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II. Allowable Exposure Time of WP Transiting from Transporter Bedplate to Emplacement Drift Entrance						3		
III. Summary of Categorization Results and Derived Requirements						163		
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ACRONYMS

BWR	boiling water reactor
CWPRB	Cask and Waste Package Receipt Building
CHF	Canister Handling Facility
CSNF	commercial spent nuclear fuel
DBGM	design basis ground motion
DOE	U.S. Department of Energy
DPC	dual-purpose canister
DTF	dry-transfer facility
EPRI	Electric Power Research Institute
FHF	Fuel Handling Facility
GET	generalized event tree
HAM	horizontal aging module
HEPA	high-efficiency particulate air
HLW	high-level radioactive waste
HTC	horizontal transfer cask
HVAC	heating, ventilation, and air-conditioning
ITS	important to safety
LEL	lower explosive limit
LWT	legal weight truck
LLW	low-level radioactive waste
MCO	multicanister overpack
MSC	monitored geologic repository site-specific cask
MTHM	metric tons of heavy metal
OWT	overweight truck
PWR	pressurized water reactor
SNF	spent nuclear fuel or commercial spent nuclear fuel (Section headings in Section 6.3.2 through 6.3.12 are taken from a reference that uses SNF to mean CSNF.)
SRTC	site-rail transfer cart
SSC	structure, system, or component

ACRONYMS (Continued)

TCBA	Transportation Cask Buffer Area
TCRRF	Transportation Cask Receipt/Return Facility
WP	waste package

1 PURPOSE

The purposes of this analysis are:

- Categorize (as Category 1, Category 2, or Beyond Category 2) internal event sequences that may occur before permanent closure of the repository at Yucca Mountain.
- Categorize external event sequences that may occur before permanent closure of the repository at Yucca Mountain. This includes examining DBGM-1 seismic classifications and upgrading to DBGM-2, if appropriate, to ensure Beyond Category 2 categorization.
- State the design and operational requirements that are invoked to make the categorization assignments valid.
- Indicate the amount of material put at risk by Category 1 and Category 2 event sequences.
- Estimate frequencies of Category 1 event sequences at the maximum capacity and receipt rate of the repository.
- Distinguish occurrences associated with normal operations from event sequences. It is beyond the scope of the analysis to propose design requirements that may be required to control radiological exposure associated with normal operations.
- Provide a convenient compilation of the results of the analysis in tabular form (Attachment III).

The results of this analysis are used as inputs to the consequence analyses in an iterative design process that is depicted in Figure 1. Categorization of event sequences for permanent retrieval of waste from the repository is beyond the scope of this analysis. Cleanup activities that take place after an event sequence and other responses to abnormal events are also beyond the scope of the analysis.

An event sequence is defined by the U.S. Nuclear Regulatory Commission to be "a series of actions and/or occurrences within the natural and engineered components of a geologic repository operations area that could potentially lead to exposure of individuals to radiation" (10 CFR 63.2 [DIRS 158535]). The definition further states that 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 operating personnel." The most frequent event sequences, those belonging to Category 1, are "expected to occur one or more times before permanent closure of the geologic repository operations area" (10 CFR 63.2 [DIRS 158535]). Category 2 includes the remaining "event sequences that have at least one chance in 10,000 of occurring before permanent closure" (10 CFR 63.2 [DIRS 158535]). Event sequences that do not have at least one chance in 10,000 of occurring before permanent closure are categorized as

Beyond Category 2. An event with no potential for “exposure of individuals to radiation,” is not considered an event sequence.

As shown by the two decision diamonds near the center of Figure 1, event sequences are categorized as Category 1, Category 2, or Beyond Category 2. Descriptions of the Category 1 and 2 event sequences are inputs to the consequence analyses, as represented by the parallel paths proceeding from Event Sequence Categorization. If unacceptable consequences are found, design or operational changes may become necessary (as indicated by the feedback loop back up to the top). If consequences are acceptable, the structures, systems and components (SSCs) and operational features that were credited for the categorization and consequence calculations become inputs to the nuclear safety design basis. If some of the design and operational features that were credited (as reflected in the Q-List and the system description documents and facility description documents) are found less than optimal by design or performance-assessment organizations, alternative design or operational features may be adopted (as reflected in the second point of entry into the feedback loop to the top). Whenever design or operational features are changed, new internal or external event sequences may be identified (as reflected in the box at the top of the diagram).

This document uses the following generic terms. The specific canister or cask name is used as required.

- “DOE SNF canister” includes standardized DOE SNF canisters and the DOE SNF canisters known as multicanister overpacks (MCOs);
- “DOE canister” includes DOE HLW canisters as well as DOE SNF canisters.
- The term “cask” is used as an abbreviation for “transportation cask” to maintain consistency with potential event descriptions in *Internal Hazards Analysis for License Application* (BSC 2005 [DIRS 171428]).
- Monitored geologic repository site-specific casks (MSCs) are referred to as MSCs.
- “Aging cask” is a generic term that refers to MSCs and horizontal aging modules (HAMS)

The activities that would be involved in handling commercial multipurpose canisters used by utilities, which could conceivably be received at the repository and transferred intact into waste packages (WPs) for disposal, are beyond the scope of this analysis because the current design does not allow for their use.

2 QUALITY ASSURANCE

The Office of Civilian Radioactive Waste Management quality assurance program applies to this design analysis because it relates to performance of the preclosure safety analysis.

3 USE OF SOFTWARE

3.1 SOFTWARE APPROVED FOR QUALITY-AFFECTING WORK

None used.

Figure 1. Process Flow for Preclosure Safety Analysis and Postclosure Performance Assessment

3.2 COMMERCIAL OFF-THE-SHELF SOFTWARE USED

Microsoft Excel 97 SR-2 was used to calculate results in tables throughout the document. Excel is appropriate because standard mathematical expressions and operations available in Excel were used to derive the results. The formulas, inputs, and results are presented at the point of use.

4 INPUTS

4.1 PROJECT DATA

4.1.1 WP Inventory Information

The nominal numbers of WPs in various configurations to be emplaced are given in Table 1.

