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Preclosure Nuclear Safety Design Bases

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ACRONYMS AND ABBREVIATIONS

ACRONYMS

CRCF	Canister Receipt and Closure Facility
DOE	U.S. Department of Energy
EDGF	Emergency Diesel Generator Facility
HVAC	heating, ventilation, and air-conditioning
IHF	Initial Handling Facility
ITS	important to safety
LLWF	Low-Level Waste Facility
RF	Receipt Facility
SSC	structure, system, or component
SSCs	structures, systems, and components
TAD	transportation, aging, and disposal
WHF	Wet Handling Facility

ABBREVIATIONS

cm	centimeter
ft	foot
hr	hour
mi	mile
yr	year

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1. PURPOSE

The purpose of this report is to document the structures, systems, and components (SSCs) that have been determined to be important to safety (ITS) for the transportation, aging, and disposal (TAD) canister-based repository design during the Yucca Mountain Repository preclosure period and to document the preclosure nuclear safety design bases associated with the ITS SSCs. This report does not categorize SSCs as ITS (or non-ITS) or generate the preclosure nuclear safety design bases associated with the ITS SSCs. Instead, this report serves to document the results of the analyses and calculations that have been completed that accomplish the selection of ITS SSCs and their nuclear safety design bases, as well as design requirements from other preclosure safety calculations and analyses (including seismic analyses, criticality analyses, and external hazards analyses) that generate design requirements.

The scope of this report does not include the assignment of design requirements to SSCs or natural or engineered barriers that are important to waste isolation (ITWI).

2. QUALITY ASSURANCE

As determined from Section 2.1.C.1.1 of the *Quality Management Directive* (Ref. 8.1.1), the activity under which this report was developed is subject to the repository quality assurance program requirements because this report lists SSCs that are ITS, their safety functions, and their controlling parameters and values, as defined by 10 CFR 63.2, (Ref. 8.3.1) and it is part of the preclosure safety analysis. Therefore, the approved version of this document is designated as QA: QA. This report was prepared in accordance with PA-PRO-0313, REV 6, *Technical Reports* (Ref. 8.1.2) and LS-PRO-0201, REV 5, *Preclosure Safety Analyses Processes* (Ref. 8.1.4).

3. USE OF SOFTWARE

The operating environment used in writing this report included the use of Microsoft® Word 2003 software installed on a Dell OPTIPLEX 745 personal computer. The operating system used on this computer is Microsoft Windows XP Professional Version 5.1.2600. The use of Microsoft® Word software is classified as Level 2 software usage per Attachment 12 of *Software Management* (Ref. 8.1.3). No software (approved for quality assurance work or commercially available) was used for any calculation in this analysis.

4. DIRECT INPUT

The following analyses were used as input for documenting the classification of SSCs and the preclosure nuclear safety design bases for the ITS SSCs.

4.1. *Frequency Analysis of Aircraft Hazards for License Application.* 000-00C-WHS0-00200-000-00F (Ref. 8.2.2). Basis: This input is appropriate for use because it provides design requirements for the surface facilities associated with aircraft hazards.

4.2 *External Events Hazards Screening Analysis.* 000-00C-MGR0-00500-000-00C (Ref. 8.2.3). Basis: This input is appropriate for use because it provides design requirements for the surface facilities associated with external events.

4.3 *Seismic Event Sequence Quantification and Categorization.* 000-PSA-MGR0-01100-000-00A (Ref. 8.2.4). Basis: This input is appropriate for use because it provides design requirements associated with seismic events.

4.4 *Preclosure Criticality Safety Analysis.* TDR-MGR-NU-000002-001 (Ref. 8.2.5). Basis: This input is appropriate for use because it provides the analysis basis associated with criticality safety.

4.5 *Initial Handling Facility Reliability and Event Sequence Categorization Analysis.* 51A-PSA-IH00-00200-000-00A (Ref. 8.2.6). Basis: This input is appropriate for use because it provides the IHF SSCs classified as ITS and provides the nuclear safety design bases associated with the IHF ITS SSCs.

4.6 *Canister Receipt and Closure Facility Reliability and Event Sequence Categorization Analysis.* 060-PSA-CR00-00200-000-00A (Ref. 8.2.7). Basis: This input is appropriate for use because it provides the CRCF SSCs classified as ITS and provides the nuclear safety design bases associated with the CRCF ITS SSCs.

4.7 *Wet Handling Facility Reliability and Event Sequence Categorization Analysis.* 050-PSA-WH00-00200-000-00A (Ref. 8.2.8). Basis: This input is appropriate for use because it provides the WHF SSCs classified as ITS and provides the nuclear safety design bases associated with the WHF ITS SSCs.

4.8 *Receipt Facility Reliability and Event Sequence Categorization Analysis.* 200-PSA-RF00-00200-000-00A (Ref. 8.2.9). Basis: This input is appropriate for use because it provides the RF SSCs classified as ITS and provides the nuclear safety design bases associated with the RF ITS SSCs.

4.9 *Subsurface Reliability and Event Sequence Categorization Analysis.* 000-PSA-MGR0-00500-000-00A (Ref. 8.2.10). Basis: This input is appropriate for use because it provides the Subsurface Facility SSCs classified as ITS and provides the nuclear safety design bases associated with the Subsurface Facility ITS SSCs.

4.10 *Intra-Site Operations Reliability and Event Sequence Categorization Analysis.* 000-PSA-MGR0-00900-000-00A (Ref. 8.2.11). Basis: This input is appropriate for use because it provides the intra-site operations SSCs classified as ITS and provides the nuclear safety design bases associated with the intra-site operations ITS SSCs.

4.11 *Repository System Codes.* 000-30X-MGR0-01200-000-00E (Ref. 8.2.12). Basis: This input is appropriate for use because it documents the repository architecture for the facilities, process systems, and infrastructure systems.

5. PRECLOSURE SAFETY ANALYSIS PROCESS

The following sections describe the preclosure safety analysis process, which includes the classification of SSCs as ITS or non-ITS and the development of safety functions and controlling parameters and values (the nuclear safety design bases) for the ITS SSCs. This discussion is provided as a general overview of the preclosure safety analysis process.

5.1 PRECLOSURE SAFETY ANALYSIS

The preclosure safety analysis provides a safety assessment of the repository design and develops the nuclear safety design bases. The nuclear safety design bases and the supporting design information (including the categorization of SSCs) are subject to design control and the other quality assurance criteria of 10 CFR 63.142.

5.2 EVENT SEQUENCE IDENTIFICATION

The first element of the preclosure safety analysis involves performing a systematic review of relevant site and facility features and processes and potential preclosure internal and external initiating events in order to define the set of event sequences. As defined in 10 CFR 63.2, an event sequence is a series of actions and/or occurrences within the natural and engineered components of the geologic repository operations area (GROA) that could potentially lead to exposure of individuals to radiation (including nuclear criticality). An event sequence includes one or more initiating events and associated combinations of repository system component failures, including those produced by the action or inaction of operation personnel. Both internal and external events are evaluated using master logic diagrams supported by hazard analyses, event sequence diagrams, event trees, and fault trees. These methods require a sufficient degree of engineering and design details associated with the site, repository facilities, and SSCs. Event sequences are developed and their frequencies (and uncertainties) are estimated using historical data for similar SSCs or structural fragility calculations. The frequency of occurrence is expressed in terms of the frequency of the particular event sequence occurring during the repository preclosure period.

5.3 CATEGORIZATION OF EVENT SEQUENCES

Based on frequency of occurrence, event sequences are categorized as Category 1 or Category 2 event sequences, as defined in 10 CFR 63.2, or as Beyond Category 2 event sequences. Category 1 event sequences are "those event sequences that are expected to occur one or more times before permanent closure." Category 2 event sequences are "other event sequences that have at least one chance in 10,000 of occurring before permanent closure." The list of Category 1, Category 2, and beyond Category 2 event sequences forms a part of the repository licensing bases.

5.4 DOSE CONSEQUENCES FOR CREDIBLE EVENT SEQUENCES

Offsite (public) and onsite (public and worker) doses are calculated for normal operations and Category 1 event sequences on an annual basis, whereas offsite (public) doses are calculated for individual Category 2 event sequences. The annual dose limits for workers apply to normal operations and Category 1 event sequences, which are expected to occur during the preclosure

operating period of the repository facilities. The radiation dose to construction workers (e.g., the onsite public) during normal operations and phased construction is included as part of the normal operations and Category 1 event sequence dose. If the calculated doses are found to exceed the applicable dose limits, the design is modified or procedural safety controls established. The event sequence analysis is then changed to conform with these modifications. The dose calculation process is also repeated and the results are reevaluated in an iterative process until the calculated doses are within the performance objectives of 10 CFR 63.111.

5.5 PRECLOSURE CRITICALITY SAFETY

10 CFR 63.112(e)(6) (Ref. 8.3.1) requires that preclosure safety analyses must include the consideration of means to prevent and control criticality. The criticality safety analysis process begins with the establishment of criticality safety design and operational criteria. These criteria are established through the review and analysis of waste forms, canister designs, facility designs and characteristics, and the operational sequences performed in the waste-handling facilities. The event sequence analyses serve as an input to the criticality safety analyses by classifying the event sequences (as Category 1, Category 2 or beyond Category 2) if important-to-criticality conditions exist. If an important-to-criticality event sequence cannot be screened from consideration (as having a beyond Category 2 frequency), criticality calculations are performed over the range of parameters that characterize the event sequence. If the calculations indicate that there is a potential for criticality, the design is modified or procedural safety controls established. The event sequence analysis is then changed to conform with these modifications. The criticality safety analysis process is also repeated and the results are reevaluated in an iterative process until criticality safety is ensured.

5.6 IDENTIFICATION OF ITS SSCS

Structures are defined as elements that provide support or enclosure such as buildings, free standing tanks, basins, dikes, and stacks. Systems are collections of components assembled to perform a function, such as heating, ventilation, and air conditioning (HVAC). Components are items of equipment such as pumps, valves, relays, piping, cable trays, conduit or elements of a larger array, such as digital controllers.

The classification of SSCs as ITS (or non-ITS) is an iterative process based on, and consistent with, the level of development of the repository design, which provides input to the classification of SSCs.

Important to safety is defined in 10 CFR 63.2 as:

> *"Important to safety*, with reference to structures, systems, and components, means those engineered features of the geologic repository operations area whose function is:
>
> (1) To provide reasonable assurance that high-level waste can be received, handled, packaged, stored, emplaced, and retrieved without exceeding the requirements of § 63.111(b)(1) for Category 1 event sequences; or
>
> (2) To prevent or mitigate Category 2 event sequences that could result in radiological exposures exceeding the values specified at § 63.111(b)(2) to any individual located on or beyond any point on the boundary of the site."

Implementation of this regulatory definition of ITS has produced the following specific criteria in the preclosure safety analysis to classify SSCs:

> An SSC is classified as ITS if it appears in an event sequence and at least one of the following criteria applies:
>
> - The SSC is relied upon to reduce the frequency of an event sequence from Category 1 to Category 2
> - The SSC is relied upon to reduce the frequency of an event sequence from Category 2 to beyond Category 2
> - The SSC is relied upon to reduce the aggregated dose of Category 1 event sequences by reducing the event sequence mean frequency
> - The SSC is relied upon to perform a dose mitigation or criticality control function.

An SSC is classified as non-ITS if the preceding criteria do not apply. In addition, an SSC is classified as non-ITS if at least one of the following criteria applies:

- The SSC is relied upon to exclusively perform only the normal operational functions of the repository
- The SSC performs a defense-in-depth function for which another SSC provides an ITS function.

The classification process involves the selection of the SSCs in the identified event sequences (including event sequences that involve nuclear criticality) that are relied upon to perform the identified safety functions such that the preclosure performance objectives of 10 CFR Part 63 are not exceeded. The ITS classification extends only to the attributes of the SSC involved in providing the ITS function. If one or more components of a system are determined to be ITS, the system is identified as ITS, even though only a portion of the system may actually be relied upon to perform a nuclear safety function.

5.7 DEVELOPMENT OF NUCLEAR SAFETY DESIGN BASES

Design bases are established for the ITS SSCs as described in 10 CFR 63.2:

> "Design bases means that information that identifies the specific functions to be performed by a structure, system, or component of a facility and the specific values or ranges of values chosen for controlling parameters as reference bounds for design. These values may be constraints derived from generally accepted "state-of-the-art" practices for achieving functional goals or requirements derived from analysis (based on calculation or experiments) of the effects of a postulated event under which a structure, system, or component must meet its functional goals..."

The safety functions and controlling parameters and values (which together are referred to as the nuclear safety design bases in the preclosure safety analysis) are developed from the applicable event sequence analysis results for the SSCs that have been classified as ITS. In general, the controlling parameters and values can be grouped in, but are not limited to, the following categories:

1. Mean frequency of SSC failure: It is demonstrated by analysis that the ITS SSC has a mean frequency of failure of the safety function, with consideration of uncertainties, less than or equal to the stated criterion value

2. Specific design features (e.g., a designed-in speed limit for ITS equipment)

3. Mean unavailability over time period: It is demonstrated by analysis that the ITS SSC or SSCs (e.g., HVAC and ITS electrical power) will have a mean unavailability over a period of a specified number of days, with consideration of uncertainties, of less than or equal to the criterion value.

These controlling parameters and values and reliability and availability goals ensure that the ITS SSCs perform their identified safety functions such that the 10 CFR Part 63 preclosure performance objectives are met. Frequencies and probabilities associated with the controlling parameters and values provide a direct link from the design to the 10 CFR Part 63 requirement for the categorization of event sequences. The parameters and values in Tables B-1 through G-1 are derived from the event sequence analyses completed in References 8.2.6 through 8.2.11 as well as requirements developed in references 8.2.2 through 8.2.5 (based on the analysis of external events, criticality safety, and seismic events). These values provide reasonable assurance, in some cases with considerable conservatism, that the categorization of event sequences provided in References 8.2.6 through 8.2.11 is realized.

6. ARCHITECTURE

6.1 FACILITIES

The list of facilities included in the current repository design is provided in *Basis of Design for the TAD Canister-Based Repository Design Concept* (Ref. 8.2.1). Of particular interest to this

report are the facilities that have radioactive material present and, therefore, present the possibility of event sequences leading to radioactive releases. These facilities include the Aging Facility, Wet Handling Facility (WHF), Receipt Facility (RF), Canister Receipt and Closure Facility (CRCF), Initial Handling Facility (IHF), Low-Level Waste Facility (LLWF), and the Subsurface Facility. The Warehouse and Non-Nuclear Receipt Facility (WNNRF) and Balance of Plant (BOP) facilities are not expected to have any radioactive material present under normal operations. The Emergency Diesel Generator Facility (EDGF) houses equipment that provides a mitigative function in the event of an event sequence.

6.2 SYSTEMS

In general, repository systems are subdivided into process systems and infrastructure systems. Process systems include systems that involve primary processes in the waste handling and waste isolation systems while the infrastructure systems are those systems that are needed to provide support to the process systems and the facilities. Process and infrastructure systems exist and operate in multiple facilities. The process and infrastructure systems described in this report are based on the architecture presented in *Repository System Codes* (Ref. 8.2.12).

The repository Waste Handling System and Waste Isolation System facilities described in this report and the repository process systems that are present in these facilities include the following (Ref. 8.2.12, Figure 2):

- Emergency Diesel Generator Facility

- Aging Facility
  - Aging handling system

- Wet Handling Facility
  - Wet handling facility mechanical handling system
  - Remediation system
  - Cask/canister/waste package process system

- Receipt Facility
  - Receipt facility mechanical handling system
  - Cask/canister/waste package process system

- Canister Receipt and Closure Facility
  - Canister receipt and closure facility mechanical handling system
  - Cask/canister/waste package process system
  - DOE/commercial waste package system
  - Emplacement and retrieval system

- Initial Handling Facility
  - Initial handling facility mechanical handling system
  - Cask/canister/waste package process system
  - DOE/commercial waste package system
  - Naval waste package system

  - Emplacement and retrieval system

- Subsurface Facility
  - Natural barrier system
  - Engineered barrier system
  - DOE and commercial waste package system
  - Naval waste package system
  - Emplacement and retrieval system.

The architecture for the repository process systems and their SSCs, as well as the infrastructure systems, provide the framework for presenting the list of SSCs that have been identified as ITS as well as their nuclear safety design bases. The current preclosure safety analysis collects several processes and activities external to the surface facilities, including the EDGF, the Aging Facility, the LLWF, and the truck and railcar staging areas, into a group called Intra-Site Operations. Activities associated with the emplacement of waste packages are collected into a group called Subsurface Operations. The nuclear safety design bases are presented for these groups, as well as for the WHF, RF, CRCF, and IHF in the appendices to this report.

7. RESULTS AND CONCLUSIONS

The classification of the SSCs that comprise the TAD canister-based repository design was performed in references 8.2.6 through 8.2.11. Table A-1 in Appendix A presents the list of ITS and non-ITS SSCs, as identified in these analyses.

The nuclear safety design bases for the ITS SSCs are also developed in references 8.2.6 through 8.2.11. The nuclear safety design bases for the IHF, CRCF, WHF, RF, Intra-Site Operations, and Subsurface Operations are presented in Tables B-1 through G-1, respectively. In addition, any requirements developed in references 8.2.2 through 8.2.5 (based on the analysis of external events, criticality safety, and seismic events) are included in the appropriate portions of these tables. As the repository design evolves and additional design information is made available, the results of the preclosure safety analysis will be revised (as necessary). The classifications of SSCs and the nuclear safety design bases for the ITS SSCs will be re-evaluated and this report will be revised accordingly.

8. REFERENCES

8.1 PROCEDURES/DIRECTIVES

8.1.1. BSC 2007. *Quality Management Directive.* QA-DIR-10, Rev.2. Las Vegas, Nevada: Bechtel SAIC Company.

8.1.2 PA-PRO-0313, Rev. 6. *Technical Reports*. Las Vegas, Nevada: Bechtel SAIC Company.

8.1.3. IT-PRO-0011, Rev. 7. *Software Management.* Las Vegas, Nevada: Bechtel SAIC Company.

8.1.4 LS-PRO-0201, Rev 5. *Preclosure Safety Analysis Process*. Las Vegas, Nevada: Bechtel SAIC Company.

8.2 DESIGN INPUTS

8.2.1 BSC 2008. *Basis of Design for the TAD Canister-Based Repository Design Concept.* 000-3DR-MGR0-00300-000-002. Las Vegas, Nevada: Bechtel SAIC Company.

8.2.2 BSC 2007. *Frequency Analysis of Aircraft Hazards for License Application.* 000-00C-WHS0-00200-000-00F. Las Vegas, Nevada: Bechtel SAIC Company.

8.2.3 BSC 2008. *External Events Hazards Screening Analysis.* 000-00C-MGR0-00500-000-00C. Las Vegas, Nevada: Bechtel SAIC Company.

8.2.4 BSC 2008. *Seismic Event Sequence Quantification and Categorization.* 000-PSA-MGR0-01100-000-00A. Las Vegas, Nevada: Bechtel SAIC Company.

8.2.5 BSC 2008. *Preclosure Criticality Safety Analysis.* TDR-MGR-NU-000002 REV 01. Las Vegas, Nevada: Bechtel SAIC Company.

8.2.6 BSC 2008. *Initial Handling Facility Reliability and Event Sequence Categorization Analysis.* 51A-PSA-IH00-00200-000-00A. Las Vegas, Nevada: Bechtel SAIC Company.

8.2.7 BSC 2008. *Canister Receipt and Closure Facility Reliability and Event Sequence Categorization Analysis.* 060-PSA-CR00-00200-000-00A. Las Vegas, Nevada: Bechtel SAIC Company.

8.2.8 BSC 2008. *Wet Handling Facility Reliability and Event Sequence Categorization Analysis.* 050-PSA-WH00-00200-000-00A. Las Vegas, Nevada: Bechtel SAIC Company.

8.2.9 BSC 2008. *Receipt Facility Reliability and Event Sequence Categorization Analysis.* 200-PSA-RF00-00200-000-00A. Las Vegas, Nevada: Bechtel SAIC Company.

8.2.10 BSC 2008. *Subsurface Reliability and Event Sequence Categorization Analysis.* 000-PSA-MGR0-00500-000-00A. Las Vegas, Nevada: Bechtel SAIC Company.

8.2.11 BSC 2008. *Intra-Site Operations Reliability and Event Sequence Categorization Analysis.* 000-PSA-MGR0-00900-000-00A. Las Vegas, Nevada: Bechtel SAIC Company.

8.2.12 BSC 2007. *Repository System Codes*. 000-30X-MGR0-01200-000-00E. Las Vegas, Nevada: Bechtel SAIC Company.

8.3 DESIGN CONSTRAINTS

8.3.1 10 CFR 63. 2007. *Energy: Disposal of High-Level Radioactive Wastes in a Geologic Repository at Yucca Mountain, Nevada*. Internet Accessible.

APPENDIX A
PRECLOSURE SAFETY CLASSIFICATION OF REPOSITORY SSCs

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Table A-1. Preclosure Safety Classification of Repository SSCs

System or Facility	Subsystem or Function (as Applicable)	Component[5]	Preclosure Safety Classification
Aging Facility	Aging Facility	Aging Pad	ITS
		Horizontal Aging Module (HAM) (170-HAC0-ENCL-00001)	ITS
		Mobile Platform (170-HAP0-PLAT-00001-2)	Non-ITS
		Support Structures (including utility buildings, if applicable)	Non-ITS
	Aging Handling/Cask Transfer	Cask Tractor (for use with the Cask Transfer Trailer) (170-HAT0-HEQ-00001)	ITS
		Cask Transfer Trailers (for use with Transportation Casks and Horizontal Shielded Transfer Casks [HSTCs]) (PWR DPC: 170-HAT0-TRLY-00001) (BWR DPC: 170-HAT0-TRLY-00002)	ITS
		Mobile Cranes (170-HAT0-CRN-00001-2)	Non-ITS
		Site Transporter (170-HAT0-MEQ-00001)	ITS
	Aging Handling/Aging Overpack	Horizontal Shielded Transfer Cask (for use with Horizontal Aging Module]) (170-HAC0-HEQ-00001)	ITS
		Aging Overpack (AO) (TAD: 170-HAC0-ENCL-00003) (Vertical DPC: 170-HAC0-ENCL-00002)	ITS

Table A-1. Preclosure Safety Classification of Repository SSCs (continued)

System or Facility	Subsystem or Function (as Applicable)	Component[5]	Preclosure Safety Classification
Balance of Plant Facilities	Balance of Plant facilities that include Administration, Security, Utilities, Emergency Response, Offsite, Warehouse and Non-Nuclear Receipt; Materials and Consumables, Maintenance and Repair, Transportation, Balance of Plant Construction, Central Control Center, and Infrastructure	Structures	Non-ITS
	Balance of Plant	Roads, Rails for Commercial Railcars	Non-ITS
		Surface Rails for the Transport and Emplacement Vehicle (TEV)	Non-ITS
		Flood Control Features	ITS
Canister Receipt and Closure Facility	Canister Receipt and Closure Facility (CRCF)	Structure	ITS
		Rails for the Commercial Railcars (Inside the Building)	Non-ITS
		Rails for the TEV (Inside the Waste Package Loadout Room)	ITS
		Shield Windows	Non-ITS
		Shield Doors (Including Anchorages) and Equipment Confinement Doors	ITS
		ALARA Shielding Features[1]	Non-ITS
		DOE Canister Slide Gates (060-HTC0-HTCH-00005, 6, 7, 8, 9)	ITS
		Cask Port Slide Gates (060-HTC0-HTCH-00001, 2)	ITS
		TAD Slide Gates (060-HTC0-HTCH-00010, 11)	ITS
		Waste Package Port Slide Gates (060-HTC0-HTCH-00003, 4)	ITS

Table A-1. Preclosure Safety Classification of Repository SSCs (continued)

System or Facility	Subsystem or Function (as Applicable)	Component[5]	Preclosure Safety Classification
Canister Receipt and Closure Facility (continued)	Canister Receipt and Closure Facility (CRCF) (continued)	Cask Preparation Platform (060-HMH0-PLAT-00001)	ITS
		Waste Package Transfer Carriage Docking Stations (060-HL00-75-00001, 2)	Non-ITS
		CRCF Loadout Platforms (060-HL00-PLAT-00001, 2, 3)	Non-ITS
Cask/Canister/ Waste Package Process System	Cask Cavity Gas Sampling	Entire (IHF, RF, CRCF, WHF)	Non-ITS
	Cask Cooling	Cask/DPC Overpressure Protection Features (WHF)	ITS
		System Components Other than Cask/DPC Overpressure Protection Features (WHF)	Non-ITS
	Cask, Canister, and Waste Package Inerting	Entire (IHF, CRCF, WHF)	Non-ITS
	Decontamination Water Treatment	Entire (WHF)	Non-ITS
	Waste Package Survey	Entire (IHF, CRCF)	Non-ITS
	Waste Package Decontamination	Entire (IHF, CRCF)	Non-ITS
	TAD Drying	Entire (WHF)	Non-ITS
Communications System	Communications	Entire	Non-ITS
Digital Control and Management Information System	Digital Control & Management Information System	Entire	Non-ITS
DOE and Commercial Waste Package System	DOE and Commercial Waste Package	Entire	ITS
	Defense High-Level Waste/DOE SNF Codisposal	DOE Standardized Canister	ITS

Table A-1. Preclosure Safety Classification of Repository SSCs (continued)

System or Facility	Subsystem or Function (as Applicable)	Component[5]	Preclosure Safety Classification
DOE and Commercial Waste Package System (continued)	Defense High-Level Waste/DOE SNF Codisposal (continued)	High-Level Radioactive Waste (HLW) Canister	ITS
	Canistered Spent Nuclear Fuel	Dual-Purpose Canister (DPC)	ITS
		Transportation, Aging and Disposal (TAD) Canister	ITS
Electrical Power System	Switchyard and Standby Power	Entire	Non-ITS
	ITS Power	ITS Distribution (Feeders Up to and including ITS Loads, ITS Direct Current Power, ITS Uninterruptible Power Supply Power)	ITS
		ITS Diesel Generators A and B (including ITS diesel generator fuel oil system, ITS diesel generator air start system, ITS diesel generator jacket water cooling system, ITS diesel generator lubricating oil system, ITS diesel generator air intake and exhaust system)	ITS
	Emergency Power (Life Safety)	Entire	Non-ITS
	Normal Power	Entire	Non-ITS
	Normal Direct Current Electrical Power	Entire	Non-ITS
	Normal Uninterruptible Power Supply Power	Entire	Non-ITS
	Site Electrical Distribution (for Normal Power)	Entire	Non-ITS
	Renewable Energy	Entire	Non-ITS
	Standby Diesel Generator	Entire	Non-ITS
Electrical Support System	Lighting	Entire	Non-ITS
	Grounding	Entire	Non-ITS
	Lightning Protection	Entire	Non-ITS
	Cathodic Protection	Entire	Non-ITS
	Heat Tracing	Entire	Non-ITS
	Cable Raceway	Entire	Non-ITS

Table A-1. Preclosure Safety Classification of Repository SSCs (continued)

