4.7.3.6 Communication Subsystems

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

4.7.3.7 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.

4.7.3.8 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.

4.8 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 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 0.

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

<table>
<tr><th>Cask System</th><th>Canister</th><th>Overpack</th><th>Appendix</th></tr>
<tr><td rowspan="3">NUHOMS®-MP187 Cask System</td><td>FO-DSC</td><td rowspan="3">HSM (Model 80)</td><td rowspan="3">Appendix A.4</td></tr>
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<tr><td>MAGNASTOR</td><td>TSC1 thru TSC4</td><td>CC1 thru CC4</td><td>Appendix G.4</td></tr>
</table>

CHAPTER 5
OPERATING PROCEDURES

Table of Contents

List of Tables

5. OPERATING PROCEDURES

This chapter provides a description of the Waste Control Specialist, LLC (WCS) Consolidated interim Storage Facility (CISF) operations. Detailed procedures will be developed as described in Chapter 13 which will ensure that routine operations are conducted in a safe manner. The operating procedures will integrate appropriate information from the Technical Specifications [5-1].

5.1 Description of Operations

Section 2.1 of the Technical Specifications [5-1] lists the canisters authorized for storage at the WCS CISF. Table 5-1 provides the cross reference to the applicable appendix and section for each canister/storage overpack where the system specific operating procedures are presented.

The following sub-sections provide a high-level narrative for receiving and dispatching the canisterized spent nuclear fuel (SNF) or Greater than Class C (GTCC) waste in the authorized transportation casks at the WCS CISF and an overview of operations for the NUHOMS® and NAC Systems.

5.1.1 Receiving and Dispatch Operations for All Cask/Canister Systems

Receipt operations involve site receipt systems and the Cask Handling Building cask off-loading and loading systems.

In addition, the receipt inspection of the canisters upon arrival at the WCS CISF will be in accordance with reference [5-2]. This Post-transportation Verification will invoke visual inspections of the two most limiting canisters from each reactor site and an evacuated volume helium leak test of each canister as prudent measures to confirm that a canister remains able to perform its safety function and is therefore acceptable for storage under the WCS CISF. As described in [5-2], the helium leak test will be performed by flushing the cavity between the transportation cask and the canister and then evacuating the space and sampling the space for helium coming from the canister.

Loaded transportation casks are received at the WCS CISF, bills of lading and other shipping papers are inspected, the site railcar mover is hitched, and a security inspection and Radiation Safety (RS) radiation survey of the incoming transportation casks are performed. The casks are moved to the Cask Handling Building for transfer and storage preparation. Once access is obtained to the transportation cask test ports for the cask cavity, a helium leak test will be performed to verify the integrity of the canister inside the cask in accordance with the requirements of reference [5-2]. The visual inspection of the two limiting canisters from each site will take place during the transfer of the canister to the storage overpack. The identification of the canisters subject to the visual inspections, and the requirements for the inspections are defined in reference [5-2].

Receipt of the loaded transportation casks takes place in the Cask Handling Building.

Dispatch of empty or loaded transportation casks also takes place from the Cask Handling Building. Dispatch of empty transportation casks occurs after SNF or GTCC waste canisters are received, transferred and placed into storage, or when SNF or GTCC canisters are retrieved from storage and placed in the transportation casks for shipment off-site. After the empty or loaded transportation casks are ready for shipment in the Cask Handling Building, shipping paperwork is prepared and the casks are dispatched off-site.

5.1.2 NUHOMS® Systems

The NUHOMS® system includes a NUHOMS® transportation/transfer cask and a Horizontal Storage Module (HSM) along with the associated transfer equipment. The NUHOMS® transportation/transfer casks are metal, cylindrical multi-wall transportation casks that contains a welded canister. The casks are designed and qualified for both transportation and storage (transfer) operations.

For storage (transfer) operations, the NUHOMS® cask in the transportation configuration (containing welded canisters) is received at the site and taken to the Cask Handling Building. The cask is radiologically surveyed, the cask cavity is vented and canister leak tested, and the cask is decontaminated (if required). The cask is placed it its transfer configuration to ready for transfer operations. This includes removing the impact limiters and lifting it (horizontal lift) off the railcar and placing it on the transfer vehicle with one of the 130-ton overhead bridge cranes. All lifts of the loaded cask, regardless of configuration (transportation or transfer) are maintained below 80 inches.

The transfer vehicle moves the cask to the Storage Area, where operators prepare for field transfer of the canister into an HSM. The cask is moved to within a few feet of the HSM, positioned and approximately aligned and the top cover plate is removed. The transfer vehicle is backed to the HSM and docked. The cask is final aligned with the HSM, and a hydraulic ram system is extended and engaged to push the canister into the HSM.

The hydraulic ram system is disengaged and removed, and the empty cask is retracted and moved clear. The HSM door is installed using a portable yard crane. The top cover plate of the empty cask is reinstalled. The empty cask is moved to the Cask Handling Building and prepared for dispatch and reuse.

For retrieval operations, the NUHOMS® cask is received at the site and taken to the Cask Handling Building. The cask is radiologically surveyed, the cask cavity is vented and tested, and the cask is decontaminated (if required). The cask is then converted to the transfer configuration and lifted and placed horizontally on the transfer vehicle by one of the overhead bridge cranes. The transfer vehicle takes the cask to the Storage Area, where operators prepare for field transfer of the canister from the HSM to the cask. The cask is moved to within a few feet of the HSM and approximately aligned, and the top cover plate is removed. The transfer vehicle is backed to the HSM and the cask is docked. The cask is final aligned to the HSM and the hydraulic ram system is extended and engaged to pull the canister from inside the HSM into the cask.

The hydraulic ram system is then disengaged and moved. The cask is retracted and moved clear, the cask's top cover plate is reinstalled, and the cask is towed to the Cask Handling Building to be prepared for dispatch. The cask is horizontally lifted from the transfer vehicle by an overhead bridge crane and positioned over the transporter in the Cask Handling Building shipping/receiving area by the overhead bridge crane, lowered, secured and prepared for dispatch (placed in transportation configuration), including radiological surveys and decontamination (if required).

5.1.3 NAC Systems

The NAC systems include the NAC transportation casks, Vertical Cask Transporter (VCT), Canister Transfer System and the Vertical Concrete Cask (VCC) storage overpack. The NAC transportation casks are a metal, cylindrical multi-wall transportation cask that contains a welded canister. At the Cask Handling Building, the NAC transportation cask is received, radiologically surveyed and decontaminated (if required), upended and placed under the Canister Transfer System using the VCT. The canister is then removed vertically from the transportation cask and placed into the VCC via the appropriate transfer cask which is part of the Canister Transfer System. Once the lid in installed on the VCC, the VCT is used to move the VCC to the Storage Area where it is placed on the appropriate storage pad.

For retrieval operations, the VCT retrieves the VCC, and moves it to the Cask Handling Building and places it under the Canister Transfer System. The NAC transportation cask is received and radiologically surveyed and decontaminated (if required), upended and placed under the Canister Transfer System using the VCT. The canister is then removed vertically from the storage overpack and placed into the transportation cask via appropriate transfer cask with the Canister Transfer System. The transportation cask is then moved and down ended onto the transporter with the VCT, secured and prepared for dispatch, including radiological surveys and decontamination (if required).

5.2 References

5-1 Proposed SNM-1050, WCS Interim Storage Facility Technical Specifications, Amendment 0.

5-2 "Post Transport Package Evaluation," QP-10.02, Revision 0.

Table 5-1
Operating Procedures for the Storage Systems at the WCS CISF

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</table>

CHAPTER 6
WASTE CONFINEMENT AND MANAGEMENT

Table of Contents

6. WASTE CONFINEMENT AND MANAGEMENT

This chapter describes the waste management systems of the WCS CISF and demonstrates that waste materials generated as a result of WCS CISF operation are safely contained and disposed. The WCS CISF handles only canisterized spent nuclear fuel (SNF) and Greater-than Class C (GTCC) waste; therefore, the only radioactive wastes are solid wastes generated from residual quantities of radioactive contamination on the exterior surfaces of the transportation casks. No waste processing facilities are provided by the WCS CISF design.

The CISF does not have a SNF pool or any associated wastes generated as a result of pool operations or maintenance.

6.1 On-Site Waste Sources

This section describes and characterizes the potential gaseous, liquid and solid wastes generated as a result of WCS CISF operations. Radioactive isotopes anticipated in facility waste consist of very small quantities of mixed fission products and activation products associated with light water reactor operation. The term "waste" as used in this chapter refers to those materials generated during WCS CISF operation, and does not include SNF or GTCC wastes stored or otherwise handled at the WCS CISF.

6.1.1 Gaseous Wastes

Discrete or containerized gaseous wastes are not generated at the WCS CISF; however, airborne radioactive contamination can be generated in the Cask Handling Building. The potential sources include very small quantities of aerosols of surface contamination from the exterior of the transportation casks or from the exterior of the canisters.

Airborne radioactive contamination levels in the Cask Handling Building exhaust are expected to be less than the limits listed in Table 2 of 10 CFR 20 Appendix B. Continuous High-Efficiency Particulate Air (HEPA) filtration of facility exhaust is not required.

6.1.2 Liquid Wastes

6.1.2.1 Low-Level Liquid Radioactive Waste Water

There are no radioactive liquid wastes generated by the receipt, transfer and storage of canisterized SNF or GTCC waste at the WCS CISF.

6.1.2.2 Non-Radioactive Waste Water

Non-radioactive or conventional waste water may potentially be generated at the WCS CISF. The waste water may be generated by fire protection operations, building and equipment leakage, fuel tank leakage, equipment and floor washing, railcar wash-down, and general cleaning and equipment maintenance. This waste water may contain some or all of the following constituents.

- Suspended solids
- Dissolved solids
- Nutrients
- Acids and alkalis
- Heavy metals
- Fuel, oil, and grease.

Only very low levels of the above constituents are expected in WCS CISF conventional waste water.

6.1.3 Sanitary Wastes

Sanitary wastes generated at the WCS CISF include the effluents from drinking water fountains, water closets, lavatories, mop sinks and other similar fixtures.

6.1.4 Solid Wastes

Solid radioactive wastes are generated at the WCS CISF as a result of cask contamination surveillance and decontamination activities. These wastes generally consist of paper or cloth swipes, paper towels, protective clothing, and other job control wastes contaminated with low levels of radioactivity.

Solid radioactive wastes will be collected in containers and temporarily stored in the Cask Handling Building. Small volumes of solid radioactive wastes are anticipated. These low activity wastes will be disposed of at the adjacent WCS waste disposal facility in compliance with applicable federal and state regulations.

6.2 Off-Gas Treatment and Ventilation

There is no radioactive off-gas generated by the receipt, transfer and storage of SNF or GTCC waste canisters at the WCS CISF because the confinement boundaries for canisters are designed to perform their safety function (provide confinement) for all normal, off-normal and accident conditions as described in Chapters 7, 11 and 12 and associated appendices.

6.3 Liquid Waste Treatment and Retention

6.3.1 Cask Handling Building

There are no radioactive liquid wastes generated by the receipt and transfer of canisterized SNF or GTCC waste at the WCS CISF.

6.3.2 Conventional Waste Water Systems

Separate waste water collection systems are provided at the WCS CISF to collect all non-radioactive or conventional waste water generated by operations in the Cask Handling Building and Security and Administration Building operations. The systems utilize above ground waste water tanks designed to contain and store conventional waste water. All tanks are sized to meet conventional waste water system requirements and are installed during initial construction of the WCS CISF. The conventional waste water systems are designed to minimize the generation of hazardous and mixed wastes.

All design considerations for materials for conventional waste water drainage piping systems and components conform to the minimum requirements of the American Society of Mechanical Engineers/American National Standards Institute (ASME/ANSI) B31.1-2014 Code [6-1]. This code invokes the American Society for Testing and Materials (ASTM) and American Water Works Association (AWWA) standards. All underground waste water and sewer pressure and drainage piping subject to freezing and damage will be buried below the local area frost line, maintaining proper ditch conditions, proper backfill, trench compaction, and protection from above-ground structures and traffic loads. Drain piping is designed to minimize the number of traps, loops and flanges that may accumulate foreign material. Cathodic protection is provided as necessary.

6.3.2.1 Cask Handling Building Conventional Waste Water System

The Cask Handling Building conventional waste water system is designed to collect and process waste water generated in the building, and to retain the waste water in order to permit required sampling prior to release or transfer. The system is designated as conventional quality.

The Cask Handling Building conventional waste water system consists of a conventional waste water collection tank, waste water drain/transfer piping and valves, and required tank level instrumentation. The conventional waste water collection tank is an above ground tank constructed of high-density polyethylene (HDPE).

Cask Handling Building process waste water is directed to the collection tank by building collection points and drain piping. The contents of the conventional waste water tank may be sampled and analyzed prior to release to ensure compliance with a Publically Owned Treatment Works (POTW) Permit. Waste water in compliance with discharge limits is released to a POTW Permit. Waste water not meeting discharge permit limits is collected and temporarily stored on-site for processing and disposal at the adjacent WCS waste management facilities or transferred to an off-site vendor for treatment and disposal.

6.3.2.2 Other Conventional Waste Water System

Conventional waste water collection systems are also provided for the Security and Administration Building. These systems are similar in design and operation to the Cask Handling Building conventional waste water system. The procedure for sample, analysis and release of conventional waste water collected in the Security and Administration Building is identical to that discussed in Section 6.3.2.1.

6.3.3 Sanitary Waste Systems

Sanitary wastes are generated in the Cask Handling Building and the Security and Administration Building and collected in above ground collection tanks. The contents of sanitary waste tanks are sampled and analyzed prior to release to ensure compliance with a Publically Owned Treatment Works (POTW) permit.

6.4 Solid Wastes

Solid low-level radioactive wastes are generated at the WCS CISF as a result of contamination surveillance and transportation cask decontamination activities. These wastes are collected, packaged and temporarily stored at the WCS CISF as described below. The program for the collection, handling and disposal of low-level radioactive wastes is designed to minimize both the spread of radioactive contamination and the quantity of radioactive waste generated.

6.4.1 Collection and Packaging

Solid low-level radioactive waste is collected in containers and located in areas where waste is expected to be generated. When the containers are full they are sealed and surveyed for external radiation levels and transferrable contamination. The sealed containers are then placed in metallic containers and temporarily stored until they are transported for disposal at WCS's licensed and/or permitted disposal facilities. All low-level radioactive waste containers are labeled in accordance with 10 CFR 20.1904 requirements.

6.4.2 Storage/Disposal Facility

Low-level metallic containers are temporarily stored in an area specifically designated for that purpose. The temporary storage area is roped off or otherwise barricaded and clearly posted. Periodically, the low-level waste containers are transported to WCS's licensed or permitted disposal facilities. Transfers are made in accordance with 10 CFR 20.2006 requirements.

6.5 Radiological Impact of Normal Operations Summary

There are no gaseous orliquid effluents generated by the storage of canisterized SNF or GTCC waste at the WCS CISF. The only operation at the WCS CISF that may generate small volumes of solid waste is the decontamination of transportation casks, which will have no significant impact on the existing WCS licensed or permitted disposal facilities. As stated above, periodic transfers are made in accordance with 10 CFR 20.2006 requirements.

6.6 References

6-1 ASME/ANSI B31.1-2014, "Power Piping," American Society of Mechanical Engineers/American National Standards Institute.

CHAPTER 7
INSTALLATION DESIGN AND STRUCTURAL EVALUATION

Table of Contents

List of Tables

List of Figures

7. INSTALLATION DESIGN AND STRUCTURAL EVALUATION

This chapter presents the structural description, design, design criteria and design analysis for important-to-safety (ITS) structures to be employed at the Waste Control Specialists, LLC (WCS) Consolidated Interim Storage Facility (CISF) including:

1. The NUHOMS® system HSMs (Model 80, Model 102 and AHSM), the various models of DSCs, and the use of the MP197HB and MP187 transportation casks for on-site transfer of the DSCs.

2. The NAC system Vertical Concrete Casks (VCCs) and canisters (UMS, MPC and MAGNASTOR), Vertical Cask Transporter (VCT), and the Canister Transfer System (CTS) including transfer casks.

Structures described in this chapter include the confinement structures, systems and components (SSCs), CTS, VCT, storage pads for the vertical systems and structures classified as ITS.

7.1 Descriptions of Systems, Structures and Components

ITS WCS CISF SSCs are described in sufficient detail to evaluate their structural stability, functional suitability, and to provide an adequate basis for WCS CISF approval. Details of the individual NUHOMS® and NAC systems are included in Appendices A.7 through G.7.

Table 7-1 lists the base WCS CISF structures and their QA classifications. The locations of these structures are shown in Figure 1-3.

The Cask Handling Building, Security and Administration Building and access gates (Vehicle Sally Ports) are commercial grade construction classified as not-important-to-safety (NITS), are designed to industrial standards and are not discussed in this chapter.

7.2 Confinement SSCs

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

Only NRC-approved storage systems are used at the WCS CISF. The proposed cask systems to be utilized at the WCS CISF are evaluated against site parameters and generally shown to bound the site parameters (see Chapter 3 and referenced appendices). Where the actual site parameters exceed the bounds of those assumed in the individual cask certificates of compliance, the delta is addressed for those areas affected by the variations and are documented in the appropriate Chapter, and associated Appendices.

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

7.3 Pool and Pool Confinement Facilities

There are no pools at the WCS CISF.

7.4 Reinforced Concrete Structures – Important To Safety

The NUHOMS® Horizontal Storage Modules (HSMs), NAC VCCs and storage pads for the vertical systems comprise the only WCS CISF reinforced concrete structures that are important to radiological safety. The individual Appendices describing each of the proposed system components provide the structural descriptions and evaluations for each of the selected cask systems. Table 7-2 provides the cross reference to the applicable appendix and section for each canister/storage overpack where the structural evaluation is discussed.

7.5 Cask Handling Building

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

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

7.5.1 Canister Transfer System

7.5.1.1 Introduction

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

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

The canister being handled by the CTS is classified as a critical load, per NUREG-0554 and NUREG-0612 [7-3]. Safe handling of this critical load is accomplished by ensuring that failure of any single component, i.e. single failure proof, do not result in loss of the capability of the system to safely retain the load or by designing components with twice the required design factors of safety. The single failure proof CTS, which includes the lifting boom, trolley and lift beams, and seismic cross bracing, is designed in accordance with the American Society of Mechanical Engineers, ASME NOG-1 [7-4]. The United States Nuclear Regulatory Commission's position, as stated in Regulatory Issue Summary 2005-25 [7-5], is that the application of the criteria for Type 1 cranes from ASME NOG-1, "Rules for Construction of Overhead and Gantry Cranes," to the design of new overhead heavy load handling systems is an acceptable method for satisfying the guidelines of NUREG-0554. Components not within the scope of ASME NOG-1, such as the lift links, shackles, slings, transfer cask lift plates, chain hoist and canister lift adapter, are designed with twice the required factors of safety, resulting in a factor of safety of at least six on material yield strength and at least ten on material ultimate strength. All lifting components are proof load tested prior to use.

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The CTS major design data is tabulated in Table 7-3. Design parameters for the major components are presented in Table 7-4.

7.5.1.2 Code Applicability

NUREG-0554 Criteria:

- Single-failure-proof features are limited to hoisting and braking systems for trolley and bridge. Other load-bearing items such as the girders are conservatively designed but need not be considered single failure proof (Section 1, second paragraph).

NUREG-0800 Criteria:

- An overhead handling system that complies with ASME NOG-1 criteria for Type 1 cranes is an acceptable method for compliance with the NUREG-0554 guidelines (Section I. 4.C).

NUREG-0612 Criteria:

- Scope is control of heavy loads over SNF pool, fuel in core, or equipment that may be required to achieve safe shutdown (Section 1.1).
- Special lifting devices should satisfy ANSI N14.6 [7-9] (paragraph 5.1.1(4)).
- Twice the design safety factor is required for lifting devices (paragraph 5.1.6(1)(a)).
- New cranes shall be designed to meet NUREG-0554 (paragraph 5.1.6(2)).

ANSI N14.6 Criteria:

- Does not apply to cranes.
- Scope is special lifting device that transmits the load from structural parts of the container to the hook of an overhead hoisting system (paragraph 1.3).
- Load bearing members shall have a factor of safety of 3 to yield and 5 to ultimate (para.4.2.1.1).
- For critical loads, load bearing members shall have twice the normal stress design factor (paragraph 7.2.1).

ASME NOG-1 Criteria:

- NRC position as documented in RIS 2005-25 and NUREG-0800 [7-43] is that ASME NOG-1 is an acceptable method for satisfying the guidelines of NUREG-0554.
- Type I crane is used to handle a critical load. It is designed to support the critical load during a seismic event, but does not have to be operational after the event (Section 1150).
- Load combinations provided in Section 4140.
- Operating load allowable stress is 0.5 of yield and extreme environmental load allowable stress is 0.9 of yield (Table 4311-1).

- Gantry overturning shall have a safety factor of 1.5, unrestrained, for operational loading, and 1.1 under extreme environmental, with restraints (paragraph 4457).

7.5.1.3 Component Design Basis

Gantry Crane Telescoping Booms

ASME NOG-1 for operating loads and seismic: For seismic analytical model use Maximum Critical Load (MCL) of 100 Metric Tons (MT). Refer to NOG-1, paragraph 4140 for load combinations and Section 4300 for allowable stress criteria. Use LSI Model 24PT500WXTDPIC lift booms, with a combined lifting capacity of 454 MT (500 tons).

Lift Beams Connecting the Tops of the Telescoping Booms

ASME NOG-1 for operating loads and seismic: MCL = 100 MT. Load split equally between two lift beams. Controlling design case is with the trolley beam at the centerline of the bridge girder.

Trolley Beam between the Lift Beams

ASME NOG-1 for operating loads and seismic: MCL = 100 MT. Load applied at two points, 50 MT each, spread equal to the spread of the transfer cask trunnions. Lifting links on the trolley beam for slings between the trolley beam and the transfer cask trunnions, each set of two lifting links with a 6” pin between, designed for 100 MT (double the applied static load of the loaded transfer cask). Lifting links on the trolley beam centerline for attachment of the upper end of the chain hoist; set of two links designed for 100 MT (double the applied static load of the loaded canister). The loaded canister load on the center of the trolley beam is not applied coincident with the loaded transfer cask load. The transfer cask rests on top of the VCC during lowering of the loaded canister into the VCC. Thus, there are three sets of lifting links on the trolley beam, identical design.

Chain hoist between Trolley Beam and Canister Lift Adapter

ASME HST-5 and ASME B30.16, with safety factor of 5 on the rated load: Use commercial hardware with rated load at least twice the design basis load of the loaded canister (50 MT), in order to meet the criteria of ASME NUM-1. Ingersoll Rand Model HA3-100, 100 MT capacity.

Canister Lift Adapter

ANSI N14.6 with factors of safety of 6 and 10: Design load of 100 MT.

Slings between Trolley Beam and Transfer Cask Trunnions

ASME B30.9 with a safety factor of 5 on the rated load: Use commercial hardware with rated load at least twice the design load of the loaded transfer cask in order to meet the criteria of NUREG 0612. Each twin-path sling, doubled in a basket hitch, and two shackles designed for 50 MT each.

7.5.1.4 Operations Specification and Design Criteria

The CTS is a shielded handling system used to remove the canisterized contents from the transportation cask and placing them into the VCC. It is specifically used for NAC vertical storage systems.

The operational period, including system dry-runs and loading the projected eight phases of VCC is between twenty and forty years. There may be up to three hundred sixty loading cycles per phase. Even at this demand, a metal fatigue analysis is not required, due to the combined effect of the low number of full-load cycles and the very low allowable stresses of ASME NOG-1.

Lifting and lowering speeds for the CTS raising the transfer cask to the top of the VCC are limited to 30 cm/minute. Loaded CTS propel speed during transition to the empty VCCs is 60 to 90 cm/minute. Powered side shifters at the ends of the trolley beam, driven by a hydraulic motor, are used for slight adjustment (less than 5 cm) under load to center the transfer cask into the transfer cask adapter on top of the transportation cask and the VCC. The powered side shifter propel speed under load is controlled to a maximum of a 10 centimeters per minute. Table 7-5 summarizes the component speed limits.

The design criteria used for the CTS is specified in ASME NOG-1, Section 4000. 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.

Maximum Critical Load

The maximum critical load (MCL) is the weight of the transfer cask containing a MAGNASTOR loaded canister with the canister lift adapter bolted to the top of the canister. The resulting total weight is rounded up and specified as the maximum critical load (MCL), which is 100 metric tons. The MCL is also the Design Rated Load (DRL) for the CTS system. The canister air chain hoist, trolley beam lifting links, transfer cask seismic restraint ring and transfer cask lift rigging are included in the crane dead load. Dead load is the weight of all components prior to lifting the loaded transfer cask or loaded canister.

Additional design margins are inherently applied to mechanical and electrical components subject to wear, to allow for possible degradation due to wear. The mechanical and electrical components are designed for use on a 454 metric ton rated gantry crane versus the CTS 100 metric ton MCL.

The CTS MCL of 100 metric tons are prominently marked on the CTS lift beams in large letters and numbers. The chain hoist MCL of 50 metric tons is marked on the chain hoist load block.

No noncritical loads of a magnitude greater than the MCL are anticipated. Thus, the DRL of the crane is the same as the MCL. Only the MCL is displayed on the crane lift beams (bridge girders).

Operating Environment

The Crane is located inside the Cask Handling Building (CHB) adjacent to the WCS CISF Storage Area in a controlled environment. The design basis temperature is 0°C to 40°C with humidity of 0% to 100%.

Radiation doses from the loaded transfer cask, the loaded transportation cask or loaded VCCs are extremely low, and there are no identified hazardous chemical conditions. The CTS paint system, although protected by the CHB, is suitable for outdoor exposure in a marine environment. General CTS maintenance includes monthly cleaning and recoating of any paint damaged areas.

Material Properties

ASME NOG-1 addresses the concern for material brittle fracture more comprehensively than NUREG-0554. Thus, the CTS material testing follows the criteria specified in ASME NOG-1. The CTS is primarily constructed from ASTM A572 Grade 50 plate material. Material Properties can be found in Chapter 15

In accordance with the requirements of ASME NOG-1 and ASME Section III, carbon steel materials exceeding 5/8 inch (16 mm) are impact tested in accordance with ASTM A370. Weld filler materials for welds with an effective throat exceeding 5/8 inch (16 mm) are also impact tested.

ASME NOG-1 requires that the impact test temperature be at least 30°F below the minimum operating temperature. Acceptance values shall be per ASTM A370 Section 26.1 with the lowest service temperature of 32°F (0°C).

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Lamellar Tearing

The lift and trolley beams and the hydraulic booms are fabricated from plate steel, not rolled structural members. Primary loads are not applied in the through thickness of the material without adequate stiffening. Joints subject to lamellar tearing are avoided in the design, except for possible low loading conditions not susceptible to lamellar tearing.

All butt welds, as defined by ASME, are radiographed and all other primary welds are magnetic particle or dye penetrant examined in accordance with the requirements of ASME NOG-1, Section 4251.4.

Structural Fatigue

A fatigue analysis is not necessary if the loading cycles are less than twenty thousand full-load cycles. The load cycles for the CTS are less than two hundred for the construction period and operations loading of twenty-seven hundred VCCs.

Welding Procedures

All welds and welding procedures are performed and qualified in accordance with the ASME Boiler and Pressure Vessel Code Section IX [7-7] or AWS D1.1 [7-8], including preheat and post-weld heat treatment recommendations.

7.5.1.5 Safety Features

The CTS System fully meets the single-failure-proof criteria of NUREG-0612, providing a combination of fail-safe features and redundant design factors, as well as structures designed to the criteria of ASME NOG-1 for compliance with NUREG-0554 for single-failure-proof critical load handling. Additionally, a failure modes and effect analysis (FMEA) has been performed to further identify the design redundancy.

Auxiliary Systems

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Proprietary Information on Pages 7-15 through 7-16
Withheld Pursuant to 10 CFR 2.390

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7.5.1.6 Emergency Repairs

If the CTS is immobilized because of malfunction or failure of controls or components while holding the load, the crane can hold the load indefinitely while repairs or adjustments are made. The repairs may be made at any location or the gantry propel system can be put into a coast position and the CTS pulled to the loading zones at the ends of the operations area.

In lieu of a "manual operation" to lower the load to the ground, a back-up electric motor and hydraulic pump are provided in each of the two control modules. If there were a malfunction of the remote control CARL, manual control levers on the control module may be used to propel the crane and lower the load.

7.5.1.7 Hoisting Machinery

The CTS is designed in accordance with NUREG-0554 and ASME NOG-1 to lift the 100 metric ton loaded transfer cask and move it to the top of the VCC. All static and dynamic loadings during gantry crane travel and seismic loading with the transfer cask in the extended position have been evaluated. Wedge locks on the hydraulic booms and hydraulic locking valves on the hydraulic lift cylinders provide single-failure-proof redundancy. Lifting devices are designed for twice the lifted load, in accordance with NUREG 0612 and ANSI N14.6, as applicable.

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A 100 metric ton air operated chain hoist is used to lower the 50 metric ton canister into the VCC. In accordance with NUREG-0612, components with twice the required lifting capacity satisfy single failure proof requirements.

Reeving System

Drum Support

Head and Load Blocks

Hoisting Speed

CMAA Specification #70 [7-10] recommends that the hoist raising and lowering speed for a 100 ton crane be no more than 122 cm/minute. The lift and lower speed for the CTS booms are limited to 30 cm/minute, which is also much less than the 152 cm/minute allowed by NOG-1 Table 5331.1-1. The lowering speed of the canister air hoist is 46 cm/minute. These low lift and lower speeds of the CTS and canister air hoist provide an extra margin of safety for the operator.

Designing Against Two-Blocking and Load Hang-up

Lifting Devices

Standard and special lifting devices that are attached to the CTS are conservatively designed to factors of safety of at least ten on ultimate, and thus, satisfy the required single-failure-proof criteria. Standard lifting devices include the three sets of double lifting links on the CTS trolley beam used to support the transfer cask rigging and the canister chain hoist. The transfer cask rigging includes Twin-Path slings and shackles extending from the double lifting links to transfer cask lift plates which engage with the transfer cask trunnions.

Wire Rope Protection

Side loads may be generated with a wire rope reeving system if hoisting is done at angles departing from a normal vertical lift. The CTS does not utilize a wire rope reeving system for hoisting, thus wire rope protection against side loads due to hoisting angles departing from a normal vertical lift is not needed. The canister chain hoist can only operate vertically because it is positioned on the centerline of the transfer cask, between the two transfer cask lifting points. Thus, the CTS and canister chain hoist are not susceptible to a side load failure mechanism due to hoisting angles departing from a normal vertical lift.

Machinery Alignment

The proper functioning of the canister chain hoist and CTS during load handling is ensured by providing adequate support strength of the individual component parts and the welds or bolting that binds them together. Gear trains used to propel the CTS and the trolley beam powered side shifters each have redundancy or more than twice the required capacity.

Hoist Braking System

The CTS wedge locks automatically engage if there is any loss of hydraulic pressure for the lift cylinders. The wedge locks have the capacity for holding over four times the MCL. The canister chain hoist disc air brake has a 100 metric ton stopping capability, which is double the chain hoist MCL. Additional braking safety provided by the inherent drive train braking of the rotary piston motor, which limits lowering speed to approximately 1/2 the normal lowering speed of 0.46 m/minute. This is demonstrated during factory testing.

The chain hoist "drive train braking" is verified by releasing the holding brake while supporting the hoist MCL (50 metric tons), and recording the maximum lowering speed. The hoist is rated for more than twice the load to be lifted.

7.5.1.8 Bridge and Trolley

Braking Capacity

The CTS has enhanced safety features because the base lift housings and the trolley beam powered side shifters does not move unless power is applied to the drive motor. This ensures that the crane motion stops whenever power is shut off.

Safety Stops

7.5.1.9 Drivers and Controls

Driver Selection

The horsepower rating of the canister chain hoist driving motor is matched with the design load and acceleration to avoid overpowering. The hoist is equipped with limiting devices to shut off power when the chain hoist hook approaches the end of travel.

Driver Control Systems

The control systems include consideration for the hoisting of all loads. There are separate control systems for the canister hoist and the CTS. Interlocks prevent simultaneous raising or lowering of the transfer cask, movement of the crane, or movement of the trolley beam. Procedure controls ensure that the chain hoist is not operated during crane movements. The air hose line is not hooked up to the chain hoist until after the transfer cask is seated into the transfer cask adapter. Additionally, the transfer cask closed doors and the transfer cask top retaining ring limit inadvertent movement of the canister out of the transfer cask when unloading/loading with the CTS.

Malfunction Protection

Means are provided in the control circuits to sense and respond to abnormal conditions. The wedge lock brakes are automatically engaged with a loss of hydraulic pressure. Boom and chain hoist brakes are capable of holding the MCL. Limit switches are provided to prevent chain hoist over travel or two blocking.

Slow Speed Drives

Jogging is not used with the CTS. Raising/lowering and propel speeds are much lower than NUREG-0554 or ASME NOG-1 recommendations.

Safety Devices

Control Stations

7.5.1.10 Installation Instructions

Crane assembly and installation instructions are provided by LSI for the CTS and by Ingersoll Rand for the chain hoist. A LSI field technician supports and advises crane assembly and load testing.

Operation and Maintenance manuals include a full explanation of the crane handling system, its controls, and the limitations for the system, and includes the requirements for installation, testing, preparation for operation and maintenance.

7.5.1.11 Testing and Preventative Maintenance

Assembly, inspection and testing of the CTS are performed in accordance with ASME NOG-1, Section 7000, under the approved WCS CISF Quality Assurance (QA) program. All required documentation is verified prior to shipment.

Electrical inspection of the LSI fabricated hydraulic booms and controls are performed by LSI at the LSI shop prior to shipment. NAC is also witness operations and load testing of the hydraulic booms. LSI field technicians provide oversight during assembly and testing of the crane at the WCS CISF.

7.5.1.12 Static and Dynamic Load Tests

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Two-Block Tests

Operational Tests

Operational tests of the CTS components and the site assembly are performed to verify the proper functioning of limit switches and other safety devices and performance of the crane as designed (Table 7-9).

7.5.1.13 Maintenance

After installation, the crane may be subject to degradation due to use and exposure. Good maintenance practices, inspection prior to each cask loading, and additional design margins ensure that the crane operates safely and maintains its full MCL rating of 100 metric tons. The crane is in service for approximately 20 to 40 years, loading as many as 2000 VCCs. Typical maintenance steps to maintain the CTS while in service would be similar to those when the crane was initially placed into service. These steps are described in the gantry crane operations manual and include the following pre-start checks:

- Verify adequate fuel level.
- Verify proper engine oil level.
- Verify proper hydraulic oil level with lift cylinders fully retracted.
- Check oil for cloudy or milky appearance.
- Check twin line hoses for damage.
- Perform full lubrication.
- Ensure no leaks around the tops of the cylinders or component damage.

- Check hose reel hoses for damage.
- Check all hoses that are exposed to sunlight for cracks.
- Check cylinder bolts and lock washers.
- Check wheel box bolts for tightness.
- Check pressure gauges and operating pressure.
- Visually check all boom and base exterior welds for cracks.
- Check the hydraulic oil filter.
- Verify lift and propel handles are shifted to the desired position.
- Thoroughly clean all hydraulic connection points.
- Engage all safety devices.
- Check all system surfaces to be sure they are clean.
- Touch-up any paint damaged areas.
- Check track and top of lift beams for debris.
- Perform a “no-load” test for the full range of motion and speed. Perform a functional test using the transfer cask and empty canister.

Local firms with hydraulic gantry crane operating and maintenance experience are used to perform specialized periodic inspection and maintenance.

7.5.1.14 Operating Manual

Operating and maintenance manuals for the gantry crane and the canister chain hoist are provided at the conclusion of shop manufacturing and load testing. The manuals incorporate features of the equipment specific to WCS CISF. The manuals provide information and procedures for use in checking, testing and operating the CTS and the canister chain hoist.

7.5.1.15 Quality Assurance

The WCS CISF Quality Assurance Program is implemented to ensure that the requirements of NUREG-0554 with regards to design, fabrication, installation, testing and operation of crane systems for safe handling of critical loads are implemented. The CTS and associated components are procured under the WCS CISF QA program. Detailed quality assurance requirements for suppliers are identified in the supporting QA plan. There are two graded quality categories for the CTS, defined as Quality Categories B and C.

ASME NOG-1, Section 2000 requires that the manufacturer of Type I cranes (a crane that is used to handle a critical load) meet the basic and supplemental requirements of ASME NQA-1 [7-11]. The CTS is procured under the WCS CISF QA program, which fully complies with ASME NQA-1.

Testing Requirements for the CTS are summarized in Table 7-10. Assembly and load testing of the crane component parts are performed under the WCS CISF QA program.

7.5.2 Vertical Cask Transporter (VCT)

7.5.2.1 Description

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. Typical applications for the VCT are the handling of VCCs at operating or decommissioning nuclear power plants and are applicable for the WCS CISF.

Delivery of the loaded VCC is a designated 'haul path' that is evaluated for this activity. The haul path is from the Cask Handling Building to the Storage Area.

The VCT is a commercially developed, self-contained, on-site vehicle designed, fabricated and tested under the following code related references:

- ASME B30.1 [7-27] (Jacks, Industrial Rollers, Air Casters, and Hydraulic Gantries).
- ANSI N14.6 [7-9] (For Radioactive Materials - Special Lifting Devices for Shipping Containers Weighing 10 000 Pounds (4500 kg) or More).

Upon completion of fabrication, the VCT is statically load tested to 125% rated load and functionally tested with 100% of rated load to demonstrate proper operation. Personnel designated to operate the VCT receive training and the movement of the cask systems is well controlled.

7.5.2.2 VCT Operations

Personnel are trained to operate the VCT in accordance with approved procedures and all the controls used on the VCT are fail safe (‘dead man’) type controls.

7.5.2.3 VCT Inspections

VCT inspections are based on their associated Code requirements (ANSI N14.6 and ASME B30.1), as applicable, and good operating/engineering practices. Inspections are performed to ensure equipment is in good working order and that any postulated failures, which would result in equipment damage or personnel injury, do not occur.

VCT inspections are required IAW requirements specified in ASME B30.1. In summary, these inspections are based on type of inspection (Frequent or Periodic). Only Periodic inspections require formal documentation. Any rigging or other hardware is inspected per the appropriate ASME Chapter. Any deficiency identified that meets the Removal Criteria is corrected before allowing the VCT to return to service.

The VCT lift links, lifting pins and associated header beam are designed to the ANSI N14.6 design criteria for “Special lifting devices for Critical Loads”, from ANSI N14.6. As such, annual inspections of these components are performed in accordance with the requirements specified in ANSI N14.6 (e.g. testing to verify continuing compliance, Maintenance & Repair, etc.).