Table 1. Waste Package Inventory Information

Configuration Number	Waste Package Type	Number of Waste Packages	Waste Package Loadings			
			SNF Unit	Units per Waste Package	Glass ^c Canisters per Waste Package	Glass ^c Unit
1	CSNF (AP)	4,299	PWR	21	0	—
2	CSNF (CR)	95	PWR	21	0	—
3	CSNF (Long)	163	BWR	12	0	—
4	CSNF	2,831	BWR	44	0	—
5	CSNF	84	BWR	24	0	—
6	Codisposal	1,403	Short Canister	1	5	Short
7a	Codisposal	1,608	Long Canister	1	5	Long
7b	Codisposal	7	None	0	5	Long
8a	Codisposal	192	Wide Canister	1	3	Long
8b	Codisposal	202	MCO	2	2	Long
9	Naval (Short) ^a	144	Canister	1	0	—
10	Naval (Long) ^b	156	Canister	1	0	—
Total Codisposal Waste Packages		3,412				
Total Commercial and Naval SNF		7,772				
Grand Total		11,184				

NOTES: ^a Naval (short) is a waste package that contains one short naval canister.

^b Naval (long) is a waste package that contains one long naval canister.

^c Glass is high-level radioactive waste glass.

BWR = boiling water reactor; CSNF = commercial spent nuclear fuel; AP = absorber plate; CR = control rod; PWR = pressurized water reactor; MCO = multi-canister overpack; SNF = spent nuclear fuel.

SOURCE: BSC 2004 [DIRS 170022], Table 6-3.

4.1.2 Selected WP Characteristics

The following dimensions pertain to the Naval Long WP (BSC 2004 [DIRS 169062]):

- 75.8 inches (outside diameter of the outer corrosion barrier)
- 236.3 inches (total length less lid-lifting feature).

4.1.3 Characteristics of the Ground Support in the Emplacement Drifts

The recommended ground support in the emplacement drifts consists of 3 m long Super Swellex rock bolts, spaced at 1.25 m, and 3 mm thick Bernold-type perforated sheets, made of stainless steel and installed in a 240° arc around the drift periphery (BSC 2004 [DIRS 170292], p. 110). The rock bolts are made of circular steel tube with a diameter of around 5 cm and a thickness of 3 mm (BSC 2004 [DIRS 170292], pp. 17 and 83).

4.1.4 External Hazards

The analysis *Monitored Geologic Repository External Events Hazards Screening Analysis* (BSC 2004 [DIRS 167266], Table 3) found that the following hazards should be considered: aircraft crash, rainstorm and flooding, range fire, loss of offsite or onsite power, nearby industrial or military activities, seismic activity, tornado and extreme wind, lightning, ash fall due to volcanism, drift degradation, extreme weather (temperature) fluctuation, and sandstorm.

The *Industrial/Military Activity-Initiated Accident Screening Analysis* found that there are no existing or planned military or industrial activities that initiate event sequences with radiological consequences during the preclosure period (BSC 2003 [DIRS 162761], Section 8).

4.1.5 Potential Internal Events

The categorization analysis is based on the design and operation of the repository as described in *Internal Hazards Analysis for License Application* (BSC 2005 [DIRS 171428]). The one-to-one correspondence between third-level subsections starting with Section 6.6.1 of *Internal Hazards Analysis for License Application* and Section 6.3.2 of the present analysis will guide the reader (Table 2). The lowest-level subsections within Section 6.3 of the present analysis correspond to specific potential events that are identified in *Internal Hazards Analysis for License Application*.

Table 2. Crosswalk to Internal Hazards Analysis

Functional Area Covered	Section in This Document	Section in Internal Hazards Analysis (BSC 2005 [DIRS 171428])
Cask and Waste Package Receipt Building (CWPRB), Transportation Cask Buffer Area (TCBA)	6.3.2	6.6.1
Canister Handling Facility (CHF)	6.3.3	6.6.2
Dry Transfer Facility (DTF)	6.3.4	6.6.3
Fuel Handling Facility (FHF)	6.3.5	6.6.4
Surface and Subsurface Facilities: WP Subsurface Transport and Emplacement	6.3.6	6.6.5
Surface Facilities: SNF Aging System	6.3.7	6.6.6
Subsurface Facilities: Construction Hazards	6.3.8	6.6.7
Surface Facilities: Construction Hazards	6.3.9	6.6.8
Subsurface Facilities Drip Shield Installation	6.3.10	6.6.9
Subsurface Facilities: Retrieval	6.3.11	6.6.10
Surface Facilities: Site-Generated Radiological Waste Disposal	6.3.12	6.6.11

4.1.6 Height of Emplacement Drifts and Emplacement Drifts Turnouts

The diameter of the emplacement drifts is 5.5 m and the height of the emplacement drift turnouts is 7 m (BSC 2003 [DIRS 165572], Table 8).

4.1.7 Number of Emplacement Drifts

Ninety-six emplacement drifts are needed to contain the waste packages in the repository, based on BSC (2003 [DIRS 165572], Table IV-3), which gives the number of drifts in each of the four panels that compose the subsurface layout of the repository, and BSC (2003 [DIRS 165572], p. 59) which indicates that the waste packages will occupy Panels 1, 3, 4, and up to Drift 17 in Panel 2.

4.1.8 Not used

4.1.9 Fire-Induced Event Sequence Categorization

The fire-induced event sequences involving a direct exposure of an SNF or HLW waste form to a fire, which are identified in *Internal Hazards Analysis for License Application* (BSC 2005 [DIRS 171428], Sections 6.6.1 through 6.6.11), are categorized in the *Fire-Induced Event Sequence Analysis* (BSC 2004 [DIRS 171488]). The analysis also categorizes the event sequences involving indirect damage fire scenarios.

The analysis (BSC 2004 [DIRS 171488], Section 7) concludes that even if a precise determination of the characteristics of possible fire events in the repository is not possible at this stage of the design, the potential for a fire and the severity of the fire relative to the waste form is manageable without the need for a fire suppression system.

Controls on the presence and amount of combustibles in the different areas of the repository will be implemented through design and operational requirements. This ensures that any Category 1 or Category 2 event sequence potentially initiated by a fire will be precluded.