System or Facility	Subsystem or Function (as Applicable)	Component[5]	Preclosure Safety Classification
Emergency Diesel Generator Facility	Emergency Diesel Generator Facility	Structure	Non-ITS
Emplacement and Retrieval /Drip Shield Installation System	Emplacement and Retrieval /Drip Shield Installation System	Transport and Emplacement Vehicle (TEV)	ITS
		Drip Shield Gantry	Non-ITS
		Inspection Gantry	Non-ITS
Environmental/ Meteorological Monitoring System	Environment and Meteorological Monitoring	Entire	Non-ITS
Fire Protection System	Fire Water	Entire	Non-ITS
	Fire Barriers	Entire	Non-ITS
	Explosion Protection	Entire	Non-ITS
	Fire Suppression	Preaction valves, sprinkler heads, and system actuation panels associated with double-interlock preaction suppression systems that protect areas where there is a potential for canister breach (CRCF, WHF)	ITS
		Fire suppression system components other than those associated with double-interlock preaction suppression systems that protect areas where there is a potential for canister breach	Non-ITS
	Fire Detection	Fire detection system for the ITS preaction valves with associated detectors and control box (CRCF, WHF)	ITS
		Fire detection system or all other systems except the preaction valve with associated detectors and control box	Non-ITS
	Fire Alarm	Entire	Non-ITS
Initial Handling Facility	Initial Handling Facility (IHF)	Structure	ITS

Table A-1. Preclosure Safety Classification of Repository SSCs (continued)

System or Facility	Subsystem or Function (as Applicable)	Component[5]	Preclosure Safety Classification
Initial Handling Facility (continued)	Initial Handling Facility (continued)	Rails for the Commercial Railcars (Inside the Building)	Non-ITS
		Rails for the TEV (Inside the Waste Package Loadout Room)	ITS
		Shield Doors (Including Anchorages)	ITS
		ALARA Shielding Features[2]	Non-ITS
		Cask Port Slide Gate (51A-HTC0-HTCH-00001)	ITS
		Waste Package Port Slide Gate (51A-HTC0-HTCH-00002)	ITS
		Cask Preparation Platform (51A-HMH0-PLAT-00001)	ITS
		Waste Package Transfer Carriage Docking Station (51A-HL00-75-00001)	Non-ITS
		IHF Loadout Platforms (51A-HL00-PLAT-00001-2)	Non-ITS
Low-Level Radioactive Waste Management System	Low-Level Radioactive Waste Management	Entire	Non-ITS
Low-Level Waste Facility	Low-Level Waste Facility	Structure	Non-ITS
Mechanical Handling System	Cask Handling	Transportation Cask	ITS
		Site Prime Mover	ITS
		Cask Handling Yoke (CRCF: 060-HM00-BEAM-00001; IHF: 51A-HM00-BEAM-00001; RF: 200-HM00-BEAM-00001; WHF: 050-HM00-BEAM-00001)	ITS
		Pool Cask Handling Yoke (WHF: 050-HM00-BEAM-00002)	ITS
		Platform Shield Plate (RF: 200-HM00-BUF-00001) (CRCF: 060-HM00-BUF-00001–2) (WHF: 050-HM00-BUF-00001)	Non-ITS

Table A-1. Preclosure Safety Classification of Repository SSCs (continued)

System or Facility	Subsystem or Function (as Applicable)	Component[5]	Preclosure Safety Classification
Mechanical Handling System (continued)	Cask Handling (continued)	Cask Handling Crane (IHF: 300-ton; 51A-HM00-CRN-00001) (CRCF: 200-ton; 060-HM00-CRN-00001) (RF: 200-ton; 200-HM00-CRN-00001) (WHF: 200-ton; 050-HM00-CRN-00001)	ITS
		Decontamination Pit Equipment – Spray Nozzle (WHF: 050-HM00-NZL-00001)	Non-ITS
		Decontamination Pit Equipment – Pump Module (WHF: 050-HM00-P-00001)	Non-ITS
		Long Reach Tool Adapter (WHF: 050-HM00-TOOL-00001)	Non-ITS
		Pool Yoke Lift Adapter (WHF: 050-HM00-TOOL-00002)	ITS
		Cask Transfer Trolley and Pedestals Trolleys: (IHF: 51A-HM00-TRLY-00001; CRCF: 060-HM00-TRLY-00001-2; RF: 200-HM00-TRLY-00001; WHF: 050-HM00-TRLY-00001) Pedestals: (IHF: 51A-HM00-PED-00001-2; CRCF: 060-HM00-PED-00001-2; RF: 200-HM00-PED-00001; WHF: 050-HM00-PED-00001-5) Naval Cask Pedestal: (IHF: [51A-HM00-PED-00003])	ITS
		Cask Preparation Crane; 30-ton (IHF: 51A-HM00-CRN-00002)	ITS
		Horizontal Cask Stand (RF: 200-HM00-RK-00001)	Non-ITS
		Mobile Lift (CRCF: 060-HM00-ELEV-00001; RF: 200-HM00-ELEV-00001; WHF: 050-HM00-ELEV-00001)	Non-ITS
	Cask Handling/Cask Receipt	Entrance Vestibule Crane; 20-ton (WHF: 050-HMC0-CRN-00001)	ITS
		Cask Tilting Frame (CRCF: 060-HMC0-FRM-00001; RF: 200-HMC0-FRM-00001; WHF: 050-HMC0-FRM-00001)	Non-ITS
		Mobile Access Platform (IHF: 51A-HMC0-PLAT-00001; CRCF: 060-HMC0-PLAT-00001; RF: 200-HMC0-PLAT-00001; WHF: 050-HMC0-PLAT-00001)	Non-ITS

Table A-1. Preclosure Safety Classification of Repository SSCs (continued)

System or Facility	Subsystem or Function (as Applicable)	Component[5]	Preclosure Safety Classification
Mechanical Handling System (continued)	Cask Handling/Cask Receipt (continued)	Impact Limiter Lifting Device (IHF: 51A-HMC0-HEQ-00001-2; CRCF: 060-HMC0-HEQ-00001-8, 19-20; RF: 200-HMC0-HEQ-00001, 3, 5, 7, 9, 11, 14; WHF: 050-HMC0-HEQ-00001-9)	Non-ITS
		Personnel Barrier Lifting Device (IHF: 51A-HMC0-HEQ-00003-4; CRCF: 060-HMC0-HEQ-00010-17, 21-22; RF: 200-HMC0-HEQ-00002, 4, 6, 8, 10, 12, 13; WHF: 050-HMC0-HEQ-00010-18)	Non-ITS
		Lid Bolting Room Crane; 10-ton (RF: 200-HMC0-CRN-00001)	ITS
		Naval Cask Lift Bail (IHF: 51A-HMC0-BEAM-00001)	ITS
		Naval Cask Lift Plate (IHF: 51A-HMC0-HEQ-00005)	ITS
		Horizontal Lifting Beam (RF: 200-HMC0-BEAM-00001)	ITS
	Cask Handling/Cask Preparation	Auxiliary Pool Crane; 10-ton (WHF: 050-HMH0-CRN-00001)	ITS
		Preparation Station Jib Cranes (1 and 2) (WHF: 050-HMH0-CRN-00002, 3)	ITS
		Cask Support Frame (Preparation Station #2) (WHF: 050-HMH0-FRM-00001)	ITS
		Cask Lid Lifting Grapples (CRCF: 060-HMH0-HEQ-00012; RF: 200-HMH0-HEQ-00008) Lid Lifting Grapples (WHF: 050-HMH0-HEQ-00001-4, 6) Truck Cask Lid Lifting Grapples (WHF: 050-HMH0-HEQ-00007-9)	ITS

Table A-1. Preclosure Safety Classification of Repository SSCs (continued)

System or Facility	Subsystem or Function (as Applicable)	Component[5]	Preclosure Safety Classification
Mechanical Handling System (continued)	Cask Handling/Cask Preparation (continued)	Truck Cask Lid Adapters (WHF: 050-HMH0-HEQ-00010-11) Rail Cask Lid Adapters (WHF: 050-HMH0-HEQ-00012-13; CRCF: 060-HMH0-HEQ-00003-4; RF: 200-HMH0-HEQ-00002; IHF: 51A-HMH0-HEQ-00002)	ITS
		Truck Cask Lid Adapters (CRCF: 060-HMH0-HEQ-00001-2; IHF: 51A-HMH0-HEQ-00001)	Non-ITS
		Cask Lid Bolt Impact Wrench (RF: 200-HMH0-HEQ-00003)	Non-ITS
		DPC Lid Adapter (CRCF: 060-HMH0-HEQ-00005-6; WHF: 050-HMH0-HEQ-00014; RF: 200-HMH0-HEQ-00001)	ITS
		Cask Shield Ring (WHF: 050-HMH0-HEQ-00015-19)	Non-ITS
		Long Reach Grapple Adapter (WHF: 050-HMH0-TOOL-00001-2)	ITS
	Cask Handling/Waste Package Preparation	Waste Package Handling Crane; 100-ton (IHF: 51A-HMP0-CRN-00001; CRCF: 060-HMP0-CRN-00001)	ITS
		Waste Package Pallet Yoke (IHF: 51A-HMP0-BEAM-00001; CRCF: 060-HMP0-BEAM-00001)	Non-ITS
	Cask Handling/Cask Restoration	Entire	Non-ITS
	Waste Transfer/Fuel Assembly Transfer	Spent Fuel Transfer Machine (WHF: 050-HTF0-FHM-00001)	ITS
		PWR Lifting Grapples (WHF: 050-HTF0-HEQ-00001) BWR Lifting Grapples (WHF: 050-HTF0-HEQ-00002)	ITS
		W74 Upper Basket Lifting Device (WHF: 050-HTF0-HEQ-00003)	Non-ITS

Table A-1. Preclosure Safety Classification of Repository SSCs (continued)

System or Facility	Subsystem or Function (as Applicable)	Component[5]	Preclosure Safety Classification
Mechanical Handling System (continued)	Waste Transfer/Fuel Assembly Transfer (continued)	SNF Staging Racks (WHF: 050-HTF0-RK-00001 [PWR SNF]) (WHF: 050-HTF0-RK-00010 [BWR SNF]) (WHF: 050-HTF0-RK-00011 [DFCA SNF])	ITS
		Truck Cask Handling Frame (WHF: 050-HTF0-RK-00007)	ITS
	Waste Transfer/ Canister Transfer	Canister Transfer Machine Maintenance Crane; 15-tons (IHF: 51A-HTC0-CRN-00001, CRCF: 060-HTC0-CRN-00001; WHF: 050-HTC0-CRN-00001)	Non-ITS
		Canister Transfer Machine Maintenance Crane; 15-tons (RF: 200-HTC0-CRN-00001)	ITS
		Canister Transfer Machine (IHF: 51A-HTC0-FHM-00001; CRCF: 060-HTC0-FHM-00001-2; RF: 200-HTC0-FHM-00001; WHF: 050-HTC0-FHM-00001)	ITS
		Canister Grapples (IHF: 51A-HTC0-HEQ-00003, 4; CRCF: 060-HTC0-HEQ-00003-7) Canister Transfer Machine Grapples (IHF: 51A-HTC0-HEQ-00001; CRCF: 060-HTC0-HEQ-00001-2; RF: 200-HTC0-HEQ-00001; WHF: 050-HTC0-HEQ-00001)	ITS
		Naval Canister Lifting Adapter (IHF: 51A-HTC0-HEQ-00005)	ITS
		DOE Waste Package Inner Lid Grapple (IHF: 51A-HTC0-HEQ-00007)	ITS
		Naval Waste Package Inner Lid Grapple (IHF: 51A-HTC0-HEQ-00008)	ITS
		TAD Canister Staging Racks (and Thermal Barrier) (CRCF: 060-HTC0-RK-00011-12)	ITS
		DOE Canister Staging Racks (and Thermal Barrier) (CRCF: 060-HTC0-RK-00006-10)	ITS
		Shielded Transfer Cask (STC) (TAD: 050-HT00-HEQ-00001) (DPC: 050-HT00-HEQ-00002)	ITS

Table A-1. Preclosure Safety Classification of Repository SSCs (continued)

System or Facility	Subsystem or Function (as Applicable)	Component[5]	Preclosure Safety Classification
Mechanical Handling System (continued)	Waste Package Closure	Robotic Arms. (IHF: 51A-HWH0-HEQ-00001-2; CRCF: 060-HWH0-HEQ-00001-2)	Non-ITS
		Remote Handling System Bridge (Included as part of: IHF: 51A-HWH0-HEQ-00003; CRCF: 060-HWH0-HEQ-00003, 5)	ITS
		Portions of Remote Handling System That Do Not Include The Bridge (Included as part of: IHF: 51A-HWH0-HEQ-00003; CRCF: 060-HWH0-HEQ-00003, 5)	Non-ITS
		Remote Handling System Manipulator Arm (IHF: 51A-HWH0-HEQ-00004; CRCF: 060-HWH0-HEQ-00004)	Non-ITS
		Lid Handling Tool (IHF: 51A-HWH0-TOOL-00001; CRCF: 060-HWH0-TOOL-00001)	Non-ITS
		Waste Package Closure Room Crane; 15-ton (IHF: 51A-HW00-CRN-00001; CRCF: 060-HW00-CRN-00001)	Non-ITS
		Closure Support Room Cranes; 5-ton (CRCF: 060-HW00-CRN-00002 [north]-3 [south])	Non-ITS
		Process Opening Cover (IHF: 51A-HW00-HTCH-00001; CRCF: 060-HW00-HTCH-00001-2)	Non-ITS
	TAD Closure	TAD Closure Jib Crane (WHF: 050-HC00-CRN-00001)	ITS
		Cask Support Frame (TAD Closure Station) (WHF: 050-HC00-FRM-00001)	ITS
		TAD Canister Welding Machine (WHF: 050-HC00-TOOL-00001)	Non-ITS
	Waste Package Loadout	Waste Package Shield Ring Lift Beam (IHF: 51A-HL00-BEAM-00001; CRCF: 060-HL00-BEAM-00001)	Non-ITS
		Waste Package Shield Rings (IHF: 51A-HL00-HEQ-00001-2; CRCF: 060-HL00-HEQ-00001-6)	ITS

Table A-1. Preclosure Safety Classification of Repository SSCs (continued)

System or Facility	Subsystem or Function (as Applicable)	Component[5]	Preclosure Safety Classification
Mechanical Handling System (continued)	Waste Package Loadout (continued)	Waste Package Transfer Trolley (including Pedestals, Seismic Rail Restraints, and Rails) Trolleys: (IHF: 51A-HL00-TRLY-00001; CRCF: 060-HL00-TRLY-00001-2) Pedestals: (CRCF: 060-HL00-PED-00001-8; IHF: 51A-HL00-PED-00001-4)	ITS
		Waste Package Transfer Carriage (IHF: 51A-HL00-TRLY-00002; CRCF: 060-HL00-TRLY-00004-5)	Non-ITS
	Dual-Purpose Canister Cutting	DPC Cutting Machine (WHF: 050-HD00-TOOL-00001)	Non-ITS
		Siphon Tube Shear Tool (WHF: 050-HD00-TOOL-00002)	Non-ITS
		DPC Cutting Jib Crane (WHF: 050-HD00-CRN-00001)	ITS
		Cask Support Frame (DPC Cutting Station) (WHF: 050-HD00-FRM-00001)	ITS
		DPC Lid Receptacle (WHF: 050-HD00-RCP-00001)	Non-ITS
		DPC Adapter Plate Types 1, 2, 3 (WHF: 050-HD00-HEQ-00002, 3, 4)	Non-ITS
		DPC Shield Plug Lift Adapter (WHF: 050-HD00-HEQ-00005)	Non-ITS
Naval SNF Waste Package System	Naval SNF Waste Package	Entire	ITS
	Naval SNF Canister	Entire	ITS
Non-Nuclear Handling System	Non-Nuclear Handling	Entire	Non-ITS
Non-Radiological Waste Management System	Non-Radiological Waste Management	Entire	Non-ITS
Plant Services System	Plant Services	Entire	Non-ITS

Table A-1. Preclosure Safety Classification of Repository SSCs (continued)

System or Facility	Subsystem or Function (as Applicable)	Component[5]	Preclosure Safety Classification
Pool Water Treatment and Cooling System	Pool Water Treatment and Cooling	Entire	Non-ITS
Radiation/ Radiological Monitoring System	Radiation/ Radiological Monitoring	Entire	Non-ITS
Receipt Facility	Receipt Facility (RF)	Structure	ITS
		Rails for Railcars	Non-ITS
		Shield Doors (Including Anchorages)	ITS
		ALARA Shielding Features[3]	Non-ITS
		Cask Port Slide Gate (200-HTC0-HTCH-00001)	ITS
		AO Port Slide Gate (200-HTC0-HTCH-00002)	ITS
		Cask Preparation Platform (200-HMH0-PLAT-00001)	ITS
		Lid Bolting Room Platform (200-HMC0-PLAT-00003)	ITS
Safeguards and Security System	Safeguards and Security	Entire	Non-ITS
Subsurface Facility	Subsurface Facility	Rails	Non-ITS
		Emplacement Drift Doors	Non-ITS
	Emplacement	Nonemplacement Openings	Non-ITS
		Ground Support for Emplacement Drifts	Non-ITS
		Ground Support for Nonemplacement Openings	Non-ITS
		Emplacement Drifts	Non-ITS
		Emplacement Drift Invert (Steel and Ballast)	Non-ITS
		Waste Package Emplacement Pallet	Non-ITS
		Drip Shield	Non-ITS
		Drip Shield Emplacement Gantry	Non-ITS
	Post-emplacement	Entire	Non-ITS
	Subsurface Development	Excavation	Non-ITS

Table A-1. Preclosure Safety Classification of Repository SSCs (continued)

System or Facility	Subsystem or Function (as Applicable)	Component[5]	Preclosure Safety Classification
Subsurface Ventilation System	Subsurface Ventilation	Entire	Non-ITS
Surface Non-Confinement HVAC System	Surface Non-Confinement HVAC	Portions of the surface non-confinement HVAC system that do not support the cooling of ITS electrical equipment and battery rooms (IHF, CRCF, WHF, RF, EDGF)	Non-ITS
		Portions of the surface non-confinement HVAC system that support the cooling of ITS electrical equipment and battery rooms (EDGF)	ITS
Surface Nuclear Confinement HVAC System	Surface Nuclear Confinement HVAC	Portions of the surface nuclear confinement HVAC system that exhaust from areas with a potential for a breach (WHF and CRCF)	ITS
		Portions of the surface nuclear confinement HVAC system that support the cooling of ITS electrical equipment and battery rooms (WHF and CRCF)	ITS
		Portions of the surface nuclear confinement HVAC system that do not exhaust from areas with a potential for a breach or do not support the cooling of ITS electrical equipment and battery rooms, including SSCs that supply ITS confinement areas (IHF, CRCF, WHF, RF)	Non-ITS
Wet Handling Facility	Wet Handling Facility (WHF)	Structure	ITS
		Rails for Railcars	Non-ITS
		Shield Doors (Including Anchorages) and Equipment Confinement Doors	ITS
		ALARA Shielding Features[4]	Non-ITS
		Pool Structure	ITS
		Cask Port Slide Gate (050-HTC0-HTCH-00002)	ITS
		Overpack Port Slide Gate (050-HTC0-HTCH-00001)	ITS
		Aging Overpack Access Platform (050-HAC0-PLAT-00001)	ITS
		TAD Closure Station (050-HC00-PLAT-00001)	ITS

Table A-1. Preclosure Safety Classification of Repository SSCs (continued)

System or Facility	Subsystem or Function (as Applicable)	Component[5]	Preclosure Safety Classification
Wet Handling Facility (continued)	Wet Handling Facility (continued)	DPC Cutting Station (050-HD00-PLAT-00001)	ITS
		Preparation Station #1 (050-HMH0-PLAT-00001)	ITS
		Preparation Station #2 (050-HMH0-PLAT-00002)	ITS
		DPC Transfer Station (050-HTF0-RK-00002)	Non-ITS
		Staging Shelf Transfer Station (050-HTF0-RK-00008)	Non-ITS
		Staging Shelf Dual Transfer Station (050-HTF0-RK-00009)	Non-ITS
		DPC Unloading Bay Gate (050-WH00-DR-00002)	Non-ITS
		Deep Remediation Station (050-HR00-RK-00001)	Non-ITS
		RC Transfer Station (050-HTF0-RK-00004)	Non-ITS
		STC/TAD Transfer Station (050-HTF0-RK-00003)	Non-ITS
		TC Transfer Station (050-HTF0-RK-00005)	Non-ITS
		(Pool) Crush Pads (050-HM00-ABS-00001-5)	Non-ITS
		Decontamination Pit; Decontamination Pit Seismic Restraints (050-HM00-BRAC-00001)	ITS
		Decontamination Pit Cover (050-HM00-HTCH-00001)	Non-ITS

Table A-1. Preclosure Safety Classification of Repository SSCs (continued)

System or Facility	Subsystem or Function (as Applicable)	Component[5]	Preclosure Safety Classification
Wet Handling Facility (continued)	Wet Handling Facility (continued)	Decontamination Pit Platform (050-HM00-PLAT-00002)	Non-ITS

NOTE: ALARA = as low as is reasonably achievable; AO = aging overpack; BWR = boiling water reactor; CRCF = Canister Receipt and Closure Facility; DFCA = damaged fuel canister assembly; DOE = U.S. Department of Energy; DPC = dual-purpose canister; EDGF = Emergency Diesel Generator Facility; HAM = horizontal aging module; HLW = high-level radioactive waste; HVAC = heating, ventilation, and air-conditioning; IHF = Initial Handling Facility; ITS = Important to Safety; PWR = pressurized water reactor; RC = rail cask; RF = Receipt Facility; SNF = spent nuclear fuel; SSCs = systems, structures, and components, STC = shielded transfer cask; TAD = transportation, aging, and disposal; TC = transportation cask; TEV = transport and emplacement vehicle; WHF = Wet Handling Facility.

1. ALARA shielding features for the CRCF include the shielding function of the platforms.
2. ALARA shielding features for the IHF include the shielding function of the platforms.
3. ALARA shielding features for the RF include the shielding function of the platforms.
4. ALARA shielding features for the WHF include the shielding function of the platforms, the decontamination pit, and the Cask Preparation Area Equipment Confinement Door.
5. The numbers appearing in parentheses are component numbers.

Source: Refs. 8.2.2 through 8.2.11.

APPENDIX B
PRECLOSURE NUCLEAR SAFETY DESIGN BASES FOR THE IHF ITS SSCs

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Table B-1. Preclosure Nuclear Safety Design Bases for IHF ITS SSCs

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
DOE and Commercial Waste Package System (DS)	DOE and commercial waste package	Entire	Provide containment	DS.IH.01. The mean conditional probability of breach of a sealed waste package resulting from a side impact shall be less than or equal to 1×10^{-8} per impact. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-11-HLW (Seq. 4-6)
				DS.IH.02. The mean conditional probability of breach of a sealed waste package resulting from a drop of a load onto the waste package shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-11-HLW (Seq. 3-6)
				DS.IH.03. The mean conditional probability of breach of a sealed waste package resulting from an end-on impact or collision shall be less than or equal to 1×10^{-5} per impact. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-11-HLW (Seq. 5-6)
	HLW	HLW Canister	Provide containment	DS.IH.04. The mean conditional probability of breach of an HLW canister resulting from a drop of the canister shall be less than or equal to 3×10^{-2} per drop. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-07-HLW (Seq. 4-5)
				DS.IH.05. The mean conditional probability of breach of an HLW canister resulting from a side impact or collision shall be less than or equal to 1×10^{-8} per impact. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-07-HLW (Seq. 7-5)
				DS.IH.06. The mean conditional probability of breach of an HLW canister contained within a waste package resulting from the spectrum of fires shall be less than or equal to 3×10^{-4} per fire event. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-13-HLW (Seq. 5-5)
				DS.IH.07. The mean conditional probability of breach of an HLW canister contained within a cask resulting from the spectrum of fires shall be less than or equal to 2×10^{-6} per fire event. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-13-HLW-WP (Seq. 5-5)

Table B-1. Preclosure Nuclear Safety Design Bases for IHF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
DOE and Commercial Waste Package System (DS) (continued)	HLW (continued)	HLW Canister (continued)	Provide containment (continued)	DS.IH.08. The mean conditional probability of breach of an HLW canister located within the CTM shield bell resulting from the spectrum of fires shall be less than or equal to 1×10^{-4} per fire event. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-13-HLW-WP (Seq. 5-5)
				DS.IH.09. The mean conditional probability of breach of an HLW canister, given the drop of another HLW canister onto the first canister, shall be less than or equal to 3×10^{-2} per drop. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-07-HLW (Seq. 2-5)
Emplacement and Retrieval and Drip Shield Installation (HE)	Emplacement and Retrieval and Drip Shield Installation	Transport and Emplacement Vehicle (TEV)	Protect against[c] derailment of a TEV during loading of a waste package	HE.IH.01. The mean frequency of derailment of the TEV at the loadout station due to the spectrum of seismic events shall be less than or equal to 1×10^{-4} /yr[a]. (Ref. 8.2.4, Table 6.10-1)	IHF-S-IE-NVL (Seq. 16-2)
			against[c] a tipover of the TEV	HE.IH.02. The mean frequency of tipover of the TEV due to the spectrum of seismic events shall be less than or equal to 2×10^{-6} /yr [a]. (Ref. 8.2.4, Table 6.10-1)	IHF-S-IE-NVL (Seq. 16-2)
			against[c] ejection of the waste package from the shielded enclosure of the TEV	HE.IH.03. The mean frequency of ejection of a waste package from the TEV due to the spectrum of seismic events shall be less than or equal to 2×10^{-4} /yr[a]. (Ref. 8.2.4, Table 6.10-1)	IHF-S-IE-NVL (Seq. 16-2)

Protect

Protect

Table B-1. Preclosure Nuclear Safety Design Bases for IHF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Initial Handling Facility (IH)	Initial Handling Facility	Structure	Maintain building structural integrity to protect ITS SSCs inside the building from external events	IH.01. The mean frequency of building collapse due to winds less than or equal to 120 mph shall not exceed 1×10^{-6}/yr. (Ref. 8.2.3) IH.02. The mean frequency of building collapse due to volcanic ashfall less than or equal to a roof load of 21 lb/ft^2 shall not exceed 1×10^{-6}/yr. (Ref. 8.2.3) IH.03. The IHF shall be located such that there is a distance of at least one-half mile between the IHF and the repository heliport. (Ref. 8.2.2)	Initiating event does not require further analysis[b]
			Protect against[c] building collapse onto waste containers	IH.04. The mean frequency of collapse of the IHF structure due to the spectrum of seismic events shall be less than or equal to 2×10^{-6} /yr[a]. (Ref. 8.2.4, Table 6.10-1)	IHF-S-IE-HLW (Seq. 03)
		Rails for the TEV (Inside the Waste Package Loadout Room)	Protect against[c] derailment of the TEV during loading of a waste package	IH.05 The mean frequency of TEV derailment due to failure of the TEV rail system (at the loadout station) due to the spectrum of seismic events shall be less than or equal to 1×10^{-4} /yr[a]. (Ref. 8.2.4, Table 6.10-1)	IHF-S-IE-NVL (Seq. 16-2)
		Shield Doors (Including Anchorages)	Protect against[c] direct exposure of personnel	IH.06. Equipment and personnel shield doors shall have a mean probability of inadvertent opening of less than or equal to 1×10^{-6} per transfer. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-12A-HLW (Seq. 2)
			Preclude collapse onto waste containers	IH.07. An equipment shield door falling onto a waste container as a result of an impact from a conveyance shall be precluded. (Ref. 8.2.6, Table 6.9-1)	Initiating event does not require further analysis[b]