7.5.2.4 Summary

The VCT is a uniquely designed on-site vehicle used to lift and move transportation casks and VCC overpacks containing canisters of SNF or GTCC waste inside and outside of the Cask Handling Building.

The ‘haul path’ is analyzed, and where necessary, enhancements to the travel path are implemented to ensure that any sensitive underground utilities.

The VCT is not an overhead hoisting system as defined by any ASME Standard, rather it is a mobile hydraulic gantry crane and adheres to applicable ASME B30.1 requirements. The lift links, lifting pins and header beam are designed, load tested and inspected in accordance with the requirements as specified in ANSI N14.6.

7.6 Other Structures, Systems, and Components Subject to NRC Approval

This section describes the structural design, design criteria and design analysis for the storage pads for the NUHOMS® and NAC Systems.

7.6.1 Storage Pads

The WCS CISF storage pads are conventional cast-in-place reinforced concrete mat foundation structures. They provide a level and stable surface for placement and storage of VCCs and HSMs. The pads are designed for normal operating loads, severe environmental loads and extreme environmental loads as referenced by NUREG-1567 [7-28]. The storage pads for the NAC VCCs are designed as ITS structures as described below. The storage pads for the NUHOMS® system modules are classified as NITS as discussed in Section 3.4.3 of reference [7-29].

The purpose of this evaluation is to structurally qualify the WCS CISF Storage Pad designs for the vertical systems. The licensing-basis WCS CISF VCC configuration is a 3x8 array of MAGNASTOR casks, which envelopes the other NAC International casks to be stored at the WCS CISF. The qualification is conducted in accordance with the NUREG-0800 [7-43], NUREG-1536 [7-42] and NUREG-1567 [7-28]. A geotechnical liquefaction and elastic settlement analysis is performed as part of Calculation NAC004-CALC-02 [7-48].

7.6.1.1 Design Inputs

Proprietary Information on Pages 7-32 through 7-35
Withheld Pursuant to 10 CFR 2.390

7.6.1.2 Design Basis

The design of WCS CISF is based on NUREG-1567 [7-28] with reference to NUREG-1536 [7-42] and NUREG-0800 [7-43]. Guidance from NUREG-1567 is utilized for this design. Codes of record and regulatory guides referenced in NUREG-1567 are utilized throughout the design. The code and regulatory guide years/revisions are based on the reference year for IBC 2009 [7-45] (building code for Texas) and the newest revision of the regulatory guides. The codes of record and regulatory guides used for the design, where applicable, are as follows:

- ACI 318-08 [7-39]
- ACI 349-06 (latest revision endorsed by the NRC) [7-31]
- ASCE 7-05 [7-34]
- ASCE 43-05 [7-44]
- Regulatory Guide 1.61, Rev. 1 [7-38]

- Regulatory Guide 1.76, Rev. 1 [7-35]

7.6.1.3 Design Load Considerations

Thermal Load

Thermal loading of the storage pad is not considered in detail given that the heat transferred to the storage pad is very small and is only in relatively small localized areas. Furthermore, the local cask concrete elevated temperature, which occurs only near the cask top, is less than the ACI 349-06 (Ref. [7-31], Section E.4) accident temperature limits of 350 °F for the concrete surface.

Cask Drop Load

The cask drop accident has been considered with respect to the structural integrity of the cask as part of the MAGNASTOR FSAR [7-40]. The cask drop impact to the storage pad is not considered here because such an accident would result in localized damage to the storage pad, but not result in a loss of stability of the storage pad. In the case of such an accident, the storage pad would need to be evaluated and repaired as needed.

Tornado-Missile Impact Load

Tornado-missile impact load has been considered with respect to the structural integrity of the cask as part of the MAGNASTOR FSAR [7-40]. Tornado-missile impact to the directly to the storage pad or to a cask on the storage pad is not considered here because such an extreme condition would result in localized damage to the storage pad, but not result in a loss of stability of the storage pad. In the case of such an accident, the storage pad would need to be evaluated and repaired as needed. This is consistent with NUREG-1536 (Ref. [7-42], Table 3-3), which states for the tornado load case "[t]he load combination (capacity/demand >1.00 for all sections) shall be satisfied without missile loadings. Missile loadings are additive (concurrent) to the loads caused by wind pressure and other loads; however, local damage may be permitted at the point of impact if there is no loss of intended function of any structure important to safety."

Seismic Inertia Loading

The seismic load case includes various cask layouts, but not does not consider short-term configurations (e.g., VCT in operation). All three directions of seismic excitation are conservatively considered simultaneously.

7.6.1.4 Load Combinations

Per NUREG-1567 (Ref. [7-28], Section 5.4.3.4), load combinations for reinforced concrete structures including Independent Spent Fuel Storage Installations (ISFSIs) are per NUREG-1536 (Ref. [7-42], Table 3-3) and ACI 349 [7-31]. Load combinations from the two sources are presented only with applicable load cases. Note that ACI 318-08 [7-39] are enveloped by ACI 349 [7-31] load combinations. Thermal, piping, pipe break, soil, snow and flooding load cases are not included for clarity. Vertical cask transporter loads are considered as live loads as opposed to crane loads.

ACI 349-06 Load Combinations

$U = 1.4D$ (Ref. [7-31], Eq. 9-1)

$U = 1.2D + 1.6L$ (Ref. [7-31], Eq. 9-2)

$U = 1.2D + 0.8L$ (Ref. [7-31], Eq. 9-3)

$U = 1.2D + 1.6(L + E_O)$ (Ref. [7-31], Eq. 9-4)

$U = 1.2D + 1.6(L + W)$ (Ref. [7-31], Eq. 9-5)

$U = D + 0.8L + E_{SS}$ (Ref. [7-31], Eq. 9-6)

$U = D + 0.8L + W_t$ (Ref. [7-31], Eq. 9-7)

$U = D + 0.8L$ (Ref. [7-31], Eq. 9-8)

$U = D + 0.8L + E_{SS}$ (Ref. [7-31], Eq. 9-9)

*Note: All dead loads shall be considered at 0.9 where dead load reduces the effects of other loads. Similarly, live load shall be considered zero where live load reduces the effects of other loads.

NUREG-1536 Load Combinations

$U = 1.4D + 1.7L$ (Ref. [7-42], Table 3-3)

$U = 1.05D + 1.275L$ (Ref. [7-42], Table 3-3)

$U = 1.05D + 1.275(L + W)$ $U = D + L + E_{SS}$ (Ref. [7-42], Table 3-3)

$U = D + L + W_t$ (Ref. [7-42], Table 3-3)

*Note: All dead loads shall be varied by 5% where dead load reduces the effects of other loads.

NUREG-1536 Stability Load Combinations (Overturning and Sliding)

$O/S \geq 1.5D$ (Ref. [7-42], Table 3-3)

$O/S \geq 1.1(D + E_{SS})$ (Ref. [7-42], Table 3-3)

$O/S \geq 1.1(D + W_t)$ (Ref. [7-42], Table 3-3)

Governing Load Combinations

Governing load combinations are compiled based on code load combinations, considerations for reduced dead and live load effects, and directions of seismic excitation. Furthermore, SSE seismic load is shown to envelope the tornado wind load (Section 7.6.1.6); therefore, tornado wind load combinations are not included. Because the operational wind load is applied to the transporter, but the seismic load is not considered for the transporter, the operational wind load case is included.

Strength

$U \geq 1.4D + 1.7L$

$U \geq 1.2D + 1.6(L \pm E_O)$

$U \geq 0.9D + 0.9\ L^{**} + 1.6(\pm E_O)$

$U \geq 1.2D + 1.6(L \pm W)$

$U \geq 0.9D + 0.9\ L^{**} + 1.6(\pm W)$

$U \geq D + L \pm E_{SS}$

$U \geq 0.9D \pm E_{SS}$

$U \geq 1.4D + 1.7L^*$

Notes:

L* includes the weight of the loaded vertical cask transporter L** includes the weight of the casks, but not occupancy live load.

Stability

$S/1.5 \geq D + L^{**}$

$S/1.1 \geq D + L^{**} \pm E_{SS}$

Notes:

L** includes the weight of the casks, but not occupancy live load

7.6.1.5 Cask Layout Configurations

During the life of the storage pad, several different configurations and numbers of casks are possible. The analysis has been performed on four representative enveloping configurations. The configurations are based on initially loading one of the short sides of the storage pad and then adding casks systematically across the pad. There are also several permutations of VCT locations (one VCT on pad considered per VCT load combination). The considered cask and VCT configurations are presented in Figure 7-9. The VCT locations are shown as the transporter tread locations. Note that for the VCT load combinations, the cask is considered to be supported by the VCT.

GTSTRUDL Modeling

The static GTSTRUDL model utilizes a six-degree-of-freedom plate bending and stretching element (SBHQ6) to represent the concrete pad. The slab stiffness is reduced to account for cracking (Concrete Pad Stiffness Properties). The concrete pad is supported on nonlinear (compression only) soil springs (Nonlinear Soil Springs). Rigid members are used to locate the cask center of gravity in the model. Element body forces are used to represent the self-weight of the concrete. Element surface loads are used to represent live loads on the pad. Joint forces are used for the cask and VCT loads. GTSTRUDL input files can be provided for each of the analyzed configurations.

Concrete Pad Stiffness Properties

From ACI 349-06 (Ref. [7-31], Section 8.6.1) and ACI 318-08 (Ref. [7-39], Section 8.7.1), "[u]se of any set of reasonable assumptions shall be permitted for computing relative flexural and torsional stiffness…" To approximate the effective stiffness of the storage pad, effective stiffness for reinforced concrete members provided in ASCE 43-05 (Ref. [7-44], Table 3-1) are used conservatively considering "[w]alls and diaphragms – cracked" because slabs- on-grade are not addressed. The effective stiffness' are as follows:

Effective flexural rigidity: $0.5E_cI_g$ (Ref. [7-44], Table 3-1)

Effective shear rigidity: $0.5G_cA_w$ (Ref. [7-44], Table 3-1)

Shear modulus, $G_e = 0.4E_C = 0.4 \cdot 3{,}605$ ksi = 1,442 ksi (Ref. [7-44], Table 3-1)

To represent the effective flexural rigidity and shear rigidity, 50 percent of the elastic modulus and shear modulus are used in the GTSTRUDL model and the actual 36-in thickness is used.

Effective elastic modulus, $E_{e,eff} = 1{,}803$ ksi

Effective shear modulus, $G_{e,eff} = 721$ ksi

Nonlinear Soil Springs

Nonlinear (compression only) springs are included at each storage pad node using the GTSTRUDL function "CALCULATE SOIL SPRING VALUES COMPRESSION ONLY DIR Y…." The GTSTRUDL command uses the user-input soil stiffness of 150 psi/in (Ref. [7-32], Section 4.3.2) combined with the tributary area from each node's connecting element(s) to compute a spring stiffness in force per unit length.

7.6.1.6 Analysis

Proprietary Information on Pages 7-42 through 7-55
Withheld Pursuant to 10 CFR 2.390

7.6.1.10 Results and Conclusions

Based on the evaluations performed, it is concluded that the licensing design of the NAC storage pad for Andrews, TX meets all of the applicable structural requirements of NUREG-1567 [7-28] with reference to NUREG-1536 [7-42] and NUREG-0800 [7-43]. Therefore, the NAC storage pad for Andrews, TX is qualified and acceptable. The WCS CISF licensing design includes consideration of four cask configurations on the pad based on systematically loading the pad with casks from one short side moving across to the other. Seismic, operational wind, and tornado wind were all considered to act on the casks. In the case of an SSE event, the VCCs do not overturn; however, the casks could slide up to 1.28 in (considering a safety factor of two). Furthermore, the concrete pad could slide up to 1.02 in (considering a safety factor of two).

Impact from cask drop or tornado-generated missiles was not considered with respect to the storage pad. The casks are already qualified for impact conditions and impact to the storage pad is an accident condition where damage is acceptable as long as there is no loss of function. The VCT was considered at several locations while fully supporting a cask. Operational wind load was applied to the VCT; however, seismic and tornado wind were not considered given that cask movements are infrequent evolutions.

7.6.2 Settlement and Soil Liquefaction

The purpose of this evaluation is to determine the liquefaction potential and elastic settlement of the storage pad located at the WCS CISF in Andrews, Texas.

The scope of work included:

- Review of Drawing NAC004-C-001, Rev. 0 showing the dimensions and general arrangement of the storage pad [7-30], and review of Drawing NAC004-C-002, Rev. 0 showing the structural concrete plan, sections, and details [7-37].
- Review of “Report of Geotechnical Exploration” performed by GEOServices, LLC [7-32].
- Liquefaction potential evaluation using the data from reference [7-32].
- Elastic settlement evaluation under static loading conditions using the data from reference [7-32].

7.6.2.1 Design Basis

Proprietary Information on Pages 7-57 through 7-64
Withheld Pursuant to 10 CFR 2.390

7.6.2.6 Results and Conclusions

Based on the evaluation presented, it is concluded that overall the soils below the storage pad are not susceptible to liquefaction.

Based on analysis, the estimated settlement at the center of the storage pad (assuming the pad to be flexible for settlement purposes) for a uniform bearing pressure of 3,000 psf is on the order of 0.15 to 0.3 inch, with a differential settlement (between the corner and center of the concrete pad) on the order of ¼ inch or less.

7.6.3 Soil Structure Interaction

This section documents the Soil Structure Interaction (SSI) analysis to support a concrete pad design for the storage pads located at the WCS CISF in Andrews Country, Texas. The analysis is conducted in accordance with NUREG-0800 [7-43].

The SSI analysis considers the concrete pad design with the MAGNASTOR VCC, which envelopes the NAC-UMS and NAC-MPC VCCs to be stored at the WCS CISF, for 4 cask load configurations, 3 soil cases, and 3 time histories, totaling 36 analysis cases to obtain enveloping maximum accelerations at the VCC center of gravities, the concrete pad center of gravity, and an evaluation for sliding and overturning of the VCCs. The SSI analysis supports structural design of the storage pad system.

7.6.3.1 Design Basis

Proprietary Information on Pages 7-66 through 7-67
Withheld Pursuant to 10 CFR 2.390

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7.6.3.4 Results and Conclusions

Following SSI analysis of 36 analysis cases it was found that the enveloping maximum accelerations at the MAGNASTOR Cask center of gravity are as follows:

- 0.45g in the X/E-W Direction for Case 29, Coyote Lake earthquake on BE soil at cask CG B1 for cask configuration 4
- 0.40g in the Y/N-S Direction for Case 30, Coyote Lake earthquake on UB at cask CG A2 for cask configuration 4
- 0.28g in the Z/Vertical Direction for Case 22, Norcia earthquake on LB soil at cask CG B3 for cask configuration 3

The MAGNASTOR cask envelopes all other vertical VCC types to be stored at the WCS CISF. Through examining the instantaneous coefficient of friction demand, it is deemed that cask sliding is likely to occur for at least 1 cask due to a maximum coefficient of friction demand of 0.46, which is greater than the coefficient of friction of 0.35 for cask steel-to-concrete contact for a light broom finish on the concrete pad.

Through examining the instantaneous factor of safety against overturning following evaluation of the cask CG accelerations obtained from deterministic SSI analysis, it is deemed that overturning does not occur for any casks with a minimum observed overturning factor of safety of 1.23 which is greater than the required factor of safety against overturning of 1.1.

7.6.4 NITS Storage Pads

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Proprietary Information on This Page
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Table 7-1
WCS CISF Structures and QA Classification

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

Table 7-2
Structural Evaluations for the Storage Systems at the WCS CISF

Cask System	Canister	Overpack	Appendix
NUHOMS®-MP187 Cask System	FO-DSC	HSM (Model 80)	Appendix A.7
	FC-DSC		
	FF-DSC		
Standardized Advanced NUHOMS® System	NUHOMS® 24PT1	AHSM	Appendix B.7
Standardized NUHOMS® System	NUHOMS® 61BT	HSM Model 102	Appendix C.7
	NUHOMS® 61BTH Type 1		Appendix D.7
NAC-MPC	Yankee Class	VCC	Appendix E.7
	Connecticut Yankee	VCC	
	LACBWR	VCC	
NAC-UMS	Classes 1 thru 5	VCC	Appendix F.7
MAGNASTOR	TSC1 thru TSC4	CC1 thru CC4	Appendix G.7

Proprietary Information on Pages 7-77 through 7-78
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Table 7-5
Component Speed

Component	Max Speed	Function Description
Crane propel	90 cm/minute	Travel from loading zone to VCC
Crane lift	30 cm/minute	Lift transfer cask to top of VCC
Side shifter propel	10 cm/minute	Align transfer cask to adapter on VCC
Chain hoist lift	46 cm/minute	Lower canister into VCC

Table 7-6
Stress Ratios for Gantry Crane Members

Component	Maximum Stress Ratios (Usage Factors)‡
Lifting Booms	0.45
Lift Beams	0.65
Trolley Beam	0.80
Horizontal Struts	0.82

‡ Usage factor ratio is calculated stress divided by ASME NOG-1 allowable stress

Table 7-7
Factors of Safety for Main Components for Transfer Cask Lift

Component	Maximum Factor of Safety[ǂ]
Lift Links	4.54
Lift Link Pins	4.17
Slings	3.57
Shackles	3.14
TFR Lift Plates	5.56

ǂ Factor of Safety is the ASME NOG-1 allowable stress divided by calculated stress

Table 7-8
Load Testing

Component	Min. Test Load	Reference
Gantry Lift Boom, each	124.7 MT	110% rated load, ASME B30.1, 1-6.4.2
Assembled Gantry Crane	100 MT	ASME NOG-1, para. 7422
Assembled Gantry Crane	125 MT	ASME NOG-1, para. 7423(a)(b)
Boom Wedge Locks	125 MT	ASME NOG-1, para. 7423 (b)(4)
Chain Hoist	125 MT	ASME B30.16, para. 16-2.2.2(b)
Chain Hoist Hook	181.4 MT	ASME B30.10, table 10-1.7-1
Lifting Links, each	100 MT	ASME B30.26, para 26-4.4.2
Transfer Cask Slings	113.4 MT	ASME B30.9, para. 9-6.6.2(a)
Transfer Cask Shackle, each	100 MT	ASME B30.26, para 26-1.4.2(a)
Transfer Cask Lift Plate	152 MT	ANSI N14.6, para 7.3.1(a), spc. lift device
Canister Lift Adapter	150 MT	ANSI N14.6, para 7.3.1(a), spc. lift device

Table 7-9
Safety Device Testing

Feature/Component	Testing*
Boom wedge locks	Hold load at 125% MCL
Wedge lock engagement	Engage with reduced oil pressure
Control stop button	All functions stop upon actuation
Gantry crane propel braking	Motion stops with lever in neutral
Lifting braking	Motion stops with lever in neutral
Chain hoist two-block limit switch	Motion stops
Side shifter propel	Motion stops with lever in neutral

* See operations and O&M manuals for component testing frequency

Table 7-10
Testing Requirements

Critical Component	Charpy	MTR	MT or PT
Trolley Beam	X	X	X
Lift Beams	X	X	X
Struts	X	X	X
Cross Bracing	X	X	No welds
Boom Sections	X	X	X
Base Enclosure	X	X	X
Lifting Links	X	X	No welds
Chain Hoist Hook	Not required	X	X

Table 7-11
Enveloping Element Forces (kip/in) and Moments (kip-in/in) for Cask Configuration 1

**** MAXIMUM AND MINIMUM SUMMARY OF ABOVE ENVELOPE RESULTS ****

RESULT	MAXIMUM	LOAD	JOINT	MINIMUM	LOAD	JOINT
NXX	0.886027E+02	133	5668	-0.882248E+02	127	5668
NYY	0.160126E+03	131	1389	-0.160117E+03	129	1389
NXY	0.645948E+02	131	126	-0.645948E+02	127	1146
MXX	0.581259E+02	131	403	-0.997999E+02	132	869
MYY	0.515278E+02	132	323	-0.912022E+02	108	869
MXY	0.158822E+02	133	6612	-0.158822E+02	132	6981
VXX	0.482835E+01	128	3445	-0.482834E+01	132	7495
VYY	0.485770E+01	128	2997	-0.485770E+01	129	3402

Table 7-12
Enveloping Element Forces (kip/in) and Moments (kip-in/in) for Cask Configuration 2

**** MAXIMUM AND MINIMUM SUMMARY OF ABOVE ENVELOPE RESULTS ****

RESULT	MAXIMUM	LOAD	JOINT	MINIMUM	LOAD	JOINT
NXX	0.519769E+02	132	5225	-0.516184E+02	126	5225
NYY	0.804491E+02	130	1398	-0.804603E+02	128	1398
NXY	0.336569E+02	126	1146	-0.336569E+02	130	126
MXX	0.524997E+02	134	819	-0.813840E+02	108	869
MYY	0.511820E+02	104	931	-0.966439E+02	105	617
MXY	0.216265E+02	105	2635	-0.216265E+02	109	8485
VXX	0.403804E+01	104	3445	-0.403803E+01	108	7495
VYY	0.398227E+01	104	2997	-0.365465E+01	109	5337

Table 7-13
Enveloping Element Forces (kip/in) and Moments (kip-in/in) for Cask Configuration 3

**** MAXIMUM AND MINIMUM SUMMARY OF ABOVE ENVELOPE RESULTS ****

RESULT	MAXIMUM	LOAD	JOINT	MINIMUM	LOAD	JOINT
NXX	0.697765E+02	132	5225	-0.693990E+02	126	5225
NYY	0.114004E+03	130	1398	-0.113953E+03	127	1398
NXY	0.471218E+02	128	126	-0.471218E+02	132	1146
MXX	0.534518E+02	134	819	-0.917819E+02	132	869
MYY	0.639595E+02	131	991	-0.854730E+02	108	869
MXY	0.234838E+02	104	2743	-0.234838E+02	108	8593
VXX	0.443911E+01	104	3445	-0.443911E+01	108	7495
VYY	0.444899E+01	104	2997	-0.384120E+01	129	8586

Table 7-14
Enveloping Element Forces (kip/in) and Moments (kip-in/in) for Cask Configuration 4

**** MAXIMUM AND MINIMUM SUMMARY OF ABOVE ENVELOPE RESULTS ****

RESULT	MAXIMUM	LOAD	JOINT	MINIMUM	LOAD	JOINT
NXX	0.826192E+02	132	5225	-0.822430E+02	126	5225
NYY	0.139142E+03	130	1398	-0.139099E+03	127	1398
NXY	0.561974E+02	126	1146	-0.561974E+02	130	126
MXX	0.556960E+02	130	359	-0.973071E+02	132	869
MYY	0.622557E+02	131	1003	-0.894480E+02	108	869
MXY	0.244392E+02	105	2851	-0.244392E+02	109	8701
VXX	0.470246E+01	104	3445	-0.470245E+01	108	7495
VYY	0.471676E+01	128	2997	-0.423826E+01	105	3294

Table 7-15
Load Combination 108 Resultant Force For Width Cut, Cask Configuration 2 (kip & kip-in)

```
======================================================================
  LOADING - 108
======================================================================

    LOCATION OF CENTROID (REFER TO NOTE ABOVE) =    0.9900000E+02


         IN-PLANE NORMAL FORCE,        P =    0.1542928E+02

         IN-PLANE SHEAR FORCE
            (PARALLEL TO CUT),         V =    0.6118734E+03

         OUT-OF-PLANE (TRANSVERSE)
            SHEAR FORCE,              FZ =    0.1948777E+03

         BENDING MOMENT (MOMENT
            VECTOR PARALLEL TO CUT), MB =    0.4643966E+04

         TWISTING MOMENT (MOMENT
            VECTOR NORMAL TO CUT),    MT =    0.8634955E+03

         IN-PLANE ROTATIONAL
            DEFORMATION MOMENT,       MZ =   -0.2557984E+05
```

Table 7-16
Load Combination 105 Resultant Force For Length Cut, Cask Configuration 3 (kip & kip-in)

```
=================================================================
 LOADING - 105
=================================================================


   LOCATION OF CENTROID (REFER TO NOTE ABOVE) =    0.9529411E+02


        IN-PLANE NORMAL FORCE,       P =   -0.6539403E+02

        IN-PLANE SHEAR FORCE
           (PARALLEL TO CUT),        V =    0.3542167E+03

        OUT-OF-PLANE (TRANSVERSE)
           SHEAR FORCE,             FZ =    0.2026964E+03

        BENDING MOMENT (MOMENT
           VECTOR PARALLEL TO CUT), MB =    0.3908143E+04

        TWISTING MOMENT (MOMENT
           VECTOR NORMAL TO CUT),   MT =    0.1125222E+04

        IN-PLANE ROTATIONAL
           DEFORMATION MOMENT,      MZ =    0.9938373E+03
```

Table 7-17
Load Combination 301 Enveloping Reactions Cask Configuration 1 (kip & kip-in)

```
**** Summary of Global Reaction Envelopes ****

================================================
  Type          Value        Load     Joint
================================================

Force X  Min  -0.645959E-08  301      611
         Max   0.654836E-08  301      661
Force Y  Min   0.000000E+00  301      126
         Max   0.000000E+00  301      126
Force Z  Min  -0.159837E-07  301      126
         Max   0.159541E-07  301      1146
Moment X Min   0.000000E+00  301      126
         Max   0.000000E+00  301      126
Moment Y Min   0.000000E+00  301      126
         Max   0.000000E+00  301      126
Moment Z Min   0.000000E+00  301      126
         Max   0.000000E+00  301      126
================================================
```

Table 7-18
Load Combination 302 To 309 Enveloping Reactions Cask Configuration 1
(kip & kip-in)

```
**** Summary of Global Reaction Envelopes ****

=================================================
  Type          Value         Load     Joint
=================================================

Force X  Min  -0.252924E+04  303      611
         Max   0.252924E+04  307      611
Force Y  Min   0.000000E+00  302      126
         Max   0.000000E+00  302      126
Force Z  Min  -0.252999E+04  306      126
         Max   0.252999E+04  307      126
Moment X Min   0.000000E+00  302      126
         Max   0.000000E+00  302      126
Moment Y Min   0.000000E+00  302      126
         Max   0.000000E+00  302      126
Moment Z Min   0.000000E+00  302      126
         Max   0.000000E+00  302      126
=================================================
```

Table 7-19
Load Combination 301 Maximum Displacements Cask Configuration 3 (in)

```
****SUMMARY OF MAXIMUM GLOBAL DISPLACEMENTS****
        INDEPENDENT IN EACH COORDINATE


=============================================
* RESULT *    MAXIMUM     LOAD     JOINT    *
*========*==================================*
* X-DISP * -0.121221E-02  301      213      *
* Y-DISP * -0.938189E-01  301      621      *
* Z-DISP * -0.160898E-02  301      613      *
=============================================
```

Table 7-20
Load Combination 302 to 309 Maximum Displacements Cask Configuration 2 (in)

```
****SUMMARY OF MAXIMUM GLOBAL DISPLACEMENTS****
        INDEPENDENT IN EACH COORDINATE


=============================================
* RESULT *    MAXIMUM     LOAD     JOINT    *
*========*==================================*
* X-DISP * -0.121571E+00  306      127      *
* Y-DISP * -0.125408E+00  308      563      *
* Z-DISP * -0.100084E+00  308      101      *
=============================================
```

Proprietary Information on Pages 7-95 through 7-96
Withheld Pursuant to 10 CFR 2.390

Table 7-23
SSI Analysis Cases

Case Number	Time History	Soil Case	Cask Configuration
1	Coyote Lake	LB	1
2	Coyote Lake	BE	1
3	Coyote Lake	UB	1
4	Norcia	LB	1
5	Norcia	BE	1
6	Norcia	UB	1
7	N. Palm Springs	LB	1
8	N. Palm Springs	BE	1
9	N. Palm Springs	UB	1
10	Coyote Lake	LB	2
11	Coyote Lake	BE	2
12	Coyote Lake	UB	2
13	Norcia	LB	2
14	Norcia	BE	2
15	Norcia	UB	2
16	N. Palm Springs	LB	2
17	N. Palm Springs	BE	2
18	N. Palm Springs	UB	2
19	Coyote Lake	LB	3
20	Coyote Lake	BE	3
21	Coyote Lake	UB	3
22	Norcia	LB	3
23	Norcia	BE	3
24	Norcia	UB	3
25	N. Palm Springs	LB	3
26	N. Palm Springs	BE	3
27	N. Palm Springs	UB	3
28	Coyote Lake	LB	4
29	Coyote Lake	BE	4
30	Coyote Lake	UB	4
31	Norcia	LB	4
32	Norcia	BE	4
33	Norcia	UB	4
34	N. Palm Springs	LB	4
35	N. Palm Springs	BE	4
36	N. Palm Springs	UB	4

Proprietary Information on Pages 7-98 through 7-105
Withheld Pursuant to 10 CFR 2.390

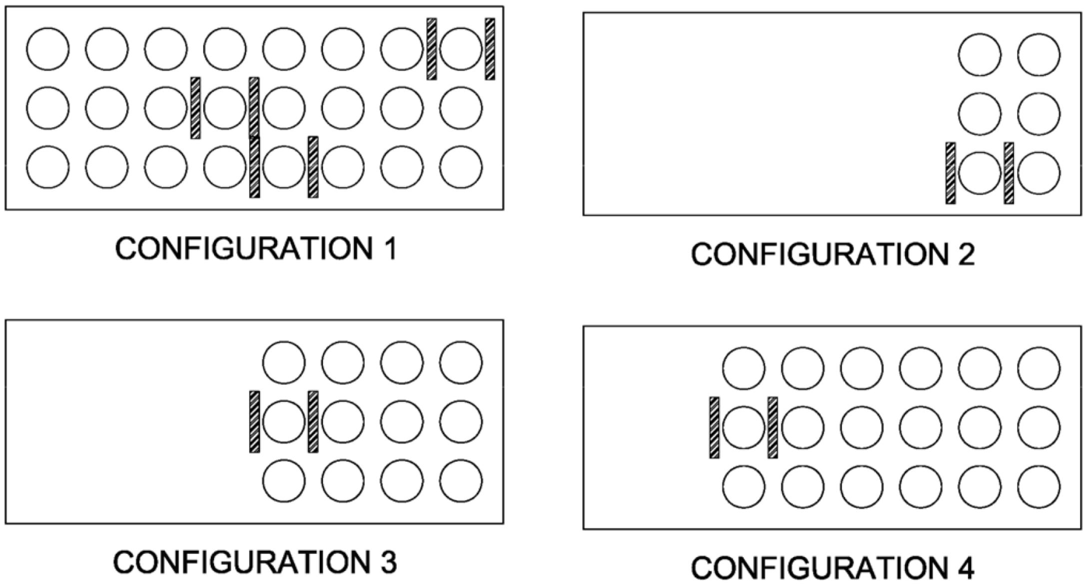

Figure 7-9
Cask Layout Design Configurations and VCT Locations

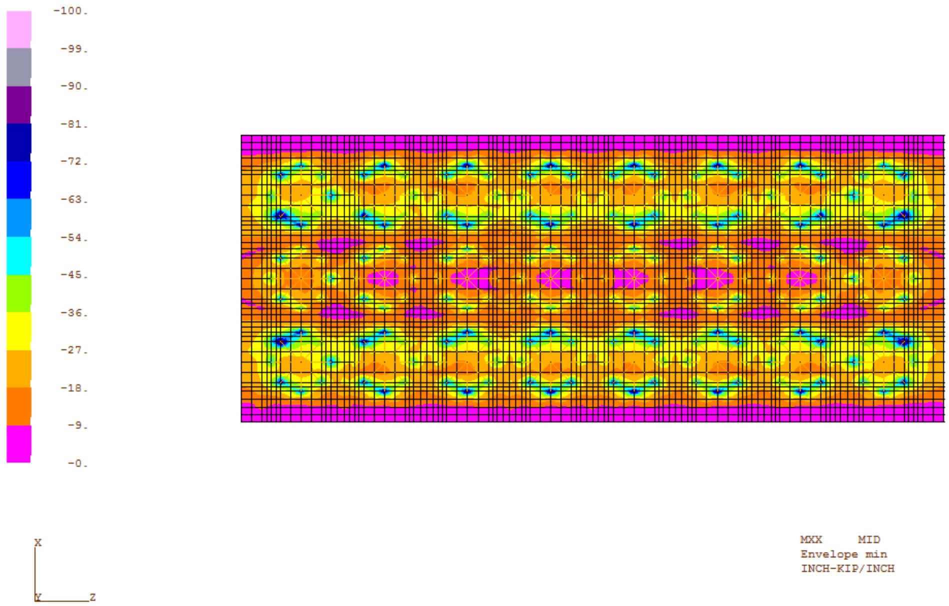

Figure 7-10
Enveloping Negative Moment Resultants (kip-in/in) About Global Z-Axis (local M_{XX}) - Configuration 1

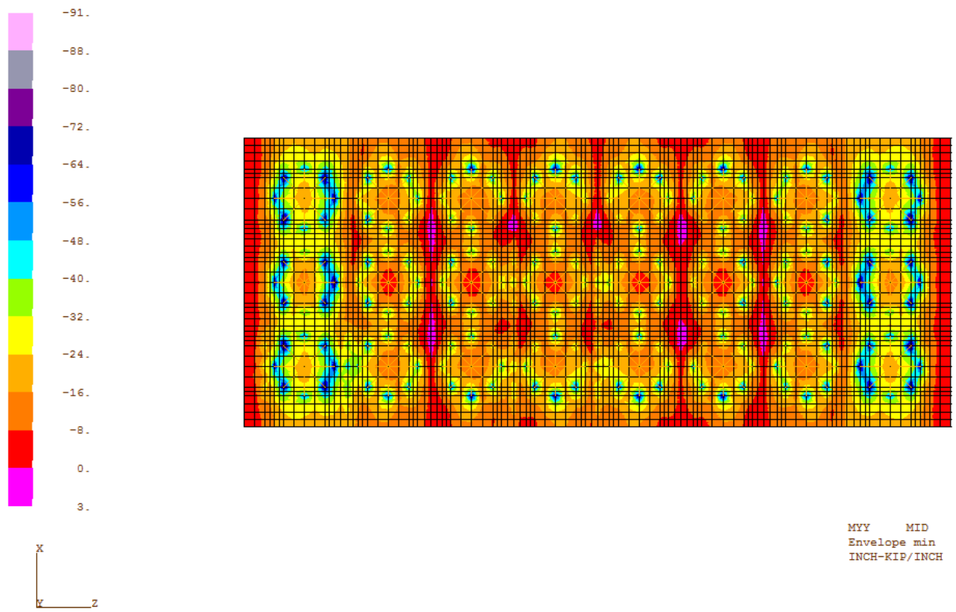

Figure 7-11
Enveloping Negative Moment Resultants (kip-in/in) About Global X-Axis (local M_{YY}) - Configuration 1

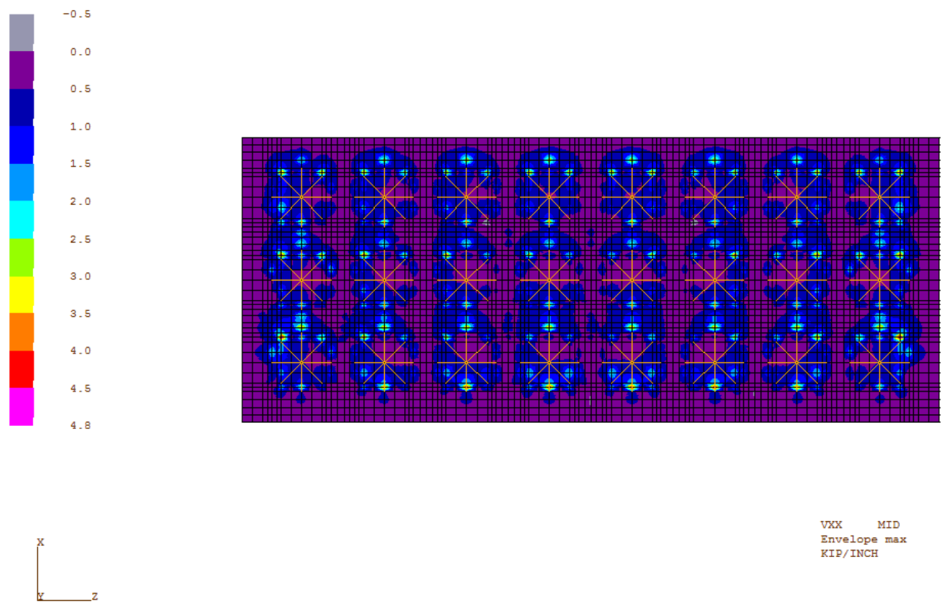

Figure 7-12
Enveloping Element Shear (kip/in) In The Global Y-Direction On The X-Face (local V_{XX}) - Configuration 1

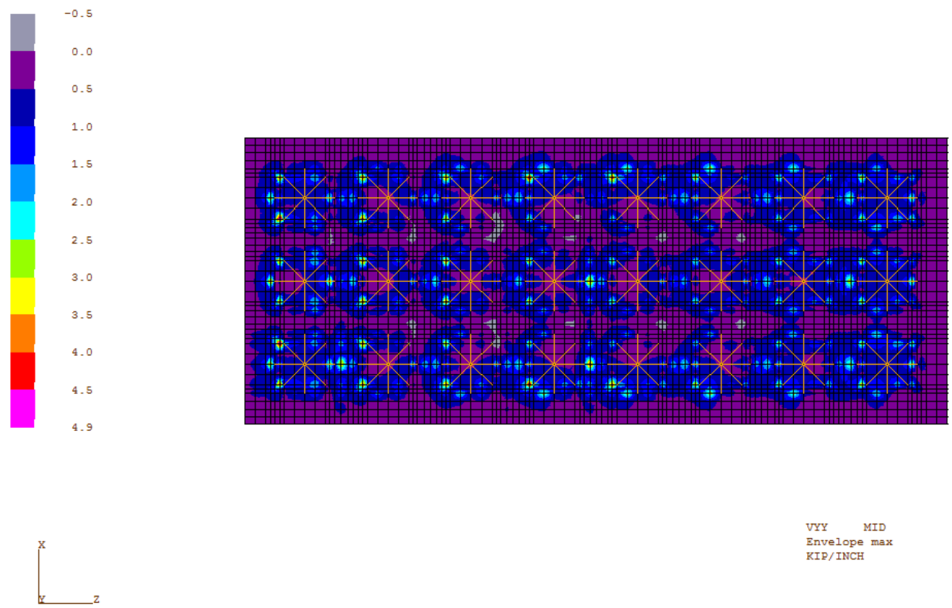

Figure 7-13
Enveloping Element Shear (kip/in) In The Global Y-Direction On The Z-Face (local V_{YY}) - Configuration 1