4.1.10 Criticality Safety for CSNF Assemblies

The analysis *Surface Facility Criticality Safety Calculations* (BSC 2004 [DIRS 168132], Section 5.2.3.1) determined that a drop of one or two CSNF assemblies does not pose a criticality safety concern. This result ensures that drops, collisions, and other handling impacts of a CSNF assembly (allowing for rearrangement of fuel rods and without credit for burnup or moderator control) does not pose a criticality safety concern. This input is needed to ensure criticality safety in the handling of CSNF assemblies. Credit is not taken for moderator control because assembly-handling events can occur in the remediation pool.

4.1.11 Design Requirements and Categorization Results Related to the SNF Aging System

A description of system operations, internal hazards, event sequences, and safety strategies associated with the SNF Aging System are identified and evaluated in the report *SNF Aging System Safety Study* (Cogema 2004 [DIRS 171793], Section 6). Safety strategies crediting SSCs and controls are identified to ensure that there are no Category 1 or Category 2 event sequences initiated by external hazards (Cogema 2004 [DIRS 171793], Section 6.3.2). The Cogema study develops internal hazard event sequences and safety strategies for vertical and horizontal aging systems (Cogema 2004 [DIRS 171793], Tables 6-4 and 6-5). Twenty-three internal event sequences for a vertical aging system and twenty-seven internal event sequences for a horizontal aging system are developed. All of the internal event sequences for the SNF Aging System are determined to be Beyond Category 2 based on implementing specified safety approaches (Cogema 2004 [DIRS 171793], Section 6.3.3, including Tables 6-4 and 6-5). The safety approaches identified in the *SNF Aging System Safety Study* are a source of design requirements in addition to the design requirements that are generated by the present analysis.

The *SNF Aging System Safety Study* does not consider potential event sequences that may occur inside process buildings. In addition, potential event sequences that may occur at the interface between the SNF Aging System and the other portions of the facility are considered in the present analysis as well as in the *SNF Aging System Safety Study*. The following nuclear safety design approaches from *SNF Aging System Safety Study* (Cogema 2004 [DIRS 171793], Table 6-6) are used in the present analysis to address potential event sequences that may occur inside process buildings or at the interface with the SNF Aging System:

- S.12. Ensure aging and transfer casks can withstand a drop from the maximum handling height of an MSC transporter or HTC [horizontal transfer cask] trailer without loss of function.
- S.23. Limit size, mass, maximum speed and motive force [of the MSC Transporter and HTC Trailer/Tractor] to limit potential damage caused by collisions.

- S.24. Preclude tipover [of the MSC Transporter and HTC Trailer/Tractor] during transfer by ensuring that transfer equipment design precludes failure modes that could result in tipover under design-basis load-handling conditions.
- S.25. Preclude tipover during transfer by ensuring minimum tipover resistance/stability standards are maintained consistent with roadway design.
- S.26. Provide reliable means to stop and maintain stability [of the MSC Transporter and HTC Trailer/Tractor].

4.1.12 Design Requirements and Categorization Results Related to Aircraft Hazards

An event sequence initiated by an aircraft crash is Beyond Category 2 given the restrictions on aircraft operations and the design requirements credited in *Frequency Analysis of Aircraft Hazards for License Application* (BSC 2005 [DIRS 171786], Section 7) are observed.

4.1.13 Design Requirements and Categorization Results Related to Tornado and Extreme Wind

The *Extreme Wind/Tornado/Tornado Missile Hazard Analysis* (BSC 2004 [DIRS 171471], Section 9) provides design requirements related to tornado and extreme winds. To render event sequences involving tornado and extreme wind Beyond Category 2, stationary structures that are important to safety (ITS), as well as aging casks, must be designed for tornado missiles, extreme straight wind (90 mi/h), and tornado wind (189 mi/h). Tornado missiles and tornado wind are screened out for transporters (including WP transporters and transporters used to carry waste to and from the aging pads); however, transporters must be designed to function in extreme straight wind.

4.1.14 Design Requirements and Categorization Related to Seismic Events

Preclosure Seismic Design Methodology for a Geological Repository at Yucca Mountain (BSC 2004 [DIRS 170564]) outlines the approach that is taken in seismic design of SSCs that are important to safety (ITS). The seismic methodology report also outlines the application of seismic margins analysis to demonstrate compliance with 10 CFR Part 63 [DIRS 158535], including categorization of seismic event sequences. Implementation of design requirements from the seismic analysis ensures that surface facilities are designed such that seismic events will not initiate Category 1 or Category 2 event sequences that exceed the dose limits in 10 CFR Part 63 [DIRS 158535].

The *Seismic Analysis for Preclosure Safety* assigns DBGM-1 to the SSCs listed in Table 3 (BSC 2004 [DIRS 171470], Table IV-1). SSCs designed to withstand a DBGM-1 earthquake are presumed to fail if an earthquake that exceeds DBGM-1 occurs. As noted in Section 6.2.6, the resulting seismically initiated event sequence is Category 2.

Table 3. SSCs Assigned DBGM-1 Seismic Classification

SSC	Safety Function for DBGM-1 Assignment
Permanent shielding (CHF, DTF, FHF)	Shielding integrity remains intact
Cask pit protective cover (Cask Preparation)	Shielding integrity remains intact
WP pit protective cover (WP Preparation)	No failure
MSC pit protective cover (WP Preparation)	No failure
HLW canister	No breach
WP transporter	Shielding integrity remains intact
Fuel Handling Machine and grapples (Wet Remediation)	Maintain waste form
Spent Fuel Transfer Machine and grapples (Dry Transfer)	Maintain waste form
Inlet and outlet dampers and ducting for fuel element staging areas (DTF only, Surface Industrial Heating Ventilation, and Air-Conditioning (HVAC), required for passive airflow).	No failure
Stack for fuel element staging areas (DTF only, Surface Industrial HVAC, required for passive airflow)	Controlled failure (potential for seismic interaction)
HEPA filters (Primary Surface Nuclear HVAC)	No discharge
Exhaust ducting and dampers (Primary Surface Nuclear HVAC)	No discharge

SOURCE: BSC 2004 [DIRS 171470], Table IV-1.