Table B-1. Preclosure Nuclear Safety Design Bases for IHF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Initial Handling Facility (IH) (continued)	Initial Handling Facility (continued)	Shield Doors (Including Anchorages) (continued)	Protect against[c] equipment shield door collapse onto a waste container	IH.08. The mean frequency of collapse of equipment shield doors (including attachment of door to wall and frame anchorages) due to the spectrum of seismic events shall be less than or equal to 6×10^{-6} /yr [a]. (Ref. 8.2.4, Table 6.10-1)	IHF-S-IE-HLW (Seq. 11-6)
		Cask Port Slide Gate (51A-HTC0-HTCH-00001)	Protect against[c] dropping a canister due to spurious closure of the slide gate	IH.HTC.01. The mean probability of a canister drop resulting from a spurious closure of the slide gate shall be less than or equal to 2×10^{-6} per transfer. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-07-HLW (Seq. 4-5)
			against[c] direct exposure to personnel	IH.HTC.02. The mean probability of inadvertent opening of a slide gate shall be less than or equal to 1×10^{-9} per transfer. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-12A-HLW (Seq. 2)
		Protect	Preclude canister breach	IH.HTC.03. Closure of the slide gate shall be incapable of breaching a canister. (Ref. 8.2.6, Table 6.9-1)	Initiating event does not require further analysis[b]
		Waste Package Port Slide Gate (51A-HTC0-HTCH-00002)	Protect against[c] dropping a canister due to a spurious closure of the slide gate	IH.HTC.04. The mean probability of a canister drop resulting from a spurious closure of the slide gate shall be less than or equal to 4×10^{-9} per transfer. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-12A-HLW (Seq. 2)

Table B-1. Preclosure Nuclear Safety Design Bases for IHF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Initial Handling Facility (IH) (continued)	Initial Handling Facility (continued)	Waste Package Port Slide Gate (51A-HTC0-HTCH-00002) (continued)	Protect against[c] direct exposure to personnel	IH.HTC.05. The mean probability of inadvertent opening of a slide gate shall be less than or equal to 2×10^{-6} per transfer. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-12A-HLW (Seq. 2)
			Preclude canister breach	IH.HTC.06. Closure of the slide gate shall be incapable of breaching a canister. (Ref. 8.2.6, Table 6.9-1)	Initiating event does not require further analysis[b]
			Preclude canister drop onto floor	IH.HTC.07. The waste package port slide gate shall be incapable of opening without a waste package transfer trolley with waste package in position to receive a canister. (Ref. 8.2.6, Table 6.9-1)	Initiating event does not require further analysis[b]
		Cask Preparation Platform (51A-HMH0-PLAT-00001)	Protect against[c] platform collapse	IH.HMH.01. The mean frequency of collapse of the cask preparation platform due to the spectrum of seismic events shall be less than or equal to 9×10^{-4} /yr[a]. (Ref. 8.2.4, Table 6.10-1)	IHF-S-IE-NVL (Seq. 09-6)
Mechanical Handling System (H)	Cask Handling	Transportation Cask (Analyzed as a Representative Cask)	Provide containment	H.IH.01. The mean conditional probability of breach of a canister in a sealed cask resulting from a cask drop shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-01-NVL (Seq. 3-6)
				H.IH.02. The mean conditional probability of breach of a canister in a sealed cask resulting from a drop of a load onto the cask shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-01-NVL (Seq. 2-6)

Table B-1. Preclosure Nuclear Safety Design Bases for IHF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Mechanical Handling System (H) (continued)	Cask Handling (continued)	Transportation Cask (Analyzed as a Representative Cask) (continued)	Provide containment (continued)	H.IH.03. The mean conditional probability of breach of a canister contained within a sealed cask resulting from a side impact or collision shall be less than or equal to 1×10^{-8} per impact. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-04-NVL (Seq. 7-5)
			Preclude lid contact with canisters	H.IH.04. The geometry of the casks that carry HLW canisters shall preclude lid contact with canisters following a drop of a cask lid. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-07-HLW (Seq. 2)
			Protect against[c] direct exposure to personnel	H.IH.05. The mean conditional probability of loss of cask gamma shielding resulting from a drop of a cask shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-02-HLW (Seq. 2-3)
				H.IH.06. The mean conditional probability of loss of cask gamma shielding resulting from a collision or side impact to a cask shall be less than or equal to 1×10^{-8} per impact. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-02-HLW (Seq. 5-3)
				H.IH.07. The mean conditional probability of loss of cask gamma shielding resulting from drop of a load onto a cask shall be less than or equal to 1×10^{-5} per impact. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-02-HLW (Seq. 6-3)
		Site Prime Mover	Limit speed	H.IH.08. The speed of the site prime mover shall be limited to 9 mi/hr. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-01-HLW (Seq. 4-6)
			Preclude fuel tank explosion	H.IH.09. The fuel tank of a site prime mover that enters the facility shall preclude fuel tank explosions. (Ref. 8.2.6, Table 6.9-1)	Initiating event does not require further analysis[b]

Table B-1. Preclosure Nuclear Safety Design Bases for IHF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Mechanical Handling System (H) (continued)	Cask Handling (continued)	Cask Handling Yoke (51A-HM00-BEAM-00001)	Protect against[c] drop	H.IH.HM.01. The cask handling yoke is an integral part of the load-bearing path. See Cask Handling Crane requirements. (Ref. 8.2.6, Table 6.9-1 and Ref. 8.2.4, Table 6.10-1)	See Cask Handling Crane requirements
		Cask Handling Crane; 300-ton (51A-HM00-CRN-00001)	Protect against[c] drop	H.IH.HM.02. The mean probability of dropping a loaded cask from less than the two-block height resulting from the failure of a piece of equipment in the load-bearing path shall be less than or equal to 3×10^{-5} per transfer. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-02-HLW (Seq. 2-6)
				H.IH.HM.03. The mean probability of dropping a loaded cask from the two-block height resulting from the failure of a piece of equipment in the load-bearing path shall be less than or equal to 4×10^{-7} per transfer. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-02-HLW (Seq. 3-6)
			Limit drop height	H.IH.HM.04. The two-block drop height shall not exceed 40 ft from the bottom of the shortest cask to the floor. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-02-HLW (Seq. 3-6)
			Protect against[c] drop of a load onto a cask	H.IH.HM.05. The mean probability of dropping a load onto a loaded cask or its contents shall be less than or equal to 3×10^{-5} per cask handled. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-02-HLW (Seq. 6-6)
			Limit speed	H.IH.HM.06. The speed of the trolley and bridge shall be limited to 20 ft/min. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-02-HLW (Seq. 5-6)
			against[c] crane collapse onto a waste container	H.IH.HM.07. The mean frequency of collapse of the Cask Handling Crane due to the spectrum of seismic events shall be less than or equal to 8×10^{-6} /yr[a]. (Ref. 8.2.4, Table 6.10-1)	IHF-S-IE-NVL (Seq. 07-6)

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Table B-1. Preclosure Nuclear Safety Design Bases for IHF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Mechanical Handling System (H) (continued)	Cask Handling (continued)	Cask Handling Crane; 300-ton (51A-HM00-CRN-00001) (continued)	Protect against[c] a cask or heavy object drop from the crane	H.IH.HM.08. The mean frequency of a hoist system failure of the Cask Handling Crane due to the spectrum of seismic events shall be less than or equal to 2×10^{-5} /yr[a]. (Ref. 8.2.4, Table 6.10-1)	IHF-S-IE-NVL (Seq. 07-6)
		Cask Transfer Trolley (CTT) and Pedestals (Trolley: 51A-HM00-TRLY-00001) (Cask Pedestals: 51A-HM00-PED-00001-2) (Naval Cask Pedestal: 51A-HM00-PED-00003)	Limit speed	H.IH.HM.09. The speed of the CTT shall be limited to 2.5 mi/hr. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-05-HLW (Seq. 3-5)
			against[c] spurious movement	H.IH.HM.10. The mean probability of spurious movement of the CTT while a canister is being lifted by the CTM shall be less than or equal to 1×10^{-9} per transfer. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-07-NVL (Seq. 3-5)
		Protect	against[c] impact and inducing stresses on the waste container or on the facility structure	H.IH.HM.11. The mean frequency of sliding impact of the CTT into a wall or structural column and inducing stresses that can breach the waste container due to the spectrum of seismic events shall be less than or equal to 1×10^{-6} /yr[a]. (Ref. 8.2.4, Table 6.10-1)	IHF-S-IE-HLW (Seq. 10-6)

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Table B-1. Preclosure Nuclear Safety Design Bases for IHF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Mechanical Handling System (H) (continued)	Cask Handling (continued)	Cask Transfer Trolley (CTT) and Pedestals (continued)	Protect against[c] impact and inducing stresses on the waste container or on the facility structure (continued)	H.IH.HM.12. The mean frequency of rocking impact of the CTT into a wall or structural column and inducing stresses that can breach the waste container due to the spectrum of seismic events shall be less than or equal to 1×10^{-6}/yr[a]. (Ref. 8.2.4, Table 6.10-1)	IHF-S-IE-HLW (Seq. 10-6)
	Cask	Preparation Crane; 30-ton (51A-HM00-CRN-00002)	Protect against[c] drop	H.IH.HM.13. The mean probability of a drop of a load onto a loaded cask shall be less than or equal to 3×10^{-5} per transfer. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-04-NVL (Seq. 4-5)
			against[c] collapse of the cask preparation crane	H.IH.HM.14. The mean frequency of collapse of the cask preparation crane due to the spectrum of seismic events shall be less than or equal to 8×10^{-6}/yr[a]. (Ref. 8.2.4, Table 6.10-1)	IHF-S-IE-HLW (Seq. 08-6)
	Cask Handling/Cask Receipt	Naval Cask Lift Bail (IHF: 51A-HMC0-BEAM-00001)	Protect against[c] drop	H.IH.HMC.01. The naval cask lift bail is an integral part of the load-bearing path. See Cask Handling Crane requirements. (Ref. 8.2.6, Table 6.9-1 and Ref. 8.2.4, Table 6.10-1)	See Cask Handling Crane requirements
	Protect	Naval Cask Lift Plate (IHF: 51A-HMC0-HEQ-00005)	Protect against[c] drop	H.IH.HMC.02. The naval cask lift plate is an integral part of the load-bearing path. See Cask Handling Crane requirements. (Ref. 8.2.6, Table 6.9-1 and Ref. 8.2.4, Table 6.10-1)	See Cask Handling Crane requirements

Table B-1. Preclosure Nuclear Safety Design Bases for IHF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Mechanical Handling System (H) (continued)	Cask Handling/Cask Preparation	Rail Cask Lid Adapters (51A-HMH0-HEQ-00002)	Protect against[c] drop	H.IH.HMH.01. The rail cask lid adapter is integral to the load-bearing path for the HLW rail cask lid. See Cask Handling Crane requirements. (Ref. 8.2.4, Table 6.10-1)	See Cask Handling Crane requirements
	Cask Handling/ Waste Package Preparation	WP Handling Crane (51A-HMP0-CRN-00001)	Protect against[c] collapse of the WP handling crane	H.IH.HMP.01. The mean frequency of collapse of the WP handling crane due to the spectrum of seismic events shall be less than or equal to 8×10^{-6}/yr .[a] (Ref. 8.2.4, Table 6.10-1)	IHF-S-IE-NVL (Seq. 15-6)
	Waste Transfer/ Canister Transfer	Canister Transfer Machine (CTM) (51A-HTC0-FHM-00001)	Protect against[c] drop	H.IH.HTC.01. The mean probability of drop of a canister from below the two-block height due to the failure of a piece of equipment in the load-bearing path shall be less than or equal to 2×10^{-4} per transfer. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-07-HLW (Seq. 4-5)
				H.IH.HTC.02. The mean probability of drop of a canister from the two-block height due to the failure of a piece of equipment in the load-bearing path shall be less than or equal to 3×10^{-8} per transfer. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-07-HLW (Seq. 5-5)
			Limit drop height	H.IH.HTC.03. The two-block drop height shall not exceed 40 ft from the bottom of a canister to the cavity floor of the cask or waste package. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-07-HLW (Seq. 5-5)

Table B-1. Preclosure Nuclear Safety Design Bases for IHF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Mechanical Handling System (H) (continued)	Waste Transfer/ Canister Transfer (continued)	Canister Transfer Machine (CTM) (51A-HTC0-FHM-00001) (continued)	Protect against[c] drop of a load onto a canister	H.IH.HTC.04. The mean probability of dropping a load onto a canister shall be less than or equal to 1×10^{-3} per transfer. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-07-HLW (Seq. 2-5)
			Protect against[c] spurious movement	H.IH.HTC.05. The mean probability of spurious movement of the CTM while a canister is being lifted or lowered shall be less than or equal to 7×10^{-9} per transfer. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-07-HLW (Seq. 3-5)
			Preclude canister breach	H.IH.HTC.06. Closure of the CTM slide gate shall be incapable of breaching a canister. (Ref. 8.2.6, Table 6.9-1)	Initiating event does not require further analysis[b]
			Preclude non-flat-bottom drop of a naval SNF canister	H.IH.HTC.07. The CTM shall preclude non-flat-bottom drops of naval canisters. (Ref. 8.2.6, Table 6.9-1)	Initiating event does not require further analysis[b]
			Protect against[c] direct exposure of personnel	H.IH.HTC.08. The mean probability of inadvertent radiation streaming due to the inadvertent opening of the CTM slide gate, the inadvertent raising of the CTM shield skirt, or an inadvertent motion of the CTM away from an open port shall be less than or equal to 1×10^{-4} per transfer. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-12B-HLW (Seq. 2)
			Limit speed	H.IH.HTC.09. The speed of the CTM trolley and bridge shall be limited to 20 ft/min. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-07-HLW (Seq. 7-5)

Table B-1. Preclosure Nuclear Safety Design Bases for IHF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Mechanical Handling System (H) (continued)	Waste Transfer/ Canister Transfer (continued)	Canister Transfer Machine (CTM) (51A-HTC0-FHM-00001) (continued)	Protect against[c] drop	H.IH.HTC.10. The mean frequency of drop by the CTM of the naval SNF canister resulting in breach of the canister shall be less than or equal to 2×10^{-5} over the preclosure period. (Ref. 8.2.6, Table 6.9 1)	IHF-ESD-07-NVL (Seq. 4-5)
			Protect against[c] collapse of the CTM	H.IH.HTC.11. The mean frequency of collapse of the CTM due to the spectrum of seismic events shall be less than or equal to 1×10^{-5} /yr [a]. (Ref. 8.2.4, Table 6.10-1)	IHF-S-IE-HLW (Seq. 12-5)
			Protect against[c] a canister or heavy object drop from the CTM	H.IH.HTC.12. The mean frequency of a hoist system failure of the CTM due to the spectrum of seismic events shall be less than or equal to 2×10^{-5}/yr [a]. (Ref. 8.2.4, Table 6.10-1)	IHF-S-IE-HLW (Seq. 12-5)
		Canister Transfer Machine Grapple (51A-HTC0-HEQ-00001) Canister Grapples (51A-HTC0-HEQ-00003, 4)	Protect against[c] drop	H.IH.HTC.13. Grapples are an integral part of the load-bearing path. See Canister Transfer Machine requirements. (Ref. 8.2.6, Table 6.9-1 and Ref. 8.2.4, Table 6.10-1)	See Canister Transfer Machine requirements

Table B-1. Preclosure Nuclear Safety Design Bases for IHF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Mechanical Handling System (H) (continued)	Waste Transfer/ Canister Transfer (continued)	Canister Transfer Machine Grapple (continued)	Protect against drop of a load onto a canister	H.IH.HTC.14. The grapples are an integral part of the load-bearing path. See Canister Transfer Machine requirements. (Ref. 8.2.6, Table 6.9-1 and Ref. 8.2.4, Table 6.10-1)	See Canister Transfer Machine requirements
		Naval Canister Lifting Adapter (51A-HTC0-HEQ-00005)	Protect against[c] drop of a canister	H.IH.HTC.15. The naval canister lifting adapter is an integral part of the load-bearing path of the CTM. See Canister Transfer Machine requirements. (Ref. 8.2.6, Table 6.9-1 and Ref. 8.2.4, Table 6.10-1)	See Canister Transfer Machine requirements
		DOE Waste Package Inner Lid Grapple (51A-HTC0-HEQ-00007)	Protect against[c] the drop of a load onto a canister	H.IH.HTC.16. The lid grapple is an integral part of the load-bearing path of the CTM. See Canister Transfer Machine requirements. (Ref. 8.2.6, Table 6.9-1 and Ref. 8.2.4, Table 6.10-1)	See Canister Transfer Machine requirements
		Naval Waste Package Inner Lid Grapple (51A-HTC0-HEQ-00008)	Protect against[c] the drop of a load onto a canister	H.IH.HTC.17. The lid grapple is an integral part of the load-bearing path of the CTM. See Canister Transfer Machine requirements. (Ref. 8.2.6, Table 6.9-1 and Ref. 8.2.4, Table 6.10-1)	See Canister Transfer Machine requirements
	Waste Package Closure	Remote Handling System Bridge (51A-HWH0-HEQ-00003)	Protect against[c] collapse of the Remote Handling System bridge	H.IH.HWH.01. The mean frequency of collapse of the Remote Handling System bridge due to the spectrum of seismic events shall be less than or equal to 8×10^{-6} /yr[a]. (Ref. 8.2.4, Table 6.10-1)	IHF-S-IE-HLW (Seq. 13-6)
	Waste Package Loadout	Waste Package Shield Rings (51A-HL00-HEQ-00001-2)	Provide lateral and vertical stability to the waste package in the WPTT	H.IH.HL.01. The mean frequency of the shield ring becoming displaced from the WPTT due to the spectrum of seismic events shall be less than or equal to 2×10^{-5} /yr[a]. (Ref. 8.2.4, Table 6.10-1)	IHF-S-IE-HLW (Seq. 14-6)

Table B-1. Preclosure Nuclear Safety Design Bases for IHF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Mechanical Handling System (H) (continued)	Waste Package Loadout (continued)	Waste Package Transfer Trolley (including Pedestals, Seismic Rail Restraints, and Rails) (Trolley: 51A-HL00-TRLY-00001) (Pedestals: 51A-HL00-PED-00001-4)	Preclude rapid tilt-down	H.IH.HL.02. The WPTT shall be incapable of rapid tilt-down. (Ref. 8.2.6, Table 6.9-1)	Initiating event does not require further analysis[b]
			Limit speed	H.IH.HL.03. The speed of the WPTT shall be limited to 2.5 mi/hr. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-08-NVL (Seq. 2-5)
			Protect against spurious movement	H.IH.HL.04. The mean probability of spurious movement of the WPTT while a canister is being lowered by the CTM shall be less than or equal to 1×10^{-9} per transfer. (Ref. 8.2.9, Table 6.9-1)	IHF-ESD-07-NVL (Seq. 3-5)
			against[c] a tipover of the WPTT holding a loaded waste package	H.IH.HL.05. The mean frequency of tipover of the WPTT due to the spectrum of seismic events shall be less than or equal to 2×10^{-6}/yr[a]. (Ref. 8.2.4, Table 6.10-1)	IHF-S-IE-HLW (Seq. 14-6)

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Table B-1. Preclosure Nuclear Safety Design Bases for IHF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Mechanical Handling System (H) (continued)	Waste Package Loadout (continued)	Waste Package Transfer Trolley (including Pedestals, Seismic Rail Restraints, and Rails) (continued)	Protect against[c] rocking (which induces an impact into a wall) of a WPTT holding a loaded waste package	H.IH.HL.06. The mean frequency of the rocking impact of the WPTT into a wall or column due to the spectrum of seismic events shall be less than or equal to 2×10^{-5}/yr[a]. (Ref. 8.2.4, Table 6.10-1)	IHF-S-IE-HLW (Seq. 14-6)
Naval SNF Waste Package System (DN)	Naval SNF Waste Package	Entire	Provide containment	DN.IH.01. The mean conditional probability of breach of a sealed waste package resulting from a side impact shall be less than or equal to 1×10^{-8} per impact. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-11-NVL (Seq. 4-6)
				DN.IH.02. The mean conditional probability of breach of a sealed waste package resulting from a drop of a load onto the waste package shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-11-NVL (Seq. 3-6)
				DN.IH.03. The mean conditional probability of breach of a sealed waste package resulting from an end-on impact or collision shall be less than or equal to 1×10^{-5} per impact. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-11-NVL (Seq. 5-6)
	Naval SNF Canister	Naval SNF Canister (Analyzed as a Representative Canister)	Provide containment	DN.IH.04. The mean frequency of drop by the CTM of the naval SNF canister resulting in breach of the canister shall be less than or equal to 2×10^{-5} over the preclosure period. (Ref. 8.2.6, Table 6.9 1)	IHF-ESD-07-NVL (Seq. 4-5)

Table B-1. Preclosure Nuclear Safety Design Bases for IHF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Naval SNF Waste Package System (DN) (continued)	Naval SNF Canister (continued)	Naval SNF Canister (Analyzed as a Representative Canister) (continued)	Provide containment (continued)	DN.IH.05. The mean conditional probability of breach of a canister resulting from a drop of a load onto the canister shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-07-NVL (Seq. 2-5)
				DN.IH.06. The mean conditional probability of breach of a canister resulting from a side impact or collision shall be less than or equal to 1×10^{-8} per impact. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-07-NVL (Seq. 6-5)
				DN.IH.07. The mean conditional probability of breach of a canister contained within a cask resulting from the spectrum of fires shall be less than or equal to 1×10^{-6} per fire event. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-13-NVL (Seq. 8-6)
				DN.IH.08. The mean conditional probability of breach of a canister located within the CTM shield bell resulting from the spectrum of fires shall be less than or equal to 1×10^{-4} per fire event. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-13-NVL (Seq. 8-6)

Table B-1. Preclosure Nuclear Safety Design Bases for IHF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Naval SNF Waste Package System (DN) (continued)	Naval SNF Canister (continued)	Naval SNF Canister (Analyzed as a Representative Canister) (continued)	Provide containment (continued)	DN.IH.09. The mean conditional probability of breach of a canister contained within a waste package resulting from the spectrum of fires shall be less than or equal to 1×10^{-4} per fire event. (Ref. 8.2.6, Table 6.9-1)	IHF-ESD-13-NVL (Seq. 8-6)

Notes:

Facility Codes: IH = Initial Handling Facility

System Codes: DN = Naval Spent Nuclear Fuel Waste Package; DS = DOE and Commercial Waste Package; H = Mechanical Handling; HE = Emplacement and Retrieval/Drip Shield Installation; HL = Waste Package Loadout; HM = Cask Handling

Subsystem Codes: HMC = Cask Receipt; HMH = Cask Preparation ; HMP = Waste Package Preparation; HTC = Canister Transfer; HWH = Material Handling

Acronyms: CTM = canister transfer machine; CTT = cask transfer trolley; DOE = U.S. Department of Energy; IHF = Initial Handling Facility; ITS = important to safety; SNF = spent nuclear fuel; SSC = structure, system, or component; HLW = high-level radioactive waste; TEV = transport and emplacement vehicle; WPTT = waste package transfer trolley.

a. Control values shown represent the integration of the probability distribution of SSC failure (i.e., the loss of safety function) with the seismic hazard curve (Ref. 8.2.4, Figure 6.1-1).

b. Design requirement is applied to reduce the frequency of any event sequence that could result in damage to a waste container to the beyond category 2 frequency range.

c. 'Protect against' in this table means either 'reduce the probability of' or 'reduce the frequency of.'

d. The numbers appearing in parentheses are component numbers.

e. Refer to Ref. 8.2.6 for the description of these event sequences.