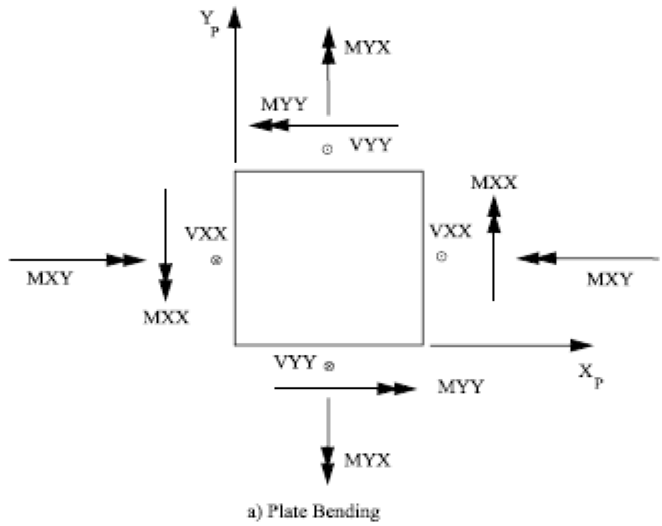

Figure 7-14
GTSTRUDL Plate Bending Element Sign Convention

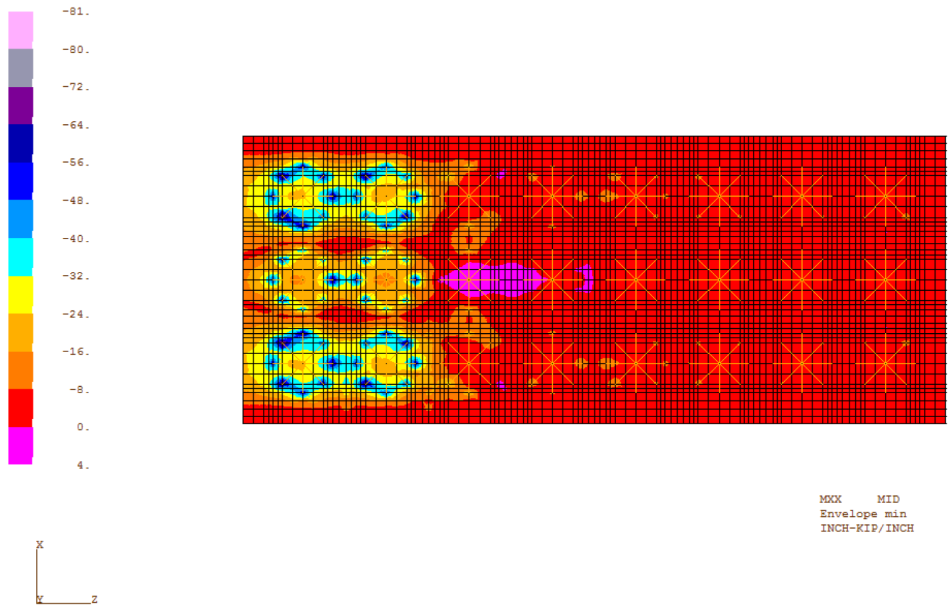

Figure 7-15
Enveloping Negative Moment Resultants (kip-in/in) About Global Z-Axis (local M_{XX}) - Configuration 2

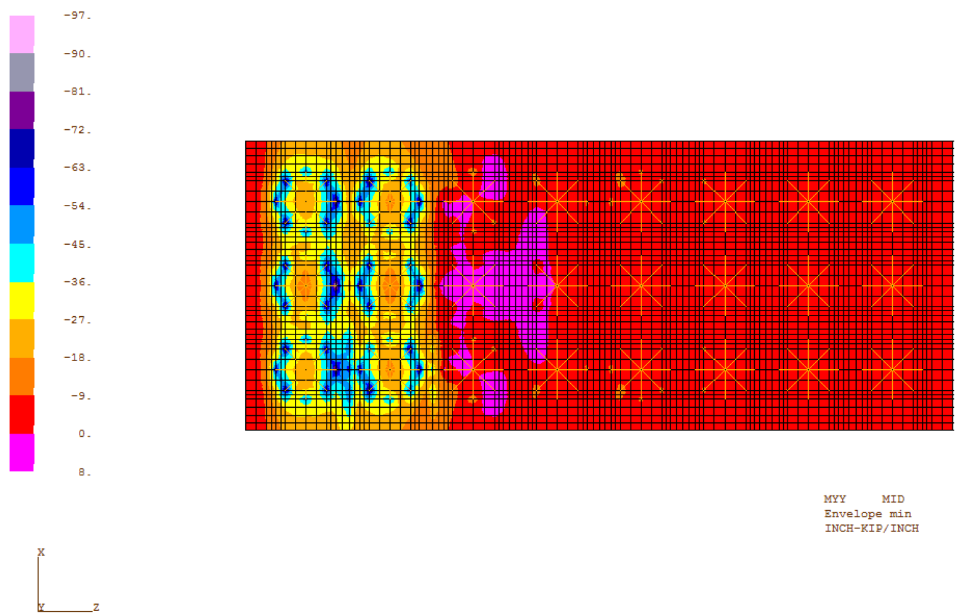

Figure 7-16
Enveloping Negative Moment Resultants (kip-in/in) About Global X-Axis (local M_{YY}) - Configuration 2

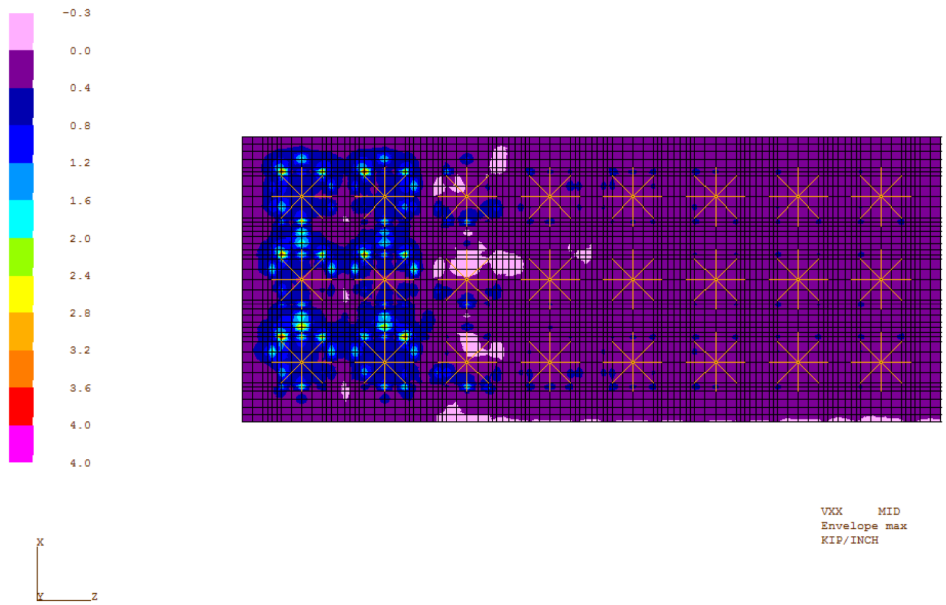

Figure 7-17
Enveloping Element Shear (kip/in) In The Global Y-Direction On The X-Face (local V_{XX}) - Configuration 2

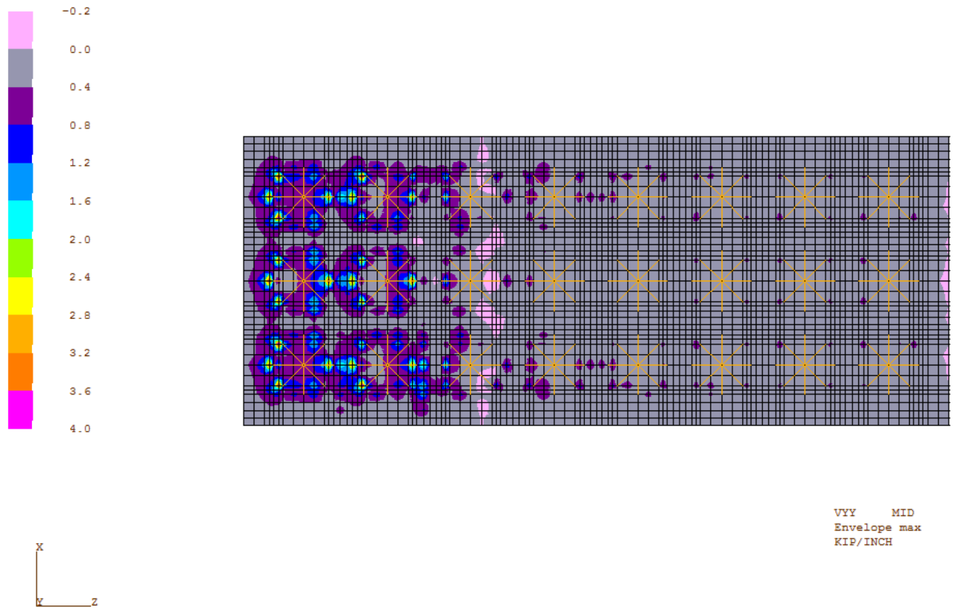

Figure 7-18
Enveloping Element Shear (kip/in) In The Global Y-Direction On The Z-Face (local V_{YY}) - Configuration 2

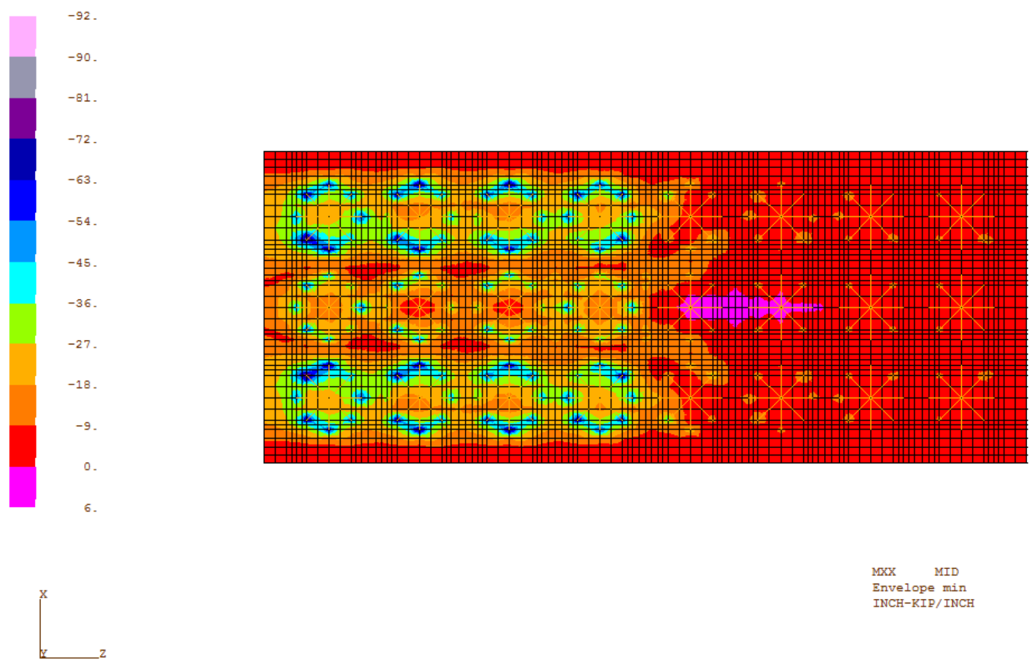

Figure 7-19
Enveloping Negative Moment Resultants (kip-in/in) About Global Z-Axis (local M_{XX}) - Configuration 3

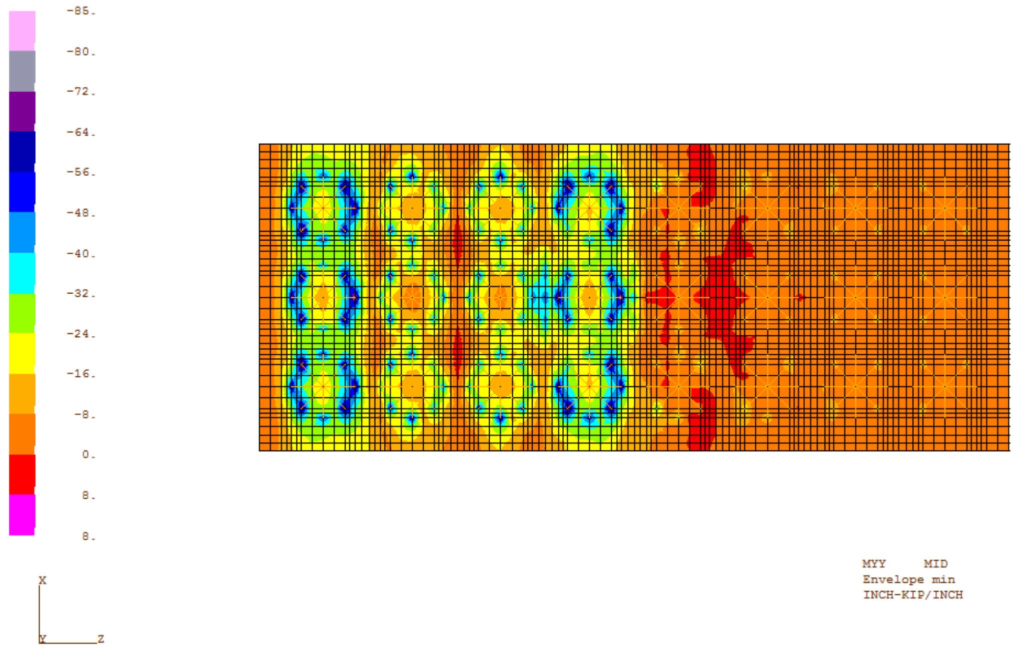

Figure 7-20
Enveloping Negative Moment Resultants (kip-in/in) About Global X-Axis (local M_{YY}) - Configuration 3

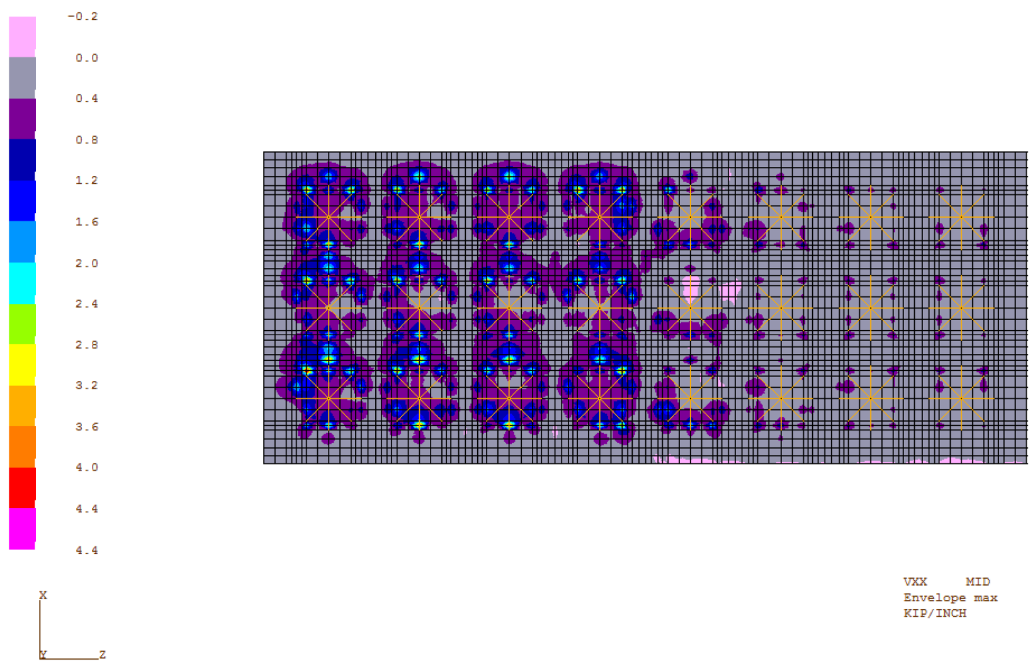

Figure 7-21
Enveloping Element Shear (kip/in) In The Global Y-Direction On The X-Face (local V_{XX}) - Configuration 3

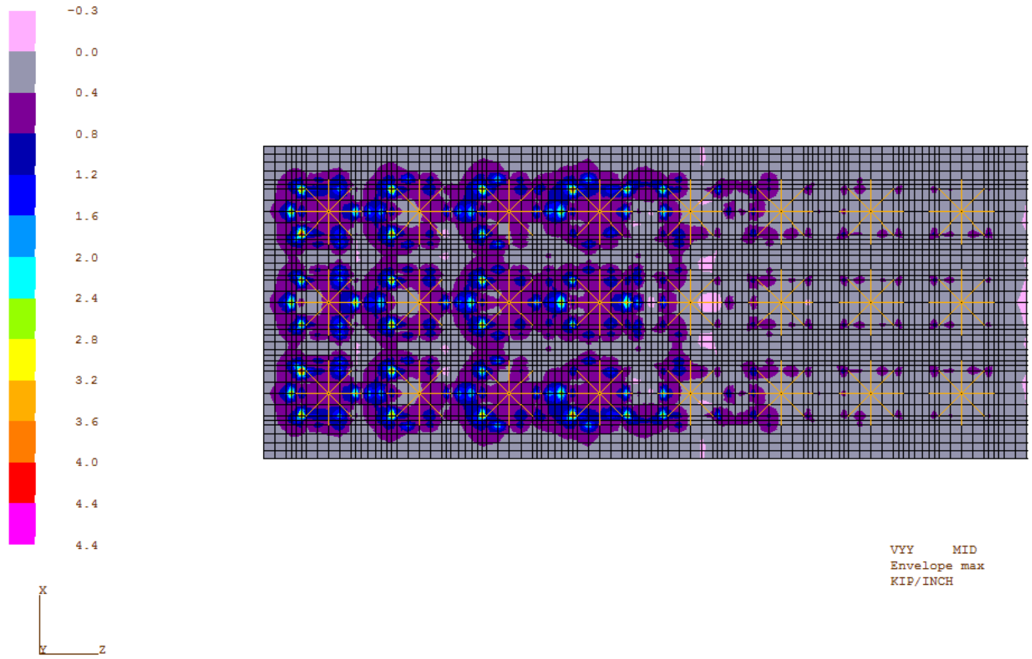

Figure 7-22
Enveloping Element Shear (kip/in) In The Global Y-Direction On The Z-Face (local V_{YY}) - Configuration 3

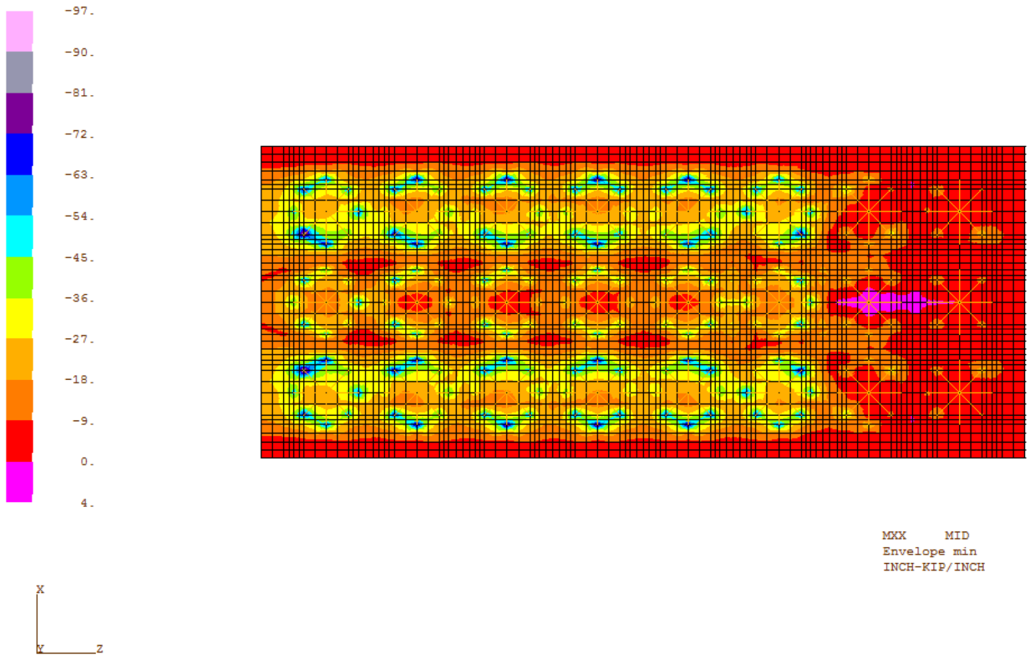

Figure 7-23
Enveloping Negative Moment Resultants (kip-in/in) About Global Z-Axis (local M_{XX}) - Configuration 4

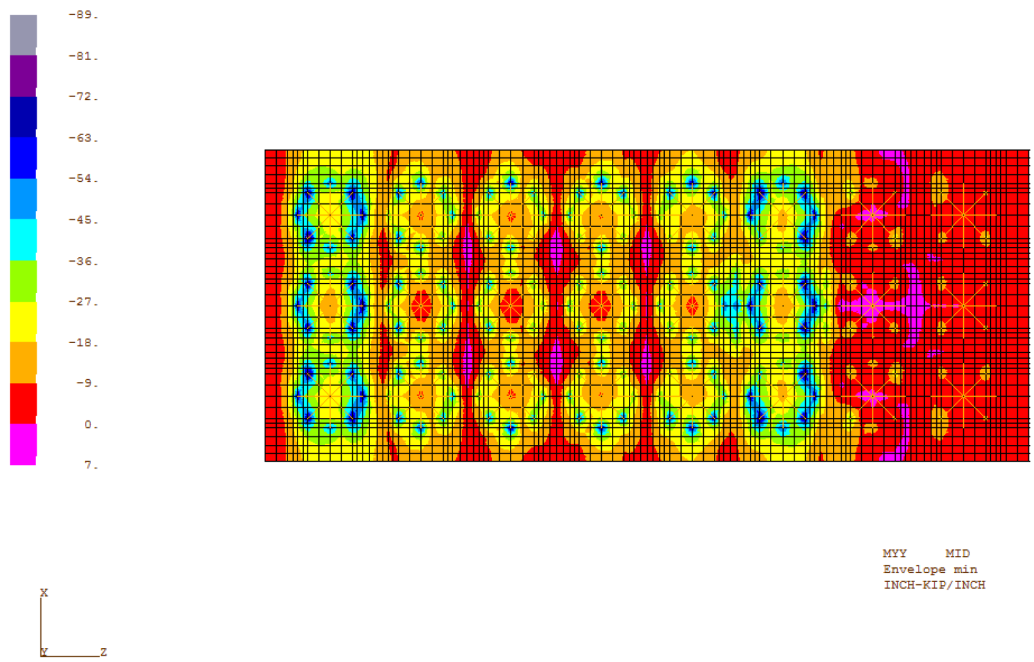

Figure 7-24
Enveloping Negative Moment Resultants (kip-in/in) About Global X-Axis (local M_{YY}) - Configuration 4

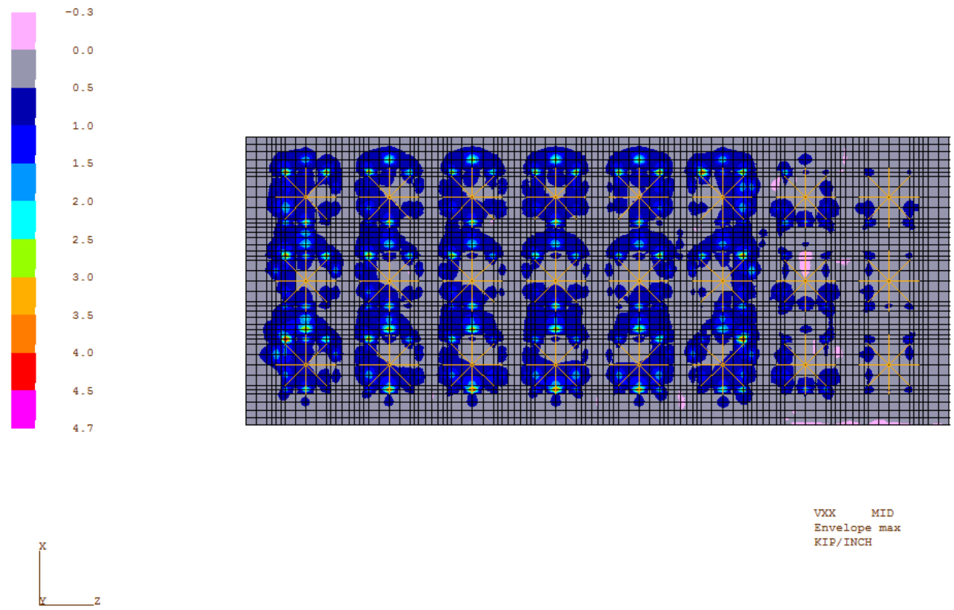

Figure 7-25
Enveloping Element Shear (kip/in) In The Global Y-Direction On The X-Face (local V_{XX}) - Configuration 4

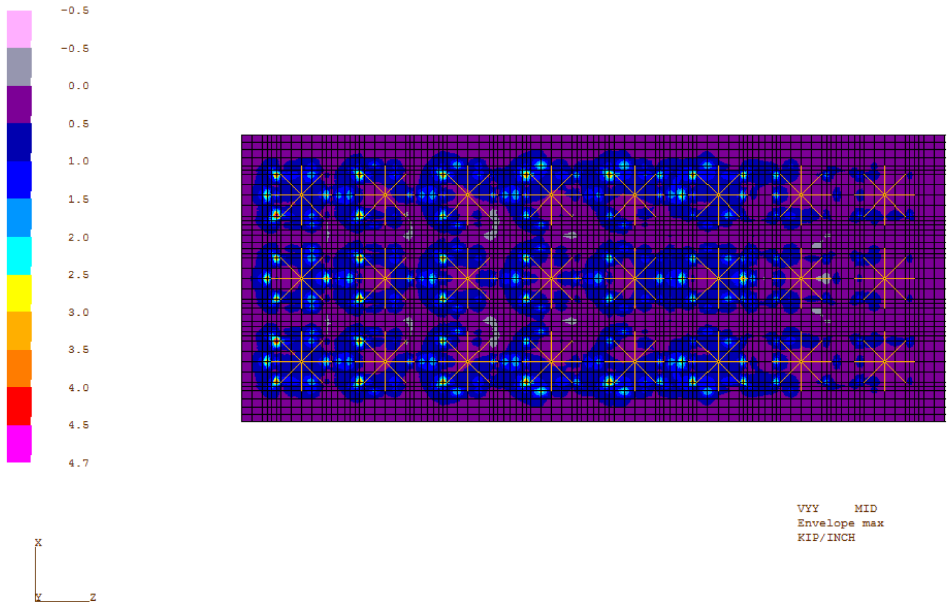

Figure 7-26
Enveloping Element Shear (kip/in) In The Global Y-Direction On The Z-Face (local V_{YY}) - Configuration 4

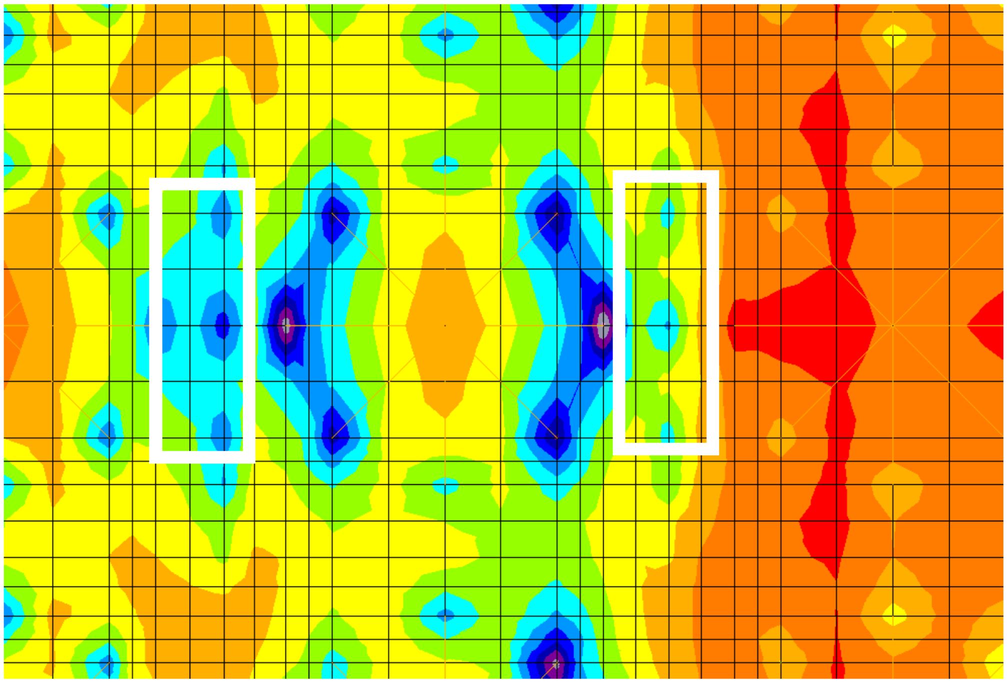

Figure 7-27
Excerpt Of Load Configuration 3 Enveloping Negative Moment Resultants About Global X-Axis (Local M_{YY}) Showing Effect Of VCT Loading

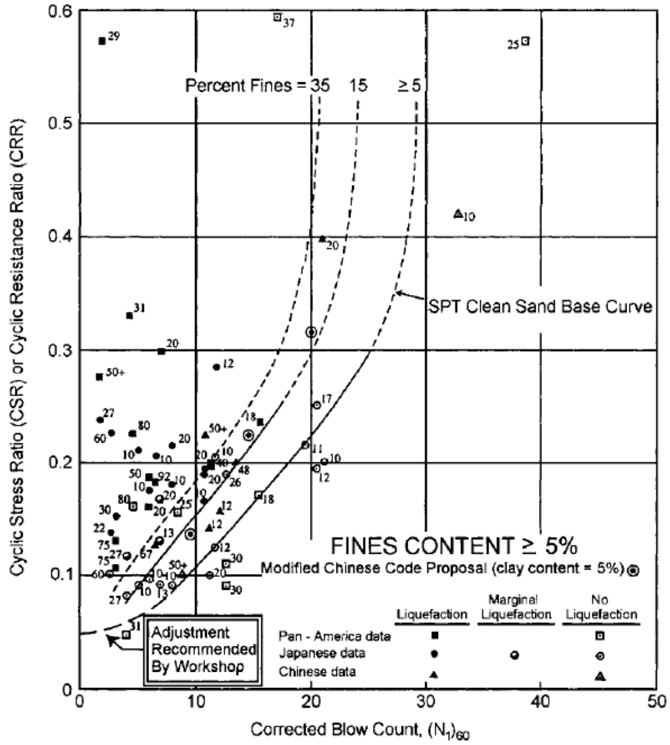

Figure 7-28
SPT-based liquefaction curves for M = 7.5 earthquakes)

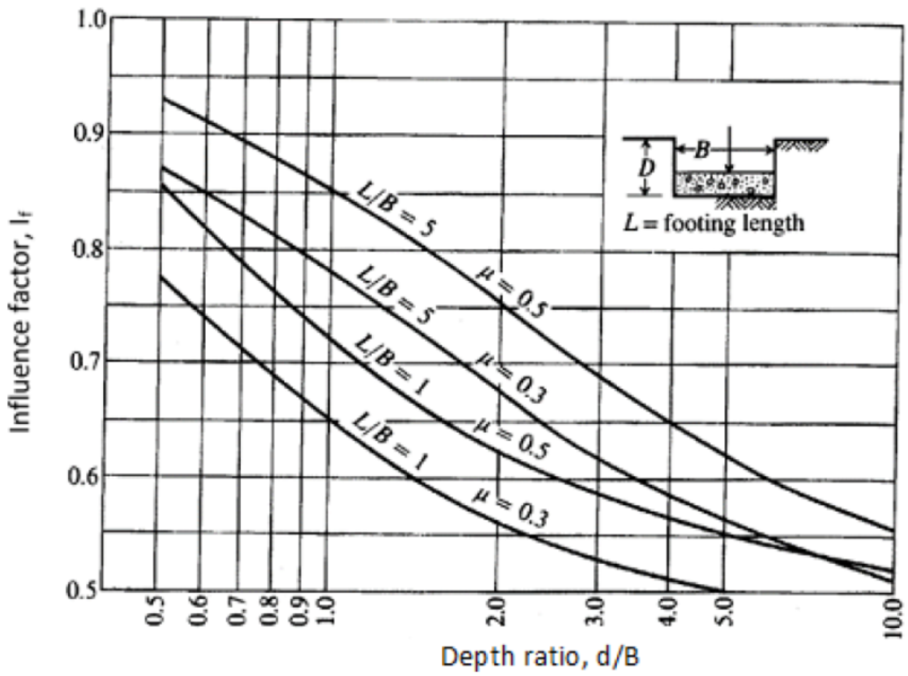

Figure 7-29
Footing Depth to Influence Factor

Proprietary Information on Pages 7-127 through 7-128
Withheld Pursuant to 10 CFR 2.390

CHAPTER 8
THERMAL EVALUATION

Table of Contents

List of Tables

8. THERMAL EVALUATION

The purpose of this chapter is to demonstrate that the Waste Control Specialists, LLC (WCS) Consolidated Interim Storage (CISF) structures, systems, and components (SSCs) important-to-safety (ITS) and spent nuclear fuel (SNF) material temperatures remain within allowable values or criteria for normal, off-normal, and accident conditions. Canisters containing Greater Than Class C (GTCC) waste are bounded by the evaluations performed for canisters containing SNF and therefore are also applicable to GTCC waste canisters.

The design of the WCS CISF is based on the use of cask systems that have been certified under 10 CFR 72. Chapter 3 identifies additional design criteria that cask systems must meet in order to be used at the WCS CISF. The design of the WCS CISF ensures that the receipt, handling, transfer, storage and monitoring of the vendor cask systems is in accordance with the safety analyses and limiting conditions for operation.

8.1 Thermal Design Criteria and Features

This section presents the thermal design criteria for the WCS CISF and summarizes thermal safety design and licensing bases applicable to authorized WCS CISF storage systems. WCS CISF design features and thermal safety evaluation assumptions are presented to demonstrate consistency with authorized storage system design and licensing bases.

8.1.1 Criteria

As specified in the Technical Specifications [8-1] only canisters that were loaded and stored in accordance with the listed Site Specific or General Licenses are acceptable for storage at the WCS CISF. Thermal assessments documented in this Chapter and associated Appendices verify that the WCS CISF characteristics and environmental conditions are bounded by the cask thermal analyses. Consistent with design and regulatory guidance, thermal safety is demonstrated for all WCS CISF cask systems to demonstrate SNF cladding integrity under all identified thermal loading conditions.

8.1.2 Features

WCS CISF storage systems are designed to ensure that the stored materials remain within thermal loading conditions under normal, off-normal and accident-level conditions during all operations, transfers and storage. SNF storage confinement features provide a passive cooling function for the cask systems by air convection.

8.2 Stored Material Specifications

SNF characteristics addressed in the individual canister/cask system thermal safety evaluations are provided in Appendices A.8, B.8, C.8, D.8, E.8, F.8 and G.8, depending on the canister/cask system. It is required that packages received at the WCS CISF are loaded in accordance with SAR and regulatory requirements applicable at the site where the SNF was originally loaded and stored. As stated in Section 7.2, to provide assurance that the packages received at the WCS CISF are acceptable for storage, prior to receipt of a canister, a records review is performed to verify that the canister being received was fabricated, loaded, stored and maintained in accordance with the Site Specific or General License requirements prior to shipment. In addition, the receipt inspection of the canisters upon arrival at the WCS CISF is to be in accordance with reference [8-2]

8.3 Thermal Assessment

Section 8.4 provides the reference to the appropriate Appendix for each authorized canister/cask system listed in the Technical Specifications [8-1] as acceptable for storage at the WCS CISF. Each Appendix then provides reference to the applicable design/licensing basis thermal analysis bounding the conditions of operations and storage at the WCS CISF.

There is no thermal analysis required beyond that documented in the Appendices for each system identified in Section 8.4.

8.4 Thermal Analysis

Section 2.1 of the Technical Specifications [8-1] lists the canisters authorized for storage at the WCS CISF. Table 8-1 provides the cross reference to the applicable appendix and section for each canister/storage overpack where the thermal evaluation is discussed.

8.5 References

8-1 Proposed SNM-1050, WCS Interim Storage Facility Technical Specifications, Amendment 0.

8-2 "Post Transport Package Evaluation," QP-10.02, Revision 0.

Table 8-1
Thermal Evaluations for the Storage Systems at the WCS CISF

Cask System	Canister	Overpack	Appendix
NUHOMS®-MP187 Cask System	FO-DSC	HSM (Model 80)	Appendix A.8
	FC-DSC		
	FF-DSC		
Standardized Advanced NUHOMS® System	NUHOMS® 24PT1	AHSM	Appendix B.8
Standardized NUHOMS® System	NUHOMS® 61BT	HSM Model 102	Appendix C.8
	NUHOMS® 61BTH Type 1		Appendix D.8
NAC-MPC	Yankee Class	VCC	Appendix E.8
	Connecticut Yankee	VCC	
	LACBWR	VCC	
NAC-UMS	Classes 1 thru 5	VCC	Appendix F.8
MAGNASTOR	TSC1 thru TSC4	CC1 thru CC4	Appendix G.8

CHAPTER 9
RADIATION PROTECTION

Table of Contents

List of Tables

List of Figures

9. RADIATION PROTECTION

This chapter provides occupational exposure and off-site dose rates for operation of the Waste Control Specialists, LLC (WCS) Consolidated Interim Storage (CISF). The occupational exposure and off-site dose rates are very conservative, as the dose rates on and around the transportation/transfer casks are based upon design basis transportation sources, and the dose rates on and around the storage overpacks are based upon design basis source terms in the existing storage Final Safety Analysis Reports [9-3, 9-4, 9-5, 9-9, 9-10, 9-11]. These storage source terms, in most cases, are much higher than what can be accommodated by the transportation casks and therefore, significant decay is required prior to shipment to the WCS CISF.

9.1 Ensuring That Occupational Radiation Exposures Are ALARA

9.1.1 Policy Considerations

The WCS CISF is designed and operated to provide radiation protection for workers in conformance with applicable regulatory criteria so that occupational radiation exposures are maintained ALARA.

Operation of the WCS CISF is in accordance with an ALARA policy that includes, as a minimum, the following criteria.