4.1.15 Requirements Related to Range Fire

Range fire has been identified as a potential external hazard. The *Wildfire Exposure Calculation* (BSC 2004 [DIRS 168205], Section 7) concluded that the required minimum separation distance between structures containing radiological material and combustible vegetation is 33 feet and complies with applicable fire protection codes and standards for protection of structures from wildfire exposure and hazards (BSC 2004 [DIRS 168205], Section 7).

4.1.16 Characteristics of the Drip Shield and Its Emplacement Gantry

The drip shield and its emplacement gantry are designed to straddle the waste package during installation (BSC 2004 [DIRS 168381]).

4.1.17 Design Requirements and Categorization Related to Waste Package Transporter Runaway

The *Waste Package Transporter Preclosure Safety Analysis* (BSC 2004 [DIRS 169554]) analyzes the probability of a transporter runaway event sequence. Two scenarios of uncontrolled descent are analyzed (BSC 2004 [DIRS 169554], Section 6.5). The first scenario involves a failure to stop or slow the WP transporter given that some undefined initiating event has attempted to accelerate the transporter or allowed it to exceed its maximum allowable speed. The second scenario assumes 1) a coupler failure between the locomotive and the WP transporter car; 2) the WP transporter car is located ahead of the locomotive on the downgrade; and 3) the automatic brake system on the transporter fails to stop or retard the now decoupled railcar. Based on BSC (2004 [DIRS 169554], Section 6.5), operator-induced runaways can be eliminated from further consideration, and only a failure of components of the service and regenerative

brake systems can initiate an uncontrolled descent. Thus, the two scenarios mentioned previously are the only ones relevant for analyzing the transporter runaway event sequences.

The results of the analysis (BSC 2004 [DIRS 169554], Sections 6.4 and 6.10) show that because of design features, involving principally the use of diversified braking systems, the probability of the scenarios for a transporter runaway can meet the reliability goal that makes the transporter runaway Beyond Category 2. The numerical value of this reliability goal was determined to be 8.3×10^{-9} runaway per trip (BSC 2004 [DIRS 169554], Section 6.4).

4.1.18 Characteristics of DOE SNF Canisters

DOE SNF may arrive at the repository in a standardized canister or an MCO. The term "DOE SNF canisters" includes standardized and MCO canisters.

- DOE SNF standardized canisters can withstand, without breaching, a drop in any orientation from a height of 23 ft (7 m) onto an essentially unyielding flat surface (BSC 2004 [DIRS 168792], Section 6).
- MCO canisters can withstand, without breaching, a flat-bottom drop (3 degrees or less off vertical) from a height of 23 ft (7 m) and a drop in any orientation from a height of 2 ft (0.6 m) (individually—not both in sequence) onto an essentially unyielding flat surface (BSC 2004 [DIRS 168792], Section 6).
- The probability that a DOE SNF canister, whether MCO or standardized, is defective such that it may breach if dropped from within the height limits stated above is conservatively estimated as 2.3×10^{-4} (BSC 2004 [DIRS 168792], Section 6).

4.2 INPUTS FROM EXTERNAL SOURCES

4.2.1 Characteristics of Transportation Casks

Transportation casks with impact limiters must be evaluated under normal conditions of transport which include high and low ambient temperatures and insolation (10 CFR 71.71 [DIRS 171308]).

Hypothetical accident conditions under which transportation casks must be evaluated include "exposure of the specimen fully engulfed, except for a simple support system, in a hydrocarbon fuel/air fire of sufficient extent, and in sufficiently quiescent ambient conditions, to provide an average emissivity coefficient of at least 0.9, with an average flame temperature of at least 800°C (1475°F) for a period of 30 minutes, or other thermal test that provides the equivalent total heat input to the package and which provides a time-averaged environmental temperature of 800°C" (10 CFR 71.73 [DIRS 171308]).

Transportation casks with impact limiters are required to withstand (without breach) a 9-m (30-ft) drop onto a flat, essentially unyielding, horizontal surface, striking the surface in a position for which maximum damage is expected and a 1-m (40-in) drop onto a vertical 15-cm (6-in) diameter mild steel bar in a position for which maximum damage is expected (10 CFR 71.73 [DIRS 171308]).

Material within transportation casks must be subcritical under the hypothetical accident conditions in 10 CFR 71.73 [DIRS 171308] even with the most reactive credible configuration of the fissile material and moderation by water to the most reactive credible extent (10 CFR 71.55 [DIRS 171308]).

4.3 CRITERIA

The categorization analysis takes credit for criteria from existing requirements documents. This section identifies those existing requirements.

4.3.1 Repository Capacity

The capacity of the repository is 70,000 metric tons of heavy metal (MTHM), including 63,000 MTHM of CSNF and 7,000 MTHM of DOE SNF, HLW, and naval SNF. This is a requirement from the *Project Requirements Document* (Canori and Leitner 2003 [DIRS 166275], PRD-014/T-001 p. 3-95).

4.3.2 Precipitation and Flooding

Facilities that could be damaged by flooding shall be located above the probable maximum flood elevation or appropriately protected from flood (BSC 2004 [DIRS 171599], Section 6.1.2.1) and the repository shall be designed to withstand and operate in the precipitation environment described in Table 4 (BSC 2004 [DIRS 171599], Section 6.1.1.1.2). Site drainage shall protect the ramp, ramp portal, shaft, and shaft collar areas from water inflow as a result of the probable maximum flood (BSC 2004 [DIRS 171599], Section 4.2.1.2.6). Site drainage shall contain and route stormwater from natural surface water drainage ways around surface facilities and provide water drainage for systems located on pads (BSC 2004 [DIRS 171599], Section 4.2.1.2.6). Site drainage shall be designed for the runoff accumulated from the storms identified in Table 4 (BSC 2004 [DIRS 171599], Section 4.2.1.2.6)

These criteria are used in Section 6.2.2.