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APPENDIX C
PRECLOSURE NUCLEAR SAFETY DESIGN BASES FOR THE CRCF ITS SSCs

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Table C-1. Preclosure Nuclear Safety Design Bases for CRCF ITS SSCs

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequences (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Aging (AP)	Aging Handling/ Cask Transfer	Site Transporter (170-HAT0-MEQ-00001)	Protect against[c] spurious movement	AP.CR.HAT.01. The mean probability of spurious movement of the site transporter while the canister is being lifted or lowered shall be less than or equal to 1×10^{-9} per transfer. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD09-TAD (Seq. 4-3)
			Limit speed	AP.CR.HAT.02. The speed of the site transporter shall be limited to 2.5 mi/hr. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD06-TAD (Seq. 4-4)
			Preclude fuel tank explosion	AP.CR.HAT.03. The site transporter fuel tank shall preclude fuel tank explosions. (Ref. 8.2.7, Table 6.9-1)	Initiating event does not require further analysis[b]
			Reduce severity of a drop	AP.CR.HAT.04. The site transporter shall preclude a drop of an aging overpack from a height greater than 3 ft measured from the equipment base. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD16-DPC (Seq. 3-3)
			Protect against[c] sliding impact and inducing stresses on the waste container	AP.CR.HAT.05. The mean frequency of a sliding impact of the site transporter into a wall and inducing stresses on the waste container due to the spectrum of seismic events shall be less than or equal to 2×10^{-5}/yr[a]. (Ref. 8.2.4, Table 6.10-3)	CRCF-S-IE-TWP (Seq. 06-5)
			Protect against[c] tipover of a site transporter	AP.CR.HAT.06. The mean frequency of a tipover of the site transporter due to the spectrum of seismic events shall be less than or equal to 2×10^{-6}/yr[a]. (Ref. 8.2.4, Table 6.10-3)	CRCF-S-IE-TWP (Seq. 06-5)
	Aging Handling/ Aging Overpack	Aging Overpack (TAD: [170-HAC0-ENCL-00003]) (Vertical DPC: [170-HAC0-ENCL-00002])	Protect against[c] direct exposure to personnel	AP.CR.HAC.01. The mean conditional probability of loss of shielding of the aging overpack resulting from an impact or collision shall be less than or equal to 1×10^{-5} per impact. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD02-TAD (Seq. 2-2)

Table C-1. Preclosure Nuclear Safety Design Bases for CRCF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequences (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Aging (AP) (continued)	Aging Handling/ Aging Overpack (continued)	Aging Overpack (TAD: [170-HAC0-ENCL-00003]) (Vertical DPC: [170-HAC0-ENCL-00002]) (continued)	Protect against[c] direct exposure to personnel (continued)	AP.CR.HAC.02. The mean conditional probability of loss of shielding of the aging overpack resulting from a drop shall be less than or equal to 5×10^{-6} per drop. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD16-TAD (Seq. 3-2)
Canister Receipt and Closure Facility (CR)	Canister Receipt and Closure Facility (CRCF)	Structure	Maintain building structural integrity to protect ITS SSCs inside the building from external events	CR.01. The mean frequency of building collapse due to winds less than or equal to 120 mph shall not exceed 1×10^{-6}/yr. (Ref. 8.2.3) CR.02. The mean frequency of building collapse due to volcanic ash fall less than or equal to a roof load of 21 lb/ft^{2}shall not exceed 1×10^{-6}/yr. (Ref. 8.2.3) CR.03. The CRCF shall be located such that there is a distance of at least one-half mile between the CRCF and the repository heliport. (Ref. 8.2.2)	Initiating event does not require further analysis[b]
			Protect against[c] building collapse onto waste containers	CR.04. The mean frequency of collapse of CRCF structure due to the spectrum of seismic events shall be less than or equal to 2×10^{-6}/yr [a]. (Ref. 8.2.4, Table 6.10-3)	CRCF-S-IE-TWP (Seq. 03)
		Rails for the Transport and Emplacement vehicle (TEV) (Inside Waste Package Loadout Room)	Protect against[c] derailment of the TEV during loading of a WP	CR.05. The mean frequency of the TEV derailment due to failure of the TEV rail system (at the loadout station) due to the spectrum of seismic events shall be less than or equal to 1×10^{-4}/yr. (Ref. 8.2.4, Table 6.10-3)	CRCF-S-IE-TWP (Seq. 12-2, 12-7)
		Shield Doors (Including Anchorages) and Equipment Confinement Doors	Protect against[c] direct exposure of personnel	CR.06. Equipment and personnel shield doors shall have a mean probability of inadvertent opening of less than or equal to 1×10^{-7} per waste container handled. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD18-TAD (Seq. 2)

Table C-1. Preclosure Nuclear Safety Design Bases for CRCF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequences (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Canister Receipt and Closure Facility (CR) (continued)	Canister Receipt and Closure Facility (CRCF) (continued)	Shield Doors (Including Anchorages) and Equipment Confinement Doors (continued)	Preclude collapse onto waste containers	CR.07. An equipment shield door falling onto a waste container as a result of impact from a conveyance shall be precluded. (Ref. 8.2.7, Table 6.9-1)	Initiating event does not require further analysis[b]
			Mitigate the consequences of radionuclide release	CR.08. The mean probability that the HVAC system in the CRCF confinement areas becomes unavailable (during a 30-day mission time following a radionuclide release) due to the simultaneous opening of an equipment confinement door and a cask unloading room shield door shall be less than or equal to 3×10^{-7}. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD09-TAD (Seq. 3-5)
			Protect against[c] equipment shield door collapse onto a waste container	CR.09. The mean frequency of collapse of equipment shield doors (including attachment of door to wall and frame anchorages) due to the spectrum of seismic event shall be less than or equal to 6×10^{-6}/yr [a]. (Ref. 8.2.4, Table 6.10-3)	CRCF-S-IE-TAD-AO (Seq. 10-6)
		DOE Canister Slide Gates (060-HTC0-HTCH-00005, 6, 7, 8, 9)	Protect against[c] dropping a canister due to a spurious closure of the slide gate	CR.HTC.01. The mean probability of a canister drop resulting from a spurious closure of the slide gate shall be less than or equal to 2×10^{-6} per transfer. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD09-DSTD (Seq. 3-3)
			Protect against[c] direct exposure to personnel	CR.HTC.02. The mean probability of occurrence of an inadvertent opening of a slide gate shall be less than or equal to 4×10^{-9} per transfer. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD18-DSTD (Seq. 2)
			Preclude canister breach	CR.HTC.03. Closure of the slide gate shall be incapable of breaching a canister. (Ref. 8.2.7, Table 6.9-1)	Initiating event does not require further analysis[b]

Table C-1. Preclosure Nuclear Safety Design Bases for CRCF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequences (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Canister Receipt and Closure Facility (CR) (continued)	Canister Receipt and Closure Facility (CRCF) (continued)	Cask Port Slide Gates (060-HTC0-HTCH-00001, 2)	Protect against[c] dropping a canister due to a spurious closure of the slide gate	CR.HTC.04. The mean probability of a canister drop resulting from a spurious closure of the slide gate shall be less than or equal to 2×10^{-6} per transfer. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD09-HLW (Seq. 3-3)
			Protect against[c] direct exposure to personnel	CR.HTC.05. The mean probability of occurrence of an inadvertent opening of a slide gate shall be less than or equal to 4×10^{-9} per transfer. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD18-TAD (Seq. 2)
			Preclude canister breach	CR.HTC.06. Closure of the slide gate shall be incapable of breaching a canister. (Ref. 8.2.7, Table 6.9-1)	Initiating event does not require further analysis[b]
		TAD Slide Gates (060-HTC0-HTCH-00010, 11)	Protect against[c] dropping a canister due to a spurious closure of the slide gate	CR.HTC.07. The mean probability of a canister drop resulting from a spurious closure of the slide gate shall be less than or equal to 2×10^{-6} per transfer. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD09-TAD (Seq. 3-3)
			Protect against[c] direct exposure to personnel	CR.HTC.08. The mean probability of occurrence of an inadvertent opening of a slide gate shall be less than or equal to 4×10^{-9} per transfer. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD18-TAD-(Seq. 2)
			Preclude canister breach	CR.HTC.09. Closure of the slide gate shall be incapable of breaching a canister. (Ref. 8.2.7, Table 6.9-1)	Initiating event does not require further analysis[b]

Table C-1. Preclosure Nuclear Safety Design Bases for CRCF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequences (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Canister Receipt and Closure Facility (CR) (continued)	Canister Receipt and Closure Facility (CRCF) (continued)	Waste Package Port Slide Gates (060-HTC0-HTCH-00003, 4)	Protect against[c] dropping a canister due to a spurious closure of the slide gate	CR.HTC.10. The mean probability of a canister drop resulting from a spurious closure of the slide gate shall be less than or equal to 2×10^{-6} per transfer. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD09-HLW (Seq. 3-3)
			against[c] direct exposure to personnel	CR.HTC.11. The mean probability of occurrence of an inadvertent opening of a slide gate shall be less than or equal to 4×10^{-9} per transfer. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD18-TAD (Seq. 2)
			Preclude canister breach	CR.HTC.12. Closure of the slide gate shall be incapable of breaching a canister. (Ref. 8.2.7, Table 6.9-1)	Initiating event does not require further analysis[b]
		Protect	Preclude canister drop onto floor	CR.HTC.13. The waste package port slide gate shall be incapable of opening without a waste package transfer trolley with waste package in position to receive a canister. (Ref. 8.2.7, Table 6.9-1)	Initiating event does not require further analysis[b]
		Cask Preparation Platform (060-HMH0-PLAT-00001)	Protect against[c] platform collapse	CR.HMH.01. The mean frequency of collapse of the cask preparation platform due to the spectrum of seismic events shall be less than or equal to 3×10^{-6}/yr [a]. (Ref. 8.2.4, Table 6.10-3)	CRCF-S-IE-TAD-AO (Seq. 08-6)

Table C-1. Preclosure Nuclear Safety Design Bases for CRCF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequences (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Canister Receipt and Closure Facility (CR) (continued)	Canister Receipt and Closure Facility (CRCF) (continued)	Cask Preparation Platform (060-HMH0-PLAT-00001) (continued)	Protect against[c] platform collapse or waste container breach due to an impact from the cask transfer trolley or site transporter	CR.HMH.02. The mean frequency of platform collapse or waste container breach from the impact of the cask transfer trolley or site transporter into the platform due to the spectrum of seismic events shall be less than or equal to 2×10^{-5}/yr[a]. (Ref. 8.2.4, Table 6.10-3)	CRCF-S-IE-TAD-AO (Seq. 12-5)
DOE and Commercial Waste Package System (DS)	DOE and Commercial Waste Package	Entire	Provide containment	DS.CR.01. The mean conditional probability of breach of a sealed waste package resulting from a side impact shall be less than or equal to 1×10^{-8} per impact. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD13-WP-TAD (Seq. 2-4)
				DS.CR.02. The mean conditional probability of breach of a sealed waste package resulting from a drop of a load onto the waste package shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD15-WP-TAD (Seq. 3-4)
				DS.CR.03. The mean conditional probability of breach of a sealed waste package resulting from an end-on impact or collision shall be less than or equal to 1×10^{-5} per impact. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD15-WP-TAD (Seq. 3-4)
	Defense High-Level Waste/DOE SNF Codisposal	DOE Standardized Canister	Provide containment	DS.CR.04. The mean conditional probability of breach of a DOE standardized canister resulting from a drop of the canister shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD09-DSTD (Seq. 3-3)

Table C-1. Preclosure Nuclear Safety Design Bases for CRCF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequences (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
DOE and Commercial Waste Package System (DS) (continued)	Defense High-Level Waste/DOE SNF Codisposal (continued)	DOE Standardized Canister (continued)	Provide containment (continued)	DS.CR.05. The mean conditional probability of breach of a DOE standardized canister resulting from a drop of a load onto the canister shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD09-DSTD (Seq. 6-3)
				DS.CR.06. The mean conditional probability of breach of a DOE standardized canister resulting from a side impact or collision shall be less than or equal to 1×10^{-8} per impact. (Ref. 8.2.7, Table 6.9 1)	CRCF-ESD10-WP-H&D (Seq. 3-3)
				DS.CR.07. The mean conditional probability of breach of a DOE standardized canister contained within a waste package resulting from the spectrum of fires shall be less than or equal to 3×10^{-4} per fire event. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD20-WP-H&D (Seq. 3-3)
				DS.CR.08. The mean conditional probability of breach of a DOE standardized canister contained within a cask or staging area resulting from the spectrum of fires shall be less than or equal to 2×10^{-6} per fire event. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD20-DSTD (Seq. 5-5)
				DS.CR.09. The mean conditional probability of breach of a DOE standardized canister located within the CTM Shield Bell resulting from the spectrum of fires shall be less than or equal to 1×10^{-4} per fire event. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD20-DSTD (Seq. 5-5)
				DS.CR.10. The mean conditional probability of breach of a DOE standardized canister, given the drop of an HLW canister onto the DOE standardized canister, shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD09-DSTD (Seq. 6-3)
				DS.CR.11. The mean conditional probability of breach of a DOE Standardized canister, given the drop of another DOE standardized canister onto the first canister, shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD09-DSTD (Seq. 6-3)

Table C-1. Preclosure Nuclear Safety Design Bases for CRCF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequences (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
DOE and Commercial Waste Package System (DS) (continued)	Defense High-Level Waste/DOE SNF Codisposal (continued)	HLW Canister	Provide containment	DS.CR.12. The mean conditional probability of breach of an HLW canister resulting from a drop of the canister shall be less than or equal to 3×10^{-2} per drop. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD09-HLW (Seq. 3-3)
				DS.CR.13. The mean conditional probability of breach of a HLW canister resulting from a drop of a load onto the canister shall be less than or equal to 3×10^{-2} per drop. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD09-HLW (Seq. 6-3)
				DS.CR.14. The mean conditional probability of breach of an HLW canister resulting from a side impact or collision shall be less than or equal to 1×10^{-8} per impact. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD10-WP-H&D (Seq. 3-3)
				DS.CR.15. The mean conditional probability of breach of an HLW canister contained within a waste package resulting from the spectrum of fires shall be less than or equal to 3×10^{-4} per fire event. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD20-WP-H&D (Seq. 3-3)
				DS.CR.16. The mean conditional probability of breach of an HLW canister contained within a cask resulting from the spectrum of fires shall be less than or equal to 2×10^{-6} per fire event. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD20-HLW (Seq. 5-5)
				DS.CR.17. The mean conditional probability of breach of an HLW canister located within the CTM Shield Bell resulting from the spectrum of fires shall be less than or equal to 1×10^{-4} per fire event. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD20-HLW (Seq. 5-5)
				DS.CR.18. The mean conditional probability of breach of an HLW canister, given the drop of a DOE standardized canister onto the HLW canister, shall be less than or equal to 3×10^{-2} per drop. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD09-HLW (Seq. 6-3)

Table C-1. Preclosure Nuclear Safety Design Bases for CRCF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequences (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
DOE and Commercial Waste Package System (DS) (continued)	Defense High-Level Waste/DOE SNF Codisposal (continued)	HLW Canister (continued)	Provide containment (continued)	DS.CR.19. The mean conditional probability of breach of an HLW canister, given the drop of another HLW canister onto the first canister, shall be less than or equal to 3×10^{-2} per drop. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD09-HLW (Seq. 6-3)
	Canistered Spent Nuclear Fuel	Dual-Purpose Canister (DPC) (Analyzed as a Representative Canister)	Provide containment	DS.CR.20. The mean conditional probability of breach of a canister resulting from a drop of the canister shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD09-DPC (Seq. 3-3)
				DS.CR.21. The mean conditional probability of breach of a canister resulting from a drop of a load onto the canister shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD09-DPC (Seq. 6-3)
				DS.CR.22. The mean conditional probability of breach of a canister resulting from a side impact or collision shall be less than or equal to 1×10^{-8} per impact. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD14-DPC (Seq. 2-3)
				DS.CR.23. The mean conditional probability of breach of a canister contained within a cask resulting from the spectrum of fires shall be less than or equal to 2×10^{-6} per fire event. (Ref. 8.2.7, Table 6.9 1)	CRCF-ESD20-DPC (Seq. 5-5)
				DS.CR.24. The mean conditional probability of breach of a canister contained within an aging overpack resulting from the spectrum of fires shall be less than or equal to 1×10^{-6} per fire event. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD20-DPC (Seq. 5-5)
				DS.CR.25. The mean conditional probability of breach of a canister located within the CTM shield bell resulting from the spectrum of fires shall be less than or equal to 1×10^{-4} per fire event. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD20-DPC (Seq. 4-3)

Table C-1. Preclosure Nuclear Safety Design Bases for CRCF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequences (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
DOE and Commercial Waste Package System (DS) (continued)	Canistered Spent Nuclear Fuel (continued)	Transportation, Aging, and Disposal (TAD) Canister (Analyzed as a Representative Canister)	Provide containment	DS.CR.26. The mean conditional probability of breach of a canister resulting from a drop of the canister shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD09-TAD (Seq. 3-3)
				DS.CR.27. The mean conditional probability of breach of a canister resulting from a drop of a load onto the canister shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD11-WP-TAD (Seq. 3-3)
				DS.CR.28. The mean conditional probability of breach of a canister resulting from a side impact or collision shall be less than or equal to 1×10^{-8} per impact. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD06-TAD (Seq. 4-3)
				DS.CR.29. The mean conditional probability of breach of a canister contained within a waste package resulting from the spectrum of fires shall be less than or equal to 3×10^{-4} per fire event. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD20-TAD (Seq. 7-5)
				DS.CR.30. The mean conditional probability of breach of a canister contained within a cask resulting from the spectrum of fires shall be less than or equal to 2×10^{-6} per fire event. (Ref. 8.2.7, Table 6.9 1)	CRCF-ESD20-TAD (Seq. 7-5)
				DS.CR.31. The mean conditional probability of breach of a canister located within the aging overpack resulting from the spectrum of fires shall be less than or equal to 1×10^{-6} per fire event. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD20-TAD (Seq. 7-5)
				DS.CR.32. The mean conditional probability of breach of a canister located within the CTM Shield Bell resulting from the spectrum of fires shall be less than or equal to 1×10^{-4} per fire event. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD20-TAD (Seq. 7-5)

Table C-1. Preclosure Nuclear Safety Design Bases for CRCF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequences (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Electrical Power System (EE)	ITS Power	ITS Distribution (Feeders Up to and including ITS Loads, ITS Direct Current Power, ITS Uninterruptible Power Supply Power)	Provide electrical power to ITS Surface Nuclear Confinement HVAC Systems	EE.CR.01. The mean conditional probability for ITS electrical power distribution failure, given the loss of offsite power, shall be less than or equal to 7×10^{-3} over a period of 720 hours following a radionuclide release. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD11-WP-H&M (Seq. 3-3)
		ITS diesel generators (including ITS diesel generator fuel oil system, ITS diesel generator air start system, ITS diesel generator jacket water cooling system, ITS diesel generator lubricating oil system, ITS diesel generator air intake and exhaust system.)	Provide electrical power to ITS Surface Nuclear Confinement HVAC Systems	EE.CR.02. The mean conditional probability for ITS electrical power failure, given the loss of offsite power, shall be less than or equal to 3×10^{-1} over a period of 720 hours following a radionuclide release. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD11-WP-H&M (Seq. 3-3)
Emplace-ment and Retrieval and Drip Shield Installation (HE)	Emplacement and Retrieval and Drip Shield Installation	Transport and Emplacement Vehicle (TEV)	Protect against[c] derailment of a TEV during loading of a waste package	HE.CR.01. The mean frequency of derailment of the TEV at the loadout station due to the spectrum of seismic events shall be less than or equal to 1×10^{-4}/yr.[a] (Ref. 8.2.4, Table 6.10-3)	CRCF-S-IE-TWP (Seq. 12-7)
			Protect against[c] a tipover of the TEV	HE.CR.02. The mean frequency of tipover of the TEV due to the spectrum of seismic events shall be less than or equal to 2×10^{-6}/yr[a]. (Ref. 8.2.4, Table 6.10-3)	CRCF-S-IE-TWP (Seq. 12-7)

Table C-1. Preclosure Nuclear Safety Design Bases for CRCF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequences (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Emplace-ment and Retrieval and Drip Shield Installation (HE) (continued)	Emplacement and Retrieval and Drip Shield Installation (continued)	Transport and Emplacement Vehicle (TEV) (continued)	Protect against[c] ejection of the waste package from the shielded enclosure of the TEV	HE.CR.03. The mean frequency of ejection of a waste package from the TEV due to the spectrum of seismic events shall be less than or equal to 2×10^{-4} /yr [a]. (Ref. 8.2.4, Table 6.10-3)	CRCF-S-IE-TWP (Seq. 12-2)
Fire Protection System (FP)	Fire Suppression	Preaction valve, sprinkler heads, and system actuation panels associated with double-interlock preaction suppression systems that protect areas where there is a potential for canister breach	Maintain moderator control	FP.CR.01. The mean probability of inadvertent introduction of fire suppression water into a canister shall be less than or equal to 1×10^{-6} over a 720-hour period following a radionuclide release. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD09-TAD (Seq. 3-4)
	Fire Detection	Fire Detection System for the ITS preaction valves with associated detectors and control box	Maintain moderator control	FP.CR.02. The mean probability of inadvertent introduction of fire suppression water into a canister shall be less than or equal to 1×10^{-6} over a 720-hour period following a radionuclide release. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD09-TAD (Seq. 3-4)
Mechanical Handling System (H)	Cask Handling	Transportation Cask (Analyzed as a Representative Cask)	Provide containment	H.CR.01. The mean conditional probability of breach of a canister in a sealed cask resulting from a drop shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD04-TAD (Seq. 3-4)
				H.CR.02. The mean conditional probability of breach of a canister in a sealed cask resulting from a drop of a load onto the cask shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD03-TAD (Seq. 6-4)
				H.CR.03. The mean conditional probability of breach of a canister in a sealed cask resulting from a side impact or collision shall be less than or equal to 1×10^{-8} per impact. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD04-TAD (Seq. 4-4)

Table C-1. Preclosure Nuclear Safety Design Bases for CRCF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequences (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Mechanical Handling System (H) (continued)	Cask Handling (continued)	Transportation Cask (Analyzed as a Representative Cask) (continued)	Protect against[c] direct exposure to personnel	H.CR.04. The mean conditional probability of loss of cask gamma shielding resulting from a drop of a cask shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD04-TAD (Seq. 3-2)
				H.CR.05. The mean conditional probability of loss of cask gamma shielding resulting from a collision or side impact to a cask shall be less than or equal to 1×10^{-8} per impact. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD04-TAD (Seq. 4-2)
				H.CR.06. The mean conditional probability of loss of cask gamma shielding resulting from a drop of a load onto a cask shall be less than or equal to 1×10^{-5} per impact. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD03-TAD (Seq. 6-2)
			Preclude lid contact with canister	H.CR.07. The geometry of the casks that carry DOE standardized canisters or HLW canisters shall preclude lid contact with canisters following a drop of a cask lid. (Ref. 8.2.7, Table 6.9-1)	Initiating event does not require further analysis[b]
		Site Prime Mover	Limit speed	H.CR.08. The speed of the site prime mover shall be limited to 9 mi/hr. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD01-HLW (Seq. 4-4)
			Preclude fuel tank explosion	H.CR.09. The fuel tank of a site prime mover shall preclude fuel tank explosions. (Ref. 8.2.7, Table 6.9-1)	Initiating event does not require further analysis[b]
		Cask Handling Yoke (060-HM00-BEAM-00001)	Protect against[c] drop	H.CR.HM.01. The cask handling yoke is an integral part of the load-bearing path. See Cask Handling Crane requirements. (Ref. 8.2.7, Table 6.9-1 and Ref. 8.2.4, Table 10-3)	See Cask Handling Crane requirements
		Cask Handling Crane; 200-ton (060-HM00-CRN-00001)	Protect against[c] drop	H.CR.HM.02. The mean probability of dropping a loaded cask from less than the two-block height resulting from the failure of a piece of equipment within the load path shall be less than or equal to 3×10^{-5} per transfer with the cask yoke or 1×10^{-4} per transfer with a sling. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD03-TAD (Seq. 2-4) (yoke) CRCF-ESD03-DPC (Seq. 2-4) (sling)

Table C-1. Preclosure Nuclear Safety Design Bases for CRCF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequences (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Mechanical Handling System (H) (continued)	Cask Handling (continued)	Cask Handling Crane; 200-ton (060-HM00-CRN-00001) (continued)	Protect against[c] drop	H.CR.HM.03. The mean probability of dropping a loaded cask from a two-block height resulting from the failure of a piece of equipment within the load-bearing path shall be less than or equal to 4×10^{-7} per transfer. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD03-TAD (Seq. 7-4)
			Limit drop height	H.CR.HM.04. The two-block drop height shall not exceed 30 feet from bottom of shortest cask to the floor. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD03-TAD (Seq. 7-4)
			Protect against[c] drop of a load onto a cask	H.CR.HM.05. The mean probability of dropping a load onto a loaded cask or its contents shall be less than or equal to 4×10^{-5} per cask handled. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD03-TAD (Seq. 6-4)
			Maintain moderator control	H.CR.HM.06. The mean probability of inadvertent introduction of an oil moderator into a canister shall be less than or equal to 9×10^{-5} over a 720-hour period following a radioactive release. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD09-TAD (Seq. 3-4)
			Limit speed	H.CR.HM.07. The speed of the trolley and bridge shall be limited to 20 ft/min. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD09-TAD (Seq. 3-4)
			Protect against[c] crane collapse onto a waste container	H.CR.HM.08. The mean frequency of collapse of the cask handling crane due to the spectrum of seismic events shall be less than or equal to 8×10^{-6}/yr[a]. (Ref. 8.2.4, Table 6.10-3)	CRCF-S-IE-TAD-AO (Seq. 07-6)
			Protect against[c] a cask or heavy object drop from the crane	H.CR.HM.09. The mean frequency of a hoist system failure of the cask handling crane due to the spectrum of seismic events shall be less than or equal to 2×10^{-5}/yr.[a] (Ref. 8.2.4, Table 6.10-3)	CRCF-S-IE-TAD-AO (Seq. 07-6)

Table C-1. Preclosure Nuclear Safety Design Bases for CRCF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequences (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Mechanical Handling System (H) (continued)	Cask Handling (continued)	Cask Transfer Trolley (CTT) and Pedestals Trolleys: (060-HM00-TRLY-00001-2) Pedestals: (060-HM00-PED-00001-2)	Limit speed	H.CR.HM.10. The speed of the CTT shall be limited to 2.5 mi/hr. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD06-TAD (Seq. 3-3)
			Protect against[c] spurious movement	H.CR.HM.11. The mean probability of spurious movement of the CTT while a canister is being lifted by the CTM shall be less than or equal to 1×10^{-9} per transfer. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD09-HLW (Seq. 4-3)
			Protect against[c] impact and inducing stresses on the waste container	H.CR.HM.12. The mean frequency of the sliding of the CTT into a wall and inducing stresses that can breach the waste container due to the spectrum of seismic events shall be less than or equal to 1×10^{-6}/yr [a]. (Ref. 8.2.4, Table 6.10-3)	CRCF-S-IE-HLW (Seq. 09-6)
				H.CR.HM.13. The mean frequency of a rocking impact of the CTT into a wall and inducing stresses that can breach the waste container due to the spectrum of seismic events shall be less than or equal to 1×10^{-6}/yr [a]. (Ref. 8.2.4, Table 6.10-3)	CRCF-S-IE-HLW (Seq. 09-6)
	Cask Handling/Cask Receipt	Horizontal Lifting Beam (200-HMC0-BEAM-00001) (shared with RF)	Protect against[c] drop	H.CR.HMC.01. The horizontal lifting beam is an integral part of the load-bearing path. See Cask Handling Crane requirements. (Ref. 8.2.7, Table 6.9-1)	See Cask Handling Crane requirements

Table C-1. Preclosure Nuclear Safety Design Bases for CRCF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequences (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Mechanical Handling System (H) (continued)	Cask Handling/Cask Preparation	Cask Lid Lifting Grapple (060-HMH0-HEQ-00012)	Protect against[c] drop of a load onto a canister	H.CR.HMH.01. The cask lid lifting grapple is an integral part of the load-bearing path. See Cask Handling Crane requirements. (Ref. 8.2.7, Table 6.9-1 and Ref. 8.2.4, Table 10-3)	See Cask Handling Crane requirements
		DPC Lid Adapters (060-HMH0-HEQ-00005, 6)	Protect against[c] drop of a DPC	H.CR.HMH.02. The DPC lid adapter is an integral part of the load-bearing path. See Canister Transfer Machine requirements. (Ref. 8.2.7, Table 6.9-1 and Ref. 8.2.4, Table 10-3)	See Canister Transfer Machine requirements
		Rail Cask Lid Adapters (060-HMH0-HEQ-00003, 4)	Protect against[c] drop	H.CR.HMH.03. The rail cask lid adapters is an integral part of the load-bearing path. See Cask Handling Crane requirements. (Ref. 8.2.7, Table 6.9-1 and Ref. 8.2.4, Table 10-3)	See Cask Handling Crane requirements
	Cask Handling/ Waste Package Preparation	Waste Package Handling Crane (060-HMP0-CRN-00001)	Protect against[c] collapse of the WP handling crane	H.CR.HMP.01. The mean frequency of collapse of the waste package handling crane due to the spectrum of seismic events shall be less than or equal to 8×10^{-6}/yr[a]. (Ref. 8.2.4, Table 6.10-3)	CRCF-S-IE-TWP (Seq. 11-6)
	Waste Transfer/ Canister Transfer	Canister Transfer Machine (CTM) (060-HTC0-FHM-00001-2)	Protect against[c] drop	H.CR.HTC.01. The mean probability of dropping a canister from below the two-block height due to the failure of a piece of equipment within the load-bearing path shall be less than or equal to 1×10^{-5} per transfer for each CTM. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD09-HLW (Seq. 3-3)
			Protect against[c] drop	H.CR.HTC.02. The mean probability of drop of a canister from the two-block height due to the failure of a piece of equipment within the load-bearing path shall be less than or equal to 3×10^{-8} per transfer. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD09-HLW (Seq. 8-3)