- Maintain radiological releases and exposures to personnel below the applicable limits of 10 CFR Part 20.
- Ensure that all exposures are kept ALARA, with technological, economic and social factors taken into consideration.
- Integrate appropriate radiation protection controls into all work activities.
- Ensure that all personnel understand and follow ALARA procedures.
- Restrict access to radiation areas.
- Track individual and collective doses to identify trends and causes.
- Conduct periodic training and exercises for management, radiation workers and other site personnel in radiation protection principles and procedures, individual and group protective measures, site procedures and emergency response.
- Integrate ALARA considerations into the WCS CISF design and procedure change activities.

9.1.2 Design Considerations

Only canisters that have been previously approved by the NRC to store and transport spent nuclear fuel (SNF) and GTCC waste will be accepted at the WCS CISF. This includes commercial light water (pressurized water reactor and boiling water reactor) SNF. The controls for limiting the types and forms of SNF received at the WCS CISF are the same as those placed on the cask systems by the NRC issued site licenses or certificates of compliance for the included transportation and storage systems. The approved systems are listed in Section 2.1 of the Technical Specifications [9-13].

The storage systems are designed to comply with 10 CFR 72 ALARA requirements. Details of the design considerations for each system are cross-referenced to the applicable FSAR in the table below:

Cask System	Canister	Overpack	Design Considerations
NUHOMS®-MP187 Cask System	FO-DSC	HSM (Model 80)	Section 7.1.2 of [9-3]
	FC-DSC		
	FF-DSC		
Standardized Advanced NUHOMS® System	NUHOMS® 24PT1	AHSM	Section 10.1.2 of [9-5]
Standardized NUHOMS® System	NUHOMS® 61BT	HSM Model 102	Section 7.1.2 of [9-4]
	NUHOMS® 61BTH Type 1		
NAC-MPC	Yankee Class	VCC	Appendix E.9
	Connecticut Yankee	VCC	
	LACBWR	VCC	
NAC-UMS	Classes 1 thru 5	VCC	Appendix F.9
MAGNASTOR	TSC1 thru TSC4	CC1 thru CC4	Appendix G.9

9.1.3 Operational Considerations

Details of the operational considerations for each system are cross-referenced to the applicable FSAR in the table below:

Cask System	Canister	Overpack	Operational Considerations
NUHOMS®-MP187 Cask System	FO-DSC	HSM (Model 80)	Section 7.1.3 of [9-3]
	FC-DSC		
	FF-DSC		
Standardized Advanced NUHOMS® System	NUHOMS® 24PT1	AHSM	Section 10.1.3 of [9-5]
Standardized NUHOMS® System	NUHOMS® 61BT	HSM Model 102	Section 7.1.3 of [9-4]
	NUHOMS® 61BTH Type 1		
NAC-MPC	Yankee Class	VCC	Appendix E.9
	Connecticut Yankee	VCC	
	LACBWR	VCC	
NAC-UMS	Classes 1 thru 5	VCC	Appendix F.9
MAGNASTOR	TSC1 thru TSC4	CC1 thru CC4	Appendix G.9

9.2 Radiation Sources

The types and potential magnitudes of radiation sources at the WCS CISF that could contribute to worker or public radiation exposures are described in this section.

9.2.1 Characterization of Sources

The source terms may be classified into three general categories:

- Gamma and neutron source terms from the fuel and GTCC waste
- External radioactive contamination on a canister
- Radioisotopes associated with releases from a canister

The characteristics of each of these radiation sources are discussed in the following sections.

9.2.1.1 Spent Nuclear Fuel and GTCC Waste

Details of the storage source terms for each system are cross-referenced to the applicable FSAR in the table below:

Cask System	Canister	Overpack	Source Terms
NUHOMS®-MP187 Cask System	FO-DSC	HSM (Model 80)	Section 7.2.1 of [9-3]
	FC-DSC		
	FF-DSC		
Standardized Advanced NUHOMS® System	NUHOMS® 24PT1	AHSM	Section 5.2 of [9-5]
Standardized NUHOMS® System	NUHOMS® 61BT	HSM Model 102	Section K.5 of [9-4]
	NUHOMS® 61BTH Type 1		Section T.5 of [9-4]
NAC-MPC	Yankee Class	VCC	Appendix E.9
	Connecticut Yankee	VCC	
	LACBWR	VCC	
NAC-UMS	Classes 1 thru 5	VCC	Appendix F.9
MAGNASTOR	TSC1 thru TSC4	CC1 thru CC4	Appendix G.9

Sources (surface dose rates) for the GTCC waste canisters are bounded by the design basis fuel and are therefore modeled as fuel canisters.

These storage source terms are used to compute the dose rates on the surfaces of the storage overpacks. Separate source terms are used to compute the dose rates on the surface of the transportation/transfer casks: see Chapter 5 of the MP187 SAR [9-2]; Chapter A.5 of the MP197HB SAR [9-1]; Chapter 5 of the NAC-STC SAR [9-6]; Chapter 5 of the UMS® Universal Transport Cask [9-7]; and Chapter 5 of the MAGNATRAN® SAR [9-8]. In general, the source terms in the associated storage FSARs are larger than the source terms in the transportation SARs, although in actuality the source terms in the transportation SARs must bound the WCS CISF as-loaded source terms because the fuel must be transported to the WCS CISF. For this reason, all reported WCS CISF dose rates are highly conservative because they are based on FSAR design basis storage source terms.

9.2.1.2 Radiation Sources for Site Dose Calculations

NUHOMS® HSM

For the NUHOMS® HSM portion of the site dose calculations, flux and dose rate information on the surfaces of the HSMs are used to generate surface sources. These surface sources are used as input to a site dose calculation in which the radiation interacts primarily with air. Average neutron and gamma dose rates on the surfaces of the various HSM modules are obtained from the respective FSARs [9-3, 9-4, 9-5] and are summarized in Table 9-1. Note that the HSM surface dose rates for the HSM Model 102 are conservatively increased from the reference FSAR values.

A surface source is modeled on each of the HSM array surfaces to reproduce the applicable HSM surface dose rate indicated in Table 9-1. Source particles are started using an outward cosine distribution and spectra applicable to each HSM system.

NAC VCC

This evaluation utilizes licensing basis surface currents imported from each system's 10 CFR Part 72 licensing basis evaluation. This evaluation considers all approved contents for each system, including undamaged and damaged fuel, and all non-fuel hardware. The contents are considered using the methods of previous licensing basis site boundary evaluations (e.g., a non-fuel hardware multiplication factor for the MAGNASTOR surface currents). For most systems, no additional source is required as the directly imported surface currents have considered bounding sources (e.g., no impact on site boundary dose rates for the loading of VCCs with damaged fuel). GTCC waste is not included in the 10 CFR 72 general licensing basis evaluations. Representative site specific data is imported for GTCC waste source data. All surface currents are applied in the MCNP VCC models as a surface source with cask specific directional and energy distributions. Radial and axial source distributions are assumed to be uniformly emitting.

Example surface currents used for the MAGNATOR VCCs are provided in Table 9-2 and Table 9-3 for neutron and gamma sources, respectively.

9.2.1.3 External Radioactive Contamination

Canister removable contamination does not exceed 2,200 dpm/100 cm^2 beta/gamma emitters and 220 dpm/100 cm^2 alpha emitters as verified during loading and storage operations at the original canister loading site for the approved systems that are listed in Section 2.1 of the Technical Specifications [9-13]. No radioactive contamination is expected on the internal or external surfaces of the storage overpacks.

Finally, one additional source of external radioactive contamination would be the surfaces of the transportation casks when they arrive at the WCS CISF. The contamination levels are governed by 10 CFR Part 71 regulations.

9.2.1.4 Fission Gases

All of the canisters authorized for storage at the WCS CISF except for the FO-, FC-, and FF-DSCs are leaktight per ANSI N14.5 (see Chapter 11 and associated appendices). The confinement boundary for these canisters is demonstrated to be leaktight during all normal, off-normal, and accident conditions. Therefore, estimating the maximum quantity of fission gas products for these canisters is not required per ISG-5 [9-12].

For the FO-, FC- and FF-DSCs, the fission gases are listed in Table A.11-1 of Appendix A.11.

9.2.2 Airborne Radioactive Material Sources

The potential for significant airborne radioactive contamination at the WCS CISF is small due to the inherent protection provided by the canisters. However, there are two possible sources of airborne radioactive materials: airborne dispersion of external non-fixed contamination on individual canisters during normal operations and releases associated with a postulated confinement barrier breach.

9.2.2.1 Normal Operations

During transfer of the sealed canisters and subsequent storage in the applicable storage overpack, the only postulated mechanism for the release of airborne radioactive material is the dispersion of non-fixed surface contamination on the canister exterior. Because the contamination limits on the canisters are kept to a minimum (See section 9.2.1.3), there is no significant possibility of radionuclide release from the canister exterior surface during transfer or storage operations.

9.2.2.2 Accidents

As noted in Section 9.2.1.4, all of the canisters authorized for storage at the WCS CISF except for the FO-, FC-, and FF-DSCs are leaktight per ANSI N14.5. The confinement boundary for these canisters is demonstrated by testing to be leaktight during all normal, off-normal, and accident conditions. Therefore, evaluation of releases from inside the canisters, except for the FO-, FC-, and FF-DSCs, is not required per ISG-5 [9-12].

The 21 FO-, FC-, and FF-DSCs are fabricated and tested to a leakage rate of 10^{-5} std-cc/sec; see Section 8.2.2 of [9-3]. The actinides and fission products for a B&W 15x15 fuel assembly are computed using SCALE6/ORIGEN-ARP. Two isotopic sets are considered, based on the design basis neutron and gamma sources. The design basis neutron source has a burnup of 38,268 MWd/MTHM, enrichment of 3.18% U-235, and was discharged in 1983. The design basis gamma source has a burnup of 34,143 MWd/MTHM, enrichment of 3.21% U-235, and was discharged in 1989. The two source terms considered are decayed until June 2020, which corresponds to the loading of Phase 1. The reported source term in Table A.11-1 of Appendix A.11 are the maximum values of the two isotopic sets considered.

9.3 Radiation Protection Design Features

The radiation protection design features are discussed in this section.

9.3.1 Installation Design Features

Only canisterized SNF and GTCC waste is authorized for storage at the WCS CISF.

The Cask Handling Building houses the equipment used to handle the transition between transportation configurations under 10 CFR Part 71 to transfer operations under 10 CFR Part 72 for the canisters. The canisters are well shielded by the transportation casks and transfer casks during these operations. A thick steel plug is in place at the end of the canisters to minimize the dose rate at the cask top (and bottom for NUHOMS®) when the canisters are transferred from one overpack to another.

Table 9-4 provides the cross reference to the applicable appendix and section for each canister/storage overpack where the operational considerations for each system are discussed.

9.3.2 Access Control

The WCS CISF is located within the owner controlled area. A separate protected area consisting of a double fenced, double gated, lighted area is installed around the storage facility. Access to the protected area is controlled by locked gates, and guards will be stationed whenever the WCS CISF gates are open. Remote sensing devices are employed to detect unauthorized access to the facility.

9.3.2.1 Controlled Area

Within the controlled area, a restricted area is established to control access to radiation areas in order to maintain worker exposures ALARA.

9.3.2.2 Restricted Area

The restricted area is located on the site such that a minimum distance from any stored SNF to the security boundaries is at least 330 feet in order to maintain exposures to the public within regulatory limits. The nearest property boundary is more than 4,300 feet from the Storage Area.

9.3.3 Shielding

Shielding design features are discussed in this section.

9.3.3.1 Cask Handling Building Shielding

The Cask Handing Building itself does not provide shielding that is credited in the any of the shielding/exposure analysis. Shielding from the radiation sources within the canisters is provided by the Transportation/Transfer Casks, Transfer Casks and Storage Overpacks. The Table 9-4 provides the cross reference to the applicable appendix and section for each canister/storage overpack where each system is discussed.

9.3.3.2 Receiving Area Shielding

Shielding is provided by the 10 CFR Part 71 certified transportation cask.

9.3.3.3 Storage Area Shielding

The Table 9-4 provides the cross reference to the applicable appendix and section for each canister/storage overpack where the storage overpack shielding for each system is discussed.

9.3.4 Ventilation

Only NRC approved canisterized SNF and GTCC waste are acceptable for receipt and storage at the WCS CISF. Therefore, no safety related ventilation systems are required to support operations at the WCS CISF.

9.3.5 Area Radiation and Airborne Radioactivity Monitoring System

Area Radiation monitoring will be via the WCS Radiation Safety Program. As discussed in Section 4.5.3, no sampling is required for airborne radioactivity for the safe operation of the WCS CISF

9.3.5.1 Area Radiation Monitoring System

Section 4.3.10 describes the Radiation Monitoring Systems to be employed at the WCS CISF.

9.3.5.2 Radioactive Airborne Effluent Monitoring System

Since there is no significant possibility of radionuclide release from the canisters during transfer or storage operations, airborne effluent monitoring system is not required for the safe operation of the WCS CISF. However, during receipt and transfer operations, portable airborne monitoring systems may be used in accordance with the WCS Radiation Safety Program.

9.4 Estimated On-Site Collective Dose Assessment

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

9.4.1 Radiation Dose Rate Within the Controlled Area

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

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

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

NUHOMS® Systems

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

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

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

The outer boundary of the MCNP5 models is a sphere with a radius of approximately 7.6 km. Gamma and neutron radiation may scatter from atmospheric air down to the detector dose points (i.e., skyshine). Ground is modeled as soil 3 feet thick to capture ground scatter. Therefore, skyshine radiation is explicitly included in the dose rate results, as well as direct radiation and ground scatter.

No credit is taken for the presence of any landscape features or site buildings, which would provide additional shielding. In addition to the HSMs, a number of vertical casks are adjacent to the HSM, as indicated in Figure 9-3. No credit is taken for any blocking provided by the vertical casks.

NAC Systems

The WCS CISF is modeled explicitly. Shielding by NAC systems and AREVA TN HSMs is included in the model. Dose rates are calculated using point detectors and superimposed mesh tallies. For the location specific dose rates, point detectors were used. Neutron, gamma, and neutron-induced gammas (N-Gamma) are accounted for in the shielding evaluation. Neutron induced gammas generated within the cask shielding are included in the imported gamma surface currents. N-Gamma cases and results for the VCCs only include gammas induced from neutron interactions in air surrounding the cask systems.

9.4.1.1 Dose Rate Results

Dose rates are computed at various locations around the WCS CISF using point detectors, as indicated on Figure 9-1 through Figure 9-3. Dose rates are computed for gamma radiation, neutron radiation and secondary gamma radiation created when neutrons are absorbed in air, soil or concrete. Fluxes are converted to dose rates using ANSI/ANS-6.1.1-1977 flux to dose rate conversion factors.

The total dose rate is computed as the sum of the gamma, neutron, and secondary gamma components. The gamma and neutron dose rate is approximately 90% and 10% of the total dose rate, respectively. The 1-sigma MCNP statistical uncertainty is also provided for the total dose rate. All reported dose rate results are well-converged. Coordinates of the detectors are given in the State Plane Coordinate System (SPCS).

Dose rate results for the protected area fence are summarized in Table 9-5. Dose rate results for the locations around the WCS CISF and at the security barrier that surrounds the WCS CISF are summarized in Table 9-6. Coordinates of the detectors are given in the State Plane Coordinate System (SPCS).

9.4.1.2 Direct Dose Rate

The point detector output provides both the total and uncollided dose rate. The uncollided dose rate is representative of the “direct” component of the dose rate. The direct dose rate is provided in Table 9-5 and Table 9-6 in the “Direct” column.

9.4.1.3 Air Scattered Dose Rate

The air scattered or skyshine dose rate is provided in Table 9-5 and Table 9-6 in the "Skyshine" column and is estimated by subtracting the direct dose rate from the total dose rate. It may be observed that the direct dose rate is dominant close to the storage overpacks (< 20 m) but skyshine becomes dominant farther from the storage overpacks (> 20 m).

9.4.2 Doses to Workers

Section 2.1 of the Technical Specifications [9-13] lists the NRC approved canisters authorized for storage at the WCS CISF. Table 9-4 provides the cross reference to the applicable appendix and section for each canister/storage overpack where the Occupational Exposure for each system is discussed. The NUHOMS® systems do not require workers to approach the modules to perform surveillance of maintenance activities, therefore the only occupational exposure associated with the NUHOMS® systems is placing the canisters into storage and retrieving them again for off-site shipment. For the vertical systems the applicable appendices listed in Table 9-4 provide occupational exposures due to surveillance activities required for the VCCs.

9.5 Radiation Protection Program During Operation

The major radiation protection functions of the Radiation Protection program during operations of the Cask Handling Building are described in this section. The WCS CISF Radiation Protection program is planned and organized in accordance with the criteria of NRC Regulatory Guides 8.8 and 8.10, and NUREG-0761.

9.5.1 Organization and Functions

For occupational exposure control, radiation protection systems are provided to control personnel exposure to radiation. Administration of the Radiation Protection program is accomplished with a trained and qualified staff of Radiation Protection professionals. Tasks include radiation monitoring and communication to operations personnel.

Radiation survey information associated with transportation, transfer and storage of casks is provided. This information includes use of portable radiation monitoring equipment to measure direct gamma and neutron radiation levels in the vicinity of the casks. It also includes the measurement and control of radiation contamination. Permanent and temporary shielding is used to reduce exposure to personnel. Areas are surveyed for radiation, and job postings are provided to define the need for anti-contamination clothing, in order to reduce the potential for personnel contamination when accessing areas of potential contamination.

Radiological monitoring, sampling, maintenance and calibration are provided. General area monitoring equipment located in the shipping/receiving and transfer areas is sufficient for fixed monitoring requirements. Additionally, more detailed radiation surveys are provided by Radiation Protection personnel covering specific operations.

In the WCS CISF Radiation Protection organization, the Radiation Protection Supervisor reports to the Radiation Safety Officer without operating pressures. Sufficient Radiation Protection personnel are available to perform routine functions and to respond to anticipated occurrences and accident conditions in a timely manner. Contract services are identified in the organization, and may include instrument calibration, contamination smear counting, dosimetry counting and radiation protection training.

9.5.2 Equipment, Instrumentation and Facilities

Facility requirements to support radiation protection functions are as follows.

- Instrument calibration area (exists as part of the existing LLW operations)
- Personnel change rooms, including lockers
- Access control stations for entrance to and exit from radiation areas and, if needed, temporary contamination control areas
- Office space to accommodate Radiation Protection staff

- Counting laboratory (exists as part of the existing LLW operations).

Equipment and instrumentation provided to support radiation protection functions are as follows.

- A proportional counter for contamination smears to define surface contamination and the need for decontamination
- Hand and foot contamination monitors stationed at building exits to prevent the spread of contamination
- Portable monitoring equipment to augment fixed detector systems
- Personnel protective equipment and clothing
- Personnel dosimetry instrumentation and equipment, including the following.
  - Optically stimulated luminescence monitoring for permanent exposure records
  - Self-reading dosimeters for instantaneous readout and personnel exposure control
  - Computer hardware/software to record and analyze radiological monitoring/sampling and personnel exposure data.

9.5.3 Procedures

Radiation Protection activities are performed in accordance with procedures. Radiation Protection staff utilize procedures to perform the following.

- Take contamination swipes of potentially contaminated areas (transportation casks)
- Perform radiation surveys to define and maintain radiation dose rates in the radiation areas
- Post areas based on surveys
- Provide radiation work permits and perform pre-operational briefings
- Cover jobs to ensure radiation protection
- Evaluate personnel occupational radiation doses to determine if ALARA objectives are met
- Administer Personnel Dosimetry programs
- Perform instrument calibration and testing
- Provide ALARA review of site procedure and monitoring of operations
- Perform radiological safety training and refresher training
- Maintain records of the Radiation Protection program, including audit and other reviews of program content and implementation, radiation surveys, instrument calibrations, individual monitoring results, and records required for decommissioning

- Perform, monitor and record environmental monitoring of boundaries.

9.6 Doses to Off-Site Public

The maximum annual dose to the most exposed public individual due to operations at WCS CISF is limited to 25 mrem per 10 CFR 72.104.

9.6.1 Site Boundary Dose

The closest location of the site boundary is located at SPCS coordinate (558079.15, 6878157.94), or approximately 0.75 miles from the WCS CISF. The total dose rate at the site boundary is 4.90E-06 mrem/hr, which is less than naturally occurring background radiation. The annual dose to an individual living at the site boundary (8760 hours) due to the fully loaded facility is 4.29E-2 mrem, or essentially zero. Note that the annual dose 100 m from the WCS CISF due to postulated leakage of the FO-, FC-, and FF-canisters is 7.77E-3 mrem (see Appendix A.11, Confinement Evaluation). The total annual dose including leakage is significantly less than the 10 CFR 72.104 dose limit of 25 mrem to the whole body. Given that the annual dose contribution at the site boundary is less than 0.05 mrem/year, regardless of the contribution from any other radiation from uranium fuel cycle operations within the region, the 10 CFR 72.104 limits are met.

9.6.2 Effluent and Environmental Monitoring Program

This section describes the program for monitoring and estimating the release of radioactive materials processed and stored at the WCS CISF to the environment.

9.6.2.1 Gaseous Effluent Monitoring

As described in Section 6.1.1, there are no gaseous effluents to monitor for the WCS CISF.

9.6.2.2 Liquid Effluent Monitoring

As described in Section 6.1.2.1, there are no radioactive liquid effluents to monitor for the WCS CISF.

9.6.2.3 Solid Waste Monitoring

As described in Section 6.1.4, only one type of solid potentially radioactive wastes is generated at the WCS CISF: waste from contamination surveillance, decontamination, and maintenance activities, consisting of paper or cloth swipes, paper towels, rubber gloves and boots. Solid radioactive wastes will be collected in containers and temporarily stored in the Cask Handling Building. Small volumes of solid radioactive wastes are anticipated. These low activity wastes will be disposed of at a WCS waste disposal facility in compliance with applicable federal and state regulations.. Radiation Protection personnel periodically monitor dose rates in the solid waste storage area using portable instrumentation for ALARA purposes as part of the facility Radiation Protection program.

9.6.2.4 Environmental Monitoring

To be completed by WCS.

9.6.3 Maximum Off-Site Annual Dose

The nearest residence in Lea County, New Mexico is approximately 4 miles from the WCS CISF at SPCS coordinate (541732.42, 6873002.59). At this distance, the computed total dose rate is 4.83E-14 mrem/hr. With continuous occupancy of 8,760 hours per year, the total dose is 4.23E-10 mrem, which is essentially zero and less than the dose from natural background radiation.

9.6.4 Liquid Releases

As described in Section 6.1.2.1, there are no radioactive liquid radioactive wastes to monitor for the WCS CISF.

9.7 References

9-1 AREVA TN Document, NUH09.101 Rev. 17, "NUHOMS® -MP197 Transportation Package Safety Analysis Report." (Basis for NRC CoC 71-9302).

9-2 AREVA TN Document NUH-05-151 Rev. 17, "NUHOMS®-MP187 Multi-Purpose Transportation Package Safety Analysis Report." (Basis for NRC CoC 71-9255).

9-3 "Rancho Seco Independent Spent Fuel Storage Installation, Final Safety Analysis Report, Volume I, ISFSI System," NRC Docket No. 72-11, Revision 4.

9-4 AREVA TN Document NUH-003, Revision 14, "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel." (Basis for NRC CoC 72-1004).

9-5 AREVA TN Document, ANUH-01.0150, Revision 6, "Updated Final Safety Analysis Report for the Standardized Advanced NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel, NRC Docket No. 72-1029.

9-6 NAC International, "NAC-STC, NAC Storage Transport Cask Safety Analysis Report," Revision 17, CoC 9235 Revision 13, USNRC Docket Number 71-9235.

9-7 NAC International, "Safety Analysis Report for the UMS® Universal Transport Cask," Revision 2, CoC 9270 Revision 4, USNRC Docket Number 71-9270.

9-8 NAC International, "Safety Analysis Report for the MAGNATRAN Transport Cask," Revisions 12A, 14A, and 15A, USNRC Docket Number 71-9356.

9-9 NAC International, "NAC Multipurpose Cask Final Safety Analysis Report," Revision 10, CoC 1025 Revision 6, USNRC Docket Number 72-1025.

9-10 NAC International, "Final Safety Analysis Report for the UMS Universal Storage System," Revision 10, CoC 72-1015 Revision 5, USNRC Docket Number 72-1015.

9-11 NAC International, "MAGNASTOR® Final Safety Analysis Report," Revision 6, CoC 1031 Revision 4, USNRC Docket Number 72-1031.

9-12 NRC Spent Fuel Project Office, Interim Staff Guidance, ISG-5, Rev. 1, "Confinement Evaluation."

9-13 Proposed SNM-1050, WCS Interim Storage Facility Technical Specifications, Amendment 0.

Table 9-1
HSM Storage Systems at the WCS CISF

Exterior HSM Surfaces	HSM Model 80 (Table 7-1 of [9-3])		HSM Model 102 (Increased from Table T.5-2 of [9-4])		AHSM (Table 5.1-2 of [9-5])	
	Gammas(1)	Neutrons(1)	Gammas(1)	Neutrons(1)	Gammas(1)	Neutrons(1)
Front	10.7	0.45	18.38	0.76	1.89	0.04
Roof	35.9	0.07	28.77	0.91	0.03	0.00086
Side	0.99	0.006	2.43	0.10	0.26	0.01

(1) All dose rates in mrem/hr

Table 9-2
MAGNASTOR – Neutron Surface Currents at the WCS CISF

Group	E Lower [MeV]	E Upper [MeV]	Surface Current [/sec]			
			Radial		Top Axial	
1	1.360E+01	1.460E+01	0.000E+00	0%	0.000E+00	0%
2	1.250E+01	1.360E+01	0.000E+00	0%	0.000E+00	0%
3	1.125E+01	1.250E+01	0.000E+00	0%	0.000E+00	0%
4	1.000E+01	1.125E+01	0.000E+00	0%	0 .000E+00	0%
5	8.250E+00	1.000E+01	2.111E+03	49%	9.967E+02	100%
6	7.000E+00	8.250E+00	7.666E+03	29%	0.00OE+00	0%
7	6.070E+00	7.000E+00	1.334E+04	19%	0.000E+00	0%
8	4.720E+00	6.070E+00	2.976E+04	12%	6.406E+03	70%
9	3.680E+00	4.720E+00	3.763E+04	9%	1.968E+04	49%
10	2.870E+00	3.680E+00	4.850E+04	9%	2.239E+03	72%
11	1.740E+00	2.870E+00	4.529E+05	3%	4.769E+04	25%
12	6.400E-01	1.740E+00	4.831E+05	4%	2.760E+05	11%
13	3.900E-01	6.400E-01	4.481E+05	6%	2.406E+05	9%
14	1.100E-01	3.900E-01	1.384E+06	4%	6.962E+05	6%
15	6.740E-02	1.l00E-01	4.978E+05	5%	3.419E+05	8%
16	2.480E-02	6.740E-02	7.262E+05	4%	6.312E+05	6%
17	9.120E-03	2.480E-02	9.012E+05	4%	6.912E+05	6%
18	2.950E-03	9.120E-03	5.889E+05	4%	8.188E+05	5%
19	9.610E-04	2.950E-03	5.707E+05	5%	8.312E+05	5%
20	3.540E-04	9.610E-04	5.274E+05	6%	8.665E+05	5%
21	1.660E-04	3.540E-04	3.920E+05	7%	7.001E+05	5%
22	4.810E-05	1.660E-04	5.619E+05	5%	1.067E+06	4%
23	1.600E-05	4.810E-05	4.688E+05	5%	1.142E+06	4%
24	4.000E-06	1.600E-05	5.921E+05	6%	1.376E+06	4%
25	1.500E-06	4.000E-06	3.751E+05	7%	9.272E+05	5%
26	5.500E-07	1.500E-06	3.900E+05	8%	1.002E+06	5%
27	7.090E-08	5.500E-07	5.234E+06	1%	4.387E+06	2%
28	1.000E-11	7.090E-08	1.295E+07	1%	7.236E+06	2%
29	0.000E+00	1.000E-11	0.000E+00	0%	0.000E+00	0%
Total	--	--	2.768E+07	1%	2.331E+07	2%

Table 9-3
MAGNASTOR – Gamma Surface Currents at the WCS CISF

Group	E Lower [MeV]	E Upper [MeV]	Surface Current [/sec]			
			Radial		Top Axial	
1	1.20E+01	1.40E+01	0.00OE+00	0%	0.00OE+00	0%
2	1.00E+01	1.20E+01	5.619E+04	38%	3.280E+03	52%
3	8.00E+00	1.00E+01	1.421E+06	9%	1.778E+05	12%
4	6.50E+00	8.00E+00	1.196E+07	3%	1.289E+06	5%
5	5.00E+00	6.50E+00	1.181E+07	3%	7.945E+05	6%
6	4.00E+00	5.00E+00	1.288E+07	3%	8.856E+05	6%
7	3.00E+00	4.00E+00	1.773E+07	18%	1.125E+06	5%
8	2.50E+00	3.00E+00	1.413E+07	25%	4.934E+05	6%
9	2.00E+00	2.50E+00	4.897E+08	11%	3.386E+06	47%
10	1.66E+00	2.00E+00	3.454E+08	10%	3.371E+06	42%
11	1.44E+00	1.66E+00	3.242E+08	7%	3.760E+06	45%
12	1.22E+00	1.44E+00	8.864E+08	4%	5.968E+07	6%
13	1.00E+00	1.22E+00	1.247E+09	3%	1.389E+08	6%
14	8.00E-01	1.00E+00	1.569E+09	5%	2.879E+08	6%
15	6.00E-01	8.00E-01	2.228E+09	4%	7.754E+08	14%
16	4 .00E-01	6.00E-01	3.570E+09	3%	2 .048E+09	6%
17	3.00E-01	4.00E-01	2.401E+09	4%	1.969E+09	7%
18	2.00E-01	3.00E-01	3.088E+09	4%	2.497E+09	3%
19	1.00E-01	2.00E-01	6.673E+09	6%	3.654E+09	2%
20	5.00E-02	1.00E-01	3.061E+09	6%	1.996E+09	2%
21	2.00E-02	5.00E-02	6.157E+07	14%	5.504E+07	4%
22	1.00E-02	2.00E-02	7.970E+05	76%	4 .914E+05	33%
23	0.00E+00	1.00E-02	8.176E+05	29%	9.911E+04	80%
Total	--	--	2.602E+10	2%	1.350E+10	3%

Table 9-4
Shielding Evaluations for the Storage Systems at the WCS CISF

Cask System	Canister	Overpack	Appendix
NUHOMS®-MP187 Cask System	FO-DSC	HSM (Model 80)	Appendix A.9
	FC-DSC		
	FF-DSC		
Standardized Advanced NUHOMS® System	NUHOMS® 24PT1	AHSM	Appendix B.9
Standardized NUHOMS® System	NUHOMS® 61BT	HSM Model 102	Appendix C.9
	NUHOMS® 61BTH Type 1		Appendix D.9
NAC-MPC	Yankee Class	VCC	Appendix E.9
	Connecticut Yankee	VCC	
	LACBWR	VCC	
NAC-UMS	Classes 1 thru 5	VCC	Appendix F.9
MAGNASTOR	TSC1 thru TSC4	CC1 thru CC4	Appendix G.9

Table 9-5
Dose Rates at Protected Area Fence Around the WCS CISF

	Coordinates (ft)		Dose Rate (mrem/hr)						
Detector	**Easting**	**Northing**	**Gamma**	**Neutron**	**(n,γ)**	**Total**	**σ**	**Direct**	**Skyshine**
Protected Area Fence									
D1	562321.81	6878484.76	4.64E-01	3.98E-02	1.85E-03	5.06E-01	1%	1.38E-01	3.68E-01
D2	562485.67	6878849.66	1.61E-01	1.36E-02	7.76E-04	1.76E-01	2%	3.76E-02	1.38E-01
D3	562649.54	6879214.55	5.17E-02	3.59E-03	2.67E-04	5.56E-02	4%	9.20E-03	4.64E-02
D4	562813.40	6879579.45	1.46E-02	1.09E-03	1.21E-04	1.58E-02	2%	2.61E-03	1.32E-02
D5	562989.56	6879971.71	4.65E-03	3.04E-04	4.64E-05	5.00E-03	5%	7.48E-04	4.25E-03
D6	563655.49	6879672.66	6.12E-03	4.44E-04	6.79E-05	6.63E-03	3%	9.24E-04	5.70E-03
D7	564066.00	6879488.31	5.42E-03	3.51E-04	5.31E-05	5.83E-03	2%	9.19E-04	4.91E-03
D8	564476.50	6879303.96	3.96E-03	2.10E-04	4.12E-05	4.21E-03	3%	6.97E-04	3.51E-03
D9	565142.44	6879004.91	1.22E-03	6.08E-05	1.82E-05	1.30E-03	2%	2.17E-04	1.08E-03
D10	564966.28	6878612.65	2.95E-03	2.02E-04	3.14E-05	3.19E-03	5%	4.76E-04	2.71E-03
D11	564802.42	6878247.75	6.14E-03	3.66E-04	4.77E-05	6.55E-03	4%	9.52E-04	5.60E-03
D12	564638.55	6877882.85	9.26E-03	6.49E-04	8.67E-05	1.00E-02	2%	1.45E-03	8.54E-03
D13	564474.69	6877517.96	1.07E-02	9.00E-04	9.19E-05	1.17E-02	2%	1.12E-03	1.06E-02
D14	563481.03	6877087.22	8.38E-02	6.73E-03	4.29E-04	9.09E-02	2%	7.90E-03	8.30E-02
D15	563070.52	6877271.57	2.49E-01	2.28E-02	1.34E-03	2.73E-01	1%	1.17E-02	2.62E-01
D16	562660.01	6877455.92	4.23E-01	4.00E-02	2.26E-03	4.65E-01	1%	2.67E-02	4.38E-01

1. Detector locations shown on Figure 9-1.

2. Total = Direct + Skyshine.

Table 9-6
Dose Rates Around Facility and Security Barrier

	Coordinates (ft)		Dose Rate (mrem/hr)						
Detector	**Easting**	**Northing**	**Gamma**	**Neutron**	**(n,γ)**	**Total**	**σ**	**Direct**	**Skyshine**
Locations Around Facility									
P-001	560770.85	6878102.44	2.85E-03	2.05E-04	3.94E-05	3.09E-03	3%	4.49E-04	2.65E-03
P-002	561762.03	6877972.59	8.79E-02	6.32E-03	4.97E-04	9.48E-02	3%	1.66E-02	7.82E-02
P-003	562193.28	6878120.44	6.29E-01	4.87E-02	2.32E-03	6.80E-01	1%	1.98E-01	4.82E-01
P-004	562816.16	6877498.49	6.43E-01	5.70E-02	3.28E-03	7.03E-01	1%	4.92E-02	6.54E-01
P-005	563088.75	6877495.24	7.12E-01	6.62E-02	3.36E-03	7.82E-01	1%	6.28E-02	7.19E-01
P-006	563039.04	6877384.55	4.17E-01	4.05E-02	2.05E-03	4.60E-01	1%	2.58E-02	4.34E-01
P-007	562618.87	6876671.78	2.27E-02	2.00E-03	1.85E-04	2.48E-02	2%	9.45E-04	2.39E-02
P-008	562452.84	6877970.98	2.66E+00	2.04E-01	1.15E-02	2.88E+00	1%	1.03E+00	1.85E+00
Security Barrier									
DSB-01	562386.26	6878066.83	2.68E+00	1.59E-01	7.27E-03	2.85E+00	2%	1.24E+00	1.60E+00
DSB-02	562580.56	6877804.00	1.64E+00	1.71E-01	9.80E-03	1.83E+00	1%	2.82E-01	1.54E+00
DSB-03	562465.86	6877548.58	3.82E-01	4.27E-02	2.08E-03	4.27E-01	2%	2.51E-02	4.02E-01
DSB-04	562805.88	6878305.73	4.54E+00	2.82E-01	1.05E-02	4.84E+00	1%	2.25E+00	2.59E+00
DSB-05	562740.16	6877732.33	1.77E+00	1.70E-01	1.06E-02	1.95E+00	1%	3.22E-01	1.63E+00
DSB-06	562625.45	6877476.91	4.46E-01	4.22E-02	2.34E-03	4.91E-01	3%	2.71E-02	4.64E-01
DSB-07	562965.47	6878234.06	5.06E+00	2.82E-01	1.19E-02	5.35E+00	1%	2.45E+00	2.90E+00
DSB-08	563083.74	6877578.04	1.13E+00	1.11E-01	5.56E-03	1.25E+00	2%	1.60E-01	1.09E+00
DSB-09	562969.03	6877322.61	3.14E-01	2.85E-02	1.57E-03	3.44E-01	2%	1.71E-02	3.27E-01
DSB-10	563309.05	6878079.77	2.95E+00	1.77E-01	7.12E-03	3.14E+00	1%	1.27E+00	1.87E+00