Table 4. Precipitation Environment

Parameter and Frequency	Nominal Value	Upper Bound 90-percent Confidence Value
Maximum Annual Precipitation	20 in/y	NA
Maximum 24-h Precipitation (50-y return period)	2.79 in/day	3.30 in/day
Maximum 24-h Precipitation (100-y return period)	3.23 in/day	3.84 in/day
Maximum 24-h Precipitation (500-y return period)	4.37 in/day	5.25 in/day
Maximum 1-h Precipitation Intensity (50-y return period)	1.35 in/h	1.72 in/h
Maximum 1-h Precipitation Intensity (100-y return period)	1.68 in/h	2.15 in/h

SOURCE: BSC 2004 [DIRS 171599], Section 6.1.1.1.2.

4.3.3 Emplacement and Retrieval System

The system shall be able to determine equipment location in an emplacement drift (BSC 2004 [DIRS 171251], Section 3.1.2.2.1).

The system shall have the capability to identify the drift and location within the drift where the WP will be emplaced (BSC 2004 [DIRS 171251], Section 3.1.1.3.1).

4.3.4 Lightning

The *Project Design Criteria Document* (BSC 2004 [DIRS 171599], Section 4.3.1.5) specifies the approach for protection against lightning as follows:

- All buildings, outdoor elevated structures, electrical equipment, and electrical power lines shall be protected with lightning arresters and surge capacitors.
- The lightning protection system shall be installed for all buildings and outdoor elevated structures. The protection system shall consist of air terminals bussed together and connected by at least two down conductors to the site grounding system.

4.3.5 Not used

4.3.6 Gas Sampling and Purging

- The inside of the cask shall be sampled for elevated pressure and for gases that may indicate a hazardous condition, such as fission products and/or flammable or explosive gas mixtures. (Curry 2004 [DIRS 170557], Requirement 1.1.2.1.1-4).
- The transportation cask shall be vented to atmospheric pressure. If combustible gases are present in the sample, the transportation cask must be purged until samples show a level below LEL [lower explosive limit]. (Curry 2004 [DIRS 170557], Requirement 1.1.2.1.1-5).
- The inside of the DPC shall be sampled for gases that may indicate hazardous conditions, such as flammable or explosive gas mixtures and fission products. (Curry 2004 [DIRS 170557], Requirement 1.1.2.1.4-2).
- The DPC shall be vented to achieve atmospheric pressure. If combustible gases are present in the sample, the DPC must be purged until samples show a level below LEL. (Curry 2004 [DIRS 170557], Requirement 1.1.2.1.4-3).
- The MGR shall be capable of venting, purging, and opening sealed WPs, as required. (Curry 2004 [DIRS 170557], Requirement 1.1.4.1-6).

5 ASSUMPTIONS

5.1 ASSUMPTIONS THAT GENERATE REQUIREMENTS

Many of the assumptions that are used to categorize event sequences invoke design requirements or operational requirements that are not found in existing requirements documents. This means that the function of the assumptions in this section is not simply to provide reasonable values for inputs that are not yet established or are difficult to determine. Instead, their function is to identify features of the design that are directly relied upon to make the case for preclosure safety. The rationale in every case is that the proposed design requirement is believed to be reasonable and achievable. The subsequent nuclear safety design basis report will formalize the requirements identified in this section. If further evolution of the design reveals that some of the requirements are not achievable, or that the same safety goal could be achieved at less cost by implementing a different design requirement, then a different assumption may be made in a revision of this document and the design requirement may be changed. This iterative process is described in Section 1 and illustrated in Figure 1.

5.1.1 General Assumptions

5.1.1.1 Maximum Receipt Rate of CSNF Assemblies

Assumption: The receipt rate for CSNF in any year may not exceed 3,600 MTHM. **Rationale:** This annual receipt rate is 12 times the monthly requirement to be able to receive, handle, and emplace 300 metric tons of uranium equivalent (or, what amounts to the same thing for CSNF, 300 MTHM) monthly in the *Yucca Mountain Site Characterization Project Requirements Document* (YMP 2001 [DIRS 156713], Requirement 1.3.2E). This rate conservatively allows for a 20 percent margin above the 3,000 MTHM requirement for annual receipt capability given by the *Civilian Radioactive Waste Management System Requirements Document* (DOE 2004 [DIRS 171945], Table 1).

5.1.1.2 Criticality Safety for Canister Staging Pits or Racks

Assumption: A design requirement will ensure that the most reactive configuration of standardized DOE SNF canisters can be loaded into canister staging pits or racks (with credit for moderator control as described in Assumption 5.1.1.21) without causing a nuclear criticality. **Rationale:** This assumption is needed to ensure criticality safety in case of handling incidents. It is reasonable to expect that design calculations will demonstrate criticality safety.

5.1.1.3 Criticality Safety for DOE SNF Canisters (Given a Drop)

Assumption: Design calculations and the resulting design requirements will ensure that a drop of a DOE SNF canister will not lead to a nuclear criticality. The calculations will assume that the canister is not breached. The calculations for the staging rack will demonstrate criticality safety with the most reactive configuration of DOE SNF canisters and moderator control as described in Assumption 5.1.1.21. **Rationale:** This assumption is needed to ensure criticality safety in case of handling incidents. The requirement is achievable because moderator control is required in waste handling areas (BSC 2004 [DIRS 171599], Section 4.9.2.2.3).

5.1.1.4 Criticality Safety for MSCs, Transportation Casks, Transfer Casks, CSNF Baskets, and DPCs (Given a Drop)

Assumption: Design requirements and waste acceptance criteria will ensure that transportation casks, transfer casks, MSCs, CSNF baskets used in dry processing areas, and dual-purpose canisters (DPCs) will be designed to ensure nuclear criticality safety with optimum moderation and most reactive waste forms. Criticality safety will be maintained despite geometric rearrangements due to a drop or other handling incident. **Rationale:** The purpose of this assumption is to reduce reliance on administrative controls to prevent preclosure criticality. Drop scenarios without impact limiters are not covered by the accident scenario analyses that are performed to support licensing of a transportation cask under 10 CFR Part 71 [DIRS 171308]. To cover drops without impact limiters, subsequent calculations are needed to demonstrate subcriticality for the most reactive credible configuration of the fissile material in transportation casks, transfer casks, and MSCs and moderation to the most reactive credible extent.