Table C-1. Preclosure Nuclear Safety Design Bases for CRCF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequences (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Mechanical Handling System (H) (continued)	Waste Transfer/ Canister Transfer (continued)	Canister Transfer Machine (CTM) (060-HTC0-FHM-00001-2) (continued)	Limit drop height	H.CR.HTC.03. The two-block height shall not exceed 45 feet from the bottom of a canister to the cavity floor of the cask, aging overpack, or waste package. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD09-HLW (Seq. 8-3)
			Protect against[c] drop of a load onto a canister	H.CR.HTC.04. The mean probability of dropping a load onto a canister shall be less than or equal to 1×10^{-5} per transfer. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD09-HLW (Seq. 6-3)
			Protect against[c] spurious movement	H.CR.HTC.05. The mean probability of a spurious movement of the CTM while a canister is being lifted or lowered shall be less than or equal to 7×10^{-9} per transfer for each CTM. (Ref. 8.2.7, Table 6.9 1)	CRCF-ESD09-TAD (Seq. 4-3)
			Limit Speed	H.CR.HTC.06. The speed of the CTM trolley and bridge shall be limited to 20 ft/min. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD09-HLW (Seq. 5-3)
			Preclude non-flat bottom drop of a DPC or TAD	H.CR.HTC.07. The CTM shall preclude non-flat-bottom drops of DPCs and TADs. (Ref. 8.2.7, Table 6.9-1)	Initiating event does not require further analysis[b]
			Protect against[c] direct exposure to personnel	H.CR.HTC.08. The mean probability of inadvertent radiation streaming resulting from the inadvertent opening of the CTM slide gate, the inadvertent raising of the CTM shield skirt, or an inadvertent motion of the CTM away from an open port shall be less than or equal to 9×10^{-6} per transfer. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD18-TAD (Seq. 2)
			Maintain moderator control	H.CR.HTC.09. The mean probability of inadvertent introduction of an oil moderator into a canister shall be less than or equal to 9×10^{-5} over a 720-hour period following the breach of a canister. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD09-TAD (Seq. 3-4)

Table C-1. Preclosure Nuclear Safety Design Bases for CRCF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequences (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Mechanical Handling System (H) (continued)	Waste Transfer/ Canister Transfer (continued)	Canister Transfer Machine (CTM) (060-HTC0-FHM-00001-2) (continued)	Preclude canister breach	H.CR.HTC.10. Closure of the CTM slide gate shall be incapable of breaching a canister. (Ref. 8.2.7, Table 6.9-1)	Initiating event does not require further analysis[b]
			Maintain DOE SNF canister separation	H.CR.HTC.11. The conditional probability of inadvertent placement of more than four DOE standardized canisters in a TAD waste package, TAD staging rack, or AO shall be less than or equal to 3×10^{-6}. (Ref. 8.2.7, Table 6.9-1)	Initiating event does not require further analysis[b]
			Protect against[c] collapse of the CTM	H.CR.HTC.12. The mean frequency of collapse of the CTM due to the spectrum of seismic events shall be less than or equal to 1×10^{-5}/yr [a]. (Ref. 8.2.4, Table 6.10-3)	CRCF-S-IE-TWP (Seq. 08-5)
			Protect against[c] a canister or heavy object drop from the CTM	H.CR.HTC.13. The mean frequency of a hoist system failure of the CTM due to the spectrum of seismic events shall be less than or equal to 2×10^{-5}/yr [a]. (Ref. 8.2.4, Table 6.10-3)	CRCF-S-IE-TWP (Seq. 08-5)
		Canister Grapples (060-HTC0-HEQ-00003-7) Canister Transfer Machine Grapples (060-HTC0-HEQ-00001, 2)	Protect against[c] drop	H.CR.HTC.14. The canister grapple is an integral part of the load-bearing path. See Canister Transfer Machine requirements. (Ref. 8.2.7, Table 6.9-1 and Ref. 8.2.4, Table 10-3)	See Canister Transfer Machine requirements
			Protect against[c] drop of a load onto a canister	H.CR.HTC.15. The canister grapple is an integral part of the load-bearing path. See Canister Transfer Machine requirements. (Ref. 8.2.7, Table 6.9-1)	See Canister Transfer Machine requirements

Table C-1. Preclosure Nuclear Safety Design Bases for CRCF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequences (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Mechanical Handling System (H) (continued)	Waste Transfer/ Canister Transfer (continued)	TAD Staging Racks (and Thermal Barrier) (060-HTC0-RK-00011-12)	Protect against[c] a tipover/impact of a canister	H.CR.HTC.16. The mean frequency of collapse of the TAD staging racks due to the spectrum of seismic events shall be less than or equal to 2×10^{-6}/yr [a]. (Ref. 8.2.4, Table 6.10-3)	CRCF-S-IE-DOE-SNF (Seq. 12-5)
			Protect against canister breach	H.CR.HTC.17. The mean conditional probability of breach of a TAD contained within a staging rack resulting from the spectrum of fires shall be less than or equal to 2×10^{-6} per fire event. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD20-DSTD (Seq. 5-3)
		DOE Canister Staging Racks (and Thermal Barrier) (060-HTC0-RK-00006-10)	Protect against[c] a tipover/impact of a canister	H.CR.HTC.18. The mean frequency of collapse of the DOE canister staging racks (such that the spacing between the surface of adjacent DOE standardized canisters in a staging rack is less than 30 cm) due to the spectrum of seismic events shall be less than or equal to 2×10^{-6}/yr[a]. (Ref. 8.2.4, Table 6.10-3 and Ref. 8.2.5)	CRCF-S-IE-DOE-SNF (Seq. 12-5)
			Protect against canister breach	H.CR.HTC.19. The mean conditional probability of breach of a DOE standardized canister contained within a staging rack resulting from the spectrum of fires shall be less than or equal to 2×10^{-6} per fire event. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD20-DSTD (Seq. 5-3)
	Waste Package Closure	Remote Handling System Bridge (060-HWH0-HEQ-00003)	Protect against[c] collapse of the Remote Handling System bridge	H.CR.HWH.01. The mean frequency of collapse of the Remote Handling System bridge due to the spectrum of seismic events shall be less than or equal to 8×10^{-6}/yr [a]. (Ref. 8.2.4, Table 6.10-3)	CRCF-S-IE-DOE-SNF (Seq. 13-6)
	Waste Package Loadout	Waste Package Shield Rings (060-HL00-HEQ-00001-6)	Provide lateral and vertical stability to the waste package in the WPTT	H.CR.HL.01. The mean frequency of the shield ring becoming displaced from the WPTT due to the spectrum of seismic events shall be less than or equal to 2×10^{-5}/yr[a]. (Ref. 8.2.4, Table 6.10-3)	CRCF-S-IE-TWP (Seq. 10-6)

Table C-1. Preclosure Nuclear Safety Design Bases for CRCF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequences (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Mechanical Handling System (H) (continued)	Waste Package Loadout (continued)	Waste Package Transfer Trolley (WPTT) (including Pedestals, Seismic Rail Restraints, and Rails) (Trolleys: 060-HL00-TRLY-00001-2) (Pedestals: 060-HL00-PED-00001-8)	Preclude rapid tilt-down	H.CR.HL.02. The WPTT shall be incapable of rapid tilt-down. (Ref. 8.2.7, Table 6.9-1)	Initiating event does not require further analysis[b]
			Limit speed	H.CR.HL.03. The speed of the WPTT shall be limited to 2.5 mi/hr. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD13-WP-H&D (Seq. 3-3)
			Protect against[c] spurious movement	H.CR.HL.04. The mean probability of spurious movement of the WPTT while a canister is being lowered by the CTM shall be less than or equal to 1×10^{-9} per transfer. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD09-HLW (Seq. 4-3)
			Protect against[c] tipover of the WPTT holding a loaded waste package	H.CR.HL.05. The mean frequency of tipover of the WPTT due to the spectrum of seismic events shall be less than or equal to 2×10^{-6}/yr [a]. (Ref. 8.2.4, Table 6.10-3)	CRCF-S-IE-TWP (Seq. 10-6)

Table C-1. Preclosure Nuclear Safety Design Bases for CRCF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequences (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Mechanical Handling System (H) (continued)	Waste Package Loadout (continued)	Waste Package Transfer Trolley (WPTT) (including Pedestals, Seismic Rail Restraints, and Rails) (Trolleys: 060-HL00-TRLY-00001-2) (Pedestals: 060-HL00-PED-00001-8) (continued)	Protect against[c] rocking (which induces an impact into a wall) of a WPTT holding a loaded waste package	H.CR.HL.06. The mean frequency of rocking impact of the WPTT into a wall due to the spectrum of seismic events shall be less than or equal to 2×10^{-5}/yr [a]. (Ref. 8.2.4, Table 6.10-3)	CRCF-S-IE-TWP (Seq. 10-6)
Surface Nuclear Confinement HVAC System (VC)	Surface Nuclear Confinement HVAC	Portions of the surface nuclear confinement HVAC system that exhaust from areas with a potential for a breach	Mitigate the consequences of radionuclide release	VC.CR.01. The mean probability that the HVAC system (including HEPA filtration of exhaust air from the CRCF confinement areas) becomes unavailable during a 30-day mission time following a radionuclide release shall be less than or equal to 4×10^{-2}. This parameter does not apply in the case of large fires, which may disable the HVAC system. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD09-TAD (Seq. 3-5)
		Portions of the surface nuclear confinement HVAC system that support the cooling of ITS electrical equipment and battery rooms	Support ITS electrical function	VC.CR.02. The mean conditional probability of failure of the portions of the surface nuclear confinement HVAC system that support the cooling of ITS electrical equipment and battery rooms in the CRCF shall be less than or equal to 2×10^{-2} per ITS electrical train over a period of 720 hours following a radionuclide release. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD09-TAD (Seq. 3-5)

Table C-1. Preclosure Nuclear Safety Design Bases for CRCF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequences (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Surface Non-Confinement HVAC System (VN)	Surface Non-Confinement HVAC	Portions of the surface non-confinement HVAC system that support the cooling of ITS electrical equipment and battery rooms (EDGF)	Support ITS electrical function	VN.CR.01. The mean conditional probability of failure of the portions of the surface non-confinement HVAC system that support the cooling of ITS electrical equipment and battery rooms in the EDGF shall be less than or equal to 2×10^{-2} per ITS electrical train over a period of 720 hours following a radionuclide release. (Ref. 8.2.7, Table 6.9-1)	CRCF-ESD09-TAD (Seq. 3-5)

Notes:

Facility Codes: AP = Aging Facility; CR = Canister Receipt and Closure Facility.

System Codes: DN = Naval Spent Nuclear Fuel Waste Package; DS = DOE and Commercial Waste Package; H = Mechanical Handling; HE = Emplacement and Retrieval/Drip Shield Installation.

Infrastructure System Codes: EE = Electrical Power; FP = Fire Protection; H = Mechanical Handling; VC = Surface Nuclear Confinement HVAC ; VN = Surface Non-Confinement HVAC.

Subsystem Codes: HAT = Cask Transfer; HL = Waste Package Loadout; HM = Cask Handling; HMH = Cask Preparation; HMP = Waste Package Preparation; HTC = Canister Transfer; HWH = Material Handling.

Acronyms: CRCF = Canister Receipt and Closure Facility; CTM = canister transfer machine; CTT = cask transfer trolley; DOE = U.S. Department of Energy; DPC = dual-purpose canister; EDGF = Emergency Diesel Generator Facility; HEPA = high-efficiency particulate air; HLW = high-level radioactive waste; HVAC = heating, ventilation, and air conditioning; ITS = important to safety; RF = Receipt Facility; SNF = spent nuclear fuel; SSC = structure, system, or component; HLW = high-level radioactive waste; TAD = transportation, aging and disposal; TEV = transport and emplacement vehicle; WPTT = waste package transfer trolley.

a. Control values shown represent the integration of the probability distribution of SSC failure (i.e., the loss of safety function) with the site seismic hazard curve (Ref. 8.2.4, Figure 6.1-1).

b. Design requirement is applied to reduce the frequency of any event sequence that could result in damage to a waste container to the beyond Category 2 frequency range.

c. 'Protect against' in this table means either 'reduce the probability of' or 'reduce the frequency of.'

d. The numbers appearing in parentheses are component numbers.

e. Refer to Ref. 8.2.7 for the description of these event sequences.

APPENDIX D
PRECLOSURE NUCLEAR SAFETY DESIGN BASES FOR THE WHF ITS SSCs

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Table D-1. Preclosure Nuclear Safety Design Bases for WHF ITS SSCs

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Aging (AP)	Aging Handling/ Cask Transfer	Site Transporter (170-HAT0-MEQ-00001)	Protect against[c] spurious movement	AP.WH.HAT.01. The mean probability of spurious movement of the site transporter while the canister is being lifted or lowered shall be less than or equal to 1×10^{-9} per transfer. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD13-TAD (Seq. 6-3)
			Limit speed	AP.WH.HAT.02. The speed of the site transporter shall be limited to 2.5 mi/hr. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD03-AODPC (Seq. 3-5)
			Preclude fuel tank explosion	AP.WH.HAT.03. The site transporter fuel tank shall preclude fuel tank explosions. (Ref. 8.2.8, Table 6.9-1)	Initiating event does not require further analysis[b]
			Reduce severity of a drop	AP.WH.HAT.04. The site transporter shall preclude a vertical dropping of an aging overpack from a height greater than 3 ft measured from the equipment base. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD03-AODPC (Seq. 2-3)
			Protect against[c] sliding impact and inducing stress on the waste container	AP.WH.HAT.05. The mean frequency of sliding impact of the site transporter into a wall and introducing stresses that can breach a waste container due to the spectrum of seismic events shall be less than or equal to 2×10^{-5}/yr[a]. (Ref. 8.2.4, Table 6.10-4)	WHF-S-IE-TAD-AO (Seq. 14-5)
			Protect against[c] tipover of the site transporter	AP.WH.HAT.06. The mean frequency of tipover of the site transporter due to the spectrum of seismic events shall be less than or equal to 2×10^{-6} /yr[a]. (Ref. 8.2.4, Table 6.10-4)	WHF-S-IE-TAD-AO (Seq. 14-5)
		Cask Tractor (for use with the Cask Transfer Trailer) (170-HAT0-HEQ-00001)	Limit speed	AP.WH.HAT.07. The speed of the cask tractor shall be limited to 2.5 mi/hr. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD04-DPC (Seq. 3-4)
			Preclude fuel tank explosion	AP.WH.HAT.08. The cask tractor fuel tank shall preclude fuel tank explosions. (Ref. 8.2.8, Table 6.9-1)	Initiating event does not require further analysis[b]

Table D-1. Preclosure Nuclear Safety Design Bases for WHF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Aging (AP) (continued)	Aging Handling/ Cask Transfer (continued)	Cask Transfer Trailer (for use with Transportation Casks and Horizontal Shielded Transfer Casks (HSTCs) (PWR DPC: [170-HAT0-TRLY-00001]) (BWR DPC: [170-HAT0-TRLY-00002])	Preclude fuel tank explosion	AP.WH.HAT.09. The cask transfer trailer fuel tank shall preclude fuel tank explosions. (Ref. 8.2.8, Table 6.9-1)	Initiating event does not require further analysis[b]
			Reduce severity of a drop	AP.WH.HAT.10. The cask transfer trailer shall preclude dropping a cask from a height greater than 6 feet measured from the equipment base. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD04-DPC (Seq. 2-4)
			Preclude puncture of a cask	AP.WH.HAT.11. The cask transfer trailer shall preclude puncture of a cask due to collision. (Ref. 8.2.8, Table 6.9-1)	Initiating event does not require further analysis[b]
			Preclude puncture of a cask	AP.WH.HAT.12. The cask transfer trailer shall be designed to preclude puncture of a cask due to the spectrum of seismic events[a]. (Ref. 8.2.4, Table 6.10-5)	Initiating event does not require further analysis[b]
	Aging Handling/ Aging Overpack	Aging Overpack (TAD: [170-HAC0-ENCL-00003]) (Vertical DPC: [170-HAC0-ENCL-00002])	Protect against[c] direct exposure to personnel	AP.WH.HAC.01. The mean conditional probability of loss of shielding of the aging overpack resulting from an impact or collision shall be less than or equal to 1×10^{-5} per impact. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD03-AODPC (Seq. 3-2)
				AP.WH.HAC.02. The mean conditional probability of loss of shielding of the aging overpack resulting from a drop shall be less than or equal to 5×10^{-6} per drop. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD03-TAD (Seq. 2-2)
Cask/Canister/ Waste Package Process System (MR)	Cask Cooling	Cask/DPC Overpressure Protection Features	Protect against[c] cask failure due to overpressure	MR.WH.01. The mean probability of an overpressure of a cask or cooling system line during the cask cooling operation shall be less than or equal to 8×10^{-6} per cask. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD16-CSNF (Seq. 4-1)

Table D-1. Preclosure Nuclear Safety Design Bases for WHF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
DOE and Commercial Waste Package System (DS)	Canistered Spent Nuclear Fuel	Dual-Purpose Canister (DPC) (Analyzed as a Representative Canister)	Provide containment	DS.WH.01. The mean conditional probability of breach of a canister resulting from a drop of the canister shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD13-DPC (Seq. 2-3)
				DS.WH.02. The mean conditional probability of breach of a canister resulting from a drop of a load onto the canister shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD13-DPC (Seq. 5-3)
				DS.WH.03. The mean conditional probability of breach of a canister resulting from a side impact or collision shall be less than or equal to 1×10^{-8} per impact. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD13-DPC (Seq. 4-3)
				DS.WH.04. The mean conditional probability of breach of a canister contained within a cask resulting from the spectrum of fires shall be less than or equal to 2×10^{-6} per fire event. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD31-DPC (Seq. 7-3)
				DS.WH.05. The mean conditional probability of breach of a canister contained within an aging overpack resulting from the spectrum of fires shall be less than or equal to 1×10^{-6} per fire event. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD31-TAD (Seq. 4-3)

Table D-1. Preclosure Nuclear Safety Design Bases for WHF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
DOE and Commercial Waste Package System (DS) (continued)	Canistered Spent Nuclear Fuel (continued)	Dual-Purpose Canister (DPC) (Analyzed as a Representative Canister) (continued)	Provide containment (continued)	DS.WH.06. The mean conditional probability of breach of a canister contained within the CTM shield bell resulting from the spectrum of fires shall be less than or equal to 1×10^{-4} per fire event. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD31-DPC (Seq. 5-3)
		Transportation, Aging, and Disposal (TAD) Canister (Analyzed as a Representative Canister)	Provide containment	DS.WH.07. The mean conditional probability of breach of a canister resulting from a drop of the canister shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD13-TAD (Seq. 2-3)
				DS.WH.08. The mean conditional probability of breach of a canister resulting from a drop of a load onto the canister shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD13-TAD (Seq. 5-3)
				DS.WH.09. The mean conditional probability of breach of a canister resulting from a side impact or collision shall be less than or equal to 1×10^{-8} per impact. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD13-TAD (Seq. 4-3)
				DS.WH.10. The mean conditional probability of breach of a canister contained within a cask resulting from the spectrum of fires shall be less than or equal to 2×10^{-6} per fire event. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD31-TAD (Seq. 6-3)
				DS.WH.11. The mean conditional probability of breach of a canister located within the aging overpack resulting from the spectrum of fires shall be less than or equal to 1×10^{-6} per fire event. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD31-TAD (Seq. 4-3)
				DS.WH.12. The mean conditional probability of breach of a canister located within the CTM shield bell resulting from the spectrum of fires shall be less than or equal to 1×10^{-4} per fire event. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD31-TAD (Seq. 5-3)

Table D-1. Preclosure Nuclear Safety Design Bases for WHF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Electrical Power System (EE)	ITS Power	ITS Distribution (Feeders Up to and including ITS Loads, ITS Direct Current Power, ITS Uninterruptible Power Supply Power)	Provide electrical power to ITS Surface Nuclear Confinement HVAC Systems	EE.WH.01. The mean conditional probability for ITS electrical power distribution failure shall be less than or equal to 8×10^{-3} over a period of 720 hours following a radionuclide release. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD13-TAD (Seq. 2-5)
				EE.WH.02. The mean conditional probability for ITS electrical power distribution failure shall be less than or equal to 5×10^{-4} over a period of 24 hours following a cask overpressure or a cooling system line break. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD16-CSNF (Seq. 4-3)
		ITS diesel generators (including ITS diesel generator fuel oil system, ITS diesel generator air start system, ITS diesel generator jacket water cooling system, ITS diesel generator lubricating oil system, ITS diesel generator air intake and exhaust system)	Provide electrical power to ITS Surface Nuclear Confinement HVAC Systems	EE.WH.03. The mean conditional probability for ITS electrical power failure, given the loss of offsite power, shall be less than or equal to 3×10^{-1} over a period of 720 hours following a radionuclide release. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD13-TAD (Seq. 2-5)

Table D-1. Preclosure Nuclear Safety Design Bases for WHF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Fire Protection System (FP)	Fire Suppression	Preaction valves, sprinkler heads, and system actuation panels associated with double-interlock preaction suppression systems that protect areas where there is a potential for canister breach	Maintain moderator control	FP.WH.01 The mean probability of inadvertent introduction of fire suppression water into a canister shall be less than or equal to 6×10^{-7} over a 720-hour period following a radionuclide release. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD02-DPC (Seq. 3-5)
	Fire Detection	Fire Detection System for the ITS preaction valves with associated detectors and control box		FP.WH.02. The mean probability of inadvertent introduction of fire suppression water into a canister shall be less than or equal to 6×10^{-7} over a 720-hour period following a radionuclide release. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD02-DPC (Seq. 3-5)

Table D-1. Preclosure Nuclear Safety Design Bases for WHF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Mechanical Handling System (H)	Cask Handling	Transportation Cask (Analyzed as a Representative Cask) Shielded Transfer Cask (STC) (Analyzed as a Representative Cask) (TAD: 050-HT00-HEQ-00001) (DPC: 050-HT00-HEQ-00002) Note: only transportation casks may contain uncanistered SNF; STCs and transportation casks may contain canistered SNF	Provide containment	H.WH.01. The mean conditional probability of breach of a canister in a sealed cask resulting from a drop shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD07-DPC (Seq. 5-4)
				H.WH.02. The mean conditional probability of breach of a sealed cask containing uncanistered SNF resulting from a drop shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD05-CSNF (Seq. 5-3)
				H.WH.03. The mean conditional probability of breach of a canister in a sealed cask resulting from a drop of a load onto the cask shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD07-DPC (Seq. 4-4)
				H.WH.04. The mean conditional probability of breach of a sealed cask containing uncanistered SNF resulting from a drop of a load onto the cask shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD05-CSNF (Seq. 4-3)
				H.WH.05. The mean conditional probability of breach of a canister in a sealed cask resulting from a side impact or collision shall be less than or equal to 1×10^{-8} per impact. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD07-DPC (Seq. 3-4)
				H.WH.06. The mean conditional probability of breach of a sealed cask containing uncanistered SNF resulting from a side impact or collision shall be less than or equal to 1×10^{-8} per impact. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD05-CSNF (Seq. 3-3)

Table D-1. Preclosure Nuclear Safety Design Bases for WHF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Mechanical Handling System (H) (continued)	Cask Handling (continued)	Transportation Cask (Analyzed as a Representative Cask) Shielded Transfer Cask (STC) (Analyzed as a Representative Cask) (TAD: 050-HT00-HEQ-00001) (DPC: 050-HT00-HEQ-00002) (continued)	Provide containment (continued)	H.WH.07. The mean conditional probability of breach of a sealed cask containing uncanistered SNF resulting from the spectrum of fires shall be less than or equal to 5×10^{-2} per fire event. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD31-CSNF (Seq. 4-5)
			Protect against[c] direct exposure to personnel	H.WH.08. The mean conditional probability of loss of cask gamma shielding resulting from a drop of a cask shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD05-CSNF (Seq. 5-2)
				H.WH.09. The mean conditional probability of loss of cask gamma shielding resulting from a collision or side impact to a cask shall be less than or equal to 1×10^{-8} per impact. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD05-CSNF (Seq. 3-2)
				H.WH.10 The mean conditional probability of loss of cask gamma shielding resulting from a drop of a load onto a cask shall be less than or equal to 1×10^{-8} per impact. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD05-CSNF (Seq. 4-2)
		Site Prime Mover	Limit speed	H.WH.11. The speed of the site prime mover shall be limited to 9 mi/hr. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD01-CSNF (Seq. 3-3)
			Preclude fuel tank explosion	H.WH.12. The fuel tank of a site prime mover shall preclude fuel tank explosions. (Ref. 8.2.8, Table 6.9-1)	Initiating event does not require further analysis[b]
		Cask Handling Yoke (050-HM00-BEAM-00001)	Protect against[c] drop	H.WH.HM.01. The cask handling yoke is an integral part of the load-bearing path. See Cask Handling Crane requirements. (Ref. 8.2.8, Table 6.9-1 and Ref. 8.2.4, Table 6.10-4)	See Cask Handling Crane requirements
		Pool Cask Handling Yoke (050-HM00-BEAM-00002)	Protect against[c] drop	H.WH.HM.02. The pool cask handling yoke is an integral part of the load-bearing path. See Cask Handling Crane requirements. (Ref. 8.2.8, Table 6.9-1 and Ref. 8.2.4, Table 6.10-4)	See Cask Handling Crane requirements

Table D-1. Preclosure Nuclear Safety Design Bases for WHF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Mechanical Handling System (H) (continued)	Cask Handling (continued)	Cask Handling Crane; 200-ton (050-HM00-CRN-00001)	Protect against[c] drop	H.WH.HM.03. The mean probability of dropping a loaded cask from less than the two-block height resulting from the failure of a piece of equipment within the load path supporting the cask shall be less than or equal to 3×10^{-5} per transfer with the cask yoke or 1×10^{-4} per transfer with a sling. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD20-CSNF (Seq. 08-3) WHF-ESD06-TTC (Seq. 2-4)
				H.WH.HM.04. The mean probability of dropping a loaded cask from a two-block height resulting from the failure of a piece of equipment within the load-bearing path shall be less than or equal to 4×10^{-7} per transfer. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD20-CSNF (Seq. 09-3)
			Limit drop height	H.WH.HM.05. The two-block drop height shall not exceed 30 feet from bottom of shortest cask to the floor. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD20-CSNF (Seq. 09-3)
			Protect against[c] drop of a load onto a cask	H.WH.HM.06. The mean probability of dropping a load onto a loaded cask or its contents shall be less than or equal to 3×10^{-5} per cask handled. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD05-CSNF (Seq. 4-3)
			Maintain moderator control	H.WH.HM.07. The mean probability of inadvertent introduction of an oil moderator into a canister shall be less than or equal to 9×10^{-5} over a 720-hour period following a radionuclide release. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD05-CSNF (Seq. 4-4)
			Limit Speed	H.WH.HM.08. The speed of the trolley and bridge shall be limited to 20 ft/min. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD05-CSNF (Seq. 3-3)
			Protect against[c] crane collapse onto a waste container	H.WH.HM.09. The mean frequency of collapse of the cask handling crane due to the spectrum of seismic events shall be less than or equal to 8×10^{-6}/yr.[a] (Ref. 8.2.4, Table 6.10-4)	WHF-S-IE-BARE (Seq. 05-6)