1. Detector locations shown on Figure 9-2.
2. Total = Direct + Skyshine.

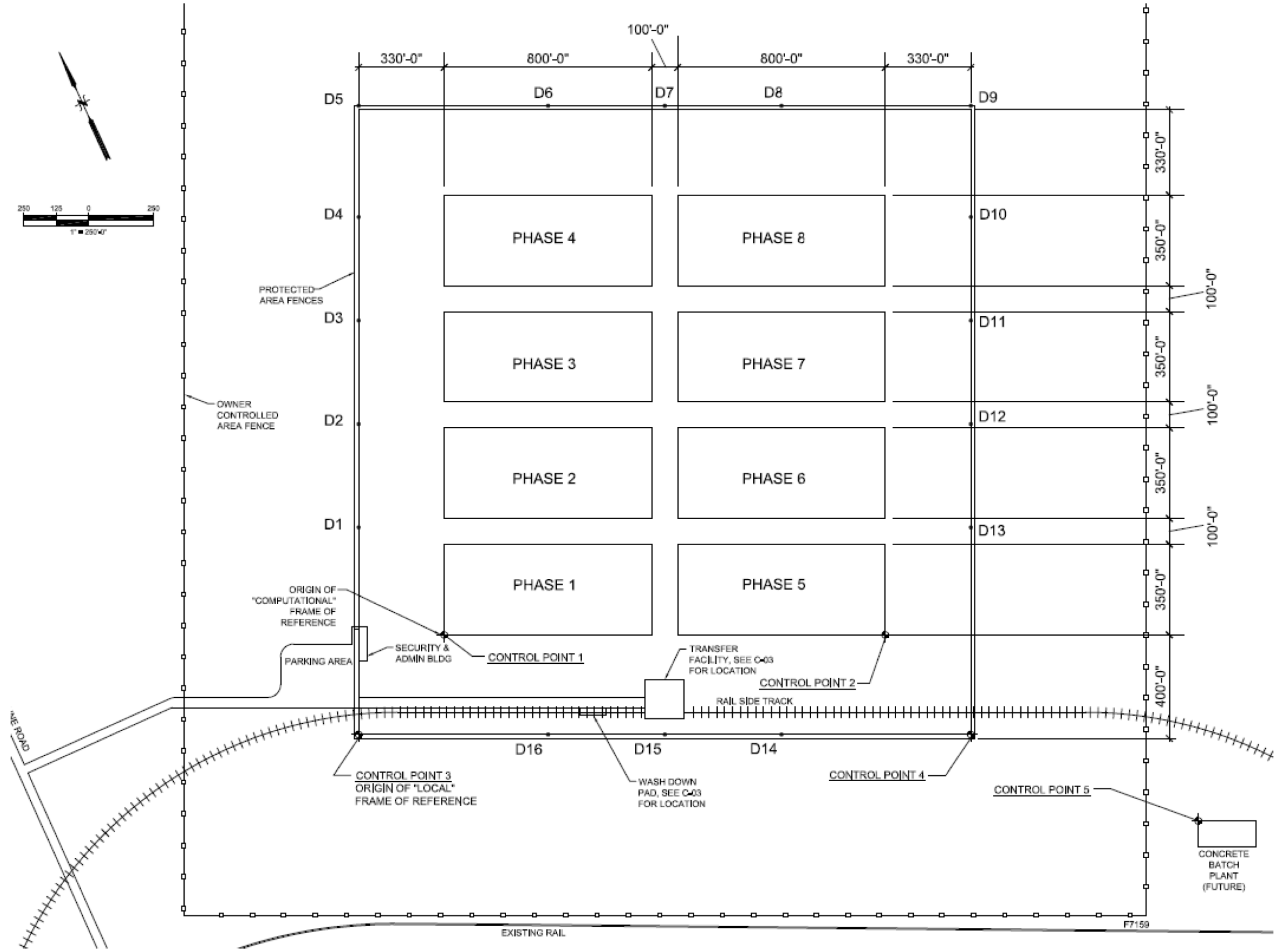

Figure 9-1
WCS CISF Conceptual Plan, Phases 1 through 8

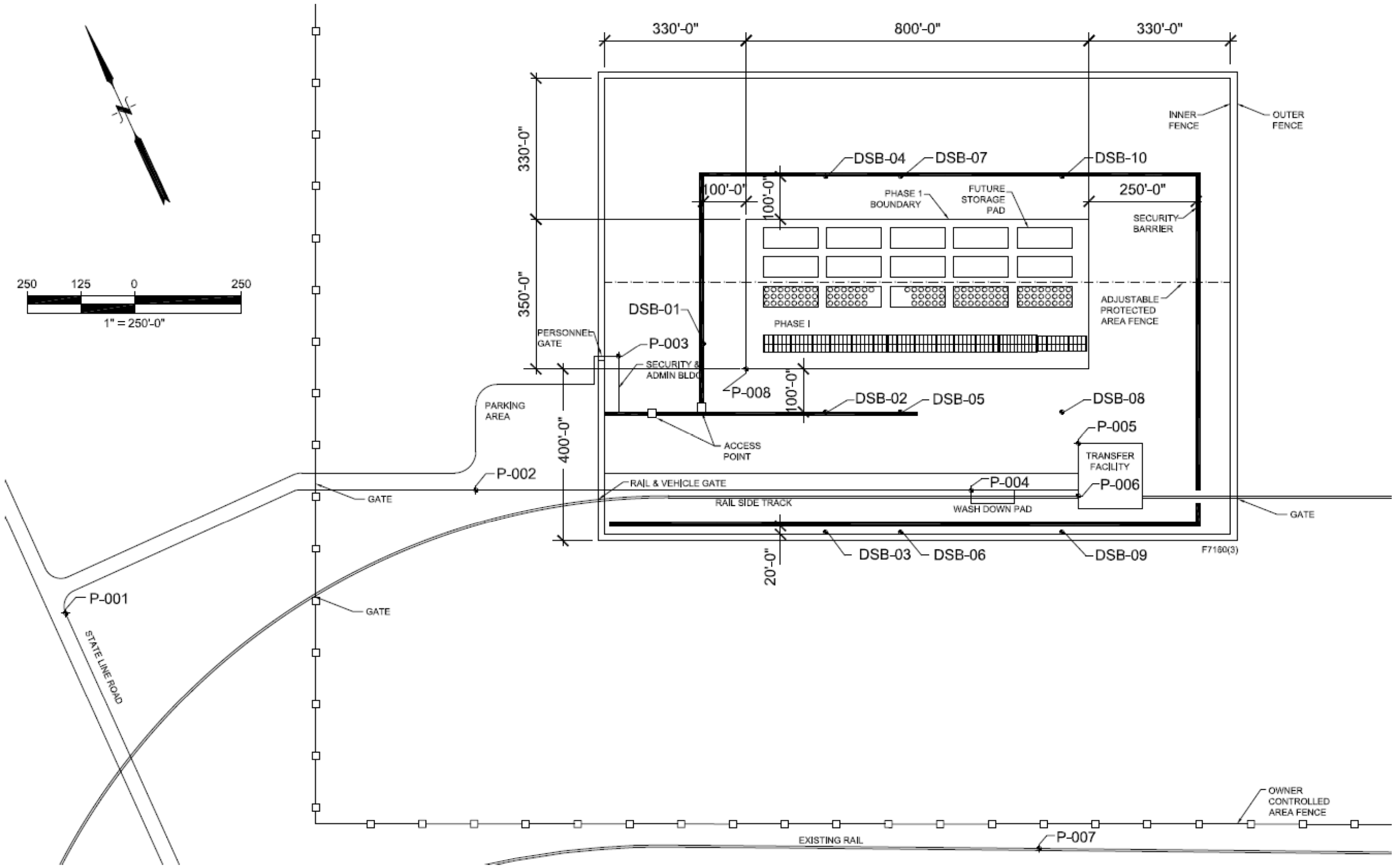

Figure 9-2
WCS CISF Plan, Phase 1

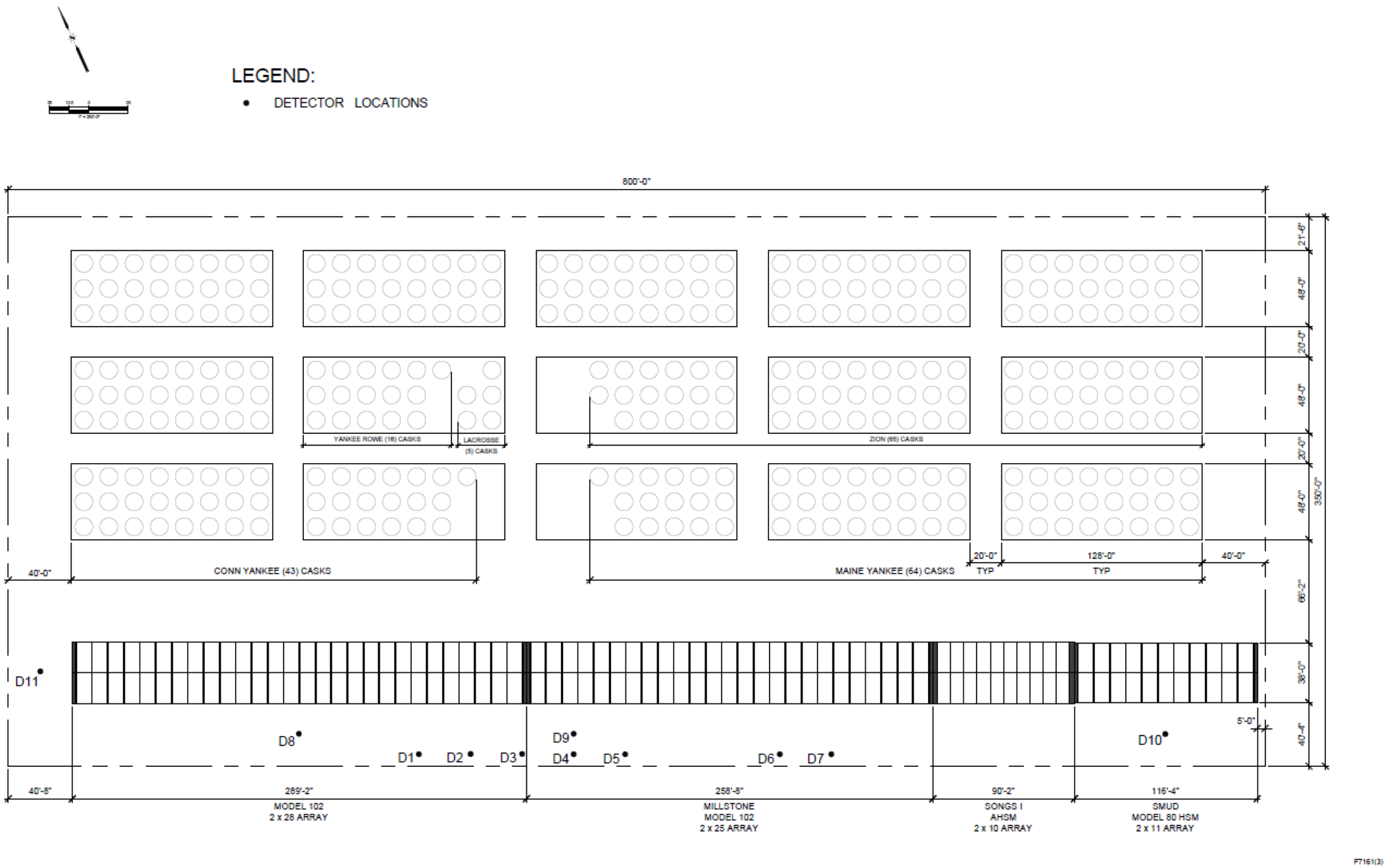

Figure 9-3
WCS CISF Storage Area Layout

CHAPTER 10
CRITICALITY EVALUATION

Table of Contents

List of Tables

10. CRITICALITY EVALUATION

Storage and transportation cask systems received at the Waste Control Specialists, LLC (WCS) Consolidated Interim Storage Facility (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. This chapter presents criticality safety criteria and summarizes design features which ensure criticality safety at the WCS CISF. The design of the canisters is such that, under all credible conditions, the highest effective neutron multiplication factor (k_{eff}) remains less than 0.95.

10.1 Criticality Design Criteria and Features

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

10.1.1 Criteria

As specified in the Technical Specifications [10-1] only canisters that were loaded and stored in accordance with the listed Site Specific or General Licenses are acceptable for storage at the WCS CISF. Criticality safety is demonstrated for all authorized storage systems in the original Site Specific and General License licensing documents. The criticality safety criterion is satisfied for all systems. Criticality safety evaluations further assume limiting spent nuclear fuel (SNF) characteristics, which are stipulated in the Technical Specifications associated with the applicable Site Specific or General License. Criticality evaluations are not required for canisters loaded with Greater Than Class C (GTCC) waste because they contain less than 15 grams of fissile material.

10.1.2 Features

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

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

Package confinement systems are likewise protected from damage. Canister cavity confinement features provide a defense-in-depth criticality control function by precluding the risk that any hydrogenous neutron moderator will be introduced into the SNF basket cavity of any package received for storage. Canister confinement features are summarized in Chapter 11. All of the canisters and associate storage overpacks have been evaluated for a 50-foot flood. The evaluations demonstrate that there is no breach of the containment boundary (well beyond water tight) as discussed in Chapters 11, A.11, B.11, C.11, D.11, E.11, F.11 and G.11. In addition, the maximum postulated flood at the WCS CISF is 1.7 inches as documented in Section 2.4.2.2. Therefore, there is no possibility of water ingress into the canisters.

10.2 Stored Material Specifications

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

10.3 Criticality Assessment

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

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

10.4 Criticality Analysis

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

10.5 References

10-1 Proposed SNM-1050, WCS Interim Storage Facility Technical Specifications, Amendment 0.

Table 10-1
Criticality Evaluations of Storage Systems at the WCS CISF

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

CHAPTER 11
CONFINEMENT EVALUATION

Table of Contents

List of Tables

11. CONFINEMENT EVALUATION

Storage and transportation cask systems received at the Waste Control Specialists, LLC (WCS) Consolidated Interim Storage Facility (CISF) are designed to ensure confinement of stored materials under normal, off-normal, and accident conditions during all operations, transfers, and storage. This chapter summarizes the system design features that ensure radiological releases are within limits and will remain As Low As Reasonably Achievable (ALARA), and that spent nuclear fuel (SNF) cladding and SNF assemblies are protected from degradation during storage.

11.1 Confinement Design Characteristics

As specified in the Technical Specifications [11-1] only canisters that were loaded and stored in accordance with the listed Site Specific and General Licenses are acceptable for storage at the WCS CISF.

Table 11-1 provides the cross reference to the applicable appendix and section for each canister/storage overpack where the confinement is discussed.

In general, all of the canisters to be stored at the WCS CISF are designed to be leak tight under all normal, off-normal, and accident conditions. Therefore, the confinement of the SNF or GTCC waste is maintained under all conditions. The only exceptions to this are the FO-, FC-, FF- Dry Shielded Canisters (DSCs or canisters) that were leak tested to a leakage rate of 10^{-5} std·cm^3/sec. The confinement evaluation for these canisters are presented in Appendix A.11.

11.2 Confinement Monitoring

No confinement monitoring is required for any of the canisters to be stored at the WCS CISF because all canisters include welded closures.

11.3 Potential Release Source Term

Only canisterized SNF and canisterized GTCC waste are authorized for shipment to and storage at the WCS CISF. No repackaging of individual SNF assemblies is performed at the WCS CISF. As stated above, in general, all of the canisters to be stored at the WCS CISF are designed and tested to be leak tight under all normal, off-normal, and accident conditions. Therefore, the confinement of the SNF is maintained under all conditions. The only exceptions to this are the FO-, FC-, FF-DSCs that were only leak tested to a leakage rate of 10^{-5} std·cm^3/sec. The potential release source terms for these canisters are presented in Section A.11.3.

11.4 Confinement Analysis

The confinement analysis for each authorized storage system is provided in appendices for this chapter. Table 11-1 provides the cross reference to the applicable appendix and section for each canister/storage overpack where the confinement is presented.

11.5 Protection of Stored Materials from Degradation

The canister materials for the authorized design were selected such that degradation is not expected during the storage period.

As described in Section 7.2, it is required that packages received at the WCS CISF are loaded in accordance with SAR and regulatory requirements applicable at the site where the SNF was originally loaded and stored. To provide assurance that the packages received at the WCS CISF are acceptable for storage, prior to receipt of a canister, a records review is performed to verify that the canister being received was fabricated, loaded, stored and maintained in accordance with the Site Specific or General License requirements prior to shipment. In addition, the receipt inspection of the canisters upon arrival at the WCS CISF is to be in accordance with reference [11-2].

In addition, the License Condition 20 requires that the CoC 1004 aging management program (AMP) be incorporated in this WCS CISF license for the NUHOMS® Systems upon approval by the NRC. Similarly, License Condition 20 requires that as the AMPs for the NAC International systems are approved by the NRC, these also are incorporated into this WCS CISF license. The AMPs are applied based on the age of the canister when it was originally loaded under the applicable Site Specific or General License at the site of origin.

Fuel cladding integrity is ensured by maintaining the storage cladding temperatures below levels that are known to cause degradation of the cladding. In addition, the SNF is stored in an inert helium atmosphere to prevent degradation of the cladding, specifically cladding rupture due to oxidation and its resulting volumetric expansion of the SNF.

There is no significant degradation of any safety components caused by the effects of galvanic or chemical reactions or by the effects of the reactions combined with the effects of long-term exposure of the materials to neutron or gamma radiation, high temperatures or other possible conditions.

11.6 References

11-1 Proposed SNM-1050, WCS Interim Storage Facility Technical Specifications, Amendment 0.

11-2 "Post Transport Package Evaluation," QP-10.02, Revision 0.

Table 11-1
Confinement Evaluations for Authorized Storage Systems at the WCS CISF

Cask System	Canister	Overpack	Appendix
NUHOMS® MP187-Cask System	FO-DSC	HSM (Model 80)	Appendix A.11
	FC-DSC		
	FF-DSC		
Standardized Advanced NUHOMS® System	NUHOMS® 24PT1	AHSM	Appendix B.11
Standardized NUHOMS® System	NUHOMS® 61BT	HSM Model 102	Appendix C.11
	NUHOMS® 61BTH Type 1		Appendix D.11
NAC-MPC	Yankee Class	VCC	Appendix E.11
	Connecticut Yankee	VCC	
	LACBWR	VCC	
NAC-UMS	Classes 1 thru 5	VCC	Appendix F.11
MAGNASTOR	TSC1 thru TSC4	CC1 thru CC4	Appendix G.11

CHAPTER 12
ACCIDENT ANALYSIS

Table of Contents

List of Tables

12. ACCIDENT ANALYSIS

The purpose of this chapter is to present the engineering analyses performed to qualify the storage and transportation systems received at the Waste Control Specialists, LLC (WCS) Consolidated Interim Storage Facility (CISF) for off-normal operating conditions and for a range of credible and hypothetical accidents conditions. In accordance with NRC Regulatory Guide 3.48 [12-1], the design events identified by ANSI/ANS 57.9-1984, [12-2] form the basis for the accident analyses performed for the WCS CISF storage and transportation systems. Off-normal events are addressed in Section 12.1 and postulated accident events are addressed in Section 12.2. These events provide a means of establishing that the WCS CISF system designs satisfy the applicable operational and safety acceptance criteria.

12.1 Off-Normal Events

Off-normal operations are design events of the second type (Design Event II) as defined in ANSI/ANS 57.9 [12-2]. Off-normal conditions consist of that set of events that, although not occurring regularly, can be expected to occur with moderate frequency or approximately once during a calendar year of WCS CISF operation.

For an operating NUHOMS® systems used at the WCS CISF, off-normal events could occur during cask handling, transfer vehicle moving, canister transfer and other operational events. Two off-normal events are defined which bound the range of off-normal conditions. In some cases, release of radionuclides are also evaluated, however this is not a limiting condition. The limiting off-normal events are defined as a jammed canister during loading or unloading from the HSM, and the extreme ambient temperatures of 30.1°F (winter) and +94.6°F (summer) and shown in Table 1-2. These events envelope the range of expected off-normal structural loads and temperatures acting on the canister, transfer cask, and HSM.

The off-normal conditions considered for the NAC system components at the WCS CISF are as follows:

- Blockage of half the storage cask air inlets
- Canister off-normal handling load
- Failure of instrumentation
- Severe environmental conditions (100°F and -40°)
- Small Release of Radioactive Particulate from the Canister Exterior

The MAGNASTOR System also considers the following:

- Crane Failure during Loaded Transfer Cask Movements
- Crane/Hoist Failure during TSC Transfer to VCC

Table 12-1 points to the appropriate Appendix for each authorized canister/cask system listed in the Technical Specifications [12-3] for the thermal-hydraulic, structural, and radiological analyses associated with these events.

12.2 Accidents

The design basis accident events specified by ANSI/ANS 57.9-1984, and other credible accidents postulated to affect the normal safe operation of the WCS CISF are described in this section. Analyses are provided for a range of hypothetical accidents, including those with the potential to result in an total effective dose equivalent of greater than 5 Rem outside the owner controlled area or or the sum of the deep-dose equivalent specified in 10 CFR 72.106.

Table 12-1 points to the appropriate Appendix for each authorized canister/cask system listed in the Technical Specifications [12-3] where each accident condition is analyzed to demonstrate that the requirements of 10 CFR 72.122 are met and that adequate safety margins exist for the WCS CISF system design. Radiological calculations are provided to confirm that on-site and off-site dose rates are within acceptable limits. The resulting accident condition stresses in the WCS CISF system components are evaluated, and compared with the applicable code limits. Where appropriate, the accident condition stresses are combined with those of normal operating loads in accordance with the load combination definitions. Load combination results for the WCS CISF and the evaluation for fatigue effects are also presented.

The postulated accident conditions addressed, as applicable to each system, in the Appendices are:

- Blockage of Air Inlets/Outlets
- Drop Accidents
- Earthquakes
- Lightning
- Fire/Explosion
- Flood
- Tornado Wind and Missiles
- Tip Over/ Overturning

12.2.1 Canister Transfer System Fire Accident

In the unlikely event of a fire inside the Cask Handling Building during canister (TSC) transfer operations of the Canister Transfer System (CTS), there is the potential that either the vertical cask transporter (VCT) or the CTS will be in proximity with the loaded TSC. There are no other combustible or flammable materials within the transfer area and as such only fuel supporting the operation of the VCT or CTS can contribute to this postulated fire accident. Three conditions are considered:

a. Loaded Transport Cask positioned in the VCT

b. CTS Operations with a Loaded Transfer Cask

c. Loaded Storage Cask positioned in the VCT

[ ]

12.2.1.1 Cause of Fire

[ ]

12.2.1.2 Detection of Fire

A fire in the vicinity of the CTS will be detected by observation of the fire or smoke.

12.2.1.3 Analysis of Fire

12.2.1.4 Corrective Actions

Immediately upon detection of the fire, appropriate actions should be taken by site personnel to extinguish the fire. The exterior surfaces of the cask should then be visually inspected for general deterioration (i.e. damaged concrete, loss of shielding, or surface discoloration that may indicate damage) could affect cask performance. This inspection will be the basis for the determination if any repair activities are necessary to maintain or return the cask to its design basis configuration.

12.2.1.5 Radiological Impact

There are no significant radiological consequences for this accident. There may be local spalling of concrete or reduction of neutron shield properties during the fire event, which could lead to some minor reduction in shielding effectiveness and an insignificant increase in radiation dose rates on the cask surface.

12.3 References

12-1 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.

12-2 American National Standards Institute, American Nuclear Society, ANSI/ANS 57.9 1984, Design Criteria for an Independent Spent Fuel Storage Installation (Dry Storage Type).

12-3 Proposed SNM-1050, WCS Interim Storage Facility Technical Specifications, Amendment 0.

Table 12-1
Off-Normal and Accident Evaluations for the Storage Systems at the WCS CISF

Cask System	Canister	Overpack	Appendix
NUHOMS®-MP187-Cask System	FO-DSC	HSM (Model 80)	Appendix A.12
	FC-DSC		
	FF-DSC		
Standardized Advanced NUHOMS® System	NUHOMS® 24PT1	AHSM	Appendix B.12
Standardized NUHOMS® System	NUHOMS® 61BT	HSM Model 102	Appendix C.12
	NUHOMS® 61BTH Type 1		Appendix D.12
NAC-MPC	Yankee Class	VCC	Appendix E.12
	Connecticut Yankee	VCC	
	LACBWR	VCC	
NAC-UMS	Classes 1 thru 5	VCC	Appendix F.12
MAGNASTOR	TSC1 thru TSC4	CC1 thru CC4	Appendix G.12

CHAPTER 13
CONDUCT OF OPERATIONS

Table of Contents

List of Figures

13. CONDUCT OF OPERATIONS

This chapter discusses the organization for the design, fabrication, construction, testing, operation, modification and decommissioning of the Waste Control Specialists LLC (WCS) Consolidated Interim Storage Facility (CISF). Included are descriptions of organizational structure, personnel responsibilities and qualifications, interface with contractors and other outside organizations.

Programs for WCS, such as radiation safety, environmental monitoring, emergency response, QA and training, will be adopted as necessary to ensure the safe operation and maintenance of the WCS CISF under 10 CFR Part 72. WCS has included in the WCS CISF license application the following proposed plans that support the conduct of WCS CISF Operations:

- Quality Assurance (QA) Plan,
- Training Plan,
- Radiation Safety, Environmental Monitoring and Occupational Safety
- Physical Security Plan,
- Safeguards Contingency Plan,
- Physical Security Plan,
- Security Training and Qualification Plan, and
- Emergency Response Plan.

10 CFR 72.48 reviews will be conducted to ensure continued compliance with WCS CISF 10 CFR Part 72 license requirements. This process will result in compliant programs that implement the 10 CFR Part 72 license requirements. WCS will maintain the appropriate administrative and managerial controls.

The development of the WCS CISF was managed by Waste Control Specialists LLC with support from AREVA Inc. (AREVA) and NAC International. Final responsibility for construction, preoperational testing, startup and operation of the WCS CISF remains with WCS. Therefore, WCS' organization and its interfaces with outside support organizations are described herein.

13.1 Organizational Structure

Contran is a holding company that owns stakes of varying sizes in subsidiaries, including the largest, Valhi, Inc. (a publicly traded company about 93% controlled by Contran). Primarily through Valhi, the company has stakes in diversified operations in chemicals; waste management (Waste Control Specialists); computer support systems, precision ball bearing slides and security products.

Valhi, operating through subsidiaries, includes companies manufacturing ergonomic computer support systems and office security products, titanium metal products for the aerospace and other markets and Waste Control Specialists - operator of hazardous-waste treatment facilities in Texas.

Waste Control Specialists LLC (WCS) operates West Texas facilities for the processing, treatment, storage and disposal of a range of low-level radioactive, hazardous, toxic and other wastes. The West Texas site includes a Resource Conservation and Recovery Act (RCRA) Subtitle C landfill for the disposal of hazardous and low-activity radiological wastes, a byproduct disposal facility and an LLRW disposal facility licensed to accept waste from nuclear power plants and federal generators such as the Department of Energy (DOE). WCS is one of only three private companies in the United States licensed to dispose of LLRW waste.

The WCS organization at the time of filing of the license application consists of WCS corporate personnel, WCS CISF personnel, as well as contracted support for engineering, design and operations, public affairs and other necessary expertise.

WCS established contracted support in several functional work areas to manage and accomplish needed tasks to prepare this license application and associated reports. WCS will name additional position titles and hire additional employees as the project moves from the pre-licensing phase to the licensing and construction phase, and subsequently, into the operational phase.

Prior to commencing construction of the WCS CISF, WCS will enter into a contract with the DOE that will provide the funding for facility construction, operation, and decommissioning, including any fees paid to hosting public entities. It is anticipated that the DOE will be the sole customer for the WCS CISF and will have title to the spent nuclear fuel (SNF) and Greater Than Class C (GTCC) waste stored at the facility. (Note, in the balance of this chapter, where ever SNF is mentioned, this included both SNF and GTCC wastes.) DOE will obtain adequate funding for this contract from the Nuclear Waste Fund, as authorized by Congress. This funding will demonstrate the necessary financial capabilities for construction, operation, and decommissioning of the WCS CISF.

13.1.1 Corporate Organization

The WCS Chief Executive Officer (CEO)/President, is the executive in charge of WCS, managing all WCS functional areas to include those actions necessary to comply with the applicable requirements of 10 CFR Part 72 Subpart G and 10 CFR Part 71 Subpart H.

The WCS CEO/President establishes the basic policies of the WCS QA Program. The WCS CEO/President is the highest level of management responsible for the WCS policies, goals, and objectives. Those reporting to the WCS CEO/President who have quality affecting responsibilities are the Vice President (VP) Licensing and Regulatory Affairs, Senior (Sr.) VP/General Manager (Sr. VP/GM) and Director of Quality Assurance (DQA).

The VP Licensing and Regulatory Affairs is responsible for the facility's license and has the authority and reporting responsibility as Responsible Officer associated with 10 CFR Part 21.

The Sr. VP/GM is responsible for the overall operation and administration of the facility.

13.1.1.1 Corporate Functions, Responsibilities, and Authorities

The WCS CEO/President establishes the basic policies of WCS. The WCS CEO/President is the highest level of management and holds the following responsibilities:

- Developing WCS policies, goals, and objectives
- Performing the long-range planning necessary to ensure stable resources for the operation of the facility
- Ensuring appropriate financial stability is maintained on an operating basis
- Ensuring decommissioning is properly funded
- Ensuring decommissioning funding remains current by means of annual decommissioning funding reviews
- Ensuring license standards for engineering and design, construction, QA, testing and operation are met through oversight by Corporate Staff, expert consultants reporting directly to the VP Licensing and Regulatory Affairs, and the WCS CISF QA personnel.

The VP Licensing and Regulatory Affairs reports directly to the WCS CEO/President and is responsible for preparation and submittal of the WCS License Application, including the Safety Analysis Report, Environmental Report and Emergency Response Plan; securing inside and/or outside expertise to assist in preparation of the License Application; and development of responses to address requests for additional information from the NRC (pre-licensing phase). Additionally, the VP Licensing and Regulatory Affairs has the authority and reporting responsibility as Responsible Officer associated with 10 CFR Part 21.

The Chief Financial Officer reports directly to the WCS CEO/President and is responsible for managing budgets, payroll, cash flows, and financial security.

The VP Legal Services reports directly to the WCS the Sr. VP/GM and serves as the WCS/CISF liaison with the NRC and other organizations on all legal matters. The WCS CEO/President is responsible for ensuring that the project's legal activities are consistent with the policies established by the WCS CEO/President.

The Director of Engineering reports to the VP Operations and is responsible for all design control and configuration management activities associated with structures, systems and components considered important-to-safety (ITS).

The Director of Logistics and Transportation reports to the Sr. VP Planning and Business Development and is responsible for Field Services & Operations and Fleet Asset Management functions associated with storage / transportation systems and other related activities subject to the requirements of the QAP.

13.1.1.2 Applicant's In-House Organization

Figure 13-1 illustrates the organizational structure of WCS. The Sr. VP/GM reports directly to the WCS CEO/President and is responsible for the overall operation and administration of the facility. The Sr. VP/GM is responsible for ensuring all activities are conducted within the limitations of the facility's license and in compliance with applicable federal and state regulations.

The VP Operations reports to the Sr. VP/GM and is responsible for scheduling of project personnel, WCS CISF work activities, operations, maintenance, project management functions and reporting performance data to the Sr. VP/GM as well as responsibilities over WCS CISF engineering activities.

The DQA reports directly to the WCS CEO/President and has overall responsibility for the implementation of the QA Program. The DQA has the responsibility and authority for developing, maintaining and verifying proper implementation of the QA Program. This responsibility includes setting priorities, objectives and ensuring activities subject to the requirements of the QAPD are performed in accordance with the implementing procedures.

Additional responsibilities assigned to the DQA position include:

- Administering the corrective action program,
- Ensuring QA staff is appropriately qualified,
- Conducting audits, surveillances and inspections to verify activities are conducted in accordance with QAPD requirements
- Initiating corrective action requests when conditions or significant conditions adverse to quality are identified by QA staff
- Periodically reporting to the WCS CEO/President and the Sr. VP/GM on the status and effectiveness of the program

The DQA and the QA organization have:

- Sufficient authority and organizational freedom to identify quality problems, require corrective action be taken and verify corrective action effectiveness
- Sufficient independence from cost and schedule considerations
- The authority to stop unsatisfactory work and prevent its further processing, installation, use or delivery
- Sufficient expertise and training in the field of Nuclear QA enabling them to assess the quality functions in accordance with the applicable regulatory criteria, codes, and standards invoked by the QAP (records will be maintained to document qualifications of the QA personnel where required)

The Radiation Safety Officer (RSO)/Director of Health and Radiation Safety is responsible for ensuring compliance to WCS' Radioactive Materials License(s) along with State and Federal regulations related to radiological safety and therefore reports to the Sr. VP/GM and has a direct line of communication to the WCS CEO/President on matters regarding safety. The RSO/Director of Health and Radiation Safety is responsible for the Radiation Safety Program and (industrial) Health and Safety Program.

The Safety Manager reports to the Radiation Health and Safety Officer (RSO)/Director of Radiation Safety and is responsible for managing the Industrial Health and Safety program to protect employees and the company and maintain safe working conditions. The Safety Manager ensures that all industrial safety programs meet compliance and reporting requirements of federal and state regulations, works with the Radiation Safety Department in promoting the nuclear culture throughout the WCS CISF, and coordinates compliance functions to ensure all safety issues are resolved and that all compliance matters are maintained as prescribed by OSHA.

The Director of Contracts and Administrative Services reports to the Sr. VP/GM and is responsible for records management and quality-related purchasing activities and is responsible for negotiating contracts and issuing procurement documents in support of engineering, fabrication, maintenance, testing and other activities associated with storage / transportation systems and other related activities subject to the requirements of the QAP.

The Training Manager reports to the Sr. VP/GM and is responsible for staff training and improvement initiatives focused on improving performance across the WCS organization.

The Manager of Facility Compliance reports to the VP Licensing and Regulatory Affairs and has the day-to-day responsibility of managing compliance with all WCS CISF licensing requirements.

13.1.1.3 Interrelationships with Contractors and Suppliers

As facility owner and licensee, WCS will retain ultimate responsibility for the safe operation of the facility and for compliance with all license conditions. AREVA is the prime contractor for the design, development, construction, operation, and maintenance of the WCS CISF. As the construction contractor for the WCS CISF, AREVA will provide an acceptable construction quality assurance program (CQAP) to WCS. WCS QA will perform surveillances and/or audits of CQAP required activities throughout construction to verify conformance to quality, technical and regulatory requirements (design bases, specifications, license conditions, etc.).

WCS contractors and suppliers of services or items classified as ITS and quality affecting activities, are pre-approved prior to award according to QA Procedures. As required, audits and/or surveys are conducted to determine supplier approval. These audits/surveys are based on one or all of the following criteria:

- The suppliers' capability to comply with the requirements of 10 CFR Part 71 Subpart H, 10 CFR Part 72 Subpart G, and other regulations, codes or standards that are applicable to the scope of work to be performed.
- A review of previous records to establish the past performance history of the supplier.
- A survey of the suppliers' facilities and review of the supplier's QA Program to assess the adequacy and verify implementation of quality controls consistent with the requirements being invoked.

WCS control of contractors and suppliers is established before award or purchase by use of WCS or sub-tier procurement documents, which specify applicable technical, regulatory, administrative, quality, and reporting requirements. WCS procurement documents require suppliers to pass on appropriate QA program requirements to sub-tier suppliers.

At the proper time, WCS operations management will hire or appoint an individual to fill the role of Construction Manager. During construction of the WCS CISF, the Construction Manager will oversee the installation in accordance with QA requirements. The Construction Manager will perform the oversight role on a daily basis. The Construction Manager will report to the Director of Engineering who in turn reports to the VP Operations. WCS will: 1) perform independent audits of the WCS CISF operations contractor's QA Program (both the achievement of quality by the WCS CISF contractor management and the verification of quality by WCS CISF contractor QA personnel); 2) provide qualified on-site staff to manage and oversee WCS CISF contractor activities; 3) retain the responsibility to budget necessary and sufficient funds to safely operate and maintain the facility, and 4) retain the authority through the establishment of initial WCS CISF contract; provisions, and as necessary through revision of the contract, to correct any deficiencies in the operation of the facility relative to its design and licensing basis.

The on-site WCS organization will be modified as necessary to ensure an appropriate interface with the WCS CISF operating contractor organization to perform the management and oversight functions discussed above.

13.1.1.4 Applicant's Technical Staff

The WCS CISF technical staff includes WCS Andrews County Site and corporate personnel, prime contractor AREVA, sub-contractors and licensing consultants. The staff that supports WCS operations is described below. The functions, responsibilities and authorities of the WCS CISF operations personnel are described in Section 13.1.2.2. The qualifications of the technical staff meet or exceed the requirements specified in Section 13.1.3.

AREVA will provide to WCS information regarding the storage systems and transportation casks necessary to support the licensing, design, construction, operation, and maintenance of the WCS CISF. Designs, calculations, and analyses performed by this vendor or any other vendors will be reviewed and approved by WCS personnel prior to construction. The actual qualifications, training and experience of the WCS and contractor staff providing oversight to the design, construction, and operation of the WCS CISF will be maintained on file to demonstrate compliance with the minimum requirements.

13.1.2 Operating Organization, Management, and Administrative Control System

The following sections describe the WCS CISF and contractor combined organization during the operational phase of the project.

13.1.2.1 On-Site Organization

This section describes the WCS CISF operations organization expected to be in place during receipt, long-term storage and eventual loading for off-site disposal of SNF. The WCS CISF operations organization will be staffed with technical personnel from the existing WCS organization and the prime contractor to perform the functions of WCS CISF specialists and key management as described in Section 13.1.2.2. An estimated 20 full-time security guards will be required to staff the operating WCS CISF. The positions shown are functional and may not correspond to actual titles or positions. Lines of authority, responsibility, and communication will be established and defined for all WCS CISF organization and supporting positions. These relationships will be documented and updated as appropriate, in organization charts, functional descriptions of departmental responsibilities and relationships, and position descriptions for key personnel. This organization will ensure the continued safe operation of the WCS CISF during all normal, off-normal, and accident conditions.

WCS administrative staff common to the adjacent site facilities will be responsible for many of the administrative requirements of the WCS CISF, including the maintenance of records in accordance with conditions of the License. WCS administrative staff will be responsible for the necessary personnel functions, ensuring that adequate business records and services are maintained, and appropriate applicable hiring standards are followed in the selection of WCS staff members. Contractors may maintain their own personnel functions, services and records, periodically transferring custody of operating records to WCS as required.

13.1.2.1.1 Safety Review Committee

The WCS CISF Safety Review Committee is responsible for reviewing and advising the WCS CEO/President on matters relating to the safe storage of SNF.

The Safety Review Committee will be composed of a minimum of a Chairperson and four members. Alternates may be substituted for regular members. The WCS CEO/President will designate, in writing, the members and alternates for this committee. The Sr. VP/GM shall be the Chairperson of the Safety Review Committee.

The Safety Review Committee will collectively have experience and knowledge in the following areas:

- SNF Handling and Storage
- Engineering
- Radiation safety
- Quality Assurance

The Safety Review Committee will meet at least once prior to receipt of SNF for storage at the WCS CISF and at least once prior to transporting the SNF off-site. The Committee will also meet at least once annually and at any time deemed necessary by the WCS CEO/President. A quorum will consist of three regular members or duly appointed alternates. At least one member of the quorum will be the Chairperson or the Chairperson's designated alternate.

The Safety Review Committee will, as a minimum, perform the following functions:

- Advise the WCS CEO/President on matters related to the safe storage of SNF.
- Notify the WCS CEO/President of any safety significant disagreement between the Safety Review Committee and the Sr. VP/GM within 24 hours.

The Safety Review Committee will be responsible for the review of:

- Proposed changes to the WCS CISF Technical Specifications or the License.
- Violations of codes, orders, license requirements, or internal procedures/instructions which are ITS storage of SNF.
- Indications of unanticipated deficiencies in any aspect of design or operation of SSCs that could affect the safe storage of SNF.
- Significant accidental, unplanned, or uncontrolled radioactive releases, including corrective action to prevent recurrence.
- Significant operational abnormalities or deviations from normal and expected performance of equipment that affects the safe storage of SNF.
- The performance of the corrective action system.
- Internal and external experience information related to the safe storage of SNF that may indicate areas for improving facility safety.
- Significant audit findings that affect the safe storage of SNF.