5.1.1.5 Pressurized-System Missiles

Assumption: An operational requirement will ensure that pressurized systems that could generate missiles energetic enough to penetrate a transportation cask with or without impact limiters, a transfer cask, a DOE canister, a naval canister, a DPC, the inner lid of a transportation cask, an MSC, a WP, or the inner lid of an MSC or WP are not present in areas where the potentially vulnerable items may be exposed. **Rationale:** This assumption ensures that the event sequences involving a pressurized system missile that breaches a container are Beyond Category 2. The requirement is achievable because the handling process does not require the use of high-pressure devices that have the potential to cause a breach. Moreover, the containers are robust structures that would withstand the effects of the failure of pressure vessels like those that may be present on vehicles and cranes.

5.1.1.6 Limitations on Combustible Materials Near Low-Level Radioactive Waste

Assumption: Operational requirements will provide a control program ensuring that any fire that may occur in areas where low level radioactive waste (LLW) forms are stored will not be of intensity, duration, or magnitude to initiate an event sequence. **Rationale:** This is achievable by ensuring adequate isolation and confinement of LLW from combustible sources and materials.

5.1.1.7 Drop Rate for the Spent Fuel Transfer Machine and Fuel Handling Machine

Assumption: Design and operational requirements will ensure that the drop rate for the spent fuel transfer machine (in the dry transfer areas) and fuel handling machine (in the pool), including transfers in single-assembly canisters, is less than or equal to 10^{-5} drops/transfer. **Rationale:** The drop rate required is achievable because it is comparable to the historical drop rate derived below from fuel-handling incidents in commercial nuclear reactors in the period from 1985 through 1999 (BSC 2001 [DIRS 157560], Section 5.2). Handling incidents are included regardless of cause; they may be caused by equipment failures, human error, or some combination of the two. The starting year for the range was chosen because incident-reporting practices were inconsistent before 1985 and because rules and regulations precipitated by the Three Mile Island accident were in place by that time (Framatome ANP 2001 [DIRS 156397],

p. 2). The end year, 1999, was the latest year for which the information was available at the time of the study (Framatome ANP 2001 [DIRS 156397], p. 2). Of the 91 fuel-handling events listed (BSC 2001 [DIRS 157560], Table I-1), nine involved fuel-assembly drops and are applicable to the repository (Event Numbers 4, 8, 29, 32, 34, 71, 80, 83, and 86). The number of fuel transfers over the period of observation was estimated to be 1,199,000 (BSC 2001 [DIRS 157560], Assumption 3.1). Thus, the computed frequency of drops per transfer is $9/1,199,000 = 7.5 \times 10^{-6}$ drops/transfer, which is rounded up to 10^{-5} drops/transfer. Calculations that use the assumed drop rate include contributions from equipment failure and human error.

5.1.1.8 Collision Rate for Individual CSNF Assembly Transfers

Assumption: Design and operational requirements will ensure that the rate of collisions during an assembly-transfer operation is less than or equal to 10^{-5} collisions/transfer. **Rationale:** The collision rate required is based on fuel-handling incidents in commercial nuclear reactors in the period from 1985 through 1999 (BSC 2001 [DIRS 157560], Section 5.2). Handling incidents are included regardless of cause; they may be caused by equipment failures, human error, or some combination of the two. The starting year for the range was chosen because incident-reporting practices were inconsistent before 1985 and because rules and regulations precipitated by the Three Mile Island accident were in place by that time (Framatome ANP 2001 [DIRS 156397], p. 2). The end year, 1999, was the latest year for which the information was available at the time of the study (Framatome ANP 2001 [DIRS 156397], p. 2). Of the 91 fuel-handling events listed (BSC 2001 [DIRS 157560], Table I-1), eight involved fuel-element collisions that damaged fuel assemblies and are applicable to the repository (Event Numbers 16, 24, 40, 56, 63, 68, 70, and 89). The number of fuel transfers over the period of observation was estimated to be 1,199,000 (BSC 2001 [DIRS 157560], Assumption 3.1). Thus, the computed frequency of collisions per transfer is $8/1,199,000 = 6.7 \times 10^{-6}$ collisions/transfer, which is rounded up to 10^{-5} collisions/transfer. Calculations that use the assumed collision rate include contributions from equipment failure and human error.

5.1.1.9 Rate of Handling-Equipment Drop or Collision Involving the Spent Fuel Transfer Machine and Fuel Handling Machine

Assumption: Design and operational requirements will ensure that the probability of dropping handling equipment onto a CSNF assembly energetically enough to breach the assembly is 10^{-7} impacts per transfer or less for each assembly transferred. The requirement applies to the spent fuel transfer machine (in the dry transfer areas) and fuel handling machine (in the pool), which are used to transfer CSNF assemblies one at a time. Because adjacent assemblies are included, and because the amount of time the equipment is suspended above an assembly may vary, the probability depends on the sequence of steps that are used to accomplish the transfer as well as the characteristics of the handling device. **Rationale:** This assumption is needed to ensure that the associated unlikely events, which appear to have little potential to initiate an event sequence, are not Category 1. The requirements are achievable because the absence of a load decreases the likelihood of failure due to mechanical stress and because operational controls can prevent suspension of handling equipment above assemblies except as required for operational purposes.

5.1.1.10 Load Drop Rate for Cranes

Assumption: Design and operational requirements will ensure that the drop rate for cranes involved in handling waste forms and their associated containers is less than or equal to 10^{-5} drops/transfer. Handling incidents that result in a drop are included in the required drop rate regardless of cause; they may be caused by equipment failures (including failures in the yokes and grapples), human error, or some combination of the two. **Rationale:** This reliability is considered achievable based on an evaluation of nuclear power plant heavy lift crane reliability performed by the U. S. Nuclear Regulatory Commission (Collins and Hubbard 2001 [DIRS 156981]). The U. S. Nuclear Regulatory Commission determined that a mean crane drop frequency of 9.6×10^{-6} drops per year assuming 100 transfers per year (that is, a drop rate of 9.6×10^{-8} per transfer) can be achieved by single-failure-proof cranes or cranes conforming to specified guidelines (Collins and Hubbard 2001 [DIRS 156981], p. 3-17). The assessment was performed for cranes that handle CSNF storage casks. Since the repository will have training for crane operators and maintenance programs similar to nuclear fuel handling facilities, it is reasonable to expect that cranes used in the repository can be designed with a drop rate of 10^{-5} drops per transfer or less.