Table D-1. Preclosure Nuclear Safety Design Bases for WHF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Mechanical Handling System (H) (continued)	Cask Handling (continued)	Cask Handling Crane; 200-ton (050-HM00-CRN-00001) (continued)	Protect against[c] a cask or heavy object drop from the crane	H.WH.HM.10. The mean frequency of a hoist system failure of the cask handling crane due to the spectrum of seismic events shall be less than or equal to 2×10^{-5}/yr.[a] (Ref. 8.2.4, Table 6.10-4)	WHF-S-IE-BARE (Seq. 05-6)
		Pool Yoke Lift Adapter (050-HM00-TOOL-00002)	Protect against[c] drop of a cask	H.WH.HM.11. The pool yoke lift adapter is an integral part of the load-bearing path. See Cask Handling Crane requirements. (Ref. 8.2.8, Table 6.9-1 and Ref. 8.2.4, Table 6.10-4)	See Cask Handling Crane requirements
		Cask Transfer Trolley (CTT) and Pedestals (Trolley: 050-HM00-TRLY-00001) (Pedestals: 050-HM00-PED-00001-5)	Limit speed	H.WH.HM.12. The CTT shall be limited to 2.5 mi/hr. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD12-DPC (Seq. 10)
			Protect against[c] spurious movement	H.WH.HM.13. The mean probability of spurious movement of the CTT while a canister is being lifted by the CTM shall be less than or equal to 1×10^{-9} per transfer (Ref. 8.2.8, Table 6.9-1)	WHF-ESD13-TAD (Seq. 6-3)
			Protect against[c] impact and inducing stresses on the waste container	H.WH.HM.14. The mean frequency of the sliding of the cask transfer trolley into a wall and inducing stresses that can breach the waste container due to the spectrum of seismic events shall be less than or equal to 1×10^{-6}/yr[a]. (Ref. 8.2.4, Table 6.10-4)	WHF-S-IE-BARE (Seq. 09-6)
				H.WH.HM.15. The mean frequency of a rocking impact of the cask transfer trolley into a wall and inducing stresses that can breach the waste container due to the spectrum of seismic events shall be less than or equal to 1×10^{-6}/yr[a]. (Ref. 8.2.4, Table 6.10-4)	WHF-S-IE-BARE (Seq. 09-6)
	Cask Handling/ Cask Receipt	Entrance Vestibule Crane (050-HMC0-CRN-00001)	Protect against[c] collapse	H.WH.HMC.01. The mean frequency of collapse of the entrance vestibule crane due to the spectrum of seismic events shall be less than or equal to 8×10^{-6}/yr[a]. (Ref. 8.2.4, Table 6.10-4)	WHF-S-IE-BARE (Seq. 07-6)

Table D-1. Preclosure Nuclear Safety Design Bases for WHF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Mechanical Handling System (H) (continued)	Cask Handling/ Cask Receipt (continued)	Horizontal Lifting Beam (200-HMC0-BEAM-00001) (shared with RF)	Protect against[c] drop	H.WH.HMC.02. The horizontal lifting beam is an integral part of the load-bearing path. See Cask Handling Crane requirements. (Ref. 8.2.9, Table 6.9-1)	See Cask Handling Crane requirements
	Cask Handling/Cask Preparation	Truck Cask Lid Adapters (050-HMH0-HEQ-00010-11) Rail Cask Lid Adapters (050-HMH0-HEQ-00012-13)	Protect against[c] drop	H.WH.HMH.01. The truck and rail cask lid adapters are an integral part of the load-bearing path. See Cask Handling Crane requirements. (Ref. 8.2.8, Table 6.9-1)	See Cask Handling Crane requirements
		Auxiliary Pool Crane; 10 ton (050-HMH0-CRN-00001)	Protect against[c] a drop of a load onto canister	H.WH.HMH.02. The mean probability of drop of a load onto a canister shall be less than or equal to 3×10^{-5} per lift. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD21-CSNF (Seq. 5-2)
			Protect against[c] collapse of the auxiliary pool crane	H.WH.HMH.03. The mean frequency of collapse of the auxiliary pool crane due to the spectrum of seismic events shall be less than or equal to 8×10^{-6}/yr[a]. (Ref. 8.2.4, Table 6.10-4)	WHF-S-IE-BARE (Seq. 14-5)
			Protect against[c] a heavy object drop from the auxiliary pool crane	H.WH.HMH.04. The mean frequency of a hoist system failure of the auxiliary pool crane due to the spectrum of seismic events shall be less than or equal to 2×10^{-5}/yr[a]. (Ref. 8.2.4, Table 6.10-4)	WHF-S-IE-BARE (Seq. 14-5)

Table D-1. Preclosure Nuclear Safety Design Bases for WHF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Mechanical Handling System (H) (continued)	Cask Handling/Cask Preparation (continued)	Preparation Station Jib Cranes (1 and 2) (050-HMH0-CRN-00002, 3)	Protect against[c] a drop of a load onto canister	H.WH.HMH.05. The mean probability of drop of a load onto a canister shall be less than or equal to 3×10^{-5} per lift. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD08-CSNF (Seq. 3-3)
			Protect against[c] collapse of the jib crane	H.WH.HMH.06. The mean frequency of collapse of the jib crane due to the spectrum of seismic events shall be less than or equal to 8×10^{-6}/yr[a]. (Ref. 8.2.4, Table 6.10-4)	WHF-S-IE-TAD-AO (Seq. 09)
			Protect against[c] a heavy object drop from the jib crane	H.WH.HMH.07. The mean frequency of a hoist system failure of the jib crane due to the spectrum of seismic events shall be less than or equal to 2×10^{-5}/yr[a]. (Ref. 8.2.4, Table 6.10-4)	WHF-S-IE-TAD-AO (Seq. 09)
		Cask Support Frame (Preparation Station #2) (WHF: 050-HMH0-FRM-00001)	Protect against tipover of a cask	H.WH.HMH.08. The mean frequency of failure of the cask support frame and anchorage due to the spectrum of seismic events shall be less than or equal to 6×10^{-5}/yr[a]. (Ref. 8.2.4, Table 6.10-4)	WHF-S-IE-TAD-AO (Seq. 08)
		Lid Lifting Grapples (050-HMH0-HEQ-00001-4, 6) Truck Cask Lid Lifting Grapples (050-HMH0-HEQ-00007-9)	Protect against[c] drop of a load onto a canister	H.WH.HMH.09. The lid lift grapple is an integral part of the load-bearing path. See Preparation Station Jib Crane and Auxiliary Pool Crane requirements. (Ref. 8.2.8, Table 6.9-1 and Ref. 8.2.4, Table 6.10-4)	See Preparation Station Jib Crane and Auxiliary Pool Crane requirements
		DPC Lid Adapter (050-HMH0-HEQ-00014)	Protect against[c] drop of a DPC	H.WH.HMH.10. The DPC lid adapter is an integral part of the load-bearing path. See Canister Transfer Machine requirements. (Ref. 8.2.8, Table 6.9-1 and Ref. 8.2.4, Table 6.10-4)	See Canister Transfer Machine requirements

Table D-1. Preclosure Nuclear Safety Design Bases for WHF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Mechanical Handling System (H) (continued)	Cask Handling/Cask Preparation (continued)	Long Reach Grapple Adapter (050-HMH0-TOOL-00001-2)	Protect against[c] drop of a load	H.WH.HMH.11. The long reach grapple adapter is an integral part of the load-bearing path. See Auxiliary Pool Crane requirements. (Ref. 8.2.8, Table 6.9-1 and Ref. 8.2.4, Table 6.10-4)	See Auxiliary Pool Crane requirements
	Waste Transfer/Fuel Assembly Transfer	Spent Fuel Transfer Machine (SFTM) (050-HTF0-FHM-00001)	Protect against[c] drop of an SNF assembly	H.WH.HTF.01. The mean probability of dropping an SNF assembly due to a failure of a piece of equipment within the load path shall be less than or equal to 5×10^{-6} per assembly transfer. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD22-FUEL (Seq. 3-1)
			Protect against[c] lifting an SNF assembly above the safe limit for workers	H.WH.HTF.02. The mean probability of lifting an SNF assembly such that 10 CFR 63.111(a) limits are exceeded shall be less than or equal to 7×10^{-7} per assembly transfer. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD30-FUEL (Seq. 2)
			Protect against[c] collapse of the SFTM	H.WH.HTF.03. The mean frequency of collapse of the SFTM due to the spectrum of seismic events shall be less than or equal to 2×10^{-5} /yr[a]. (Ref. 8.2.4, Table 6.10-4)	WHF-S-IE-BARE (Seq. 15-5)
			Protect against[c] an SNF assembly or heavy object drop from the SFTM	H.WH.HTF.04. The mean frequency of a hoist system failure of the SFTM machine due to the spectrum of seismic events shall be less than or equal to 2×10^{-5}/yr[a]. (Ref. 8.2.4, Table 6.10-4)	WHF-S-IE-BARE (Seq. 15-5)

Table D-1. Preclosure Nuclear Safety Design Bases for WHF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Mechanical Handling System (H) (continued)	Waste Transfer/Fuel Assembly Transfer (continued)	PWR/ BWR Lifting Grapple (050-HTF0-HEQ-00001) BWR Lifting Grapple (050-HTF0-HEQ-00002)	Protect against[c] drop of an SNF assembly	H.WH.HTF.05. The PWR/BWR grapples are an integral part of the load-bearing path. See Spent Fuel Transfer Machine requirements. (Ref. 8.2.8, Table 6.9-1 and Ref. 8.2.4, Table 6.10-4)	See Spent Fuel Transfer Machine requirements
		SNF Staging Rack (PWR SNF: 050-HTF0-RK-00001) (BWR SNF: 050-HTF0-RK-00010) (DFCA SNF: 050-HTF0-RK-00011)	Protect against[c] tipover of SNF	H.WH.HTF.06. The mean frequency of collapse of the SNF staging racks (sufficient to cause loss of confinement of the fuel assemblies within the staging rack fuel compartments) due to the spectrum of seismic events shall be less than or equal to 2×10^{-6}/yr[a]. (Ref. 8.2.4, Table 6.10-4 and Ref. 8.2.5)	WHF-S-IE-SNF-XFER (Seq. 09)
		Truck Cask Handling Frame (050-HTF0-RK-00007)	Protect against[c] cask drop from a crane	H.WH.HTF.07. The mean frequency of a cask drop due to a failure of the truck cask handling frame due to the spectrum of seismic events shall be less than or equal to 2×10^{-5}/yr.[a] (Ref. 8.2.4, Table 6.10-4)	WHF-S-IE-BARE (Seq. 05-6)
	Waste Transfer/ Canister Transfer	Canister Transfer Machine (050-HTC0-FHM-00001)	Protect against[c] drop	H.WH.HTC.01. The mean probability of dropping a canister from below the two-block height due to the failure of a piece of equipment within the load-bearing path shall be less than or equal to 1×10^{-5} per transfer. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD13-TAD (Seq. 2-3)
				H.WH.HTC.02. The mean probability of drop of a canister from the two-block height due to the failure of a piece of equipment within the load-bearing path shall be less than or equal to 3×10^{-8} per transfer. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD13-TAD (Seq. 3-3)

Table D-1. Preclosure Nuclear Safety Design Bases for WHF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Mechanical Handling System (H) (continued)	Waste Transfer/ Canister Transfer (continued)	Canister Transfer Machine (050-HTC0-FHM-00001) (continued)	Limit drop height	H.WH.HTC.03. The two-block drop height shall not exceed 45 feet from the bottom of a canister to the cavity floor of the cask or aging overpack. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD13-TAD (Seq. 2-3)
			Protect against[c] drop of a load onto a canister	H.WH.HTC.04. The mean probability of dropping a load onto a canister shall be less than or equal to 1×10^{-5} per transfer. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD13-TAD (Seq. 5-3)
			Protect against[c] spurious movement	H.WH.HTC.05. The mean probability of a spurious movement of the CTM while a canister is being lifted or lowered shall be less than or equal to 7×10^{-9} per transfer. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD13-TAD (Seq. 6-3)
			Limit Speed	H.WH.HTC.06. The speed of the CTM trolley and bridge shall be limited to 20 ft/min. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD13-TAD (Seq. 4-3)
			Preclude non-flat bottom drop of a DPC or TAD	H.WH.HTC.07. The CTM shall preclude non-flat-bottom drops of DPCs and TADs. (Ref. 8.2.8, Table 6.9-1)	Initiating event does not require further analysis[b]
			Protect against[c] direct exposure to personnel	H.WH.HTC.08. The mean probability of inadvertent radiation streaming resulting from the inadvertent opening of the CTM slide gate, the inadvertent raising of the CTM shield skirt, or an inadvertent motion of the CTM away from an open port shall be less than or equal to 9×10^{-6} per transfer. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD29-TAD (Seq. 3)
			Maintain moderator control	H.WH.HTC.09. The mean probability of inadvertent introduction of an oil moderator into a canister shall be less than or equal to 9×10^{-5} over a 720-hour period following the breach of a canister. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD13-TAD (Seq. 2-4)
			Preclude canister breach	H.WH.HTC.10. Closure of the CTM slide gate shall be incapable of breaching a canister. (Ref. 8.2.8, Table 6.9-1)	Initiating event does not require further analysis[b]

Table D-1. Preclosure Nuclear Safety Design Bases for WHF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Mechanical Handling System (H) (continued)	Waste Transfer/ Canister Transfer (continued)	Canister Transfer Machine (050-HTC0-FHM-00001) (continued)	Protect against[c] collapse of the CTM	H.WH.HTC.11. The mean frequency of collapse of the CTM due to the spectrum of seismic events shall be less than or equal to 1×10^{-5}/yr[a]. (Ref. 8.2.4, Table 6.10-4)	WHF-S-IE-DPC (Seq. 14-5)
			Protect against[c] a canister or heavy object drop from the CTM	H.WH.HTC.12. The mean frequency of a hoist system failure of the CTM due to the spectrum of seismic events shall be less than or equal to 2×10^{-5}/yr[a]. (Ref. 8.2.4, Table 6.10-4)	WHF-S-IE-DPC (Seq. 14-5)
		Canister Transfer Machine Grapples (050-HTC0-HEQ-00001)	Protect against[c] drop	H.WH.HTC.13. The CTM grapple is an integral part of the load-bearing path. See Canister Transfer Machine requirements. (Ref. 8.2.8, Table 6.9-1)	See Canister Transfer Machine" requirements
	TAD Closure	TAD Closure Jib Crane (050-HC00-CRN-00001)	Protect against[c] drop of a load	H.WH.HC.01. The mean probability of a drop of a load onto a cask containing a TAD shall be less than or equal to 3×10^{-5} per lift. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD25-TAD (Seq. 2-2)
			Protect against[c] collapse of the TAD closure jib crane	H.WH.HC.02. The mean frequency of collapse of the TAD closure jib crane due to the spectrum of seismic events shall be less than or equal to 8×10^{-6}/yr[a]. (Ref. 8.2.4, Table 6.10-4)	WHF-S-IE-TAD-AO (Seq. 09)
			Protect against[c] a heavy object drop from the TAD closure jib crane	H.WH.HC.03. The mean frequency of a hoist system failure of the TAD closure jib crane due to the spectrum of seismic events shall be less than or equal to 2×10^{-5}/yr[a]. (Ref. 8.2.4, Table 6.10-4)	WHF-S-IE-TAD-AO (Seq. 09)

Table D-1. Preclosure Nuclear Safety Design Bases for WHF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Mechanical Handling System (H) (continued)	TAD Closure (continued)	Cask Support Frame (TAD Closure Station) (050-HC00-FRM-00001)	Protect against tipover of a cask	H.WH.HC.04. The mean frequency of failure of the cask support frame and anchorage due to the spectrum of seismic events shall be less than or equal to 6×10^{-5}/yr.[a] (Ref. 8.2.4, Table 6.10-4)	WHF-S-IE-TAD-AO (Seq. 08)
	Dual-Purpose Canister Cutting	DPC Cutting Jib Crane (050-HD00-CRN-00001)	Protect against[c] drop of a load	H.WH.HD.01. The mean probability of a drop of a load onto a cask containing a DPC shall be less than or equal to 3×10^{-5} per lift. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD18-DPC Seq. 2-2)
			Protect against[c] collapse of the DPC cutting jib crane	H.WH.HD.02. The mean frequency of collapse of the DPC cutting jib crane due to the spectrum of seismic events shall be less than or equal to 8×10^{-6}/yr[a]. (Ref. 8.2.4, Table 6.10-4)	WHF-S-IE-TAD-AO (Seq. 09)
			Protect against[c] a heavy object drop from the DPC cutting jib crane	H.WH.HD.03. The mean frequency of a hoist system failure of the DPC cutting jib crane due to the spectrum of seismic events shall be less than or equal to 2×10^{-5}/yr[a]. (Ref. 8.2.4, Table 6.10-4)	WHF-S-IE-TAD-AO (Seq. 09)
		Cask Support Frame (DPC Cutting Station) (050-HD00-FRM-00001)	Protect against tipover of a cask	H.WH.HD.04. The mean frequency of failure of the cask support frame and anchorage due to the spectrum of seismic events shall be less than or equal to 6×10^{-5}/yr[a]. (Ref. 8.2.4, Table 6.10-4)	WHF-S-IE-TAD-AO (Seq. 08)
Surface Nuclear Confinement HVAC System (VC)	Surface Nuclear Confinement HVAC	Portions of the surface nuclear confinement HVAC system that exhaust from areas with a potential for a breach	Mitigate the consequences of radionuclide release	VC.WH.01. The mean probability that the HVAC system (including HEPA filtration of exhaust air from the WHF confinement areas) becomes unavailable during a 30-day mission time following a radionuclide release shall be less than or equal to 4×10^{-2}. This parameter does not apply in the case of large fires, which may disable the HVAC system. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD13-TAD (Seq. 2-5)

Table D-1. Preclosure Nuclear Safety Design Bases for WHF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Surface Nuclear Confinement HVAC System (VC) (continued)	Surface Nuclear Confinement HVAC (continued)	Portions of the surface nuclear confinement HVAC system that exhaust from areas with a potential for a breach (continued)	Mitigate the consequences of radionuclide release (continued)	VC.WH.02. The mean probability that the HVAC system (including HEPA filtration of exhaust air from the WHF confinement areas) becomes unavailable during a 1-day mission time following a radionuclide release from the cask sampling and cooling process shall be less than or equal to 1×10^{-3}. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD16-CSNF (Seq. 4-3)
		Portions of the surface nuclear confinement HVAC system that support the cooling of ITS electrical equipment and battery rooms	Support ITS electrical function	VC.WH.03. The mean conditional probability of failure of the portions of the surface nuclear confinement HVAC system that support the cooling of ITS electrical equipment and battery rooms in the WHF shall be less than or equal to 2×10^{-2} per ITS electrical train over a period of 720 hours following a radionuclide release. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD13-TAD (Seq. 2-5)
				VC.WH.04. The mean conditional probability of failure of the portions of the surface nuclear confinement HVAC system that support the cooling of ITS electrical equipment and battery rooms in the WHF shall be less than or equal to 5×10^{-4} per ITS electrical train over a period of 24 hours following a cask overpressure or a cooling system line break. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD13-TAD (Seq. 2-5)
Surface Non-Confinement HVAC System (VN)	Surface Non-Confinement HVAC	Portions of the surface non-confinement HVAC system that support the cooling of ITS electrical equipment and battery rooms (EDGF)	Support ITS electrical function	VN.WH.01. The mean conditional probability of failure of the portions of the surface non-confinement HVAC system that support the cooling of ITS electrical equipment and battery rooms in the EDGF shall be less than or equal to 2×10^{-2} per ITS electrical train over a period of 720 hours following a radionuclide release. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD13-TAD (Seq. 2-5)

Table D-1. Preclosure Nuclear Safety Design Bases for WHF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Wet Handling Facility (WH)	Wet Handling Facility (WHF)	Structure	Maintain building structural integrity to protect ITS SSCs inside the building from external events	WH.01. The mean frequency of building collapse due to winds less than or equal to 120 mph shall not exceed 1×10^{-6}/yr. (Ref. 8.2.3) WH.02 The mean frequency of building collapse due to volcanic ashfall less than or equal to a roof live load of 21 lb/ft^2 shall not exceed 1×10^{-6}/yr. (Ref. 8.2.3) WH.03. The WHF shall be located such that there is a distance of at least one-half mile between the WHF and the repository heliport. (Ref. 8.2.2)	Initiating event does not require further analysis[b]
			Protect against[c] building collapse onto waste containers	WH.04. The mean frequency of collapse of the WHF structure due to the spectrum of seismic events shall be less than or equal to 2×10^{-6}/yr.[a] (Ref. 8.2.4, Table 6.10-4)	WHF-S-IE-SNF-XFER (Seq. 07)
		Shield Doors (Including Anchorages)	Protect against[c] direct exposure of personnel	WH.05. Equipment shield doors shall have a mean probability of inadvertent opening of less than or equal to 1×10^{-7} per waste container handled. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD29-TAD (Seq. 3)
			Preclude collapse onto waste containers	WH.06. An equipment shield door falling onto a waste container as a result of impact from a conveyance shall be precluded. (Ref. 8.2.8, Table 6.9-1)	Initiating event does not require further analysis[b]
			Protect against[c] equipment shield door collapse onto a waste container	WH.07. The mean frequency of collapse of equipment shield doors (including attachment of door to wall and frame anchorages) due to the spectrum of seismic events shall be less than or equal to 6×10^{-6}/yr[a]. (Ref. 8.2.4, Table 6.10-4)	WHF-S-IE-BARE (Seq. 12-6)

Table D-1. Preclosure Nuclear Safety Design Bases for WHF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Wet Handling Facility (WH) (continued)	Wet Handling Facility (WHF) (continued)	Pool Structure	Maintain pool integrity to protect against[c] collapse onto waste containers and to maintain pool water retention capability	WH.08. The mean frequency of collapse of, or water loss from, the WHF pool due to the spectrum of seismic events shall be less than or equal to 2×10^{-6}/yr.[a] (Ref. 8.2.4, Table 6.10-4)	WHF-S-IE-SNF-XFER (Seq. 08)
		Cask Port Slide Gate (050-HTC0-HTCH-00002)	Protect against[c] dropping a canister due to a spurious closure of the slide gate	WH.HTC.01. The mean probability of a canister drop resulting from a spurious closure of the slide gate shall be less than or equal to 2×10^{-6} per transfer. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD13-TAD (Seq. 2-3)
			Protect against[c] direct exposure to personnel	WH.HTC.02. The mean probability of occurrence of an inadvertent opening of a slide gate shall be less than or equal to 4×10^{-9} per transfer. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD29-TAD (Seq. 3)
			Preclude canister breach	WH.HTC.03. Closure of the slide gate shall be incapable of breaching a canister. (Ref. 8.2.8, Table 6.9-1)	Initiating event does not require further analysis[b]
		Overpack Port Slide Gate (050-HTC0-HTCH-00001)	Protect against[c] dropping a canister	WH.HTC.04. The mean probability of a canister drop resulting from a spurious closure of the slide gate shall be less than or equal to 2×10^{-6} per transfer. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD13-TAD (Seq. 2-3)
			Protect against[c] direct exposure to personnel	WH.HTC.05. The mean probability of occurrence of an inadvertent opening of a slide gate shall be less than or equal to 4×10^{-9} per transfer. (Ref. 8.2.8, Table 6.9-1)	WHF-ESD29-TAD (Seq. 3)

Table D-1. Preclosure Nuclear Safety Design Bases for WHF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Wet Handling Facility (WH) (continued)	Wet Handling Facility (WHF) (continued)	Overpack Port Slide Gate (050-HTC0-HTCH-00001) (continued)	Preclude canister breach	WH.HTC.06. Closure of the slide gate shall be incapable of breaching a canister. (Ref. 8.2.8, Table 6.9-1)	Initiating event does not require further analysis[b]
		Aging Overpack Access Platform (050-HAC0-PLAT-00001)	Protect against[c] platform collapse	WH.HAC.01. The mean frequency of collapse of the aging overpack access platform due to the spectrum of seismic events shall be less than or equal to 3×10^{-6}/yr.[a] (Ref. 8.2.4, Table 6.10-4)	WHF-S-IE-TAD-AO (Seq. 15-5)
			Protect against[c] platform collapse or waste container breach due to an impact from the site transporter	WH.HAC.02. The mean frequency of platform collapse or waste container breach from the impact of the site transporter onto the platform due to the spectrum of seismic events shall be less than or equal to 2×10^{-5}/yr[a]. (Ref. 8.2.4, Table 6.10-4)	WHF-S-IE-TAD-AO (Seq. 15-5)
		TAD Closure Station (050-HC00-PLAT-00001)	Protect against[c] platform collapse	WH.HC.01. The mean frequency of collapse of the TAD closure station platform due to the spectrum of seismic events shall be less than or equal to 3×10^{-6}/yr [a]. (Ref. 8.2.4, Table 6.10-4)	WHF-S-IE-TAD-AO (Seq. 08)

Table D-1. Preclosure Nuclear Safety Design Bases for WHF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Wet Handling Facility (WH) (continued)	Wet Handling Facility (WHF) (continued)	DPC Cutting Station (050-HD00-PLAT-00001)	Protect against[c] platform collapse	WH.HD.01. The mean frequency of collapse of the DPC cutting station platform due to the spectrum of seismic events shall be less than or equal to 3×10^{-6}/yr.[a] (Ref. 8.2.4, Table 6.10-4)	WHF-S-IE-DPC (Seq. 15)
		Preparation Station #1 (050-HMH0-PLAT-00001)	Protect against[c] platform collapse	WH.HMH.01 The mean frequency of collapse of the preparation station platform due to the spectrum of seismic events shall be less than or equal to 3×10^{-6}/yr.[a] (Ref. 8.2.4, Table 6.10-4)	WHF-S-IE-BARE (Seq. 10-6)
			Protect against[c] platform collapse or waste container breach due to an impact of the cask transfer trolley	WH.HMH.02. The mean frequency of platform collapse from the impact of the cask transfer trolley onto the platform due to the spectrum of seismic events shall be less than or equal to 2×10^{-5}/yr[a]. (Ref. 8.2.4, Table 6.10-4)	WHF-S-IE-BARE (Seq. 10-6)
		Preparation Station #2 Platform (050-HMH0-PLAT-00002)	Protect against[c] platform collapse	WH.HMH.03. The mean frequency of collapse of the preparation station platform due to the spectrum of seismic events shall be less than or equal to 3×10^{-6}/yr.[a] (Ref. 8.2.4, Table 6.10-4)	WHF-S-IE-TAD-AO (Seq. 08)

Table D-1. Preclosure Nuclear Safety Design Bases for WHF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Wet Handling Facility (WH) (continued)	Wet Handling Facility (WHF) (continued	Decontamination Pit; Decontam-ination Pit Seismic Restraints (050-HM00-BRAC-00001)	Provide lateral stability to the cask in the decontamination pit	WH.HM.01. The mean frequency of the failure of the seismic restraints in the decontamination pit due to the spectrum of seismic events shall be less than or equal to 2×10^{-5}/yr. (Ref 8.2.4, Table 6.10-4)	WHF-S-IE-TAD-AO

Notes:

Facility Codes: AP = Aging Facility; WH = Wet Handling Facility.