Reports or records of these reviews will be forwarded to the WCS CEO/President within 30 days following completion of the review.

13.1.2.2 Personnel Functions, Responsibilities, and Authorities

All WCS CISF personnel will perform their activities in accordance with the requirements of the WCS CISF license, Technical Specifications, QA Procedures, Security Plans and procedures, WCS CISF procedures, and applicable federal and state regulations.

The Sr. VP/GM reports directly to the WCS CEO/President and is responsible for the safe overall operation and administration of the facility. The Sr. VP/GM is responsible for ensuring all activities are conducted within the limitations of the facility's license and in compliance with applicable federal and state regulations.

The VP Operations reports to the Sr. VP/GM and is responsible for scheduling of project personnel, WCS CISF work activities, operations, maintenance, project management functions and reporting performance data to the Sr. VP/GM as well as responsibilities over WCS CISF engineering activities.

The WCS CISF Director of Operations will report directly to the VP Operations, and will be responsible for the safe operation of the WCS CISF including maintenance of personnel training and qualifications in accordance with the WCS CISF Operations Training Program and operation of WCS CISF equipment that is ITS. The WCS CISF Director of Operations will be responsible for the day-to-day operation of the WCS CISF and will provide direction and guidance for the safe operation, maintenance, radiation safety, training and qualification of the WCS CISF and personnel. In order to ensure continuity of operation and organizational responsiveness to off-normal situations, a formal order of succession and delegation of authority will be established. The WCS CISF Director of Operations will designate in writing personnel who are qualified to act as the WCS CISF Director of Operations during an absence.

The Director of Engineering reports to the VP Operations and is responsible for all design control and configuration management activities associated with structures, systems and components considered ITS.

The DQA has the responsibility and authority for developing, maintaining and verifying proper implementation of the QA Program. Each organization within WCS is responsible for implementation of the program for their respective scope of responsibility. The DQA reports to the WCS CEO/President and has overall responsibility for the implementation of the QA Program. This responsibility includes setting priorities, objectives and ensuring activities subject to the requirements of the QAPD are performed in accordance with the implementing procedures. The DQA is independent of cost and schedule considerations and has direct access to the WCS CEO/President.

The RSO/Director of Health and Radiation Safety is responsible for ensuring compliance to WCS' Radioactive Materials License(s) along with State and Federal regulations related to radiological safety and therefore reports to the Sr. VP/GM and has a direct line of communication to the WCS CEO/President on matters regarding safety. The RSO/Director of Health and Radiation Safety is responsible for the Radiation Safety Program and (industrial) Safety Program.

The Radiation Safety Supervisor reports to the RSO/Director of Health and Radiation Safety and is responsible for ensuring implementation of the Radiation Safety Program at the WCS CISF. These duties include the training of personnel in the use of equipment, control of radiation exposure of personnel and continuous determination of the radiological status of the facility.

The Facility Security Officer/Security Manager reports to the Sr. VP/GM. The Facility Security Officer/Security Manager and security staff personnel will be responsible for WCS CISF security during routine, emergency and contingency operations.

The Health and Safety Manager reports to the RSO/Director of Health and Radiation Safety and implements WCS CISF Health and Safety programs and procedures. This includes safety training and maintaining the performance of the facility's fire protection systems.

13.1.3 Personnel Qualification Requirement

The Operator Training Program will include requirements regarding the physical condition and general health of personnel certified for the operations of equipment and controls that are important to safety such that they may not cause operational errors that could endanger other in-facility personnel or the public health and safety. Any condition that might cause impaired judgement or motor coordination will be considered in the selection of personnel for activities that are important to safety. However, these conditions will not categorically disqualify a person, if appropriate provisions are made to accommodate such condition.

The minimum qualification requirements for the WCS CISF positions that are ITS during off-loading, transfer, storage, loading and other SNF handling operations at the WCS CISF are outlined below.

13.1.3.1 Minimum Qualification Requirements

The physical condition and general health of personnel certified for the operation of equipment and controls ITS shall not be a potential cause of operational errors that could endanger other in-plant personnel or the public health and safety.

Requirements for these positions include knowledge of SNF handling and storage equipment and processes, criticality safety control, industrial safety and Radiation Safety Program concepts as they apply to the overall safety of a nuclear facility, commensurate to work performed. All off-loading, transfer, loading and other SNF handling operations at the WCS CISF will either be performed by, or supervised by, WCS CISF personnel trained and qualified by the WCS CISF Operations Training Program.

During WCS CISF operations, operation of equipment and controls identified as ITS for the WCS CISF will be limited to personnel who are trained and qualified in accordance with the WCS CISF Operations Training Program, or personnel who are under the direct visual supervision of a person who is trained and qualified in accordance with the WCS CISF Operations Training Program.

The individual qualification requirements for staff provided below are for the minimum levels. However, actual functional resumes will be available once staff is selected during construction in advance of operation under the License.

The WCS CISF Director of Operations reports directly to the VP Operations. The WCS CISF Director of Operation's qualifications include knowledge of radioactive materials handling and storage equipment and processes, criticality safety control, industrial safety and radiation safety program concepts as they apply to the overall safety of a radioactive materials facility. The WCS CISF Director of Operations must have an Associate's Degree or equivalent from a two-year college or technical institute in an engineering or scientific field generally associated with nuclear power production, fuel storage or radiation safety; or sixty hours related study in the field of hazardous waste management, environmental science and/or radiation health and additionally shall have a minimum of 10 years of radioactive materials operations experience, of which a minimum of 5 years shall be experience in management of bulk radioactive materials handling operations or an equivalent combination of training, experience and education. The WCS CISF Director of Operations will be trained and qualified in accordance with the WCS CISF Operations Training Program training and qualification requirements.

The WCS CISF Operations Supervisors report to the WCS CISF Director of Operations and shall have a high school diploma or have successfully completed the GED test and 3-5 years of radioactive materials handling facility experience of which a minimum of 1 year shall be experience in supervising radioactive materials handling operations, or equivalent combination of education and experience. Consistent with the assigned duties, WCS CISF Operations Supervisors will be trained and qualified in accordance with the WCS CISF Operations Training Program training and qualification requirements. In addition, WCS CISF Operations Supervisors are trained in the operation of plant cranes and forklifts.

All personnel that operate cranes at WCS must be certified by the "National Commission for the Certification of Crane Operators" (NCCCO). These crane operators must be certified on each crane they operate and must be designated as a competent person. This certification must be renewed every five years. Fork Lift/Power Industrial Trucks Certification is made according to 29 CFR 1910.178 at WCS with a combination of: formal and practical instruction on operation of Fork Lifts; followed by demonstration of Job Performance Measures (JPMs) for "Safe Forklift Operation/ Powered Industrial Trucks" which must be completed and signed by the student operator and Instructor. Forklift Operation/ Powered Industrial Trucks Refresher Training must be completed every three years.

WCS CISF Operators report to WCS CISF Operations Supervisors and shall have a high school diploma or have successfully completed the GED test. WCS CISF Operators shall have 2 years of radioactive materials facility experience of which a minimum of 1 year shall be radioactive materials handling operations experience. Consistent with the assigned duties, WCS CISF Operators will be trained and qualified in accordance with the WCS CISF Operations Training Program training and qualification requirements and with any vendor training and qualification requirements for the operation of vendor-specific cask/canister handling equipment. In addition, WCS CISF Operators are trained in the operation of forklifts and plant cranes.

The WCS CISF Radiation Safety Supervisors (RSS) report to the RSO/Director of Health and Radiation Safety and shall have an Associate's Degree in Health Physics/Radiation Safety Technology, or Bachelor's degree in Health Physics / Physical Science, or a related technical field, or sixty (60) hours of related study and five (5) years of experience in the field of Health Physics or combination of education and experience at the discretion RSO/Director of Health and Radiation Safety.

The WCS CISF Radiation Safety Technician (RST) report to WCS CISF Radiation Safety Supervisors and shall have an Associate's Degree in Health Physics/Radiation Safety Technology, Physical Science, or a related technical field, or fifty (50) hours of related study and two (2) years of experience in Radiation Safety, Environmental Monitoring, Industrial/Occupational safety, Radiological Instrumentation or combination of education and experience at the discretion of the Radiation Health and Safety Officer (RSO)/Director of Radiation Safety. Qualifications include knowledge of radioactive materials handling and storage equipment and processes, industrial safety and radiation safety concepts as they apply to the overall safety of a radioactive materials facility.

The DQA reports to the WCS CEO/President and shall have at least a Bachelor's degree (or equivalent) in a scientific or engineering field and at least five years of responsible experience in the implementation of a QA program or equivalent combination of education, training and experience. The DQA shall also have at least two years of experience in a management role of a QA organization at a radioactive materials facility.

The Maintenance Manager reports to the Director of Operations and shall have, as a minimum, five years of experience in facility operations and maintenance. Qualified candidates will have an in-depth knowledge of various maintenance operations, utility infrastructure operations, as well as a degree of familiarity with building systems, instrumentation, and configurations.

WCS CISF Maintenance Technicians report to the Maintenance Manager and shall have, as a minimum, two years of experience in facility operations and maintenance. Qualified candidates will have a basic knowledge of various maintenance operations, utility infrastructure operations, as well as a degree of familiarity with building systems, instrumentation, and configurations. As consistent with assigned duties, WCS CISF Maintenance Technicians will be trained and qualified in accordance with the WCS CISF Operations Training. In addition, WCS CISF Maintenance Technicians are trained in the operation of forklifts and plant cranes and they should have a working knowledge of the plant drawing system and the vendor manual system.

Waste Acceptance Specialists report to the Director of Operations and shall have, as a minimum, a Bachelor's degree (or equivalent) in an engineering, physical science or environmental discipline or five (5) years of related waste management work experience; or an equivalent combination of training, experience and education.

The Manager of Facility Compliance reports to the VP Licensing and Regulatory Affairs and shall have, as a minimum, a Bachelor's degree (or equivalent) in an engineering, or scientific field and a minimum of five years of appropriate, responsible experience in implementing and supervising a nuclear licensing and regulatory compliance program.

The Director of Engineering reports directly to the VP Operations. The Director of Engineering qualifications include, as a minimum, a Bachelor's degree in engineering and 10 years of responsible nuclear facility experience providing engineering services and at least three (3) to five (5) years supervising an engineering department. Relevant experience in a highly regulated industry is required. The Director of Engineering shall also be a Registered Professional Engineer in the state designated to host the WCS CISF.

The Health and Safety Manager reports to the RSO/Director of Health and Radiation Safety and shall have, as a minimum, a Bachelor degree in Industrial, Occupational or Radiation Safety or a minimum of 60 hours of related college level study and a minimum of 4 years of experience in the field of Industrial or Occupational Safety or equivalent combination of education, training and experience.

The Facility Security Officer/Security Manager reports to the Sr. VP/GM and shall have a minimum of five years of experience in the responsible management of physical security similar to that required for the WCS CISF. Academic training may not be credited toward fulfilling this experience requirement. In accordance with 10 CFR 73.51(d)(5), members of the WCS security organization will be trained, equipped, qualified and re-qualified to perform assigned job duties in accordance with appendix B to part 73, sections I.A. (1) (a) and (b), B(I)(a), and the applicable portions of II.

The Safeguards Information Coordinator (SGI-C) reports to the Facility Security Officer/Security Manager and shall have experience in safeguards programs and physical security.

Security Shift Supervisors report to the Facility Security Officer/Security Manager and shall have a high school diploma or equivalent and at least three years of applicable experience in physical security. Prior to appointment, the Shift Supervisor shall have satisfied WCS CISF security force training and qualification requirements. In accordance with 10 CFR 73.51(d)(5), members of the WCS security organization will be trained, equipped, qualified and re-qualified to perform assigned job duties in accordance with appendix B to part 73, sections I.A. (1) (a) and (b), B(I)(a), and the applicable portions of II.

Security Officers/Guards report to the Security Shift Supervisors and shall have a High School diploma or GED and two years security experience required. In accordance with 10 CFR 73.51(d)(5), members of the WCS security organization will be trained, equipped, qualified and re-qualified to perform assigned job duties in accordance with appendix B to part 73, sections I.A. (1) (a) and (b), B(I)(a), and the applicable portions of II.

13.1.3.2 Qualification of Personnel

The qualifications, training and experience of the WCS CISF operating contractor staff occupying the key positions described in Section 13.1.2.2 will be kept on file to demonstrate compliance with the minimum requirements set forth in Section 13.1.3.1.

13.1.4 Liaison With Outside Organizations

The WCS CISF will interface with a number of off-site organizations and agencies such as applicable DOE offices or projects as necessary to ensure the safe shipment of SNF to and from the WCS CISF.

WCS Security will establish formal arrangements, via Memoranda of Understanding (MOU), that will be established with various government law enforcement and emergency response agencies relative to the construction and operation of the WCS CISF. Each MOU will define the anticipated response actions of that response force and how each agency will interact with WCS Staff. These arrangements will be available in the site-specific WCS CISF license application documentation.

13.2 Pre-Operational Testing and Operation

This section describes the WCS CISF Pre-operational and Operational Test program. Included is a description of the administrative procedures for conducting the program and a general program description.

The testing program consists of pre-operational testing, which occurs prior to SNF receipt, and operational or start-up testing, which occurs after SNF receipt. The objectives of both are to ensure that plant structures, systems and components (SSCs):

- Have been adequately designed and constructed
- Meet regulatory and licensing requirements
- Do not adversely affect worker safety or the health and safety of the public
- Can be operated in a dependable manner to perform their intended function.

Additionally, the testing programs ensure that operating and emergency procedures are correct and that personnel have acquired the correct level of technical expertise.

13.2.1 Administrative Procedures for Conducting Test Program

The system for preparing, reviewing, approving, and implementing testing procedures and instructions for WCS CISF operations will be in accordance with written procedures meeting QAP requirements. Any changes to, or deviations from, these procedures and instructions will be reviewed and approved in accordance with Technical Specifications requirements of the 10 CFR Part 72 license via a 72.48 review.

13.2.2 Test Program Description

The objectives of the pre-operational testing program are to ensure that the receiving, transfer and storage system performs its intended safety functions and meets the operating controls and limits proposed in the license Technical Specifications applicable to the WCS CISF and each storage system.

13.2.2.1 Pre-Operational Testing

Before the operation of the WCS CISF, the following systems will be tested to ensure they are functioning properly:

- Cask unloading equipment,
- Cask Handling Building overhead bridge cranes and interlocks,
- Cask transporter vehicles,
- Storage cask/module monitoring equipment,
- Area radiation monitoring equipment,

- Electrical systems (ensure that power is available for lighting, security systems, and general service receptacles)
  - Security systems (e.g., alarm, surveillance, etc.) equipment,
  - Communications systems (ensure that all WCS CISF communication system and devices are properly connected into the Central Alarm Station and Secondary Alarm Station as applicable)
  - Fire protection equipment
  - Emergency operations center
  - Environmental monitoring
  - Potable water

To the extent practicable, functional tests of the WCS CISF operations, transfer operations, and overpack loading and retrieval will be performed to verify the storage system components (e.g., canisters, casks, transfer systems, etc.) can be operated safely and effectively. Pre-operational testing may be performed using the actual cask and dummy canister or a training cask and canister with test weights, as appropriate. The training cask and canister will be designed and fabricated to approximate the size, weight and behavior of the cask and canister system being exercised.

A dummy canister weighted to simulate actual canisters will be obtained for pre-operational testing mimicking each licensed system. A canister will be loaded into the transportation cask so receipt and transfer operations using actual equipment can be performed. The actual transfer casks/transfer equipment and storage overpacks will be used for this testing. Pre-Operations testing will include all steps to safely receive and place the canister/storage overpack on the storage pad in the Storage Area.

The facility constructor is responsible for completion of all as-built drawing verification, purging/flushing, cleaning, hydrostatic or pneumatic testing, system turnover and initial calibration of instrumentation, in accordance with design and installation specifications provided by the architect engineers and cask system vendors. The Director of Operations is responsible for coordination of the preoperational testing program.

The Pre-operational Test Plan, including test summaries for all systems, is made available to the NRC at least 90 days prior to the start of testing. Subsequent changes to the Pre-operational Test Plan are also made available to the NRC.

Pre-operational testing is performed for all SSCs ITS and associated interfaces, to ensure that all SSCs ITS are built and function as designed. Pre-operational tests (dry runs or cold tests) are also performed for all operations involving SNF (SNF), to demonstrate that operations are efficiently performed in a safe manner, and to provide verification that operating procedures are acceptable prior to receipt of SNF.

Pre-operational testing on SSCs ITS is completed prior to the on-site receipt of SNF. On systems that are not-important-to- safety (NITS) and which are not required prior to on-site receipt of SNF, pre-operational testing may be completed after SNF receipt (for example, building ventilation tests). Those systems are identified in the Pre-operational Test Plan.

For systems and components that are NITS, acceptance criteria are established only to ensure worker safety and the reliable and efficient operation of the system, and to demonstrate the performance of intended functions.

An operational readiness review will be conducted as part of the pre-operational test program, to verify that the WCS CISF is ready to receive and store SNF. The operational readiness review addresses the following areas at a minimum:

- Radiological controls
- Nuclear safety
- Operations training and procedures
- Construction
- Engineering/design control
- Fire protection
- Maintenance
- Quality assurance
- Emergency preparedness
- Safeguards and security.

Results of pre-operational tests are evaluated, and changes to SSCs and operating procedures are made as necessary. In accordance with 10 CFR 72.82(e), results of pre-operational tests will be submitted to the NRC at least 30 days prior to SNF receipt.

13.2.2.2 Operational Testing

Operational testing is performed for all SSCs ITS and associated interfaces. These tests ensure the SSCs function as designed when loaded with SNF, and that measured parameters are bounded by the safety analysis. Pre-operational tests demonstrate operations are efficiently performed in a safe manner and provide verification that operating procedures are acceptable prior to normal operations.

Operational testing associated with a particular cask system design is performed the first time the cask system is used at the WCS CISF. Testing is performed in accordance with the cask transportation CoC requirements, operations steps identified in Chapter 5 and associated appendices and the license Technical Specifications requirements.

After start-up testing is complete, inspections and tests of all SSCs ITS will continue on a routine basis to verify that SSCs continue to function as designed. This includes full load tests of the cranes that carry SNF casks and canisters.

13.2.3 Test Discussion

The purpose of the pre-operational tests is to ensure that a canister can be properly and safely retrieved from the transportation cask and placed into storage. Proper operation of the Cask Handling Building, and transfer vehicles/crawlers, as well as the associated handling equipment (e.g., lifting equipment) will provide such assurance.

Pre-operational test requirements will be specific. Detailed procedures will be developed and implemented by WCS personnel responsible for ensuring the test requirements are satisfied.

The expected results of the pre-operational tests are the successful completion of the following:

- Transferring the canister from the transportation overpack the storage overpack,
- Moving the transfer cask loaded with a canister and test weights to the storage overpack or storage pad (depending on the system)
- Emplacing canisters in a storage overpack or moving the storage overpack to the storage pad, retrieval of the canister from storage and preparing it for transportation in the same cask that provided transportation to WCS

The tests will be deemed successful if the expected results are achieved safely and without damage to any of the components or associated equipment.

Should any equipment or components require modification in order to achieve the expected results, it will be retested to affirm that the modification is sufficient. If any pre-operational test procedures are changed in order to achieve the expected results, the changes will be incorporated into the appropriate operating procedures.

13.3 Training Program

WCS will expand its existing Training Plan, TRN-1.1, to encompass training for the WCS CISF.

13.3.1 Program Description

The objective of the WCS training program for the WCS CISF is to ensure a qualified work force for safe and efficient WCS CISF operations. The training program will be used to provide this training and indoctrination and will be revised, as appropriate, to include lessons learned from operating the facilities. All individuals working in the Cask Handling Building and in the Storage Area will receive radiation and safety training and those performing cask/canister handling operations will be provided additional training, as required.

The training programs, in concert with other management systems, ensure that qualified individuals will be available to perform planned and unplanned tasks while protecting the health and safety of facility personnel and the public. WCS will maintain additional training to support the Emergency Response Plan, Physical Security Plan, Safeguards Information Plan, QA Plan, and administrative and safety requirements, as required.

13.3.1.1 General Employee Training

General Employee Training (GET) serves as orientation to WCS facilities, work processes, regulatory environment and basic safety measures such as the ALARA concept. Among other things, GET covers:

- WCS – History and Summary of Capabilities
- WCS Mission, Vision and Core Values
- Introduction and Organization
- Qualification and Training Program Descriptions
- Permits and Licenses
- Hazardous Waste Regulations and Operations
- Safety Overview Training
- General Employee Radiological Training
- Computer Security
- Quality Assurance Program
- WCS CISF Security
- Stop Work Authority
- Emergency Equipment Legend and Site Overview Map

All WCS Employees must complete GET training within 30 days of placement.

13.3.1.2 Radiation Worker Training

Radiation workers at the WCS CISF will receive Radiation Worker I or II training depending on their job function. Rad Worker I Training includes the following topics:

- Fundamentals of radioactive materials and radiation;
- Radiation versus contamination;
- Biological effects of radiation;
- Risks of occupational exposure;
- Exposure limits and minimizing exposure;
- Existing and potential areas of exposure and contamination;
- Personnel dosimetry (internal and external);
- Use of anti-contamination protective clothing (PCs);
- Contamination control;
- Methods of decontamination;
- Rights and responsibilities of radiation workers;
- Stop work authority;
- WCS CISF specific lessons learned as well as industry events;
- Federal and State Regulations and License provisions for the protection of personnel from radiation and radioactive material;
- Emergency response;
- Radiation exposure reports available to workers;
- Respiratory protection program;
- Use of radiation work permits (RWPs).

The training session is followed by a written test, which must be passed at the 80% level of competency before unescorted access is allowed into a Restricted Area.

The RSO may authorize individuals with documented radiation safety training and experience from other sites or utilities, such as the DOE, to challenge any training requirement and demonstrate the requisite level of knowledge in radiation safety by:

- Successfully passing a written exam that includes basic radiation safety training principles and facility/WCS CISF specific information; and
- Successful discussion and performance of practical factors.

Individuals unable to successfully pass the written exam or practical factors shall be required to complete the Radiation Worker II classroom instruction and testing.

Records of required training and satisfactory completion are maintained in each worker's file in the training department.

Hands-on training should be used for newly trained individuals without prior radiation work experience to ensure understanding and proficiency in applied radiation safety practices.

Each worker who is categorized as a Radiation Worker II will receive a minimum of 24 hours classroom training prior to initial assignment and 8 hours of refresher training annually. The purpose of the training is to teach proper methods for working with radiation and handling radioactive materials, to discuss the effects of radiation, to explain the risks of occupational exposure, and to identify the specific hazards associated with facility operations. The following topics will be covered, at a minimum:

- Technical Topics
  - Sources of radiation (natural and man-made),
  - Basic atomic and nuclear physics,
  - Types of radiation and their characteristics (alpha, beta, gamma, x-ray, neutron),
  - Radiation units,
  - Biological effects,
  - Risks of occupational exposure (NRC Regulatory Guide 8.29),
  - Radiation measurement and survey instruments,
  - External dosimetry (TLD, OSL, SRD, extremity),
  - Time, distance and shielding,
  - Internal dosimetry methods (whole-body counting, urinalysis and fecal analysis), contamination control (sources of contamination, protective clothing/PPE, controlled areas and exiting, and personnel surveys),
  - Personnel and equipment decontamination,
  - Airborne radioactivity,
  - Respiratory protection and coordination with industrial/chemical hazards,
  - Prenatal radiation exposure (NRC Regulatory Guide 8.13),
  - First aid considerations,
  - Radiological waste reduction,
  - Introduction to mock-up training.

- Administrative Topics
  - WCS radiation safety policy,
  - Role of the RSO and RST,
  - Authority of radiation safety personnel,
  - ALARA philosophy and practices,
  - Regulatory and administrative limits; minimizing exposure,
  - Federal and State Regulations and License provisions for the protection of personnel from radiation and radioactive material,
  - Radiological postings,
  - Radiological surveys (purposes, methods),
  - Control and removal of contaminated equipment,
  - Introduction to WCS operational procedures (additional, separate training is required for procedural qualification),
  - Introduction to WCS quality assurance (additional, separate training is required for procedural qualification),
  - Investigation and reporting of abnormal exposures,
  - Obtaining exposure records,
  - Responsibilities of individuals,
  - Radiological emergencies,
  - Respiratory protection program,
  - Radiation work permits (RWPs).

The training session is followed by a written test, which must be passed at the 80% level of competency before unescorted access is allowed into a Restricted Area.

The Radiation Health and Safety Officer (RSO)/Director of Radiation Safety may authorize individuals with documented radiation safety training and experience from other sites or utilities, such the DOE, to challenge any training requirement and demonstrate the requisite level of knowledge in radiation safety by:

- Successfully passing a written exam that includes basic radiation safety training principles and facility/WCS CISF specific information; and
- Successful discussion and performance of practical factors.

13.3.1.3 Technical Training

Classroom and field training are provided by the responsible department when appropriate or necessary. On the Job Training (OJT) is provided within most disciplines. OJT consists of, but is not limited to, task training and evaluation, procedure training, and specific discipline-related training requirements.

Certified WCS CISF Operators will be responsible for cask/canister handling and transfer operations. These individuals will be certified by WCS management and meet the requirements of the WCS CISF Equipment Operator Training and Certification Program. This program meets the requirements of 10 CFR Part 72, Subpart I. They will also meet vendor training and qualification requirements for the operation of vendor-specific cask/canister handling equipment The Certified WCS CISF Operators shall participate in initial and proficiency training programs.

Each individual will be given instructions regarding the hazards and safety precautions applicable to the type of work to be performed, general work place hazards, and the procedures for protecting themselves from injury. Only qualified individuals will operate equipment, machinery, and cranes.

In addition, WCS CISF Maintenance Technicians are trained in the operation of forklifts and plant cranes and they should have a working knowledge of the plant drawing system and the vendor manual system.

Technical Training is also used to develop the necessary manipulative skills to perform assigned work in a competent manner. Technical Training consists of the following segments.

- Initial Training
- On-the-Job Training and Qualifications
- Continuing Training
- Special Training.

13.3.1.3.1 Initial Training

Initial Training provides an understanding of the fundamentals, basic principles and procedures related to an employee's assigned work. This training may consist of, but is not limited to, live, taped and filmed lectures, self-guided study, demonstrations, laboratories, workshops and on-the-job training.

New employees or those transferred from other sections within the facility may be partially qualified due to previous training or experience. The extent of further training for these employees is determined by applicable regulations, performance in review sessions, comprehensive examinations or other techniques designed to identify the employee's level of ability.

Initial job training and qualification programs are developed for operations, maintenance and technical services classifications. Training for each program is grouped into logical blocks or modules and presented to accomplish specific behavioral objectives. Trainee progress is evaluated through written examinations, oral examinations or practical tests. Depending upon regulatory requirements, the individual's needs and plant operating conditions, allowances are made to suit specific situations.

WCS CISF specific technical training modules that may be included in initial training programs include:

- Operations Initial Training
    - WCS CISF fundamentals
    - General SNF handling systems
    - Specific SNF handling systems
    - Radiological safety
    - Equipment design and operating characteristics
    - On-site SNF cask transfer systems
    - Procedures.
- Mechanical Maintenance Initial Training
    - WCS CISF fundamentals
    - Fundamental shop skills
    - Facility and cask system familiarization.
- Instrumentation, Electrical and Performance Initial Training
    - WCS CISF fundamentals
    - Basic instrument and electrical
    - Basic performance
    - Facility and cask system familiarization.
- Radiation safety Initial Training
    - WCS CISF fundamentals
    - Fundamental radiation safety
    - Facility and cask system familiarization.
- Engineer/Professional/Supervisory Training
    - WCS CISF fundamentals
    - Facility orientation
    - SNF handling and cask system training.
- Quality Assurance
    - Basic requirements
    - General criteria
    - Applicable codes, standards and implementing documents
    - Problem identification
- Dispute resolution.

13.3.1.3.2 On-the Job Training and Qualifications

On-the-Job Training (OJT) is a systematic method of providing the required job related skills and knowledge for a position. This training is conducted in the work environment. Tasks and related procedures for each technical area supplement and complement formal classroom, practical demonstrations/evaluations and/or mock-up training. The program objective is to ensure the trainee's ability to perform job tasks as described in task descriptions and Training and Qualification.

13.3.1.3.3 Continuing Training

Continuing Training maintains and improves job-related knowledge and skills, such as:

- Facility systems and component changes
- OJT/qualifications program changes
- Procedure and directive changes
- Operating experience program document review, including industry and in-house operating experiences
- Continuing training required by regulation (e.g., Emergency Preparedness)
- General employee, special administrative, vendor and/or advanced training topics supporting elective tasks
- Training to resolve deficiencies or to reinforce seldom-used knowledge and skills
- Pre-job instruction, mock-up training and structured walk-throughs
- Quality awareness.

Continuing Training and Requalification training may overlap to some degree in definition. Requalification or Retraining refers to specific training designed for proficiency maintenance. Continuing Training consists of formal and informal components performed as needed to maintain proficiency on the job. Each organization's continuing training program is developed with a systematic approach, using information from job performance and safe operation information as a basis for determining training content. Continuing Training may be offered, as needed, on any of the topics or programs listed above.

Once the objectives for Continuing Training have been established, training methods may vary. A selected method must provide clear evidence of objective accomplishment and consistency in delivery.

13.3.1.3.4 Special Training

Special Training involves those subjects of a unique nature (i.e., QA, Specific Equipment Operation, Emergency Response) required for a particular area of work. Special training is usually given to selected personnel based on specific needs not directly related to disciplinary lines.

13.3.1.4 Personnel Certification Requirements

Operation of equipment and controls ITS is performed by trained and certified personnel. Certification training includes at a minimum the following topics:

- Dry Fuel Storage Equipment Operator Certification (includes Cask Transporter Certifications)
- Forklift (powered industrial truck)
- Crane Operator Training
- Radiation Worker II Training
- Technical Training
- Specific On-the-Job Training.

Training is specific to the task to be performed, and personnel must pass specific written and practical tests to become certified to perform that task. Refresher training and testing are conducted periodically as required by codes and standards to maintain proficiency and adapt to changes in technology, methods or job responsibilities.

13.3.1.5 Training Program Evaluations

Training and qualification activities are monitored by the Training Department. QA audits the WCS CISF Training Program. In addition, affected departments, trainees and vendors may provide input concerning Training Program effectiveness. Methods utilized to obtain this information include surveys and questionnaires. Frequently conducted classes are routinely evaluated. Evaluation information may be collected through the following methods:

- Verification of program objectives as related to job duties for which intended
- Periodic working group program evaluations
- Testing to determine student accomplishment of objectives
- Student evaluation of instruction
- Supervisor's evaluation of trainee's performance after OJT
- Supervisor's evaluation of instruction.

Unacceptable individual performance is reported to appropriate management.

13.3.2 Retraining Program

Continuing Training and Requalification training may overlap to some degree in definition. Requalification and Retraining refer to specific training designed for proficiency maintenance. Continuing Training consists of formal and informal components performed as needed to maintain proficiency on the job. Each organization's continuing training program is developed with a systematic approach, using information from job performance and safe operation information as a basis for determining training content. Continuing Training may be offered, as needed, on any of the topics or programs listed below.

Continuing Training maintains and improves job-related knowledge and skills, such as:

- Facility systems and component changes
- OJT/qualifications program changes
- Procedure and directive changes
- Operating experience program document review, including industry and in-house operating experiences
- Continuing training required by regulation (e.g., Emergency Preparedness)
- General employee, special administrative, vendor and/or advanced training topics supporting elective tasks
- Training to resolve deficiencies or to reinforce seldom-used knowledge and skills
- Pre-job instruction, mock-up training and structured walk-throughs
- Quality awareness.

Once the objectives for Continuing Training have been established, training methods may vary. A selected method must provide clear evidence of objective accomplishment and consistency in delivery.

13.3.3 Administration and Records

Upon employment, assignment to the facility, or assignment to a new job at the facility, a training file is created or reviewed for each employee. Each record includes the job title of the employee and the type and amount of both introductory and continuing training that will be given to that employee. Also included in the file are records that document the training and certifications that have been completed. Training records on WCS CISF personnel are QA records and will be kept according to all applicable statutory and regulatory requirements and supplemental WCS records management policies and procedures.

13.4 Facility Operations

This section describes the WCS CISF programs for conducting normal facility operations. Included are descriptions of procedure and record management programs and the facility review and audit, facility modification management and employee concerns programs.

13.4.1 Facility Procedures

All facility operations ITS are conducted using detailed written and approved procedures. The development, review, approval, use, distribution and changes to all procedures are governed by facility administrative procedures, all of which will be made available to the NRC prior to their use. As noted throughout the Safety Analysis Report (SAR), procedures are used to ensure that activities are carried out in a safe manner. These activities typically include procedures for the following.

- All cask handling operations including receipt, on-site movement, transfer and storage operations
- Cask Handling Building workstations
- All facility operations
- Material control and accounting activities
- Emergency Response Plan implementation
- Security and Safeguards Plan implementation
- Design changes to the facility
- Maintenance of facility structures, systems and components (SSCs)
- Construction and testing of facility SSCs
- QA program implementation
- Training.

General Procedure categories are as follows.

- Administrative Procedures: Provide rules and instructions to provide all WCS CISF personnel with a clear understanding of operating philosophy and management policies.
- Radiation Safety Procedures: Implement the radiation control program to ensure exposures are kept as low as is reasonably achievable (ALARA). Included are procedures controlling the release of effluents. Chapter 9 provides a detailed description of the Radiation Safety Program and procedures.
- Operating Procedures: Provide instructions for all WCS CISF operations, including receiving, handling and storing of SNF, to ensure all operations are performed consistently, efficiently and safely. Special processes and SNF material control and accounting procedures are also governed by operating procedures.

- Maintenance Procedures: Provide instructions for performing preventive and corrective maintenance to ensure that maintenance is performed consistently, efficiently and safely.
- Inspection and Test Procedures: Ensure that all WCS CISF SSCs are tested on a routine basis to verify operability, to ensure that they continue to meet design requirements, and to ensure that they meet quality standards commensurate with their importance to safety.
- Quality Assurance Procedures: Ensure that all WCS CISF activities are performed in accordance with the WCS CISF QA program. Design Control is included under QA procedures.
- Security Procedures: Provide instructions for protecting the facility, personnel and safeguards information in accordance with regulatory requirements and guidance.

13.4.1.1 Preparation of Procedures

At WCS, Management is responsible for routinely evaluating work performed within their functional area of responsibility to identify quality affecting work activities and ensure QA work is controlled and accomplished in accordance with a procedure or work instruction as required.

The development of all procedures, including operating, abnormal, maintenance, instrument, periodic test, radioactive waste management, radiation safety and emergency preparedness, is performed by qualified members of the facility staff. Procedures addressing receipt and handling of incoming casks are provided by the vendors and integrated into facility procedures. All procedures are sufficiently detailed so that qualified individuals can perform the required functions without direct supervision.

Initial procedure drafts are reviewed by other qualified staff members and by vendor personnel as appropriate. Initial drafts also receive a cross-disciplinary review by the appropriate organizations including Radiation Safety and QA reviews. Reviewers, designated to approve procedures, determine the necessity for additional cross-disciplinary reviews. The WCS CISF Director of Operations or designee shall approve all ITS procedures and safety-affecting procedures. The QA Manager or designee shall approve all procedures.

Procedures control the issuance of documents (e.g., work procedures or work instructions) that prescribe requirements for activities affecting quality associated with items or services classified as ITS or quality affecting to ensure adequate review, approval, release, distribution and use of documents and their revisions. Documents that prescribe requirements ITS, or qualify affecting activities are reviewed and approved for technical adequacy and inclusion of appropriate quality requirements prior to approval and issuance. Procedures are reviewed and approved by members of WCS management with direct and oversight responsibilities for work prescribed by the work procedure or work instruction. Records of completed cross-disciplinary reviews shall be maintained for all changes to ITS procedures.

13.4.1.2 Changes to Procedures

Changes to work procedures or work instructions that prescribe requirements for ITS, or qualify affecting activities, are reviewed and approved by the same organizations that performed the initial review and approval or by qualified responsible organizations. Minor changes to procedures, such as inconsequential editorial corrections, shall not require that the revised documents receive the same review and approval as the original documents. To avoid a possible omission of a required review, the type of minor changes that do not require such a review and approval and the persons who can authorize such a decision shall be clearly delineated.

Changes to procedures shall be additionally processed as described below.

1. The preparer documents the proposed change as well as the reason for the change.

2. A safety evaluation performed by a qualified reviewer includes a screening and an unreviewed safety question evaluation, in accordance with 10 CFR 72.48. If the safety evaluation reveals that a license change is needed to implement the proposed changes, NRC approval is needed prior to implementation.

3. The procedure, with proposed changes, is reviewed and approved by a qualified reviewer.

4. The WCS CISF Director of Operations or designee also reviews the procedure change and is responsible for final approval, and for determining whether cross-disciplinary review is necessary and by which groups. The need for cross-disciplinary reviews shall be considered, as a minimum, for the following.

    - For proposed changes having a potential impact on radiation safety, a review shall be performed for radiation hazards. Changes shall be approved in writing by the Radiation Health and Safety Officer (RSO)/Director of Radiation Safety or designee.

    - A criticality safety review shall be performed for proposed changes having a potential impact on criticality safety. Changes shall be approved in writing by the RSO/Director of Health and Radiation Safety Engineering or designee.

    - A QA review shall be performed for proposed changes that directly involve QA. Changes shall be approved in writing by the QA Manager.

    - A material control review shall be performed for proposed changes potentially affecting material control and accountability.

5. Records of completed cross-disciplinary reviews shall be maintained for all changes to ITS procedures.

13.4.1.3 Distribution of Procedures

Upon issue of each new or revised procedure or work instruction all hard copy previous versions of the procedure or work instruction are retrieved from each applicable controlled document location and disposed of as the newly effective procedure or work instruction or their revisions are made available at these locations, as applicable. Non-confidential, non-safeguards documents are protected.

13.4.2 Facility Records

Records management is controlled in a systematic manner in order to provide identifiable and retrievable documentation.

The WCS CISF maintains a records storage system. Access to and use of the WCS CISF records storage facility is controlled. Documents in the records storage system shall be legible and identifiable as to subject. Original or reproduced copies of documents shall be stamped, initialed, signed or otherwise authenticated and dated by authorized personnel. Computer storage of data may be used.

In order to preclude deterioration of records in the records storage system, the following requirements apply.