5.1.1.11 Rate for Handling-Equipment Drops from Cranes for Canister Transfers

Assumption: Design and operational requirements will ensure that the probability of dropping handling equipment from a crane onto a canister is 10^{-5} or less for each canister transferred. Failures are included regardless of cause; they may be caused by equipment failure, human error, or some combination of the two. **Rationale:** This assumption is needed to drive breaches due to equipment drop to Beyond Category 2 for DOE SNF canisters and to Category 2 for other canisters. The dropped equipment is most likely to strike the canister targeted for transfer, either just before the transfer or just after. Because a drop may affect a canister adjacent to the one targeted for handling and because the amount of time the equipment is suspended above a canister may vary, the probability depends on the sequence of steps that are used to accomplish the transfer as well as the characteristics of the crane. The probability of dropping handling equipment onto a canister other than the one targeted for transfer is less because the equipment would not be suspended above other canisters for long. If a different canister is struck, chances are it will be of the same type as the target canister because canisters of the same type are shipped together (Assumption 5.2.1.13) and because equipment-suspension time over canisters of a different type in a WP or staging rack is small compared to the suspension time over the target canister or canisters of the same type as the targeted canister. Therefore, the possibility of equipment drop onto a canister of a different type from the target canister is neglected in the categorization analysis. The requirements are achievable because the absence of a load decreases the likelihood of crane failure due to mechanical stress and because operational controls can prevent suspension of handling equipment above canisters except as required for operational purposes.

5.1.1.12 Probability of Exceeding the Lift-Height Limits for Cranes

Assumption: Design and operational requirements for cranes will ensure that the conditional probability of having exceeded the lift-height limit, given that a drop occurred, is 10^{-4} or less. **Rationale:** Wherever lift-height limits are credited in the analysis, this assumption is needed to

calculate the number of drops from above the lift-height requirement. Stating the design requirement in this way allows for the possibility that lifting the load above the drop-height limit and dropping the load are not statistically independent. Depending on design solutions, other conditions may be required to ensure that a drop and a breach are Beyond Category 2. For example, casks containing MCOs may require special treatment, such as placement of portable impact limiters, the failure of which could contribute to the conditional probability of a breach given a drop. Because specific design and operational solutions are not yet established, this assumption is limited to consideration of lift-height limits. The requirement is achievable because passive safety features on the crane and, if applicable, procedural controls can be used to drive the conditional probability into the required range.

5.1.1.13 Limitations on Heavy Doors

Assumption: A design requirement will ensure that closure of airlock doors, shield doors, and other applicable doors onto a transfer trolley, site-rail transfer cart (SRTC), MSC transporter, or WP transporter, would not cause a tipover of the conveyance or cause the conveyance to drop its load. A design requirement will ensure that closure of airlock doors, shield doors, and other applicable doors onto a transportation cask, transfer cask, or MSC suspended from an overhead crane will not cause the crane to drop its load. **Rationale:** This assumption is needed to dispense with identified events that may occur to initiate Category 1 or Category 2 event sequences. The requirement is achievable because there is no operational need for rapid closure of doors; in fact, rapidly closing doors would compromise operational safety.

5.1.1.14 Lift-Height Limits for Standardized DOE SNF Canisters

Assumption: A design requirement will limit lift heights for standardized DOE SNF canisters to less than the most limiting height as follows:

- 23 ft (7 m) above the floor of a cask, WP, staging rack, or staging pit (implies approximately vertical orientation)
- 2 ft (0.6 m) above the floor of the transfer cell (any orientation).

Rationale: The 23-ft limit is based on the structural capabilities of standardized DOE SNF canisters (Section 4.1.18). The 2-ft limit is not required to prevent breach of the standardized canister when dropped in any orientation (as on the floor of the transfer cell where vertical orientation is not guaranteed), but is set to 2 ft for consistency with the structural capabilities of the MCO (Section 4.1.18). The requirement is achievable because design features can limit lift heights.

5.1.1.15 Lift-Height Limits for MCOs

Assumption: Design requirements will limit lifts of MCO canisters to less than the most limiting height as follows:

- 2 ft (0.6 m) above the floor of the transfer cell (any orientation)
- 23 ft (7 m) above the floor of a cask or WP (within 3 degrees of vertical orientation).

For the drops onto the floor of a cask or WP, design requirements will restrict the size of the berth in casks and WPs such that the canister cannot be tilted more than 3 degrees from vertical upon impact with the floor of the berth.

Rationale: The assumption is needed to ensure that breach of MCO canisters is Beyond Category 2. The proposed design requirements are based on the structural capabilities of MCOs (Section 4.1.18).

5.1.1.16 Premature Movement of Turntable will Not Breach the WP

Assumption: A design requirement will preclude premature actuation of the turntable (holding the WP on an emplacement pallet) before the disengagement of the trunnion collar removal machine. **Rationale:** This assumption is needed to dispense with an identified event that may occur but has little potential to initiate an event sequence. The requirement is achievable because the system could be designed to stop attempted movement if excessive resistance is encountered.

5.1.1.17 Drop or Collision of Components Associated with a Docking Port

Assumption: A design requirement will ensure that a drop of or collision involving components associated with a docking port will not breach the lid of a cask or MSC situated at the docking port. **Rationale:** This assumption is needed to dispense with a potential event that may occur but has little potential to initiate an event sequence.

5.1.1.18 Lift-Height Limits for Transportation or Transfer Casks Without Impact Limiters and MSCs

Assumption: Design requirements limit the lift heights above an essentially unyielding surface for transportation casks without impact limiters, transfer casks without impact limiters, and MSCs as follows:

- For casks that contain MCOs
 - When credit is not taken for impact absorption by structural features other than the MCO canisters, lift height is limited to 2 ft (0.6 m) in any orientation above an essentially unyielding surface.
 - When credit is taken for impact absorption by structural features other than the MCO canisters, lift height is limited to the maximum height from which the cask can be dropped without breaching the canister.
- For naval casks, lift height is limited to 16 ft (5 m) or less in any orientation above an essentially unyielding surface.
- For other casks, lift height is limited to 23 ft (7 m) or less in any orientation above an essentially unyielding surface.