System Codes: DS = DOE and Commercial Waste Package; H = Mechanical Handling; MR = Cask/Canister/Waste Package Process System.

Infrastructure System Codes: EE = Electrical Power; FP = Fire Protection; VC = Surface Nuclear Confinement HVAC ; VN = Surface Non-Confinement HVAC.

Subsystem Codes: HAC = Aging Overpack; HAT = Cask Transfer; HC = Transport, Aging, and Disposal Canister Closure; HD = Dual Purpose Canister Cutting; HM = Cask Handling; HMH = Cask Preparation ; HT = Waste Transfer; HTC = Canister Transfer; HTF = Fuel Assembly Transfer.

Acronyms: BWR = boiling water reactor; CTM = canister transfer machine; CTT = cask transfer trolley; DOE = U.S. Department of Energy; DPC = dual-purpose canister; EDGF = Emergency Diesel Generator Facility; HVAC = heating, ventilation, and air conditioning; ITS = important to safety; PWR = pressurized water reactor; RF = Receipt Facility; SFTM = spent fuel transfer machine; SNF = spent nuclear fuel; SSC = structure, system, or component; STC = shielded transfer cask; TAD = transportation, aging and disposal; WHF = Wet Handling Facility.

a. Control values shown represent the integration of the probability distribution of SSC failure (i.e., the loss of safety function) with the site seismic hazard curve (Ref. 8.2.4, Figure 6.1-1).

b. Design requirement is applied to reduce the frequency of any event sequence that could result in damage to a waste container to the beyond category 2 frequency range.

c. 'Protect against' in this table means either 'reduce the probability' or 'reduce the frequency of.'

d. The numbers appearing in parentheses are component numbers.

e. Refer to Ref. 8.2.8 for the description of these event sequences.

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APPENDIX E
PRECLOSURE NUCLEAR SAFETY DESIGN BASES FOR THE RF ITS SSCs

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Table E-1. Preclosure Nuclear Safety Design Bases for RF ITS SSCs

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Aging (AP)	Aging Handling/ Cask Transfer	Site Transporter (170-HAT0-MEQ-00001)	Protect against[c] spurious movement	AP.RF.HAT.01. The mean probability of spurious movement of the site transporter while the canister is being lifted or lowered shall be less than or equal to 1×10^{-9} per transfer. (Ref. 8.2.9, Table 6.9-1)	RF-ESD06-TAD (Seq. 5-4)
			Limit speed	AP.RF.HAT.02. The speed of the site transporter shall be limited to 2.5 mi/hr. (Ref. 8.2.9, Table 6.9-1)	RF-ESD07-TAD (Seq. 3-3)
			Preclude fuel tank explosion	AP.RF.HAT.03. The site transporter fuel tank shall preclude fuel tank explosions. (Ref. 8.2.9, Table 6.9-1)	Initiating event does not require further analysis[b]
			Reduce severity of a drop	AP.RF.HAT.04. The site transporter shall be incapable of dropping an aging overpack from a height greater than 3 ft measured from the equipment base. (Ref. 8.2.9, Table 6.9-1)	RF-ESD07-TAD (Seq. 3-3)
			Protect against[c] sliding impact and inducing stresses that can breach a waste container	AP.RF.HAT.05. The mean frequency of a sliding impact of the site transporter into a wall and inducing stresses that can breach a waste container due to the spectrum of seismic events shall be less than or equal to 2×10^{-5}/yr.[a] (Ref. 8.2.4, Table 6.10-2)	RF-S-IE-TAD-AO (Seq. 13-5)
			Protect against[c] tipover of a site transporter	AP.RF.HAT.06. The mean frequency of a tipover of the site transporter due to the spectrum of seismic events shall be less than or equal to 2×10^{-6}/yr.[a] (Ref. 8.2.4, Table 6.10-2)	RF-S-IE-TAD-AO (Seq. 13-5)
		Cask Tractor (for use with the Cask Transfer Trailer) (170-HAT0-HEQ-00001)	Limit speed	AP.RF.HAT.07. The speed of the cask tractor shall be limited to 2.5 mi/hr. (Ref. 8.2.9, Table 6.9-1)	RF-ESD09 (Seq. 3-3)

Table E-1. Preclosure Nuclear Safety Design Bases for RF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Aging (AP) (continued)	Aging Handling/ Cask Transfer (continued)	Cask Tractor (for use with the Cask Transfer Trailer) (170-HAT0-HEQ-00001) (continued)	Preclude fuel tank explosion	AP.RF.HAT.08. The cask tractor fuel tank shall preclude fuel tank explosions. (Ref. 8.2.9, Table 6.9-1)	Initiating event does not require further analysis[b]
		Cask Transfer Trailer (for use with Transportation Casks and Horizontal Shielded Transfer Casks (HSTCs) (PWR DPC: [170-HAT0-TRLY-00001]) (BWR DPC: [170-HAT0-TRLY-00002])	Preclude fuel tank explosion	AP.RF.HAT.09. The cask transfer trailer fuel tank shall preclude fuel tank explosions. (Ref. 8.2.9, Table 6.9-1)	Initiating event does not require further analysis[b]
			Reduce severity of a drop	AP.RF.HAT.10. The cask transfer trailer shall preclude dropping a cask from a height greater than 6 feet measured from the equipment base. (Ref. 8.2.9, Table 6.9-1)	RF-ESD09 (Seq. 2-4)
			Preclude puncture of a cask due to impact	AP.RF.HAT.11. The cask transfer trailer shall preclude puncture of a cask due to collision. (Ref. 8.2.9, Table 6.9 1)	Initiating event does not require further analysis[b]
			Preclude puncture of a cask	AP.RF.HAT.12. The cask transfer trailer shall be designed to preclude puncture of casks due to the spectrum of seismic events.[a] (Ref. 8.2.4, Table 6.10-2)	Initiating event does not require further analysis[b]
	Aging Handling/ Aging Overpack	Aging Overpack (TAD: [170-HAC0-ENCL-00003]) (Vertical DPC: [170-HAC0-ENCL-00002])	Protect against[c] direct exposure to personnel	AP.RF.HAC.01. The mean conditional probability of loss of shielding of the aging overpack resulting from an impact or collision shall be less than or equal to 1×10^{-5} per impact. (Ref. 8.2.9, Table 6.9-1)	RF-EDS07-TAD (Seq. 3-2)

Table E-1. Preclosure Nuclear Safety Design Bases for RF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Aging (AP) (continued)	Aging Handling/ Aging Overpack (continued)	Aging Overpack (TAD: [170-HAC0-ENCL-00003]) (Vertical DPC: [170-HAC0-ENCL-00002]) (continued)	Protect against[c] direct exposure to personnel (continued)	AP.RF.HAC.02. The mean conditional probability of loss of shielding of the aging overpack resulting from a drop shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.9, Table 6.9-1)	RF-ESD08-TAD (Seq. 4-2)
DOE and Commercial Waste Package System (DS)	Canistered Spent Nuclear Fuel	Dual-Purpose Canister (DPC) (Analyzed as a Representative Canister)	Provide containment	DS.RF.01. The mean conditional probability of breach of a canister resulting from a drop of the canister shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.9, Table 6.9-1)	RF-ESD06-DPC (Seq. 3-3)
				DS.RF.02. The mean conditional probability of breach of a canister resulting from a drop of a load onto the canister shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.9, Table 6.9-1)	RF-ESD07-DPC (Seq. 2-3)
				DS.RF.03. The mean conditional probability of breach of a canister resulting from a side impact or collision shall be less than or equal to 1×10^{-8} per impact. (Ref. 8.2.9, Table 6.9-1)	RF-ESD01-DPC (Seq. 3-4)
				DS.RF.04. The mean conditional probability of breach of a canister contained within a cask resulting from the spectrum of fires shall be less than or equal to 2×10^{-6} per fire event. (Ref. 8.2.9, Table 6.9-1)	RF-ESD12-DPC (Seq. 5-3)
				DS.RF.05. The mean conditional probability of breach of a canister contained within an aging overpack resulting from the spectrum of fires shall be less than or equal to 1×10^{-6} per fire event. (Ref. 8.2.9, Table 6.9-1)	RF-ESD12-DPC (Seq. 2-3)

Table E-1. Preclosure Nuclear Safety Design Bases for RF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
DOE and Commercial Waste Package System (DS) (continued)	Canistered Spent Nuclear Fuel (continued)	Dual-Purpose Canister (DPC) (Analyzed as a Representative Canister) (continued)	Provide containment (continued)	DS.RF.06. The mean conditional probability of breach of a canister located within the CTM Shield Bell resulting from the spectrum of fires shall be less than or equal to 1×10^{-4} per fire event. (Ref. 8.2.9, Table 6.9-1)	RF-ESD12-DPC (Seq. 9-3)
		Transportation, Aging, and Disposal (TAD) Canister (Analyzed as a Representative Canister)	Provide containment	DS.RF.07. The mean conditional probability of breach of a canister resulting from a drop of the canister shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.9, Table 6.9-1)	RF-ESD06-TAD (Seq. 3-3)
				DS.RF.08. The mean conditional probability of breach of a canister resulting from a drop of a load onto the canister shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.9, Table 6.9-1)	RF-ESD6-TAD (Seq. 6-3)
				DS.RF.09. The mean conditional probability of breach of a canister resulting from a side impact or collision shall be less than or equal to 1×10^{-8} per impact. (Ref. 8.2.9, Table 6.9-1)	RF-ESD01-TAD (Seq. 3-4)
				DS.RF.10. The mean conditional probability of breach of a canister contained within a cask resulting from the spectrum of fires shall be less than or equal to 2×10^{-6} per fire event. (Ref. 8.2.9, Table 6.9-1)	RF-ESD12-TAD (Seq. 4-3)
				DS.RF.11. The mean conditional probability of breach of a canister located within the aging overpack resulting from the spectrum of fires shall be less than or equal to 1×10^{-6} per fire event. (Ref. 8.2.9, Table 6.9-1)	RF-ESD12-TAD (Seq. 2-3)
				DS.RF.12. The mean conditional probability of breach of a canister located within the CTM Shield Bell resulting from the spectrum of fires shall be less than or equal to 1×10^{-4} per fire event. (Ref. 8.2.9, Table 6.9-1)	RF-ESD12-TAD (Seq. 9-3)

Table E-1. Preclosure Nuclear Safety Design Bases for RF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Mechanical Handling System (H)	Cask Handling	Transportation Cask (Analyzed as a Representative Cask)	Provide containment	H.RF.01. The mean conditional probability of breach of a canister in a sealed cask resulting from a drop shall be less than or equal to 1×10^{-5} per drop. (Ref 8.2.9, Table 6.9-1)	RF-ESD-06-TAD (Seq. 3-3)
				H.RF.02. The mean conditional probability of breach of a canister in a sealed cask resulting from a drop of a load onto the cask shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.9, Table 6.9-1)	RF-ESD-06-TAD (Seq. 6-3)
				H.RF.03. The mean conditional probability of breach of a canister in a sealed cask resulting from a side impact or collision shall be less than or equal to 1×10^{-8} per impact. (Ref. 8.2.9, Table 6.9-1)	RF-ESD-06-TAD (Seq. 5-3)
			Protect against[c] direct exposure to personnel	H.RF.04. The mean conditional probability of loss of cask gamma shielding resulting from a drop of a cask shall be less than or equal to 1×10^{-8} per drop. (Ref. 8.2.9, Table 6.9-1)	RF-ESD-02-TAD (Seq. 3-2)
				H.RF.05. The mean conditional probability of loss of cask gamma shielding resulting from a collision or side impact to a cask shall be less than or equal to 1×10^{-8} per impact. (Ref. 8.2.9, Table 6.9-1)	RF-ESD-04-TAD (Seq. 3-2)
				H.RF.06. The mean conditional probability of loss of cask gamma shielding resulting from a drop of a load onto a cask shall be less than or equal to 1×10^{-5} per impact. (Ref. 8.2.9, Table 6.9-1)	RF-ESD-03-TAD (Seq. 5-2)
		Site Prime Mover	Limit speed	H.RF.07. The speed of the site prime mover shall be limited to 9 mi/hr. (Ref. 8.2.9, Table 6.9-1)	RF-ESD-01-TAD (Seq. 3-4)
			Preclude fuel tank explosion	H.RF.08. The fuel tank of a site prime mover that enters the facility shall preclude fuel tank explosions. (Ref. 8.2.9, Table 6.9-1)	Initiating event does not require further analysis[b]

Table E-1. Preclosure Nuclear Safety Design Bases for RF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Mechanical Handling System (H) (continued)	Cask Handling (continued)	Cask Handling Yoke (200-HM00-BEAM-00001)	Protect against[c] drop	H.RF.HM.01. The cask handling yoke is an integral part of the load-bearing path. See Cask Handling Crane requirements. (Ref. 8.2.9, Table 6.9-1 and Ref. 8.2.4, Table 6.10-2)	See Cask Handling Crane requirements
		Cask Handling Crane; 200-ton (200-HM00-CRN-00001)	Protect against[c] drop	H.RF.HM.02. The mean probability of dropping a loaded cask from less than the two-block height resulting from the failure of a piece of equipment within the load-bearing path shall be less than or equal to 3×10^{-5} per transfer with the cask yoke or 1×10^{-4} transfer with a sling. (Ref. 8.2.9, Table 6.9-1)	RF-ESD02-TAD (Seq. 2-4) (Yoke) RF-ESD02-DPC (Seq. 2-4) (Sling)
			Protect against[c] drop	H.RF.HM.03. The mean probability of dropping a loaded cask from a two-block height resulting from the failure of a piece of equipment within the load-bearing path shall be less than or equal to 4×10^{-7} per transfer. (Ref. 8.2.9, Table 6.9-1)	RF-ESD02-TAD (Seq. 7-4) (yoke) RF-ESD02-DPC (Seq. 7-4) (sling)
			Limit drop height	H.RF.HM.04. The two-block drop height shall not exceed 30 feet from bottom of shortest cask to the floor. (Ref. 8.2.9, Table 6.9-1)	RF-ESD-02-TAD, (Seq. 7)
			Protect against[c] drop of a load onto a cask	H.RF.HM.05. The mean probability of dropping a load onto a loaded cask or its contents shall be less than or equal to 9×10^{-5} per cask handled. (Ref. 8.2.9, Table 6.9-1)	RF-ESD-02-TAD, (Seq. 6-4)
			Limit speed	H.RF.HM.06. The speed of the trolley and bridge shall be limited to 20 ft./min. (Ref. 8.2.9, Table 6.9-1)	RF-ESD02-TAD (Seq. 6)
			Protect against[c] crane collapse onto a waste container	H.RF.HM.07. The mean frequency of collapse of the cask handling crane due to the spectrum of seismic events shall be less than or equal to 8×10^{-6}/yr. [a] (Ref. 8.2.4, Table 6.10-2)	RF-S-IE-TAD-AO (Seq. 07-6)

Table E-1. Preclosure Nuclear Safety Design Bases for RF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Mechanical Handling System (H) (continued)	Cask Handling (continued)	Cask Handling Crane; 200-ton (200-HM00-CRN-00001) (continued)	Protect against[c] a cask or heavy object drop from the crane	H.RF.HM.08. The mean frequency of a hoist system failure of the cask handling crane due to the spectrum of seismic events shall be less than or equal to 2×10^{-5}/yr.[a] (Ref. 8.2.4, Table 6.10-2)	RF-S-IE-TAD-AO (Seq. 07-6)
		Cask Transfer Trolley (CTT) and Pedestal (Trolley: 200-HM00-TRLY-00001) (Pedestal: 200-HM00-PED-00001)	Limit speed	H.RF.HM.09. The speed of the CTT shall be limited to 2.5 mi/hr. (Ref. 8.2.9, Table 6.9-1)	RF-ESD04-TAD (Seq. 3-4)
			Protect against spurious movement	H.RF.HM.10. The mean probability of spurious movement of the CTT while a canister is being lifted by the CTM shall be less than or equal to 1×10^{-9} per transfer (Ref. 8.2.9, Table 6.9-1)	RF-ESD06-TAD (Seq. 4-3
			Protect against[c] impact and inducing stresses on the waste container	H.RF.HM.11. The mean frequency of the sliding of the cask transfer trolley into a wall and inducing stresses that can breach the waste container due to the spectrum of seismic events shall be less than or equal to 1×10^{-6}/yr.[a] (Ref. 8.2.4, Table 6.10-2)	RF-S-IE-TAD-AO (Seq. 09-6)
				H.RF.HM.12. The mean frequency of a rocking impact of the cask transfer trolley into a wall and inducing stresses that can breach the waste container due to the spectrum of seismic events shall be less than or equal to 1×10^{-6}/yr.[a] (Ref. 8.2.4, Table 6.10-2)	RF-S-IE-TAD-AO (Seq. 09-6)
	Cask Handling/ Cask Receipt	Lid Bolting Room Crane (200-HMC0-CRN-00001)	Protect against[c] collapse of the lid bolting room crane	H.RF.HMC.01. The mean frequency of collapse of the lid bolting room crane due to the spectrum of seismic events shall be less than or equal to 8×10^{-6}/yr.[a] (Ref. 8.2.4, Table 6.10-2)	RF-S-IE-TAD-AO (Seq. 15-5)

Table E-1. Preclosure Nuclear Safety Design Bases for RF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Mechanical Handling System (H) (continued)	Cask Handling/ Cask Receipt (continued)	Horizontal Lifting Beam (200-HMC0-BEAM-00001)	Protect against[c] drop	H.RF.HMC.02. The horizontal lifting beam is an integral part of the load-bearing path. See Cask Handling Crane requirements. (Ref. 8.2.9, Table 6.9-1)	See Cask Handling Crane requirements
		Cask Lid Lifting Grapples (DPC) (200-HMH0-HEQ-00008)	Protect against[c] drop of a load onto a DPC	H.RF.HMH.01. The cask lid lifting grapple is an integral part of the load-bearing path. See Cask Handling Crane requirements. (Ref. 8.2.9, Table 6.9-1)	See Cask Handling Crane requirements
	Cask Handling/Cask Preparation	Rail Cask Lid Adapters (200-HMH0-HEQ-00002)	Protect against[c] drop	H.RF.HMH.02. The rail cask lid adapters are an integral part of the load-bearing path. See Cask Handling Crane requirements. (Ref. 8.2.9, Table 6.9-1)	See Cask Handling Crane requirements
		DPC Lid Adapter (200-HMH0-HEQ-00001)	Protect against[c] drop of a DPC	H.RF.HMH.03. The DPC lid adapter is an integral part of the load-bearing path. See Canister Transfer Machine requirements. (Ref. 8.2.9, Table 6.9-1 and Ref. 8.2.4, Table 6.10-2)	See Canister Transfer Machine requirements
	Waste Transfer/ Canister Transfer	Canister Transfer Machine (CTM) Maintenance Crane (200-HTC0-CRN-00001)	Protect against[c] collapse of the CTM maintenance crane	H.RF.HTC.01. The mean frequency of collapse of the CTM maintenance crane due to the spectrum of seismic events shall be less than or equal to 8×10^{-6}/yr.[a] (Ref. 8.2.4, Table 6.10-2)	RF-S-IE-TAD-AO (Seq. 12-5)
		Canister Transfer Machine (200-HTC0-FHM-00001)	Protect against[c] drop	H.RF.HTC.02. The mean probability of dropping a canister from below the two-block height due to the failure of a piece of equipment within the load-bearing path shall be less than or equal to 1×10^{-5} per transfer. (Ref. 8.2.9, Table 6.9-1)	RF-ESD06-TAD (Seq. 3-3)
				H.RF.HTC.03. The mean probability of drop of a canister from the two-block height due to the failure of a piece of equipment within the load-bearing path shall be less than or equal to 3×10^{-8} per transfer. (Ref. 8.2.9, Table 6.9-1)	RF-ESD06-TAD (Seq. 8-3)

Table E-1. Preclosure Nuclear Safety Design Bases for RF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Mechanical Handling System (H) (continued)	Waste Transfer/ Canister Transfer (continued)	Canister Transfer Machine (200-HTC0-FHM-00001) (continued)	Limit drop height	H.RF.HTC.04. The two-block drop height shall not exceed 45 feet from the bottom of a canister to the cavity floor of the cask or aging overpack. (Ref. 8.2.9, Table 6.9-1)	RF-ESD06-TAD (Seq. 8-3)
			Protect against[c] drop of a load onto a canister	H.RF.HTC.05. The mean probability of dropping a load onto a canister shall be less than or equal to 1×10^{-5} per transfer. (Ref. 8.2.9, Table 6.9-1)	RF-ESD06-TAD (Seq. 6-3)
			Protect against[c] spurious movement	H.RF.HTC.06. The mean probability of a spurious movement of the CTM while a canister is being lifted or lowered shall be less than or equal to 5×10^{-9} per transfer. (Ref. 8.2.9, Table 6.9-1)	RF-ESD06-TAD (Seq. 4-3)
			Limit Speed	H.RF.HTC.07. The speed of the CTM trolley and bridge shall be limited to 20 ft/min. (Ref. 8.2.9, Table 6.9-1)	RF-ESD06-TAD (Seq. 5-4)
			Preclude non-flat bottom drop of a DPC or TAD	H.RF.HTC.08. The CTM shall preclude non-flat-bottom drops of DPCs and TADs. (Ref. 8.2.9, Table 6.9-1)	Initiating event does not require further analysis[b]
			Protect against[c] direct exposure to personnel	H.RF.HTC.09. The mean probability of inadvertent radiation streaming resulting from the inadvertent opening of the CTM slide gate, the inadvertent raising of the CTM shield skirt, or an inadvertent motion of the CTM away from an open port shall be less than or equal to 1×10^{-6} per transfer. (Ref. 8.2.9, Table 6.9-1)	RF-ESD06-TAD (Seq. 4-2)
			Preclude canister breach	H.RF.HTC.10. Closure of the CTM slide gate shall be incapable of breaching a canister. (Ref. 8.2.9, Table 6.91)	Initiating event does not require further analysis[b]
			Protect against[c] collapse of the CTM	H.RF.HTC.11. The mean frequency of collapse of the CTM due to the spectrum of seismic events shall be less than or equal to 1×10^{-5}/yr.[a] (Ref. 8.2.4, Table 6.10-2)	RF-S-IE-TAD-AO (Seq. 11-5)

Table E-1. Preclosure Nuclear Safety Design Bases for RF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Mechanical Handling System (H) (continued)	Waste Transfer/ Canister Transfer (continued)	Canister Transfer Machine (200-HTC0-FHM-00001) (continued)	Protect against[c] a canister or heavy object drop from the CTM	H.RF.HTC.12. The mean frequency of a hoist system failure of the CTM due to the spectrum of seismic events shall be less than or equal to 2×10^{-5}/yr. [a] (Ref. 8.2.4, Table 6.10-2)	RF-S-IE-TAD-AO (Seq. 11-5)
		Canister Transfer Machine Grapples (200-HTC0-HEQ-00001)	Protect against[c] canister drop	H.RF.HTC.13. The CTM grapple is an integral part of the load-bearing path of the CTM. See Canister Transfer Machine requirements. (Ref. 8.2.9, Table 6.9-1 and Ref. 8.2.4, Table 6.10-2)	See Canister Transfer Machine requirements
Receipt Facility (RF)	Receipt Facility (RF)	Structure	Maintain building structural integrity to protect ITS SSCs inside the building from external events	RF.01. The mean frequency of building collapse due to winds less than or equal to 120 mph shall not exceed 1×10^{-6}/yr. (Ref. 8.2.3) RF.02. The mean frequency of building collapse due to volcanic ash fall less than or equal to a roof load of 21 lb/ft^{2}shall not exceed 1×10^{-6}/yr. (Ref. 8.2.3) RF.03. The RF shall be located such that there is a distance of at least one-half mile between the RF and the repository heliport. (Ref. 8.2.2)	Initiating event does not require further analysis[b]
			Protect against[c] building collapse onto waste containers	RF.04. The mean frequency of collapse of the RF structure due to the spectrum of seismic events shall be less than or equal to 2×10^{-6}/yr. [a] (Ref. 8.2.4, Table 6.10-2)	RF-S-IE-TAD-AO (Seq. 03)
		Shield Doors (Including Anchorages)	Protect against[c] direct exposure of personnel	RF.05. Equipment shield doors shall have a mean probability of inadvertent opening of less than or equal to 1×10^{-7} per waste container handled. (Ref. 8.2.9, Table 6.9-1)	RF-ESD011 (Seq. 2)
			Preclude collapse onto waste containers	RF.06. An equipment shield door falling onto a waste container as a result of impact from a conveyance shall be precluded. (Ref. 8.2.9, Table 6.9-1)	Initiating event does not require further analysis[d]

Table E-1. Preclosure Nuclear Safety Design Bases for RF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Receipt Facility (RF) (continued)	Receipt Facility (RF) (continued)	Shield Doors (Including Anchorages) (continued)	Protect against[c] equipment shield door collapse onto a waste container	RF.07. The mean frequency of collapse of equipment shield doors (including attachment of door to wall and frame anchorages) due to the spectrum of seismic events shall be less than or equal to 6×10^{-6}/yr. [a] (Ref. 8.2.4, Table 6.10-2)	RF-S-IE-TAD-AO (Seq. 10-6)
		Cask Port Slide Gate (200-HTC0-HTCH-00001)	Protect against[c] dropping a canister due to a spurious closure of the slide gate	RF.HTC.01. The mean probability of a canister drop resulting from a spurious closure of the slide gate shall be less than or equal to 5×10^{-6} per transfer. (Ref. 8.2.9, Table 6.9-1)	RF-ESD06-TAD (Seq. 3-3)
			Protect against[c] direct exposure to personnel	RF.HTC.02. The mean probability of occurrence of an inadvertent opening of a slide gate shall be less than or equal to 4×10^{-9} per transfer. (Ref. 8.2.9, Table 6.9-1)	RF-ESD-11 (Seq. 2)
			Preclude canister breach	RF.HTC.03. Closure of the slide gate shall be incapable of breaching a canister. (Ref. 8.2.9, Table 6.9-1)	Initiating event does not require further analysis[b]
		AO Port Slide Gate (200-HTC0-HTCH-00002)	Protect against[c] dropping a canister due to a spurious closure of the slide gate	RF.HTC.04. The mean probability of a canister drop resulting from a spurious closure of the slide gate shall be less than or equal to 5×10^{-6} per transfer. (Ref. 8.2.9, Table 6.9-1)	RF-ESD06-TAD (Seq. 3-3)
			Protect against[c] direct exposure to personnel	RF.HTC.05. The mean probability of occurrence of an inadvertent opening of a slide gate shall be less than or equal to 4×10^{-9} per transfer. (Ref. 8.2.9, Table 6.9-1)	RF-ESD-11 (Seq. 2)

Table E-1. Preclosure Nuclear Safety Design Bases for RF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Receipt Facility (RF) (continued)	Receipt Facility (RF) (continued)	AO Port Slide Gate (200-HTC0-HTCH-00002) (continued)	Preclude canister breach	RF.HTC.06. Closure of the slide gate shall be incapable of breaching a canister. (Ref. 8.2.9, Table 6.9-1)	Initiating event does not require further analysis[b]
		Cask Preparation Platform (200-HMH0-PLAT-00001)	Protect against[c] collapse	RF.HMH.01. The mean frequency of collapse of the cask preparation platform due to the spectrum of seismic events shall be less than or equal to 3×10^{-6}/yr. [a] (Ref. 8.2.4, Table 6.10-2)	RF-S-IE-TAD-AO (Seq. 08-6)
			Protect against[c] platform collapse due to an impact from the cask transfer trolley	RF.HMH.02. The mean frequency of platform collapse from the impact of the cask transfer trolley into the platform due to the spectrum of seismic events shall be less than or equal to 2×10^{-5}/yr. [a] (Ref. 8.2.4, Table 6.10-2)	RF-S-IE-TAD-AO (Seq. 09-6)
		Lid Bolting Room Platform (200-HMC0-PLAT-00003)	Protect against[c] platform collapse	RF.HMC.01. The mean frequency of collapse of the lid bolting room platform due to the spectrum of seismic events shall be less than or equal to 3×10^{-6}/yr. [a] (Ref. 8.2.4, Table 6.10-2)	RF-S-IE-TAD-AO (Seq. 14-5)

Table E-1. Preclosure Nuclear Safety Design Bases for RF ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Receipt Facility (RF) (continued)	Receipt Facility (RF) (continued)	Lid Bolting Room Platform (200-HMC0-PLAT-00003) (continued)	Protect against[c] collapse due to an impact from the site transporter	RF.HMC.02. The mean frequency of platform collapse from the impact of the site transporter into the platform due to the spectrum of seismic events shall be less than or equal to 2×10^{-5}/yr. [a] (Ref. 8.2.4, Table 6.10-2)	RF-S-IE-TAD-AO (Seq. 14-5)

Notes:

Facility Codes: AP = Aging Facility; RF = Receipt Facility.