- Records are not stored loosely, but firmly attached in binders or placed in folders or envelopes. Records are stored in steel file cabinets.
- Special processed records (e.g., radiographs, photographs, negatives, microfilm) which are light-sensitive, pressure-sensitive and/or temperature-sensitive, are packaged and stored as recommended by the manufacturers of those materials.
- Computer storage of records is performed in a manner to preclude inadvertent loss and to ensure accurate and timely retrieval of data.

The WCS records storage system will provide for the accurate retrieval of information without undue delay. Written instructions regarding the storage of records in the WCS records storage system include, but are not limited to, the following.

- A description of the WCS records storage system location(s) and identification of the location(s) of the various record types within the WCS records storage system
- The filing system to be used
- A method for verifying that records received are in agreement with any applicable transmittal documents and are in good condition. This is not required for documents generated within a section for use and storage in the same section's satellite files.
- A method for maintaining a record of the records received
- The criteria governing access to and control of the WCS records storage system
- A method for maintaining control of and accountability for records removed from the WCS records storage system

- A method for filing supplemental information and for disposing of superseded records.

A qualified fire protection engineer will evaluate record storage areas, including satellite files, to ensure that records are adequately protected from damage.

Records related to health and safety shall be maintained in accordance with the requirements of Title 10, Code of Federal Regulations, as described below. A WCS CISF administrative procedure shall provide a list of all applicable records and retention periods. The following records shall be retained for at least three years.

- Records of instrument calibrations
- Records of audits and inspections
- ALARA findings
- Changes to physical security records, in accordance with 10 CFR 72.180, 72.182 and 72.184.

Records of SNF inventory are retained for as long as the material is stored at the WCS CISF and for five years after the SNF is transferred out of the WCS CISF. These records are maintained in duplicate at separate locations in accordance with 10 CFR 72.72.

At a minimum, the following records are retained for the duration of the facility license.

- Records important to decommissioning
- Records of spills or other unusual occurrences involving the spread of contamination in and around the facility
- As-built drawings and modifications of structures and equipment in restricted areas where radioactive materials are used or stored, and of locations of possible inaccessible contamination
- A list of areas designated or formerly designated as restricted areas, or areas where a documented spill has occurred. This list is kept in a single document and updated at least every two years.
- Records of any changes to the WCS CISF, changes to procedures pursuant to 10 CFR 72.48, test records, the safety analysis report (SAR) and SAR updates
- Records of safety evaluations described in the WCS CISF license conditions
- Records of SNF shipment receipts, inventory, location, disposal and transfer
- Records of current SNF inventory based on a physical inspection that occurs at least once annually
- Records of written material control and inventory procedures

- Records of QA activities required by the QA program in accordance with 10 CFR 72.174
- Records of training, qualification and re-qualification as required by the WCS CISF license conditions for current and past WCS CISF staff
- Operating records, including maintenance and modifications
- Records of Facility Radiation Safety Review Committee activities
- Records of radiation exposure for all individuals entering radiation control areas
- Records of analyses required by the Radiological Environmental Monitoring program that would permit accuracy evaluation of the analyses at a later date
- Records of plant radiation surveys
- Records of environmental surveys
- Physical security records in accordance with 10 CFR 72.180, 72.182, 72.184 and 73.70.

Retention periods are specified for other facility records as necessary to meet applicable regulatory requirements. Records with no specified retention periods are kept for the duration of the facility license. Retention times should be indicated within facility procedures as specified.

13.4.3 Facility Review and Audit Program

The Audit section of the WCS QA Program establishes the measures for planned and documented audits to verify compliance and effectiveness with all aspects of the WCS QA Program. Procedures shall ensure that audits are performed by appropriately trained personnel; properly planned and scheduled, audit results are documented, reported, and reviewed by appropriate levels of supervision and management; and responsible persons in the area audited take necessary action to correct reported deficiencies.

13.4.4 Modifications to Facilities and Equipment

13.4.4.1 Facility Initiated Modifications

To provide for the continued safe and reliable operation of the WCS CISF, measures are implemented to ensure that quality is not compromised by planned modifications involving ITS SSCs. The WCS Director of Engineering is responsible for the design and implementation of SSC modifications and modifications that could impact SSCs. The design and implementation of modifications is performed in a manner to maintain quality commensurate with the remainder of the system being modified, or as dictated by applicable regulations.

In accordance with the WCS QAPD (Appendix C of the License Application) requirements, procedures shall be implemented to ensure that activities affecting quality are controlled in accordance with appropriate instructions, procedures and drawings necessary for complying with the applicable criteria of 10 CFR Part 72 Subpart G, 10 CFR Part 71 Subpart H for items and services classified as ITS. Instructions, procedures and drawings are developed, reviewed, approved, utilized and controlled in accordance with the requirements of approved procedures. These instructions, procedures and drawings include appropriate quantitative and qualitative acceptance criteria. Any changes to instructions, procedures and drawings, receive the same level of review and approval as originally required. Finally, compliance with these approved instructions, procedures and drawings is mandatory for all personnel performing activities subject to the requirements of the QAP.

Each change to the facility shall require a safety evaluation in accordance with 10 CFR 72.48. Each modification shall also be evaluated for required changes or additions to the facility's procedures, personnel training, testing program or regulatory documents.

Each modification is also evaluated and documented for radiation exposure, in keeping with the facility ALARA program, criticality, and worker safety requirements and/or restrictions. The evaluation of modifications may also include, but is not limited to, the review of:

- Modification cost
- Similar completed modifications
- QA aspects
- Potential operability or maintainability concerns
- Constructability concerns
- Post-modification testing requirements
- Environmental considerations
- Human factors

After completion of a modification to an SSC, WCS shall ensure all applicable testing has been completed for correct operation of the systems affected by the modification, and that documentation regarding the modification is complete in accordance with QAP requirement. All required records shall be available to facility staff and stored as required by the QAP.

13.4.4.2 Vendor-Initiated Modifications

Prior to receipt of any cask system for which the WCS CISF is licensed, any modifications to the cask systems performed under a vendor's or utility's 10 CFR 72.48 program shall be evaluated by facility personnel, to verify that the modified system satisfies the WCS CISF's design and licensing bases.

13.4.5 Employee Concerns Program

WCS and its prime contractor(s) shall ensure establishment and maintenance of a safety-conscious work environment (SCWE) at the WCS CISF; where a SCWE is one in which employees feel free to raise concerns, both to their management and to the NRC, without fear of retaliation. WCS will institutionalize the program in a WCS CISF procedure or program level document, based on NRC guidance for "Establishing and Maintaining a Safety Conscious Work Environment" (NRC August 2005) in order to maintain a work environment in which safety issues are raised and solutions promptly identified. All WCS CISF personnel will receive formal training on the employee concerns program. WCS SCWE Training will be derived from Principles for a Strong Nuclear Safety Culture (INPO November 2004) and Traits of a Healthy Nuclear Safety Culture (INPO 12-012, December 2012).

In addition to the Employee Concerns Program., the following actions will be taken:

- Copies of NRC Form 3, "Notice to Employees," will be posted in locations frequented by employees.
- Space will be made available on-site to NRC personnel with sufficient privacy that WCS CISF personnel may feel comfortable discussing safety or other concerns with NRC personnel.

13.5 Emergency Response Planning

An Emergency Response Plan (ERP) has been prepared for the WCS CISF with an outline and content that complies with the requirements of 10 CFR 72.32(a). The WCS CISF ERP applies specifically to emergencies that could occur at the WCS CISF.

All accidents and off-normal events evaluated in Chapter 12 of this SAR were considered in the planning basis for development of the WCS CISF ERP. The planning basis includes credible events as well as hypothetical accidents whose occurrence is not considered credible, so as not to limit the scope of Emergency Response Planning. Evaluation of the consequences of credible and hypothetical accidents postulated to occur at the WCS CISF determined that releases of radioactivity would not require response by an off-site organization to protect persons beyond the boundary of the WCS CISF owner-controlled area. There is a single emergency classification level for events at the WCS CISF, the Alert classification, which is based on the worst-case consequences of potential accidents which are postulated to occur at the WCS CISF.

Should an off-normal event or accident occur, the WCS CISF ERP requires personnel stationed at the WCS CISF to notify appropriate emergency response personnel and the Incident Commander (IC) or designee immediately. The emergency response personnel are then responsible for classifying the event in accordance with classification procedures in the WCS CISF ERP and notifying the NRC and local authorities, as stated in the WCS CISF ERP. The emergency response personnel are also responsible for calling out personnel, as necessary, who assemble at the WCS CISF to take actions to mitigate the consequences of the emergency, assess radiation and radioactivity levels in the vicinity of the WCS CISF, and return the WCS CISF to a safe and stable condition. The design of the WCS CISF provides for accessibility to equipment on-site and availability of off-site emergency facilities and services in accordance with 10 CFR 72.122(g). WCS has a central Emergency Operations Center (EOC) from which management and support personnel carry out coordinated emergency response activities. The EOC is the location having appropriate communications and informational materials to carry out the assigned emergency response mission. The primary EOC is the Executive Conference Room located in the southern section of the main administrative building within the boundaries of the existing facility. The secondary EOC is the LLRW Administration Building.

The ERP identifies Incident Commanders (ICs) who train to coordinate the response of the Emergency Response Organization (ERO) to an emergency event. These personnel may not always be present at the facility when an event occurs. One of the ICs designated in the ERP is always on-call. If the on-call IC is not at the facility, then he / she is available to those individuals present at the facility through communication device or other means. Depending upon the nature of the event, the on-call IC may designate certain duties to those present at the facility by phone or electronic communication. The IC assumes responsibilities for declaring an Alert, as appropriate, and activation of the ERO, as well as communicating with on-site emergency response personnel and appraising them of the situation at the WCS CISF. The ERP identifies responsibilities and staffing of the on-site ERO and for requesting off-site assistance. Members of the ERO will be trained on how to respond to various emergencies at the WCS CISF, as established in the ERP.

Off-site assistance may be requested as necessary from both the Andrews County Volunteer Fire Department, located 32 miles from the WCS CISF, and the Eunice, New Mexico Volunteer Fire Department, located 6 miles from the WCS CISF. Both departments have signed agreements to assist the WCS ERO in the control of major emergencies are both equipped to respond to structural fires, oil well fires and chemical tank explosions. The City of Andrews Police Department provides ambulance service for Andrews County and has agreed to provide emergency medical assistance and evacuation for the WCS CISF. Additional ambulance service is available through the Eunice Fire and Rescue Service, which has also agreed to provide emergency medical care to the facility. For off-site medical care, Carlsbad Medical Center, located in Carlsbad, New Mexico is the first choice for incidents involving radiologically contaminated individuals unless life-threatening injuries are present, in which case they would take precedence and treatment would be sought at Lea Regional Medical Center or Permian Regional Medical Center. Lea Regional Medical Center is located 25 miles to the northwest in Hobbs, New Mexico. The hospital is fully equipped to handle most types of emergencies and has a life flight helicopter available. The hospital has received training from the Waste Isolation Pilot Plants (WIPP) personnel on the handling of injury victims in the event of contamination with radioactive materials. Permian Regional Medical Center is located approximately 32 miles to the east in Andrews, Texas. The hospital is fully equipped to handle most types of emergencies. WCS also has agreements with the Andrews County Sherriff's Office and the Eunice Police Department to provide law enforcement services should they be needed at the facility. Other off-site assistance may be requested from industry or the NRC, as specified in the ERP.

The ERP was submitted to the following organizations for their review and comment in accordance with 10 CFR 72.32(a)(14):

- Andrews, Texas Police Department
- Andrews County Sherriff's Office
- Carlsbad Medical Center
- City of Andrews, Texas

- Eunice, New Mexico Fire and Rescue
- Eunice, New Mexico Police Department
- Lea Regional Medical Center
- Permian Regional Medical Center

Comments received from off-site response agencies are included as an attachment to the Emergency Response Plan.

The ERP does not cover actions to be taken for security related events at the WCS CISF. These actions will be governed by the WCS CISF Safeguards Contingency Plan.

13.6 Decommissioning Plan

13.6.1 WCS CISF Decommissioning Plan

Prior to the end of the WCS CISF life, canisters loaded with SNF will be transferred from storage casks into shipping casks and transported off-site. Since the canisters are designed to meet DOE guidance applicable to multi-purpose canisters for storage, transport and disposal of SNF, the SNF assemblies will remain sealed in the canisters such that decontamination of the canisters is not required. Following shipment of the canisters off-site and the decommissioning period begins, the WCS CISF will be decommissioned by characterization, identification, and removal of any residual radioactive material and performance of a final radiological status survey. Additional details on decommissioning are found in License Application Appendix B, “Preliminary Decommissioning Plan.”

13.6.2 Cost of Decommissioning

10 CFR 72.30(b) requires that the proposed decommissioning plan include a decommissioning cost estimate, a funding plan, and method of assuring the availability of decommissioning funds.

The cost of decommissioning the WCS CISF facilities, storage modules, and area is estimated to be approximately $12,650,000. A fully executed written contract between WCS and the US DOE will be established prior to receipt of SNF at the WCS CISF. Pursuant to this contract, DOE shall take legal title of the SNF prior to receipt and shall also be responsible for all costs associated with the decommissioning of the WCS CISF allowing for its unrestricted release pursuant to 10 CFR Part 20 Subpart E at the time of license termination. Additional details and decommissioning cost estimate information is found in License Application Appendix D, “Decommissioning Funding Plan.”

13.6.3 Decommissioning Facilitation

The design features of the dry cask storage concept, to be utilized at the WCS CISF provide for the inherent ease and simplicity of decommissioning the facility in conformance with 10 CFR 72.130. Details on these design features and measures that will be taken to both minimize the potential for contamination and facilitate any decontamination efforts which may be required are found in License Application Appendix B, "Preliminary Decommissioning Plan."

13.6.4 Recordkeeping for Decommissioning

Records important to decommissioning, as required by 10 CFR 72.30(d), will be maintained until the WCS CISF is released for unrestricted use. See Section 13.4.2 for the type of records that will be maintained for the WCS CISF. These records will be maintained in a secure storage area.

13.8 References

13-1 Regulatory Guide 1.8, "Qualification and Training of Personnel for Nuclear Power Plants," Revision 3.

13-2 "Quality Assurance Program for Consolidated Interim Spent Fuel Storage Facility and the Packaging and Transport of Radioactive Materials," QAPD-400, Revision 0.

13-3 Proposed SNM-1050, WCS Interim Storage Facility Technical Specifications, Amendment 0.

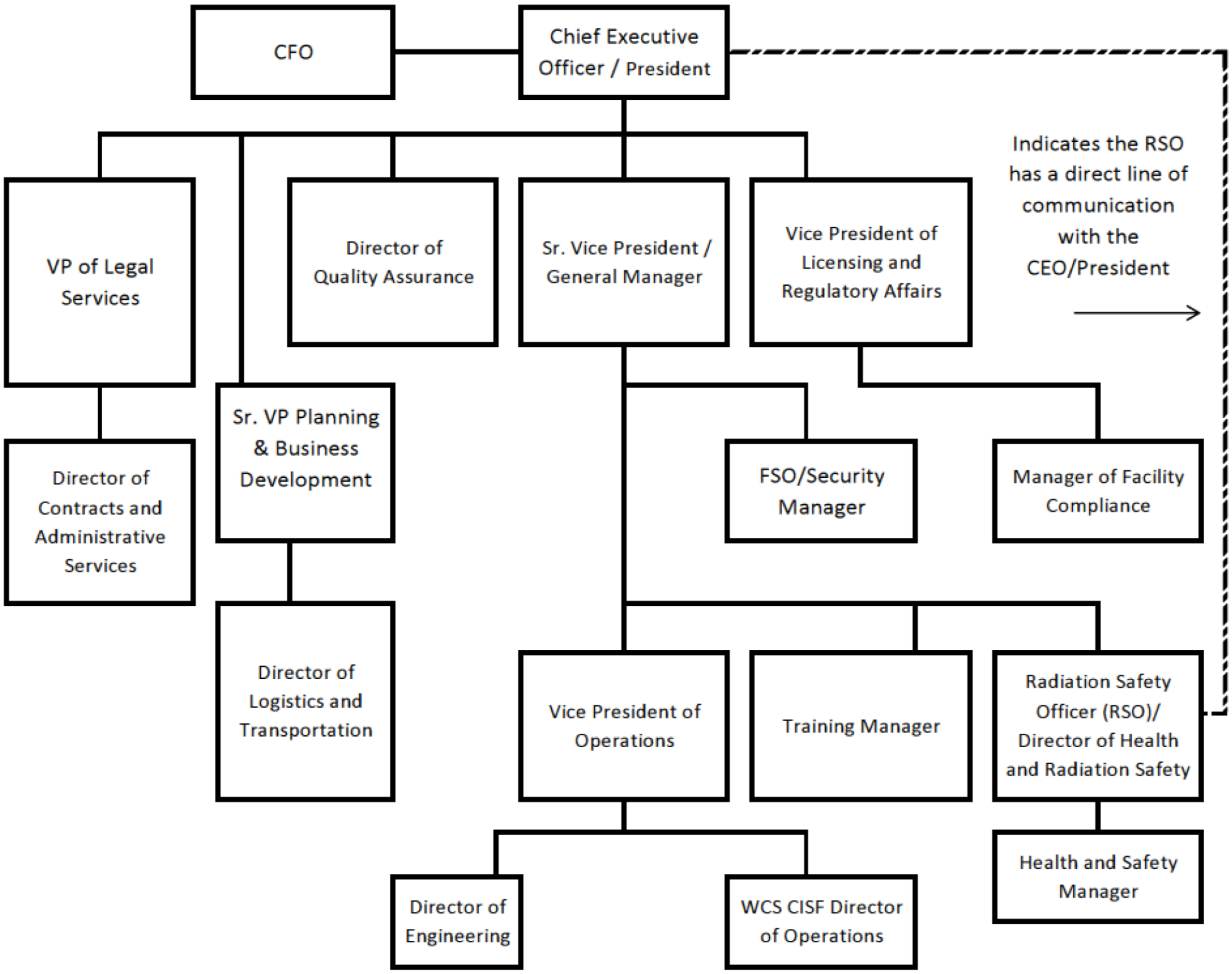

Figure 13-1
WCS Organization Chart

TECHNICAL SPECIFICATION BASES

TECHNICAL SPECIFICATION BASES

TABLE OF CONTENTS

B 2.0 SAFETY LIMITS (SLs)

BASES

BACKGROUND	The canister designs authorized for storage at the WCS CISF requires certain limits on spent fuel parameters, including fuel type, maximum allowable enrichment prior to irradiation, maximum burnup, and minimum acceptable cooling time prior to storage in the canister. Other important limitations are the radiological source terms from non-fuel assembly hardware and GTCC wastes. These limitations are included in the thermal, structural, radiological, and criticality evaluations performed for these canister designs.
APPLICABLE SAFETY ANALYSES	Various analyses have been performed that use these fuel parameters as assumptions. These assumptions are included in the thermal, criticality, structural, shielding and confinement analyses. Only canisters that have been previously approved by the NRC to store and transport commercial light water (PWR and BWR) spent nuclear fuel and GTCC waste will be received at the WCS CISF. Technical Specification 2.1 lists the authorized canisters for storage at the WCS CISF. Prior to acceptance of a canister at the WCS CISF a records review is required to verify that the canister being received was fabricated, loaded, stored and maintained in accordance with the Site Specific or General License requirements prior to shipment. This will assure that only canisters authorized for storage are stored at the WCS CISF.
FUNCTIONAL AND OPERATING LIMITS VIOLATIONS	If Functional and Operating Limits are violated, the limitations on the fuel assemblies in the DSC have not been met. Actions must be taken to place the affected fuel assemblies in a safe condition. This safe condition may be established by returning the affected fuel assemblies to the spent fuel pool. However, it is acceptable for the affected fuel assemblies to remain in the DSC if that is determined to be a safe condition. Notification of the violation of a Functional and Operating Limit to the NRC is required within 24 hours. Written reporting of the violation must be accomplished within 60 days. This notification and written report are independent of any reports and notification that may be required by 10 CFR 72.75.
REFERENCES	1. SAR Chapters 3, 7, 8, 9 and 12.

B 3.0 LIMITING CONDITION FOR OPERATION (LCO) APPLICABILITY

BASES

LCOs	LCO 3.0.1, 3.0.2, 3.0.4 and 3.0.5 establish the general requirements applicable to all Specifications and apply at all times, unless otherwise stated.
LCO 3.0.1	LCO 3.0.1 establishes the Applicability statement within each individual Specification as the requirement for when the LCO is required to be met (i.e., when the canister is in the specified conditions of the Applicability statement of each Specification).

LCO 3.0.2

LCO 3.0.2 establishes that upon discovery of a failure to meet an LCO, the associated ACTIONS shall be met. The Completion Time of each Required Action for an ACTIONS Condition is applicable from the point in time that an ACTIONS Condition is entered. The Required Actions establish those remedial measures that must be taken within specified Completion Times when the requirements of an LCO are not met. This Specification establishes that:

a. Completion of the Required Actions within the specified Completion Times constitutes compliance with a Specification; and

b. Completion of the Required Actions is not required when an LCO is met within the specified Completion Time, unless otherwise specified.

There are two basic types of Required Actions. The first type of Required Action specifies a time limit in which the LCO must be met. This time limit is the Completion Time to restore a system or component or to restore variables to within specified limits. If this type of Required Action is not completed within the specified Completion Time, the canister may have to be placed in the spent fuel pool and unloaded. (Whether stated as a Required Action or not, correction of the entered Condition is an action that may always be considered upon entering ACTIONS). The second type of Required Action specifies the remedial measures that permit continued operation of the unit that is not further restricted by the Completion Time. In this case, compliance with the Required Actions provides an acceptable level of safety for continued operation.

Completing the Required Actions is not required when an LCO is met or is no longer applicable, unless otherwise stated in the individual Specifications.

BASES

LCO 3.0.2 (continued)

The Completion Times of the Required Actions are also applicable when a system or component is removed from service intentionally. The reasons for intentionally relying on the ACTIONS include, but are not limited to, performance of Surveillances, preventive maintenance, corrective maintenance, or investigation of operational problems. Entering ACTIONS for these reasons must be done in a manner that does not compromise safety. Intentional entry into ACTIONS should not be made for operational convenience.

Individual Specifications may specify a time limit for performing an SR when equipment is removed from service or bypassed for testing. In this case, the Completion Times of the Required Actions are applicable when this time limit expires if the equipment remains removed from service or bypassed.

When a change in specified Condition is required to comply with Required Actions, the equipment may enter a specified Condition in which another Specification becomes applicable. In this case, the Completion Times of the associated Required Actions would apply from the point in time that the new Specification becomes applicable and the ACTIONS Condition(s) are entered.

LCO 3.0.3

This specification is not applicable to the WCS CISF. The placeholder is retained for consistency with the power reactor technical specifications.

LCO 3.0.4

LCO 3.0.4 establishes limitations on changes in specified Conditions in the applicability when an LCO is not met. It precludes placing the WCS CISF in a specified Condition stated in that applicability (e.g., Applicability desired to be entered) when the following exist:

a. Conditions are such that the requirements of the LCO would not be met in the Applicability desired to be entered; and

b. Continued noncompliance with the LCO requirements, if the Applicability were entered, would result in the equipment being required to exit the Applicability desired, to be entered to comply with the Required Actions.

BASES

LCO 3.0.4 (continued)

Compliance with Required Actions that permit continued operation of the equipment for an unlimited period of time in specified Condition provides an acceptable level of safety for continued operation. Therefore, in such cases, entry into a specified Condition in the Applicability may be made in accordance with the provisions of the Required Actions. The provisions of this Specification should not be interpreted as endorsing the failure to exercise the good practice of restoring systems or components before entering an associated specified Condition in the Applicability.

The provisions of LCO 3.0.4 shall not prevent changes in specified Conditions in the Applicability that are required to comply with ACTIONS. In addition, the provisions of LCO 3.0.4 shall not prevent changes in specified Conditions in the Applicability that are related to the unloading of a canister.

Exceptions to LCO 3.0.4 are stated in the individual Specifications.

Exceptions may apply to all the ACTIONS or to a specific Required Action of a Specification.

Surveillances do not have to be performed on the associated equipment out of service (or on variables outside the specified limits), as permitted by SR 3.0.1. Therefore, changing specified Conditions while in an ACTIONS Condition, either in compliance with LCO 3.0.4, or where an exception to LCO 3.0.4 is stated, is not a violation of SR 3.0.1 or SR 3.0.4 for those Surveillances that do not have to be performed due to the associated out of service equipment.

LCO 3.0.5

LCO 3.0.5 establishes the allowance for restoring equipment to service under administrative controls when it has been removed from service or not in service in compliance with ACTIONS. The sole purpose of this Specification is to provide an exception to LCO 3.0.2 (e.g., to not comply with the applicable Required Action(s)) to allow the performance of required testing to demonstrate:

a. The equipment being returned to service meets the LCO; or

b. Other equipment meets the applicable LCOs.

BASES

LCO 3.0.5 (continued)

The administrative controls ensure the time the equipment is returned to service in conflict with the requirements of the ACTIONS is limited to the time absolutely necessary to perform the allowed required testing. This Specification does not provide time to perform any other preventive or corrective maintenance.

LCO 3.0.6	This specification is not applicable to the WCS CISF. The placeholder is retained for consistency with the power reactor technical specifications.
LCO 3.0.7	This specification is not applicable to the WCS CISF. The placeholder is retained for consistency with the power reactor technical specifications.

B 3.0 SURVEILLANCE REQUIREMENT (SR) APPLICABILITY

BASES

SRs

SR 3.0.1 through SR 3.0.4 establish the general requirements applicable to all Specifications in Sections 3.1, 3.2 and 3.3 and apply at all times, unless otherwise stated.

SR 3.0.1

SR 3.0.1 establishes the requirement that SRs must be met during the specified Conditions in the Applicability for which the requirements of the LCO apply, unless otherwise specified in the individual SRs. This Specification is to ensure that Surveillances are performed to verify systems and components, and that variables are within specified limits. Failure to meet a Surveillance within the specified Frequency, in accordance with SR 3.0.2, constitutes a failure to meet an LCO.

Systems and components are assumed to meet the LCO when the associated SRs have been met. Nothing in this Specification, however, is to be construed as implying that systems or components meet the associated LCO when:

a. The systems or components are known to not meet the LCO, although still meeting the SRs; or

b. The requirements of the Surveillance(s) are known to be not met between required Surveillance performances.

Surveillances do not have to be performed when the equipment is in a specified Condition for which the requirements of the associated LCO are not applicable, unless otherwise specified.

Surveillances, including Surveillances invoked by Required Actions, do not have to be performed on equipment that has been determined to not meet the LCO because the ACTIONS define the remedial measures that apply. Surveillances have to be met and performed in accordance with SR 3.0.2, prior to returning equipment to service.

BASES

SR 3.0.1 (continued)

Upon completion of maintenance, appropriate post maintenance testing is required to declare equipment within its LCO. This includes ensuring applicable Surveillances are not failed and their most recent performance is in accordance with SR 3.0.2. Post-maintenance testing may not be possible in the current specified Conditions in the Applicability due to the necessary equipment parameters not having been established. In these situations, the equipment may be considered to meet the LCO provided testing has been satisfactorily completed to the extent possible and the equipment is not otherwise believed to be incapable of performing its function.

This will allow operation to proceed to a specified Condition where other necessary post maintenance tests can be completed.

SR 3.0.2

SR 3.0.2 establishes the requirements for meeting the specified Frequency for Surveillances and any Required Action with a Completion Time that requires the periodic performance of the Required Action on a "once per..." interval.

SR 3.0.2 permits a 25% extension of the interval specified in the Frequency. This extension facilitates Surveillance scheduling and considers plant operating conditions that may not be suitable for conducting the Surveillance (e.g., transient conditions or other ongoing Surveillance or maintenance activities).

The 25% extension does not significantly degrade the reliability that results from performing the Surveillance at its specified Frequency. This is based on the recognition that the most probable result of any particular Surveillance being performed is the verification of conformance with the SRs. The exceptions to SR 3.0.2 are those Surveillances for which the 25% extension of the interval specified in the Frequency does not apply. These exceptions are stated in the individual Specifications. The requirements of regulations take precedence over the TS. Therefore, when a test interval is specified in the regulations, the test interval cannot be extended by the TS, and the SR includes a Note in the Frequency stating, "SR 3.0.2 is not applicable."

BASES

SR 3.0.2 (continued)

As stated in SR 3.0.2, the 25% extension also does not apply to the initial portion of a periodic Completion Time that requires performance on a "once per..." basis. The 25% extension applies to each performance after the initial performance. The initial performance of the Required Action, whether it is a particular Surveillance or some other remedial action, is considered a single action with a single Completion Time. One reason for not allowing the 25% extension to this Completion Time is that such an action usually verifies that no loss of function has occurred by checking the status of redundant or diverse components or accomplishes the function of the equipment in an alternative manner.

The provisions of SR 3.0.2 are not intended to be used repeatedly merely as an operational convenience to extend Surveillance intervals (other than those consistent with refueling intervals) or periodic Completion Time intervals beyond those specified.

SR 3.0.3

SR 3.0.3 establishes the flexibility to defer declaring affected equipment as not meeting the LCO or an affected variable outside the specified limits when a Surveillance has not been completed within the specified Frequency. A delay period of up to 24 hours or up to the limit of the specified Frequency, whichever is less, applies from the point in time that it is discovered that the Surveillance has not been performed in accordance with SR 3.0.2, and not at the time that the specified Frequency was not met.

This delay period provides adequate time to complete Surveillances that have been missed. This delay period permits the completion of a Surveillance before complying with Required Actions or other remedial measures that might preclude completion of the Surveillance. The basis for this delay period includes consideration of unit conditions, adequate planning, availability of personnel, the time required to perform the Surveillance, the safety significance of the delay in completing the required Surveillance, and the recognition that the most probable result of any particular Surveillance being performed is the verification of conformance with the requirements.

When a Surveillance with a Frequency based not on time intervals, but upon specified unit conditions or operational situations, is discovered not to have been performed when specified, SR 3.0.3 allows the full delay period of 24 hours to perform the Surveillance.

BASES

SR 3.0.3 (continued)

SR 3.0.3 also provides a time limit for completion of Surveillances that become applicable as a consequence of changes in the specified Conditions in the Applicability imposed by Required Actions.

Failure to comply with specified Frequencies for SRs is expected to be an infrequent occurrence. Use of the delay period established by SR 3.0.3 is a flexibility that is not intended to be used as an operational convenience to extend Surveillance intervals.

If a Surveillance is not completed within the allowed delay period, then the equipment is considered not in service or the variable is considered outside the specified limits and the Completion Times of the Required Actions for the applicable LCO Conditions begin immediately upon expiration of the delay period. If a Surveillance is failed within the delay period, then the equipment is not in service, or the variable is outside the specified limits and the Completion Times of the Required Actions for the applicable LCO Conditions begin immediately upon the failure of the Surveillance. Completion of the Surveillance within the delay period allowed by this Specification, or within the Completion Time of the ACTIONS, restores compliance with SR 3.0.1.

SR 3.0.4

SR 3.0.4 establishes the requirement that all applicable SRs must be met before entry into a specified Condition in the Applicability.

This Specification ensures that system and component requirements and variable limits are met before entry in the Applicability for which these systems and components ensure safe operation of the facility.

The provisions of this Specification should not be interpreted as endorsing the failure to exercise the good practice of restoring systems or components to an appropriate status before entering an associated specified Condition in the Applicability. However, in certain circumstances, failing to meet an SR will not result in SR 3.0.4 restricting a change in specified Condition. When a system, subsystem, division, component, device, or variable is outside its specified limits, the associated SR(s) are not required to be performed, per SR 3.0.1, which states that Surveillances do not have to be performed on such equipment. When equipment does not meet the LCO, SR 3.0.4 does not apply to the associated SR(s) since the requirement for the SR(s) to be performed is removed. Therefore, failing to perform the Surveillance(s) within the

BASES

SR 3.0.4 (continued)

specified Frequency does not result in an SR 3.0.4 restriction to changing specified Conditions of the Applicability. However, since the LCO is not met in this instance, LCO 3.0.4 will govern any restrictions that may (or may not) apply to specified Condition changes.

The provisions of SR 3.0.4 shall not prevent changes in specified Conditions in the Applicability that are required to comply with ACTIONS. In addition, the provisions of SR 3.0.4 shall not prevent changes in specified Conditions in the Applicability that are related to the off-site shipment of canisters.

The precise requirements for performance of SRs are specified such that exceptions to SR 3.0.4 are not necessary. The specific time frames and Conditions necessary for meeting the SRs are specified in the Frequency, in the Surveillance, or both. This allows performance of Surveillances when the prerequisite Condition(s) specified in a Surveillance procedure require entry into the specified Condition in the Applicability of the associated LCO prior to the performance or completion of a Surveillance. A Surveillance that could not be performed until after entering the LCO Applicability would have its Frequency specified such that it is not "due" until the specific Conditions needed are met. Alternatively, the Surveillance may be stated in the form of a Note as not required (to be met or performed) until a particular event, condition, or time has been reached. Further discussion of the specific formats of SR annotation is found in Technical Specifications Section 1.4, operation to proceed to a specified condition where other necessary post maintenance tests can be completed.

B.3.1 RADIATION PROTECTION

B.3.1.1 SHIPPING/TRANSFER CASK (STC) Surface Contamination

BASES

BACKGROUND	Since the STC may be subject to weeping, the exterior surface of the STC is checked. Contamination on these surfaces is removed to a level that is as low as reasonably achievable (ALARA) and below the LCO limits in order to minimize radioactive contamination to personnel and the environment.
APPLICABLE SAFETY ANALYSIS	This radiation protection measure assures that the surfaces of the STC has been decontaminated. This keeps the dose to occupational personnel ALARA.
LCO	The contamination limits on the exterior surface of the STC are based on the allowed removable external radioactive contamination specified for spent fuel shipping containers in 49 CFR 173.443 (as referenced in 10 CFR 71.87(i)). Consequently, these contamination levels are considered acceptable for exposure to the general environment. This level will also ensure that the contamination levels of the inner surfaces of the HSM and potential releases of radioactive material to the environment are minimized. The HSM will protect the CANISTER from direct exposure to the elements and will, therefore, limit potential releases of removable contamination. The probability of any removable contamination being entrapped in the HSM airflow path released outside the HSM is considered extremely small. The number and location of surface swipes used to determine compliance for this LCO for both the exterior surface of the STC is based on standard industry practice.

BASES

APPLICABILITY	Measurement and comparison of the removable contamination levels for both the STC is performed during LOADING OPERATIONS.
ACTIONS	If the removable surface contamination is not within the LCO limits, action must be taken to decontaminate the STC, as appropriate, to bring the contamination level to within the limits. The Completion Time of 7 days and Prior to TRANSFER OPERATIONS is appropriate given that sufficient time is required to prepare for and perform the decontamination once the limit has been determined to be exceeded.
SURVEILLANCE REQUIREMENTS	The measurement of the removable surface contamination on the STC is performed once, prior to TRANSFER OPERATIONS, to verify it is less than the established LCO limits. This Frequency is necessary in order to confirm that the loaded STC can be moved safely to the Storage Area without releasing loose contamination to the environment or causing excessive operational doses to personnel.
REFERENCES	None.

B.3.2 NAC-MPC SYSTEM Integrity

B.3.2.1 CANISTER Maximum Time in the TRANSFER CASK

BASES

BACKGROUND	During TRANSFER OPERATIONS or prior to TRANSPORT OPERATIONS, a loaded CANISTER is transferred from one VCC to another VCC (or a TRANSPORTATION CASK) using the TRANSFER CASK. The TRANSFER CASK is placed on the VCC (or a TRANSPORTATION CASK), the bottom doors are opened, the loaded CANISTER is lifted into the TRANSFER CASK cavity, the bottom shield doors are closed and the CANISTER is lowered until it rests on the bottom doors. Subsequently, the loaded TRANSFER CASK is placed on another VCC (or TRANSPORTATION CASK) and the procedure is reversed, lowering the loaded CANISTER into another VCC (or TRANSPORTATION CASK). The LCO limits the total time a CANISTER can be maintained in the TRANSFER CASK to 25 days (600 hrs).
APPLICABLE SAFETY ANALYSIS .	Limiting the total time that a loaded CANISTER backfilled with helium may be in the TRANSFER CASK, prior to placement in a VCC, or TRANSPORTATION CASK, precludes the inappropriate use of the TRANSFER CASK as a storage component. The thermal analyses in the NAC-MPC Final Safety Analysis Report show that the short-term temperature limits for the spent fuel cladding are not exceeded for an unlimited period of time (steady state analysis). The duration of 25 days (600 hrs) is defined based on a test time of 30 days for abnormal regimes as described in PNL-4835.
LCO	Limiting the length of time that the loaded CANISTER backfilled with helium is allowed to remain in the TRANSFER CASK ensures that the TRANSFER CASK is not inappropriately used as a storage component.

BASES

APPLICABILITY	The elapsed time restrictions on a loaded CANISTER in the TRANSFER CASK apply during TRANSFER OPERATIONS and prior to TRANSPORT OPERATIONS.
ACTIONS	A note has been added to the ACTIONS, which states that, for this LCO, separate Condition entry is allowed for each NAC-MPC system. This is acceptable, since the Required Actions for each Condition provide appropriate compensatory measures for each NAC-MPC system not meeting the LCO. Subsequent NAC-MPC systems that do not meet the LCO are governed by subsequent Condition entry and application of associated Required Actions. A.1 Complete CANISTER transfer. B.1 Return CANISTER to TRANSPORTATION CASK or VCC.
SURVEILLANCE REQUIREMENTS .	SR 3.2.1.1 Verify CANISTER transfer complete.
REFERENCES	NAC-MPC FSAR Sections 4.4, 4.5, 4.A.3, 8.1, 8.2, 8.3, 8.A.1, 8.A.2 and 8.A.3.

B.3.2.2 VCC Heat Removal System

BASES

BACKGROUND	The VCC Heat Removal System is a passive, air-cooled convective heat transfer system, which ensures that heat from the CANISTER is transferred to the environment by the upward flow of air through the VCC. Relatively cool air is drawn into the annulus between the VCC and the CANISTER through the four air inlets at the bottom of the VCC. The CANISTER transfers its heat from the CANISTER surface to the air via natural convection. The buoyancy created by the heating of the air creates a chimney effect and the air flows back into the environment through the four air outlets at the top of the VCC.
APPLICABLE SAFETY ANALYSIS	The thermal analyses of the VCC take credit for the decay heat from the spent fuel assemblies being ultimately transferred to the ambient environment surrounding the VCC. Transfer of heat away from the fuel assemblies ensures that the fuel cladding and CANISTER component temperatures do not exceed applicable limits. Under normal storage conditions, the four air inlets and four air outlets are unobstructed and full air flow (i.e., maximum heat transfer for the given ambient temperature) occurs. Analyses have been performed for the complete obstruction of all of the air inlets and outlets. The complete blockage of all air inlets and outlets stops air cooling of the CANISTER. The CANISTER will continue to radiate heat to the relatively cooler inner shell of the VCC. With the loss of air cooling, the CANISTER component temperatures will increase toward their respective short-term temperature limits. The limiting component is the CANISTER basket support and heat transfer disks, which, by analysis, approach their temperature limits in 24 hours for Yankee-MPC and CY-MPC systems, if no action is taken to restore air flow to the heat removal system. The MPC-LACBWR analysis for all inlets and outlets blocked shows system temperatures remain below long-term limits for the 4.5 kW total heat load. Thermal performance of the MPC-LACBWR system is provided by radiation between the CANISTER and VCC, and air cooling convection heat transfer is not required to maintain system safety limits.

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BASES

LCO	The VCC Heat Removal System must be verified to be OPERABLE for Yankee-MPC and CY-MPC systems to preserve the assumptions of the thermal analyses. Operability of the heat removal system ensures that the decay heat generated by the stored fuel assemblies is transferred to the environment at a sufficient rate to maintain fuel cladding and CANISTER component temperatures within design limits for the Yankee-MPC and CY-MPC systems.
APPLICABILITY	The LCO is applicable during STORAGE OPERATIONS. Once a VCC containing a CANISTER loaded with spent fuel has been placed in storage, the heat removal system must be OPERABLE to ensure adequate heat transfer of the decay heat away from the fuel assemblies for the Yankee-MPC and CY-MPC systems.
ACTIONS	A note has been added to ACTIONS that states for this LCO, separate Condition entry is allowed for each VCC. This is acceptable since the Required Actions for each Condition provide appropriate compensatory measures for each VCC not meeting the LCO. Subsequent VCCs that do not meet the LCO are governed by subsequent Condition entry and application of associated Required Actions. A.1 If the VCC heat removal system has been determined to be not OPERABLE, it must be restored to OPERABLE status within 8 hours. Eight hours is reasonable based on the accident analysis that shows that the limiting VCC component temperatures will not reach their temperature limits for 24 hours after a complete blockage of all inlets and outlets. B.1 Until the completion of Required Action A.1, performance of SR 3.2.2.1 shall be performed on an increased Completion Time Frequency of 6 hours to document the OPERABLE status of the VCC heat removal system. <u>AND</u> B.2.1 If Required Action A.1 cannot be met, an engineering evaluation is performed to verify that the VCC heat removal system is OPERABLE. The Completion Time for this Required Action of 12 hours will ensure that the CANISTER remains in a safe, analyzed condition. <u>OR</u>

BASES

ACTIONS (continued)	B.2.2 Place the affected NAC-MPC SYSTEM in a safe condition. The Completion Time for this Required Action of 12 hours will ensure that the NAC-MPC system is maintained in a safe condition.
SURVEILLANCE REQUIREMENTS	SR 3.2.2.1 The long-term integrity of the stored fuel is dependent on the ability of the VCC to reject heat from the CANISTER to the environment. Visual observation that all four air inlet and outlet screens are unobstructed and intact ensures that air flow past the CANISTER is occurring and heat transfer is taking place. Complete blockage of more than two air inlet or outlet screens or the equivalent effective screen area renders the heat removal system not OPERABLE and this LCO is not met. Partial blockage of less than two air inlet or outlet screens or the equivalent effective screen area does not result in the heat removal system being not OPERABLE. However, corrective actions should be taken promptly to remove the obstruction and restore full flow through the affected air inlet and outlet screens. Alternatively, based on the thermal analyses, if the air temperature rise is less than the limits stated in the SR, adequate air flow and, therefore, adequate heat transfer is occurring to provide assurance of long-term fuel cladding integrity. The reference ambient temperature used to perform this Surveillance shall be measured at the storage pad. The Frequency of 24 hours is reasonable based on the time necessary for VCC and CANISTER components to heat up to unacceptable temperatures assuming design basis heat loads, and allowing for corrective actions to take place upon discovery of the blockage of the air inlet and outlet screens.
REFERENCES	NAC-MPC FSAR Chapter 4, Appendix 4.A and Chapter 11, Section 11.1.1, Section 11.2.8 and Appendix 11.A.

B.3.3 NAC-UMS SYSTEM Integrity

B.3.3.1 CANISTER Maximum Time in the TRANSFER CASK

BASES

BACKGROUND	The cumulative time a loaded, helium backfilled CANISTER may remain in the TRANSFER CASK is limited to 600 hours. This limit ensures that the test duration of 30 days (720 hours) considered in PNL-4835 for zirconium alloy clad fuel for storage in air is not exceeded and ensures that the TRANSFER CASK is used as intended. The time limit is established to preclude long-term storage of a loaded CANISTER in the TRANSFER CASK. For heat loads less than or equal to 20kW (PWR) forced air cooling is not required. The maximum heat load allowed by NAC-UMS TRANSPORTATION CASK for the shipment of Maine Yankee fuel is 19.92 kW.
APPLICABLE SAFETY ANALYSIS	Analyses reported in the NAC-UMS Safety Analysis Report for heat loads of 20 kW or less (PWR), and with the CANISTER backfilled with helium, the analysis shows that the fuel cladding and CANISTER components reach a steady-state temperature below the short-term allowable temperatures. Therefore, the time in the TRANSFER CASK is limited to 600 hours. This limit ensures that the test duration of 30 days (720 hours) considered in PNL 4835 for zirconium alloy clad fuel for storage in air is not exceeded and ensures that the TRANSFER CASK is used as intended. Since the 600 hours is significantly less than the 720 hours considered in PNL-4835, operation in the TRANSFER CASK to this period is acceptable.
LCO	For PWR heat loads less than or equal to 20 kW, the thermal analysis shows that the presence of helium in the CANISTER is sufficient to maintain the fuel cladding and CANISTER component temperatures below the short term temperature limits. Therefore, forced air cooling is not required for these heat load conditions. Therefore, the CANISTER may remain in the TRANSFER CASK for up to 600 hours, where the time limit is based on the test duration of 30 days (720 hours) considered in PNL 4835 for zirconium alloy clad fuel for storage in air rather than on temperature limits.

BASES

APPLICABILITY	During TRANSFER OPERATIONS the TRANSFER CASK active cooling system must be in operation or the time limits specified must be adhered to. This LCO is applicable once a CANISTER is lifted off the VCC pedestal or the TRANSPORTATION CASK is no longer in the horizontal orientation.
ACTIONS	A note has been added to the ACTIONS, which states that, for this LCO, separate Condition entry is allowed for each NAC-UMS® system. This is acceptable, since the Required Actions for each Condition provide appropriate compensatory measures for each NAC-UMS® system not meeting the LCO. Subsequent NAC-UMS® systems that do not meet the LCO are governed by subsequent Condition entry and application of associated Required Actions. A note has been added to Condition A that reminds users that all time spent in Condition A is included in the 600-hour cumulative limit. If the LCO 3.1.4. 600-hour cumulative time limit is exceeded: A.1 The CANISTER shall be placed in a VCC. <u>OR</u> A.2 The CANISTER shall be placed in a TRANSPORTATION CASK.
SURVEILLANCE REQUIREMENTS .	SR 3.3.1.1 The elapsed time from entry into the LCO conditions of Applicability until placement of the CANISTER in a VCC or TRANSPORTATION CASK shall be monitored.
REFERENCES	NAC-UMS FSAR Sections 4.4, 8.1 and 8.2.

B.3.3.2 VCC Heat Removal System

BASES

BACKGROUND	The VCC Heat Removal System is a passive, air-cooled convective heat transfer system, which ensures that heat from the CANISTER is transferred to the environment by the upward flow of air through the VCC. Relatively cool air is drawn into the annulus between the VCC and the CANISTER through the four air inlets at the bottom of the VCC. The CANISTER transfers its heat from the CANISTER surface to the air via natural convection. The buoyancy created by the heating of the air creates a chimney effect and the air flows back into the environment through the four air outlets at the top of the VCC.
APPLICABLE SAFETY ANALYSIS	The thermal analyses of the VCC take credit for the decay heat from the spent fuel assemblies being ultimately transferred to the ambient environment surrounding the VCC. Transfer of heat away from the fuel assemblies ensures that the fuel cladding and CANISTER component temperatures do not exceed applicable limits. Under normal storage conditions, the four air inlets and four air outlets are unobstructed and full air flow (i.e., maximum heat transfer for the given ambient temperature) occurs. Analyses have been performed for the complete obstruction of all of the air inlets and outlets. The complete blockage of all air inlets and outlets stops air cooling of the CANISTER. The CANISTER will continue to radiate heat to the relatively cooler inner shell of the VCC. With the loss of air cooling, the CANISTER component temperatures will increase toward their respective short-term temperature limits. The limiting components are the CANISTER basket support and heat transfer disks, which, by analysis, approach their temperature limits in 24 hours, if no action is taken to restore air flow to the heat removal system. The maximum fuel clad temperatures remain below allowable accident limits for approximately six days (150 hours) with complete air flow blockage.
LCO	The VCC Heat Removal System must be verified to be OPERABLE to preserve the assumptions of the thermal analyses. Operability of the heat removal system ensures that the decay heat generated by the stored fuel assemblies is transferred to the environment at a sufficient rate to maintain fuel cladding and CANISTER component temperatures within design limits.

BASES

APPLICABILITY

The LCO is applicable during STORAGE OPERATIONS. Once a VCC containing a CANISTER loaded with spent fuel has been placed in storage, the heat removal system must be OPERABLE to ensure adequate heat transfer of the decay heat away from the fuel assemblies.

ACTIONS

A note has been added to ACTIONS that states for this LCO, separate Condition entry is allowed for each VCC. This is acceptable since the Required Actions for each Condition provide appropriate compensatory measures for each VCC not meeting the LCO. Subsequent VCCs that do not meet the LCO are governed by subsequent Condition entry and application of associated Required Actions.

A.1

If the VCC heat removal system has been determined to not be OPERABLE, it must be restored to an analyzed safe status immediately, with adequate heat removal capability. Immediately, defined as the required action to be pursued without delay and in a controlled manner, provides a reasonable period of time (typically, one operating shift) to take action to remove the obstructions in the air flow path.

In order to meet A.1, adequate heat removal capability must be verified to exist, either by visual observation of at least two unobstructed air inlet and outlet screens or by physically clearing any blockage from two air inlet and outlet screens, to prevent exceeding the short-term temperature limits.

Thermal analysis of a fully blocked VCC shows that without adequate heat removal, the fuel cladding accident temperature limit could be exceeded over time. As a result, requiring immediate verification of adequate heat removal capability will ensure that the VCC and CANISTER components and the fuel cladding do not exceed their short-term temperature limits.

The thermal analysis also shows that complete blockage of two air inlet and outlet screens results in no potential for exceeding accident fuel cladding, VCC or CANISTER component temperature limits. As a result, verifying that there are at least two unobstructed air inlet and outlet screens will ensure that the accident temperature limits are not exceeded during the time that the remainder of the air inlet and outlet screens are returned to OPERABLE status.

AND

BASES

ACTIONS (continued)

A.2
In addition to Required Action A.1 restore the VCC Heat Removal System to OPERABLE is not an immediate concern. Therefore, restoring it within 25 days is considered a reasonable period of time.

B.1

If the Required Actions A.1 or A.2 cannot be met, an engineering evaluation is performed to verify that the VCC heat removal system is OPERABLE.

The Completion Time for this Required Action of 5 days will ensure that the CANISTER remains in a safe, analyzed condition.

<u>OR</u>

B.2
Place the affected NAC-UMS SYSTEM in a safe condition.

The Completion Time for this Required Action is 5 days. Requiring B.2 action completion within 5 days will ensure that the NAC-UMS SYSTEM is maintained in a safe condition.

SURVEILLANCE REQUIREMENTS

SR 3.3.2.1

The long-term integrity of the stored fuel is dependent on the ability of the VCC to reject heat from the CANISTER to the environment. Visual observation that all four air inlet and outlet screens are unobstructed and intact ensures that air flow past the CANISTER is occurring and heat transfer is taking place. Complete blockage of one or more air inlet or outlet screens renders the heat removal system inoperable and this LCO is not met. Partial blockage of one or more air inlet or outlet screens does not constitute inoperability of the heat removal system. However, corrective actions should be taken promptly to remove the obstruction and restore full flow through the affected air inlet and outlet screens. Alternatively, based on the analyses, if the air temperature rise is less than the limits stated in the SR, adequate air flow and, therefore, adequate heat transfer is occurring to provide assurance of long-term fuel cladding integrity. The reference ambient temperature used to perform this Surveillance shall be measured at the WCS CISF.

BASES

SURVEILLANCE REQUIREMENTS (continued)	SR 3.3.2.1 (continued) The Frequency of 24 hours is reasonable based on the time necessary for VCC and CANISTER components to heat up to unacceptable temperatures assuming design basis heat loads, and allowing for corrective actions to take place upon discovery of the blockage of the air inlet and outlet screens. SR 3.3.2.2 The initial confirmation of the OPERABILITY of the VCC is established based on air temperature measurements at the VCC outlets and the WCS CISF ambient, and verification that the air temperature rise is less than the limits stated in the SR. Following the initial confirmation, the continued OPERABILITY of the VCC shall be confirmed by one of the verification methods specified in SR 3.3.2.1. The specified Frequency of once between 5 and 30 days after beginning STORAGE OPERATIONS is reasonable and ensures that the VCC has reached thermal equilibrium and, therefore, the outlet air temperature measurements will reflect expected temperatures under normal operations. Completion of the measurements within 30 days of placement of the VCC into STORAGE OPERATIONS ensures that corrective actions can be taken to establish the OPERABLE status of the VCC within a reasonable period of time.
REFERENCES	NAC-UMS FSAR Chapter 4 and Chapter 11, Section 11.1.2 and Section 11.2.13.

B.3.4 MAGNASTOR SYSTEM Integrity

B.3.4.1 CANISTER Maximum Time in the TRANSFER CASK

BASES

BACKGROUND	When a MAGNASTOR CANISTER is lifted off a VCC pedestal or when the MAGNATRAN TRANSPORTATION CASK is no longer in the horizontal orientation, there are time limits with completing the transfer from a TRANSPORTATION CASK to a VCC and vice versa without the TRANSFER CASK active cooling system in operation.
APPLICABLE SAFETY ANALYSIS	To protect the fuel cladding from exceeding allowable temperature limits, the TRANSFER CASK active cooling system must be running or the transfer from a TRANSPORTATION CASK to a VCC and vice versa must be completed within a maximum timeframe.
LCO	A dry pressurized, helium filled and sealed CANISTER establishes the inert environment that will ensure the integrity of the fuel cladding and proper performance of the MAGNASTOR system thermal design, while precluding air in-leakage and out-leakage of radioactive materials. Table A provides the time limit for completing the first attempt at TRANSFER OPERATIONS. The heat load limit specified is the maximum heat load limit authorized in the MAGNATRAN TRANSPORTATION CASK. If the initial attempt at TRANSFER OPERATIONS is not completed in 41 hours, the TRANSFER CASK active cooling system must be placed in operation for a minimum of 24 hours to restore the CANISTER thermal condition to the initial thermal condition presented in the thermal transient analysis for the MAGNASTOR TRANSFER CASK. Once the CANISTER thermal condition is restored to the initial transient analysis condition, a subsequent transfer attempt can be performed. Per Table B, the time limit for subsequent attempts at TRANSFER OPERATIONS is 31 hours.

BASES

APPLICABILITY	During TRANSFER OPERATIONS the TRANSFER CASK active cooling system must be in operation or the time limits specified must be adhered to. This LCO is applicable once a CANISTER is lifted off the VCC pedestal or the TRANSPORTATION CASK is no longer in the horizontal orientation.
ACTIONS	A note has been added to the ACTIONS, which states that, for this LCO, separate Condition entry is allowed for each CANISTER. This is acceptable as the Required Actions for each Condition provide appropriate compensatory measures for each CANISTER not meeting the LCO. Subsequent CANISTERS that do not meet the LCO are governed by subsequent Condition entry and application of associated Required Actions. A.1 If the TRANSFER OPERATIONS is not going to be completed in time, the CANISTER must be returned to the TRANSFER CASK immediately. <u>AND</u> A.2 The TRANSFER CASK active cooling system must be operational immediately <u>AND</u> A.3 The TRANSFER CASK active cooling system must be operational for at least 24 hours before attempting a subsequent transfer attempt.
SURVEILLANCE REQUIREMENTS	SR 3.4.1.1 During TRANSFER OPERATIONS and prior to TRANSPORT OPERATIONS, the amount of time the CANISTER remains off a VCC pedestal or not in a MAGNATRAN TRANSPORTATION CASK that is not in the horizontal orientation must be continuously recorded. In addition, the amount of time the CANISTER has been in a TRANSFER CASK without the TRANSFER CASK active cooling system operational must be continuously recorded.
REFERENCES	MAGNASTOR FSAR Sections 4.4 and 9.1.

B.3.4.2 VCC Heat Removal System

BASES

BACKGROUND	The heat removal system for the VCC containing a loaded TSC is a passive, convective air-cooled heat transfer system that ensures that the decay heat emitted from the TSC is transferred to the environment by the upward flow of air through the VCC annulus. During STORAGE OPERATIONS, ambient air is drawn into the VCC annulus through the four air inlets located at the base of the VCC. The heat from the TSC surfaces is transferred to the air flow via natural circulation. The buoyancy of the heated air creates a chimney effect forcing the heated air upward and drawing additional ambient air into the annulus through the air inlets. The heated air flows back to the ambient environment through the four air outlets located in the VCC lid.
APPLICABLE SAFETY ANALYSIS	The thermal analyses of the MAGNASTOR SYSTEM take credit for the decay heat from the TSC contents being transferred to the ambient environment surrounding the VCC. Transfer of heat from the TSC contents ensures that the fuel cladding and TSC component temperatures do not exceed established limits. During normal STORAGE OPERATIONS, the four air inlets and four air outlets are unobstructed and full natural convection heat transfer occurs (i.e., maximum heat transfer for a given ambient temperature and decay heat load). Vent obstruction can be any type of accumulation within the vent that restricts airflow. Analyses have been performed for two scenarios corresponding to the complete obstruction of what is equivalent to two and four air inlets. Blockage of the equivalent area of two air inlets reduces the convective air flow through the VCC/TSC annulus and decreases the heat transfer from the TSC surfaces to the ambient environment. Under this off-normal event, no VCC or TSC components or fuel cladding exceed established short-term temperature limits, and the TSC internal pressure does not exceed the analyzed maximum pressure. The complete blockage of all four air inlets effectively stops the transfer of the decay heat from the TSC due to the elimination of the convective air flow. The TSC will continue to radiate heat to the liner of the VCC. Upon loss of air cooling, the MAGNASTOR SYSTEM component temperatures will increase toward their respective established accident temperature limits. The spent fuel cladding and fuel basket and VCC structural component temperatures do not reach their accident limits for a time period of approximately 72 hours. The internal pressure in the TSC cavity will not reach the analyzed maximum pressure condition for approximately 58 hours after a complete blockage condition occurs.

BASES

APPLICABLE SAFETY ANALYSIS (continued)	Therefore, following the identification of a reduction in the heat dissipation capabilities of the VCC by the temperature- monitoring program or the visual inspection of the air inlet and outlet screens, actions are to be taken immediately to restore at least partial convective airflow (i.e., a minimum area of what is equivalent of two air inlet and all four air outlets are unobstructed). Once partial airflow is established, the fuel cladding and the TSC and component temperatures will not exceed normal STORAGE OPERATIONS limits. Efforts to reestablish full OPERABLE status for the VCC can then be undertaken in a controlled manner. If necessary, the TSC may be transferred into the TRANSFER CASK to permit full access to the base of the VCC for repairs with minimal radiological effects.
LCO	The VCC heat removal system is to be verified to be OPERABLE to preserve the applicability of the design bases thermal analyses. The continued operability of the heat removal system ensures that the decay heat generated by the TSC contents is transferred to the ambient environment to maintain the fuel cladding and VCC and TSC temperatures within established limits.
APPLICABILITY	The LCO is applicable during STORAGE OPERATIONS. Once the VCC lid is installed following transfer of a loaded TSC, the heat removal system is required to be OPERABLE to ensure adequate heat transfer.
ACTIONS	A Note has been added to the Actions that states for this LCO, separate condition entry is allowed for each VCC. This is acceptable, as the Required Actions for each Condition provide appropriate compensatory measures for each VCC not meeting the LCO. Other VCCs that do not meet the LCO are addressed by independent Condition entry and application of the associated Required Actions. A.1 If the VCC heat removal system has been determined to be inoperable, full operability is to be restored, or at a minimum, adequate heat removal must be restored or verified to prevent exceeding fuel cladding and critical component temperatures for accident events. Adequate heat removal capability is ensured by having at least the equivalent area of two VCC air inlets and all four air outlets unobstructed, which is consistent with the analyzed off-normal event. Alternatively, adequate heat removal can be verified by measuring the exit air temperature from the four air outlets and determining the temperature rise over the WCS CISF ambient air temperature.

BASES

ACTIONS (continued)

This verification must be completed immediately where "immediately" is defined as "the required action should be pursued without delay in a controlled manner". Restoration of adequate heat removal must be completed within 58 hours of the last operability determination to ensure the TSC internal pressure limit is not exceeded per the analysis in MAGNASTOR FSAR Section 12.2.13.3, which is the most restrictive time limit.

Thermal analyses of a fully blocked VCC air inlet condition show that fuel cladding and critical basket material accident temperatures and internal pressure limits could be exceeded over time. As a result, requiring immediate verification, or restoration, of adequate heat removal capability will ensure that accident temperature and pressure limits are not exceeded. Once adequate heat removal has been reestablished or verified, the additional actions required to restore the VCC to OPERABLE status can be completed under A.2.

<u>AND</u>

A.2

In addition to Required Action A.1, efforts are required to be continued to restore the VCC heat removal system to OPERABLE.

As long as adequate heat removal capability has been verified to exist, restoring the VCC heat removal system to fully OPERABLE is not an immediate concern. Therefore, restoring it to OPERABLE within 30 days is a reasonable Completion Time.

SURVEILLANCE REQUIREMENTS

SR 3.4.2.1

The long-term integrity of the stored spent fuel is dependent on the continuing ability of the VCC to reject decay heat from the TSC to the ambient environment. Routine verification that the four air inlets and four air outlets are unobstructed and intact ensures that convective airflow through the VCC/TSC annulus is occurring and performing effective heat transfer. Alternatively, the Surveillance Requirement can be fulfilled by measuring the exit air temperature from the four air outlets and determining the temperature rise over the WCS CISF ambient air temperature. As long as the temperature increase of the convective airflow is less than the surveillance limits, adequate heat transfer is occurring to maintain VCC, TSC, and spent fuel cladding temperatures below long-term limits.

BASES

SURVEILLANCE REQUIREMENTS (Continued)	SR 3.4.2.1 (continued) If partial or complete blockage of the VCC air inlets occurs, the heat rejection system will be rendered inoperable and this LCO is not met. Immediate corrective actions are to be taken to remove the obstructions from at least two air inlets and all four air outlets, or equivalent area, to restore partial air flow, and additional corrective actions are to be taken to remove all air inlet and outlet obstructions and return the VCC to a fully OPERABLE status. The Frequency of 24 hours is reasonable based on the time necessary for the spent fuel cladding and VCC and TSC component temperatures to reach their short-term temperature limits and the internal pressure to increase to the accident condition pressure limit. The Frequency will allow appropriate corrective actions to be completed in a timely manner.
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REFERENCES	MAGNSTOR FSAR Section 4.4.

CHAPTER 15
MATERIALS EVALUATION

Table of Contents

15. MATERIALS EVALUATION

This chapter provides the detailed descriptions of the materials selected for use in the important-to-safety (ITS) storage pads for the NAC Vertical Concrete Casks (VCCs) and Canister Transfer System and Vertical Cask Transporter (VCT) operational components at the Waste Control Specialists, LLC (WCS) Consolidated Interim Storage Facility (CISF). The significant physical and mechanical properties of materials used in these components are defined, and the material specifications, tests and acceptance conditions important to material use are identified in this chapter.

15.1 Material Selection

15.1.1 ITS Storage Pads

The materials used in the construction of the ITS storage pads are:

Reinforcing bar	ASTM A615/A615M Carbon Steel
Concrete	ASTM C150 Type II Portland Cement

15.1.2 Canister Transfer System

The materials used in the construction of the Canister Transfer System are:

Lift Tower	ASTM A572, Grade 50 Carbon Steel
Lift Beam	ASTM A514 Carbon Steel
Canister Adapter	ASTM A516, Grade 70 Carbon Steel
Base and Top Plates	ASTM A572, Grade 50 Carbon Steel
Lift Pins/Bolts	ASTM A693/564, Type 630 17-4PH
	ASTM A325 & ASTM A311

15.1.3 Vertical Cask Transporter

The materials used in the construction of the VCT are:

Lift Tower	ASTM A572, Grade 50 Carbon Steel
Lift Beam	ASTM A514 Carbon Steel
Lift Links	ASTM A514 Carbon Steel
Lift Pins/Bolts	ASTM A693/564, Type 630 17-4PH
	ASTM A325 & ASTM A311

15.1.4 Canisters and Storage Overpacks

Only canisters that have been previously approved by the NRC to store and transport commercial light water (PWR and BWR) spent nuclear fuel and GTCC waste will be received at the WCS CISF. The controls for limiting the types and forms of spent nuclear fuel received at the WCS CISF are the same as those placed on the cask systems by the NRC-issued site licenses or certificates of compliance for the included transportation and storage systems. The approved systems are listed in Section 2.1 of the Technical Specifications [15-6]. As demonstrated in Chapter 2, the WCS CISF is not located in an area where the canisters will experience atmospheric chloride corrosion. However, when the Aging Management Program for a give canister is invoked at the WCS CISF, the conditions at the point of origin for the canister will be used to determine which portions of the Aging Manager Program will be applied to the canister at the WCS CISF. (See License Condition 20 for Aging Management Program Commitments for the WCS CISF).

Because only previously loaded canisters will be accepted at the WCS CISF the following topics identified in ISG-15 are remain unchanged from what has been previously reviewed and approved by the US NRC in the applications incorporated by reference listed in Section 1.6.

- Material Properties
- Weld Design and Inspection
- Galvanic and Corrosive Reactions
- Bolt Applications
- Protective Coatings and Surface Treatments
- Neutron Shielding Materials
- Materials for Criticality Control
- Seals
- Low Temperature Ductility of Ferritic Steels
- Fuel Cladding, including burnup and cladding temperature limits
- Prevention of Oxidation Damage During Loading of Fuel
- Flammable Gas Generation
- Canister Closure Weld testing and Inspection

15.2 Applicable Codes and Standards

The principal codes and standards applied to the ITS components of the Canister Transfer System and VCT and the ITS storage pads are the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, the American Society for Testing and Materials (ASTM), and the American Concrete Institute (ACI). Materials meeting the requirements of these codes and/or standards conform to acceptable minimum thickness, chemical content and formulation specifications and are fabricated using controlled processes and procedures.

Base materials for the Canister Transfer System and the VCT will adhere, as applicable, to NOG-1 [15-1] and ANSI N14.6 [15-5] fracture toughness requirements.

The following sections list the applicable codes and standards applicable to the various canisters and storage overpacks authorized for storage at the WCS CISF

15.2.1 Canisters

15.2.1.1 FO-, FC-, FF-DSCs

The DSCs are designed to meet the stress intensity allowables of the ASME Boiler and Pressure Vessel Code (1983) Section III, Division I, Subsections NB, NF, and NG for Class I components and supports, as applicable. ASME Code Service Levels A and B allowables are used for normal and off-normal operating conditions. Service Levels C and D allowables are used for accident conditions such as a postulated cask drop accident. Approved code alternatives are addressed in Section 4.3.4 of Appendix: Technical Specifications to SNM-2510.

15.2.1.2 NUHOMS®-24PT1 DSC

The DSC is designed fabricated and inspected to the maximum practical extent in accordance with ASME Boiler and Pressure Vessel Code Section III, Division 1, 1992 Edition with Addenda through 1994, including exceptions allowed by Code Case–595-1, Subsections NB, NF and NG for Class 1 components and supports. Code Alternatives are discussed in Section 4.3.4 of Appendix A: Technical Specifications for the Advanced NUHOMS® System to CoC No. 1029.

15.2.1.3 NUHOMS®-61BT DSC

The DSC is designed fabricated and inspected to the maximum practical extent in accordance with ASME Boiler and Pressure Vessel Code Section III, Division 1, 1998 Edition with Addenda through 2000, Subsections NB, NF and NG for Class 1 components and supports. Code Alternatives are discussed in Section 4.2.4 of Appendix A: Technical Specifications for the Standardized NUHOMS® Horizontal Modular Storage System to CoC No. 1004.

15.2.1.4 NUHOMS®-61BTH Type 1 DSC

The DSC is designed fabricated and inspected to the maximum practical extent in accordance with ASME Boiler and Pressure Vessel Code Section III, Division 1, 1998 Edition with 1999 Addenda, Subsections NB, NF and NG for Class 1 components and supports. Code Alternatives are discussed in Section 4.2.4 of Appendix A: Technical Specifications for the Standardized NUHOMS® Horizontal Modular Storage System to CoC No. 1004.

15.2.1.5 NAC-MPC Canister

The NAC-MPC canister and spent fuel basket are designed fabricated and inspected to the maximum practical extent in accordance with ASME Boiler and Pressure Vessel Code Section III, Subsection NB and NG, 1995 Edition with Addenda through 1995, respectively. Table B3-1 of the NAC-MPC CoC No. 1025 lists approved alternatives to the ASME Code for the design, procurement, fabrication, inspection and testing of NAC-MPC system canisters and spent fuel baskets.

15.2.1.6 NAC-UMS Canister

The NAC-UMS canister and spent fuel basket are designed fabricated and inspected to the maximum practical extent in accordance with ASME Boiler and Pressure Vessel Code Section III, Subsection NB and NG, 1995 Edition with Addenda through 1995, respectively. Table B3-1 of the NAC-MPC CoC No. 1015 lists approved alternatives to the ASME Code for the design, procurement, fabrication, inspection and testing of NAC-UMS system canisters and spent fuel baskets.

15.2.1.7 MAGNASTOR Canister

The MAGNASTOR canister and spent fuel basket are designed fabricated and inspected to the maximum practical extent in accordance with ASME Boiler and Pressure Vessel Code Section III, Subsection NB and NG, 2001 Edition with Addenda through 2003, respectively. Table 2.1-2 of the MAGNASTOR FSAR lists approved alternatives to the ASME Code for the design, procurement, fabrication, inspection and testing of MAGNASTOR system canisters and spent fuel baskets CoC No. 1031.

15.2.2 Storage Overpacks

15.2.2.1 HSM Model 80

The reinforced concrete HSMs are designed to meet the requirements of ACI 349-85. The load combinations specified in ANSI 57.9-1984, Section 6.17.3.1 are used for combining normal operating, off-normal, and accident loads for the HSM. Approved code alternatives are addressed in Section 4.3.4 of Appendix: Technical Specifications to SNM-2510.

15.2.2.2 AHSM

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

15.2.2.3 HSM Model 102

The HSM Model 102 reinforced concrete are designed to meet the requirements of ACI 349-85 and ACI 349-97 Editions, respectively. Load combinations specified in ANSI 57.9-1984, Section 6.17.3.1 are used for combining normal operating, off-normal, and accident loads for the HSM.

15.2.2.4 NAC-MPC VCC

The American Concrete Institute Specifications ACI 349 (1985) and ACI 318 (1995) govern the NAC-MPC system VCC design and construction, respectively.

15.2.2.5 NAC-UMS VCC

The American Concrete Institute Specifications ACI 349 (1985) and ACI 318 (1995) govern the NAC-UMS system VCC design and construction, respectively.

15.2.2.6 MAGNASTOR VCC

The American Concrete Institute Specifications ACI-349 (1985) and ACI-318 (1995) govern the MAGNASTOR system VCC design and construction, respectively.

15.2.3 Transfer Casks for Vertical Systems

The American National Standards Institute ANSI N14.6 (1993) and NUREG-0612 govern the NAC-MPC, NAC-UMS and MAGNASTOR system transfer cask designs, operations, fabrication, testing, inspection, and maintenance.

15.3 Material Properties

The mechanical properties of steels used in the fabrication of ITS the storage pad and Cask Transfer System and VCT components are presented in the following sections.

15.3.1 ITS Storage Pads

The ITS storage pad construction is built with the use of concrete and reinforcing bar. The following specifications and details apply to these materials.

15.3.1.1 ASTM C150 Type II Portland Cement

Values at Temperature (100°F)	
Compressive strength "specified" (psi):	4000
Modulus of Elasticity, E (× 10^6 psi):	3.605
Coefficient of Thermal Expansion, α (×10^{-6} in/in/°F):	5.5
Density "specified" (lb/ft^3)	150

15.3.1.2 ASTM A615/A615M, Grade 60 Carbon Steel Reinforcing Bar

Values at Temperature (100°F)	
Ultimate Strength (ksi):	90.0
Yield Strength (ksi):	60.0
Modulus of Elasticity, E (× 10^6 psi):	29.88
Coefficient of Thermal Expansion, α (x 10^{-6} in/in/°F)	6.1
Density (lbm/in^3)	0.284

15.3.2 Canister Transfer System

The Canister Transfer System consists of four synchronized vertical hydraulic booms and moves on steel rails the entire length of the Canister Transfer System Operations Area. This area includes loading/unloading areas at each end for transfer cask change-out, lid storage and transfer adapter storage. Between the tops of the vertical hydraulic booms, across the width of the operations zone, are two lift beams. Connecting the lift beams, in the longitudinal direction is a trolley beam that allows transverse motion. Lifting links are positioned in fixed locations on the trolley beam and are interchangeable for different transfer cask types. Loads are lifted by energizing the vertical hydraulic booms, in a synchronized motion, to raise and lower the top framework of the Canister Transfer System. The following materials are identified in the analysis of the Canister Transfer System.

15.3.2.1 ASTM A572, Gr. 50 - CTS lift tower [15-3]

Ultimate Strength (ksi):	65.0

Yield Strength (ksi):	50.0
Modulus of Elasticity, E (× 10^6 psi):	
Coefficient of Thermal Expansion, α (x 10^{-6} in/in/°F)	
Density (lbm/in^3)	

15.3.2.2 ASTM A514 - CTS Header Plate [15-4]

Ultimate Strength (ksi):	110.0
Yield Strength (ksi):	100.0

15.3.2.3 ASTM A693/564, Type 630 - Lift Pin [15-3]

Ultimate Strength (ksi):	135.0
Yield Strength (ksi):	105.0
Modulus of Elasticity, E (× 10^6 psi)	28.5
Coefficient of Thermal Expansion, α (x 10^{-6} in/in/°F)	5.9
Density (lbm/in^3)	0.29

15.3.2.4 ASTM A516, Gr 70 - Canister Adapter Plate [15-3]

Ultimate Strength (ksi):	70.0
Yield Strength (ksi):	38.0
Modulus of Elasticity, E (× 10^6 psi):	29.2
Coefficient of Thermal Expansion, α (x 10^{-6} in/in/°F)	6.4
Density (lbm/in^3)	0.284

15.3.2.5 ASTM A574, Gr 70 - Canister Adapter Plate Bolts [15-3]

Ultimate Strength (ksi):	170.0
Yield Strength (ksi):	135.0

15.3.2.6 ASTM A325 – Bolts [15-1]

Ultimate Strength (ksi):	120.0
Yield Strength (ksi):	92.0

15.3.2.7 ASTM A311, Class B – Pins [15-2]

Ultimate Strength (ksi):	170.0
Yield Strength (ksi):	135.0

15.3.2.8 ASTM A572, Grade 50 [15-1]

Ultimate Strength (ksi):	65.0

Yield Strength (ksi): 50.0

15.3.2.9 ASTM A36 [15-1]

Ultimate Strength (ksi): 58.0

Yield Strength (ksi): 36.0

15.3.2.10 ASTM A490 [15-1]

Ultimate Strength (ksi): 150.0

Yield Strength (ksi): 130.0

15.3.3 Vertical Cask Transporter

The VCT consists of two synchronized vertical hydraulic booms and is driven on steel tracks. The range of operations is areas between the Canister Transfer System and the Storage Area. Between the tops of the vertical hydraulic booms, across the width of the VCT is the lift beam, from which the lift links are hung. Lifting links are positioned in fixed locations on the beam and are interchangeable for different transportation cask and storage cask types. Loads are lifted by energizing the vertical hydraulic booms, in a synchronized motion, to raise and lower the lift beam of the VCT. The following materials are identified in the analysis of the VCT.

15.3.3.1 ASTM A572, Gr. 50 - VCT lift tower [15-3]

Values at Temperature (100°F)

Ultimate Strength (ksi): 65.0

Yield Strength (ksi): 50.0

Modulus of Elasticity, E ($\times 10^6$ psi):

Coefficient of Thermal Expansion, α (x 10^{-6} in/in/°F)

Density (lbm/in^3)

15.3.3.2 ASTM A514 - VCT Header/Lift Link [15-4]

Values at Temperature (100°F)

Ultimate Strength (ksi): 110.0

Yield Strength (ksi): 100.0

15.3.3.3 ASTM A693/564, Type 630 - Lift Pin [15-3]

Values at Temperature (70°F)

Ultimate Strength (ksi): 135.0

Yield Strength (ksi): 105.0

Modulus of Elasticity, E ($\times 10^6$ psi): 28.5

Coefficient of Thermal Expansion, α (x 10^{-6} in/in/°F)	5.9
Density (lbm/in^3)	0.29

15.4 References

15-1 ASME NOG-1-2010, "Rules for Construction of Overhead and Gantry Cranes (Top Running Bridge, Multiple Girder)," The American Society of Mechanical Engineers, 2010.

15-2 ASTM A311/A311M – 04 (Reapproved 2010), "Standard Specification for Cold-Drawn, Stress-Relieved Carbon Steel Bars Subject to Mechanical Property Requirements," ASTM International, West Conshohocken, Pennsylvania.

15-3 "Structural and Thermal Material Properties – MAGNASTOR/MAGNATRAN Cask System," NAC Calculation 71160-2101 Rev. 7, NAC International, Atlanta, Georgia.

15-4 ASTM A514/A514M – 05 (Reapproved 2009) "Standard Specification for High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding," West Conshohocken, PA, 2009.

15-5 ANSI N14.6-1993 American National Standard for Radioactive Materials – "Special Lifting Devices for Shipping Containers Weighing 10,000 Pounds (4500 kg) or More," 1993.

15-6 Proposed SNM-1050, WCS Interim Storage Facility Technical Specifications, Amendment 0.