System Codes: DS = DOE and Commercial Waste Package; H = Mechanical Handling.

Subsystem Codes: HAC = Aging Overpack; HAT = Cask Transfer; HM = Cask Handling; HMC = Cask Receipt; HMH = Cask Preparation; HTC = Canister Transfer.

Acronyms: BWR = boiling water reactor; CTM = canister transfer machine; CTT = cask transfer trolley; DPC = dual-purpose canister; HSTC = horizontal shielded transfer cask; ITS = important to safety; PWR = pressurized water reactor; RF = Receipt Facility; SNF = spent nuclear fuel; SSC = structure, system, or component; TAD = transportation, aging and disposal.

a. Control values shown represent the integration of the probability distribution of SSC failure (i.e., the loss of safety function) with the site seismic hazard curve (Ref. 8.2.4, Figure 6.1-1).

b. Design requirement is applied to reduce the frequency of any event sequence that could result in damage to a waste container to the beyond category 2 frequency range.

c. 'Protect against' in this table means either 'reduce the probability of' or 'reduce the frequency of.'

d. The numbers appearing in parentheses are component numbers.

e. Refer to Ref. 8.2.9 for the description of these event sequences.

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APPENDIX F
PRECLOSURE NUCLEAR SAFETY DESIGN BASES FOR THE INTRA-SITE OPERATIONS ITS SSCs

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Table F-1. Preclosure Nuclear Safety Design Bases for Intra-Site Operations ITS SSCs

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequences (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Aging Facility (AP)	Aging Handling/Aging Pad	Aging Pad	Protect ITS SSCs from external events	AP.SB.01. The aging pads shall be located such that there is a distance of at least one-half mile between the aging pads and the repository heliport. (Ref. 8.2.2)	Initiating event does not require further analysis[b]
			Protect against[c] aging overpack tipover	AP.SB.02. The mean frequency of aging pad structure failure causing aging overpack tipover due to the spectrum of seismic events shall be less than or equal to 1×10^{-5}/yr[a]. (Ref. 8.2.4, Table 6.10-5)	ISO-IE-S-MAIN (Seq. 03)
	Aging Handling/ Cask Transfer	Cask Tractor (for use with the Cask Transfer Trailer) (170-HAT0-HEQ-00001)	Limit speed	AP.SB.HAT.01. The speed of the cask tractor shall be limited to 2.5 mi/hr. (Ref. 8.2.11, Table 6.9-1)	ISO-ESD03-HDPC (Seq. 2-4)
			Preclude fuel tank explosion	AP.SB.HAT.02. The cask tractor fuel tank shall preclude fuel tank explosions. (Ref. 8.2.11, Table 6.9-1)	Initiating event does not require further analysis[b]
		Cask Transfer Trailer (for use with Transportation Casks and Horizontal Shielded Transfer Casks [HSTCs]) (PWR DPC: [170-HAT0-TRLY-00001]) (BWR DPC: [170-HAT0-TRLY-00002])	Preclude fuel tank explosion	AP.SB.HAT.03. The cask transfer trailer fuel tank shall preclude fuel tank explosions. (Ref. 8.2.11, Table 6.9-1)	Initiating event does not require further analysis[b]

Table F-1. Preclosure Nuclear Safety Design Bases for Intra-Site Operations ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequences (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Aging Facility (AP) (continued)	Aging Handling/ Cask Transfer (continued)	Cask Transfer Trailer (for use with Transportation Casks and Horizontal Shielded Transfer Casks [HSTCs]) (PWR DPC: [170-HAT0-TRLY-00001]) (BWR DPC: [170-HAT0-TRLY-00002]) (continued)	Reduce severity of a drop	AP.SB.HAT.04. The cask transfer trailer shall preclude dropping a cask from a height greater than 6 feet measured from the equipment base. (Ref. 8.2.11, Table 6.9-1)	ISO-ESD03-HDPC (Seq. 3-4)
			Preclude puncture of a cask	AP.SB.HAT.05. The cask transfer trailer shall preclude puncture of a cask due to collision. (Ref. 8.2.11, Table 6.9-1)	Initiating event does not require further analysis[b]
			Preclude puncture of a canister	AP.SB.HAT.06. The cask transfer trailer shall preclude puncture of a canister by the hydraulic ram. (Ref. 8.2.11, Table 6.9-1)	Initiating event does not require further analysis[b]
			Limit speed	AP.SB.HAT.07. The speed of the cask transfer trailer shall be limited to 2.5 mi/hr. (Ref. 8.2.11, Table 6.9-1)	ISO-ESD03-HDPC (Seq. 2-4)
			Preclude puncture of a cask	AP.SB.HAT.08. The cask transfer trailer shall be designed to preclude puncture of a cask due to the spectrum of seismic events. (Ref. 8.2.4, Table 6.10-5)	Initiating event does not require further analysis[b].
		Site Transporter (170-HAT0-MEQ-00001)	Limit speed	AP.SB.HAT.09. The speed of the site transporter shall be limited to 2.5 mi/hr. (Ref. 8.2.11, Table 6.9-1)	ISO-ESD02-TAD (Seq. 2-3)
			Preclude fuel tank explosion	AP.SB.HAT.10. The site transporter fuel tank shall preclude fuel tank explosions. (Ref. 8.2.11, Table 6.9-1)	Initiating event does not require further analysis[b]
			Reduce severity of a drop	AP.SB.HAT.11. The site transporter shall preclude a vertical drop of an aging overpack from a height greater than 3 ft measured from the equipment base. (Ref. 8.2.11, Table 6.9-1)	ISO-ESD02-TAD (Seq. 3-3)

Table F-1. Preclosure Nuclear Safety Design Bases for Intra-Site Operations ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequences (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Aging Facility (AP) (continued)	Aging Handling/ Cask Transfer (continued)	Site Transporter (170-HAT0-MEQ-00001) (continued)	Protect against[c] tipover of the site transporter	AP.SB.HAT.12. The mean frequency of tipover of the site transporter due to the spectrum of seismic events shall be less than or equal to 2×10^{-6} /yr.[a] (Ref. 8.2.4, Table-6.10-5)	ISO-IE-S-MAIN (Seq. 04)
	Aging Handling/Aging Overpack	Horizontal Aging Module (HAM) (170-HAC0-ENCL-00001)	Protect against[c] direct exposure to personnel	AP.SB.HAC.01. The mean conditional probability of loss of HAM gamma shielding due to an impact or collision shall be less than or equal to 1×10^{-5} per impact. (Ref. 8.2.11, Table 6.9-1)	ISO-ESD04-HDPC (Seq. 3-2)
			Protect against[c] structural collapse onto a waste container	AP.SB.HAC.02. The mean frequency of collapse of the HAM structure due to the spectrum of seismic events shall be less than or equal to 2×10^{-6}/yr[a]. (Ref. 8.2.4, Table 6.10-5)	ISO-IE-S-MAIN (Seq. 07)
		Horizontal Shielded Transfer Cask (HSTC) (170-HAC0-HEQ-00001)	Provide containment	AP.SB.HAC.03. The mean conditional probability of breach of a canister in a sealed HSTC on a cask transfer trailer resulting from a drop shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.11, Table 6.9-1)	ISO-ESD03-HDPC (Seq. 3-4)
				AP.SB.HAC.04. The mean probability of breach of a canister in an HSTC on a cask transfer trailer resulting from a drop of a load onto the HSTC shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.11, Table 6.9-1)	ISO-ESD04-HDPC (Seq. 2-3)

Table F-1. Preclosure Nuclear Safety Design Bases for Intra-Site Operations ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequences (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Aging Facility (AP) (continued)	Aging Handling/Aging Overpack (continued)	Horizontal Shielded Transfer Cask (HSTC) (170-HAC0-HEQ-00001) (continued)	Provide containment (continued)	AP.SB.HAC.05. The mean conditional probability of breach of a canister in a sealed HSTC on a cask transfer trailer resulting from a side impact or collision shall be less than or equal to 1×10^{-8} per impact. (Ref. 8.2.11, Table 6.9-1)	ISO-ESD03-HDPC (Seq. 2-4)
		Aging Overpack (TAD: [170-HAC0-ENCL-00003]) (Vertical DPC: [170-HAC0-ENCL-00002])	Protect against[c] direct exposure to personnel	AP.SB.HAC.06. The mean conditional probability of loss of shielding of the aging overpack resulting from an impact or collision shall be less than or equal to 1×10^{-5} per impact. (Ref. 8.2.11, Table 6.9-1)	ISO-ESD02-TAD (Seq. 2-2)
				AP.SB.HAC.07. The mean conditional probability of loss of shielding of the aging overpack resulting from a drop shall be less than or equal to 5×10^{-6} per drop. (Ref. 8.2.11, Table 6.9-1)	ISO-ESD02-TAD (Seq. 3-2)
			Protect against[c] sliding of an aging overpack	AP.SB.HAC.08. The mean frequency of sliding of an aging overpack (with a waste container) into another aging overpack on the aging pad due to the spectrum of seismic events shall be less than or equal to 5×10^{-6} /yr [a]. (Ref. 8.2.4, Table 6.10-5)	ISO-IE-S-MAIN (Seq. 06)
			Protect against[c] tipover of an aging overpack	AP.SB.HAC.09. The mean frequency of tipover of the aging overpack on the aging pad due to the spectrum of seismic events shall be less than or equal to 5×10^{-8} /yr[a]. (Ref. 8.2.4, Table 6.10-5)	ISO-IE-S-MAIN (Seq. 06)

Table F-1. Preclosure Nuclear Safety Design Bases for Intra-Site Operations ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequences (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Balance of Plant (SB)	Flood Protection	Flood Control Features	Protect ITS SSCs from external flooding events	SB.01. The site flood control features will be designed to the probable maximum flood. (Ref. 8.2.3)	Initiating event does not require further analysis[b]
DOE and Commercial Waste Package System (DS)	Defense High-Level Waste/DOE SNF Codisposal	DOE Standardized Canister	Provide containment	DS.SB.01. The mean conditional probability of breach of a DOE standardized canister contained within a cask resulting from the spectrum of fires shall be less than or equal to 2×10^{-6} per fire event. (Ref. 8.2.11, Table 6.9-1)	ISO-ESD09-DSTD (Seq. 2-4)
		HLW Canister	Provide containment	DS.SB.02. The mean conditional probability of breach of a HLW canister contained within a cask resulting from the spectrum of fires shall be less than or equal to 2×10^{-6} per fire event. (Ref. 8.2.11, Table 6.9-1)	ISO-ESD09-HLW (Seq. 2-3)
	Canistered Spent Nuclear Fuel	Dual-Purpose Canister (DPC) Transportation, Aging, and Disposal (TAD) Canister (Both Analyzed as a Representative Canister)	Provide containment	DS.SB.03. The mean conditional probability of breach of a canister within an aging overpack following a drop shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.11, Table 6.9-1)	ISO-ESD02-TAD (Seq. 3-3)
				DS.SB.04. The mean conditional probability of breach of a canister within an aging overpack resulting from a side impact or collision shall be less than or equal to 1×10^{-8} per event. (Ref. 8.2.11, Table 6.9-1)	ISO-ESD02-TAD (Seq. 2-3)
				DS.SB.05. The mean conditional probability of breach of a canister in a HAM resulting from a collision or side impact shall be less than or equal to 1×10^{-8} per event. (Ref. 8.2.11, Table 6.9-1)	ISO-ESD04-HDPC (Seq. 3-3)

Table F-1. Preclosure Nuclear Safety Design Bases for Intra-Site Operations ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequences (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
DOE and Commercial Waste Package System (DS) (continued)	Canistered Spent Nuclear Fuel (continued)	Dual-Purpose Canister (DPC) Transportation, Aging, and Disposal (TAD) Canister (Both Analyzed as a Representative Canister) (continued)	Provide containment (continued)	DS.SB.06. The mean conditional probability of breach of a canister resulting from a drop of a load onto a HAM shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.11, Table 6.9-1)	ISO-ESD04-HDPC (Seq. 2-3)
				DS.SB.07. The mean conditional probability of breach of a canister contained within a cask resulting from the spectrum of fires shall be less than or equal to 2×10^{-6} per fire event. (Ref. 8.2.11, Table 6.9-1)	ISO-ESD09-TAD (Seq. 2-4)
				DS.SB.08. The mean conditional probability of breach of a canister located within a HAM resulting from the spectrum of fires shall be less than or equal to 1×10^{-6} per fire event. (Ref. 8.2.11, Table 6.9-1)	ISO-ESD09-HDPC (Seq. 5-4)
				DS.SB.09. The mean conditional probability of breach of a canister contained within an aging overpack resulting from the spectrum of fires shall be less than or equal to 1×10^{-6} per fire event. (Ref. 8.2.11, Table 6.9-1)	ISO-ESD09-TAD (Seq. 5-4)
Mechanical Handling System (H)	Cask Handling Note:	Transportation Cask (Analyzed as a Representative Cask) Representative Cask includes Transportation Casks and Horizontal Shielded Transfer Casks	Provide containment	H.SB.01. The mean conditional probability of breach of a canister in a sealed cask on a railcar, truck trailer, or cask transfer trailer resulting from a drop shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.11, Table 6.9-1)	ISO-ESD01-TAD (Seq. 2-4)
				H.SB.02. The mean probability of breach of a canister in a sealed cask on a railcar, truck trailer, or cask transfer trailer resulting from a drop of a load onto the cask shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.11, Table 6.9-1)	ISO-ESD01-TAD (Seq. 5-4)

Table F-1. Preclosure Nuclear Safety Design Bases for Intra-Site Operations ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequences (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Mechanical Handling System (H) (continued)	Cask Handling (continued)	Transportation Cask (Analyzed as a Representative Cask) (continued) Note: Representative Cask includes Transportation Casks and Horizontal Shielded Transfer Casks	Provide containment (continued)	H.SB.03. The mean conditional probability of breach of a canister in a sealed cask on a railcar, truck trailer, or cask transfer trailer resulting from a side impact or collision shall be less than or equal to 1×10^{-8} per impact. (Ref. 8.2.11, Table 6.9-1)	ISO-ESD01-TAD (Seq. 3-4)
				H.SB.04. The mean conditional probability of breach of a sealed cask containing uncanistered commercial spent nuclear fuel on a truck trailer resulting from a collision followed by a rollover/drop shall be less than or equal to 1×10^{-8} per drop. (Ref. 8.2.11, Table 6.9-1)	ISO-ESD01-UCSNF (Seq. 4-4)
				H.SB.05. The mean conditional probability of breach of a sealed cask containing uncanistered commercial spent nuclear fuel resulting from a drop of a load onto the cask shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.11, Table 6.9-1)	ISO-ESD01-UCSNF (Seq. 5-4)
			Protect against[c] direct exposure to personnel	H.SB.06. The mean conditional probability of loss of gamma shielding of a cask resulting from a drop shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.11, Table 6.9-1)	ISO-ESD01-TAD (Seq. 2-2)
				H.SB.07. The mean conditional probability of loss of gamma shielding of a cask resulting from a collision or side impact shall be less than or equal to 1×10^{-8} per impact. (Ref. 8.2.11, Table 6.9-1)	ISO-ESD01-TAD (Seq. 3-2)
				H.SB.08. The mean conditional probability of loss of gamma shielding of a cask resulting from a drop of a load onto it shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.11, Table 6.9-1)	ISO-ESD01-TAD (Seq. 5-2)
		Site Prime Mover	Limit speed	H.SB.09. The speed of the site prime mover shall be limited to 9 mi/hr. (Ref. 8.2.11, Table 6.9-1)	ISO-ESD01-TAD (Seq. 2-4)

Table F-1. Preclosure Nuclear Safety Design Bases for Intra-Site Operations ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component[d]	Nuclear Safety Design Bases		Representative Event Sequences (Sequence Number[e])
			Safety Function	Controlling Parameters and Values	
Mechanical Handling System (H) (continued)	Cask Handling (continued)	Site Prime Mover (continued)	Preclude fuel tank explosion	H.SB.10. The fuel tank of a site prime mover that enters a facility shall preclude fuel tank explosions. (Ref. 8.2.11, Table 6.9-1)	Initiating event does not require further analysis[b]
Naval SNF Waste Package System (DN)	Naval SNF	Naval SNF Canister (Analyzed as a Representative Canister)	Provide containment	DN.SB.01. The mean conditional probability of breach of a canister contained within a cask resulting from the spectrum of fires shall be less than or equal to 1×10^{-6} per fire event. (Ref. 8.2.11, Table 6.9-1)	ISO-ESD09-NAV (Seq. 2-4)

Notes:

Facility Codes: AP = Aging Facility; SB = Balance of Plant.

System Codes: DN = Naval Spent Nuclear Fuel Waste Package; DS = DOE and Commercial Waste Package; H = Mechanical Handling.

Subsystem Codes: HAC = Aging Overpack; HAT = Cask Transfer.

Acronyms: BWR = boiling water reactor; DOE = U.S. Department of Energy; DPC = dual-purpose canister; HAM = horizontal aging module; HLW = high-level radioactive waste; HSTC = horizontal shielded transfer cask; ITS = important to safety; PWR = pressurized water reactor; SNF = spent nuclear fuel; SSC = structure, system, or component; TAD = transportation, aging and disposal.

a. Control values shown represent the integration of the probability distribution of SSC failure (i.e., the loss of safety function) with the site seismic hazard curve (Ref. 8.2.4, Figure 6.1-1).

b. Design requirement is applied to reduce the frequency of any event sequence that could result in damage to a waste container to the beyond Category 2 frequency range.

c. 'Protect against' in this table means either 'reduce the probability of' or 'reduce the frequency of.'

d. The numbers appearing in parentheses are component numbers.

e. Refer to Ref. 8.2.11 for the description of these event sequences.

APPENDIX G
PRECLOSURE NUCLEAR SAFETY DESIGN BASES FOR THE SUBSURFACE OPERATIONS ITS SSCs

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Table G-1. Preclosure Nuclear Safety Design Bases for the Subsurface Operations ITS SSCs

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[d])
			Safety Function	Controlling Parameters and Values	
DOE and Commercial Waste Package System (DS)	DOE and Commercial Waste Package	Entire	Provide containment	DS.SS.01. The mean conditional probability of breach of a sealed waste package resulting from a side impact shall be less than or equal to 1×10^{-8} per impact. (Ref. 8.2.10, Table 6.9-1)	SSO-ESD03-WP (Seq. 6-3)
				DS.SS.02. The mean conditional probability of breach of a sealed waste package resulting from a drop of a load onto the waste package shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.10, Table 6.9-1)	SSO-ESD01-WP (Seq. 6-4)
				DS.SS.03. The mean conditional probability of breach of a sealed waste package inside the transport and emplacement vehicle (TEV) resulting from an end-on impact or collision shall be less than or equal to 1×10^{-8} per impact. (Ref. 8.2.10, Table 6.9-1)	SSO-ESD03-WP (Seq. 2-3)
				DS.SS.04. The mean conditional probability of breach of a canister inside a sealed waste package as a result of the spectrum of fires shall be less than or equal to 3×10^{-4} per fire event. (Ref. 8.2.10, Table 6.9-1)	SSO-ESD05-WP (Seq. 3-4)

Table G-1. Preclosure Nuclear Safety Design Bases for the Subsurface Operations ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[d])
			Safety Function	Controlling Parameters and Values	
DOE and Commercial Waste Package System (DS) (continued)	DOE and Commercial Waste Package (continued)	Entire (continued)	Provide containment (continued)	DS.SS.05. The mean frequency of breach of the waste package from a rockfall due to the spectrum of seismic events shall be less than or equal to 1×10^{-6}/yr.[a] (Ref. 8.2.4, Table 6.10-6)	Based on screening analysis of physical and thermal impacts from rockfalls; see Section 6.9.2 of Ref. 8.2.4
			Protect against[c] a waste package breach due to seismic vibratory motion in an emplacement drift	DS.SS.06. The mean frequency of breach of the waste package from vibratory motion impacts in an emplacement drift due to the spectrum of seismic events shall be less than or equal to 1×10^{-6}/yr.[a] (Ref. 8.2.4, Table 6.10-6)	Based on screening analysis of waste package impacts in the emplacement drift; see Section 6.9.2 of Ref. 8.2.4
Emplacement and Retrieval/ Drip Shield Installation System (HE)	Emplacement and Retrieval/ Drip Shield Installation System	Transport and Emplacement Vehicle (TEV)	Protect against[c] TEV runaway	HE.SS.01. The mean probability of runaway of a TEV that can result in a potential breach of a waste package shall be less than or equal to 2×10^{-9} per transport. (Ref. 8.2.10, Table 6.9-1)	Initiating event does not require further analysis[b]
			Protect against[c] direct exposure of personnel	HE.SS.02. The mean probability of inadvertent TEV door opening shall be less than or equal to 1×10^{-7} per transport. (Ref. 8.2.10, Table 6.9-1)	SSO-ESD-04-WP (Seq. 4-2)

Table G-1. Preclosure Nuclear Safety Design Bases for the Subsurface Operations ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[d])
			Safety Function	Controlling Parameters and Values	
Emplacement and Retrieval/ Drip Shield Installation System (HE) (continued)	Emplacement and Retrieval/ Drip Shield Installation System (continued)	Transport and Emplacement Vehicle (TEV) (continued)	Protect against[c] a tipover of the transport and emplacement vehicle	HE.SS.03 The mean frequency of tipover of the transport and emplacement vehicle due to the spectrum of seismic events shall be less than or equal to 2×10^{-6}/yr.[a] (Ref. 8.2.4, Table 6.10-6)	SSO-IE-S-MAIN (Seq. 03)
			Protect against[c] ejection of the waste package from the shielded enclosure of the transport and emplacement vehicle	HE.SS.04. The mean frequency of ejection of a waste package from the transport and emplacement vehicle due to the spectrum of seismic events shall be less than or equal to 2×10^{-4}/yr.[a] (Ref. 8.2.4, Table 6.10-6)	SSO-IE-S-MAIN (Seq. 03)
Naval SNF Waste Package System (DN)	Naval SNF Waste Package	Entire	Provide containment	DN.SS.01. The mean conditional probability of breach of a sealed waste package resulting from a side impact shall be less than or equal to 1×10^{-8} per impact. (Ref. 8.2.10, Table 6.9-1)	SSO-ESD03-WP (Seq. 6-3)
				DN.SS.02. The mean conditional probability of breach of a sealed waste package resulting from a drop of a load onto the waste package shall be less than or equal to 1×10^{-5} per drop. (Ref. 8.2.10, Table 6.9-1)	SSO-ESD01-WP (Seq. 6-4)

Table G-1. Preclosure Nuclear Safety Design Bases for the Subsurface Operations ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[d])
			Safety Function	Controlling Parameters and Values	
Naval SNF Waste Package System (DN) (continued)	Naval SNF Waste Package (continued)	Entire (continued)	Provide containment (continued)	DN.SS.03. The mean conditional probability of breach of a sealed waste package in the TEV resulting from an end-on impact or collision shall be less than or equal to 1×10^{-8} per impact. (Ref. 8.2.10, Table 6.9-1)	SSO-ESD03-WP (Seq. 2-3)
				DN.SS.04. The mean conditional probability of breach of a canister inside a sealed waste package as a result of the spectrum of fires shall be less than or equal to 1×10^{-4} per fire event. (Ref. 8.2.10, Table 6.9-1)	SSO-ESD05-WP (Seq. 3-4)
			Protect against[c] a rockfall breaching a waste package	DN.SS.05. The mean frequency of breach of the waste package from a rockfall due to the spectrum of seismic events shall be less than or equal to 1×10^{-6}/yr [a]. (Ref. 8.2.4, Table 6.10-6)	Based on screening analysis of physical and thermal impacts from rockfalls; see Section 6.9.2 of Ref. 8.2.4

Table G-1. Preclosure Nuclear Safety Design Bases for the Subsurface Operations ITS SSCs (Continued)

System or Facility (System Code)	Subsystem or Function (as Applicable)	Component	Nuclear Safety Design Bases		Representative Event Sequence (Sequence Number[d])
			Safety Function	Controlling Parameters and Values	
Naval SNF Waste Package System (DN) (continued)	Naval SNF Waste Package (continued)	Entire (continued)	Protect against[c] a breaching a waste package (continued)	DN.SS.06. The mean frequency of breach of the waste package from vibratory motion impacts in an emplacement drift due to the spectrum of seismic events shall be less than or equal to 1×10^{-6}/yr [a]. (Ref. 8.2.4, Table 6.10-6)	Based on screening analysis of waste package impacts in the emplacement drift; see Section 6.9.2 of Ref. 8.2.4

Notes:

Facility Codes: SS = Subsurface Facility.

System Codes: DN = Naval Spent Nuclear Fuel Waste Package; DS = DOE and Commercial Waste Package; HE = Emplacement and Retrieval/Drip Shield Installation.

Acronyms: DOE = U.S. Department of Energy; ITS = important to safety; SSC = structure, system, or component; TEV = transport and emplacement vehicle.

a. Control values shown represent the integration of the probability distribution of SSC failure (i.e., the loss of safety function) with the site seismic hazard curve (Ref. 8.2.4, Figure 6.1-1).

b. Design requirement is applied to reduce the frequency of any event sequence that could result in damage to a waste container to the beyond category 2 frequency range.

c. 'Protect against' in this table means either 'reduce the probability of' or 'reduce the frequency of.'

d. Refer to Ref. 8.2.10 for the description of these event sequences.

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