These heights may be exceeded where impact absorption by crush pads or other features is credited. The crush pads shall limit the impact energy for a dropped cask to be less than or equal

to the impact energy associated with a cask dropped onto an unyielding surface from the maximum specified drop height for the cask. For casks that contain canisters, the cask and the basket structure within the cask must prevent stresses on the canisters in excess of the stresses imposed by a drop of a canister alone.

Rationale: The assumption is needed to render breach of DOE SNF canisters Beyond Category 2 and to conform with event descriptions provided to the U.S. Navy (Cogema 2004 [DIRS 169064], Section 1.3). As stated in Section 4.1.18, standardized DOE SNF canisters can withstand without breach a 23-ft (7-m) drop in any orientation. Assuming that the cask and the basket structure within the cask prevent additional stresses on the canisters within, canisters inside a cask will withstand a cask drop from the same height. This is the basis for the 23-ft limit for casks that do not contain MCOs or naval SNF. The 2-ft requirement for casks that contain MCOs is based on the fact that MCOs can withstand a 2-ft drop in any orientation without breach (Section 4.1.18). The 2-ft requirement is achievable because various means are available, such as movable crush pads, recessed railbeds, and crush pads inside the MCO casks, to limit energy transmitted to the MCO in case of a drop. The 16-ft requirement for naval casks is achievable because 16 ft provides ample room for the required lifts (Cogema 2004 [DIRS 169064], Section 1.3). Limiting lift height allows appropriate source terms to be chosen for the consequence analysis. Crane features and controls for handling transportation casks and MSCs (such as limit switches) can also be utilized to ensure that allowable lift heights will not be exceeded. For CSNF casks and for HLW casks, the 23-ft limit is used, consistent with the limit for casks that contain standardized DOE SNF canisters. Limiting lift height allows appropriate source terms to be chosen for the consequence analysis. Wherever crush pads are credited, analyses will confirm that the impact consequences associated with a drop of a cask onto energy absorbing crush pads are equal to or less than the impact consequences associated with the drop of a cask from the maximum specified drop height onto an unyielding surface.

5.1.1.19 Prevention of Crane Collisions at Speeds that Could Cause Breach

Assumption: A design requirement will limit speeds for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE canister, naval canister, or waste package involved in the transfer. **Rationale:** Design calculations will establish maximum speeds for crane transfers and design features will ensure that the maximum speeds are not exceeded.

5.1.1.20 Force Limits for Lateral Crane Movements

Assumption: A design requirement will ensure that cranes are not capable of exerting sufficient force during a transfer to breach a transportation cask, transfer cask, MSC, WP, or canister as the result of attempts to overcome mechanical constraints. **Rationale:** Design calculations will establish maximum lateral force limits for crane transfers. The requirement is achievable because the containers are robust and can withstand considerable stress without breach and because limited lateral forces are required to achieve the required crane movements.

5.1.1.21 Control of Potential Moderators

Assumption: Design and operational requirements will ensure that materials such as water, water mist, hydrogenous foam, and other hydrogenous materials that could serve as a moderator, are strictly controlled in dry-transfer areas in the Dry Transfer Facility (DTF), Canister Handling Facility (CHF), and Fuel Handling Facility (FHF) and wherever loaded unsealed WPs may be present. A design requirement will ensure that flooding of areas of the facilities where moderators are controlled is precluded by passive design features such as drains, flood control channels, curbs, elevated processing areas, and walls. In particular, there must be appropriately sized flood-control features between pipes carrying water (or other moderators) and moderator control areas. Although small quantities of water may be used in the closure cells for stress mitigation, and small quantities of other moderators, such as crane lubricating oil, may be present in other affected areas, the proposed design and operational requirements must limit the accumulation of liquid moderator in areas that contain fissile material to prevent criticality.

Rationale: The requirements are part of the criticality-prevention strategy. Criticality control will be implemented through passive controls including moderator control, geometry, and fixed neutron absorbers. Because criticality analyses assume that moderator may be present when evaluating the effects of geometry and neutron absorbers, taking credit for moderator control means that other features that prevent criticality, such as geometry and neutron absorbers, may be treated as defense in depth. For moderators that are intentionally introduced into moderator-control areas, criticality calculations will specify limits on the amounts permitted wherever such limits are required for criticality safety. Flood control is also required for operational reasons.

5.1.1.22 DOE SNF Canisters Survive Lid Drops

Assumption: Operational requirements will limit the lift height of the inner lid of a transportation cask, transfer cask, MSC, or WP to ensure that a lid drop onto a DOE SNF canister within that breaches the canister is a Beyond Category 2 event sequence. **Rationale:** The requirements are achievable because mechanical clearance for transferring the lid will require lifting the lid only a modest distance above the top of the canister. In addition, the basket structure within the WP or cask may be credited to absorb some of the impact energy.

5.1.1.23 DOE SNF Canisters Transferred Before HLW Canisters

Assumption: Operational controls will render dropping a DOE SNF canister onto a DOE HLW canister Beyond Category 2. In particular,

- DOE SNF canisters are not transferred into a WP or MSC if one or more HLW canisters are already present in the same WP or MSC.
- DOE SNF canisters are not removed from a WP or MSC if one or more HLW canisters are still present in the same WP or MSC.

Rationale: This assumption is required to ensure that DOE SNF canisters are not dropped onto the narrow neck of the HLW canisters. The requirement is achievable because it results in simple rules for determining the handling order for DOE canisters and verifiable intermediate steps.

5.1.1.24 Lift-Height Limit for HLW Canisters

Assumption: A design requirement will limit lift heights for HLW canisters to less than 23 ft (7 m) above the floor of a cask, WP, staging rack, or staging pit and 2 ft (0.6 m) above the floor of the transfer cell. **Rationale:** This assumption is needed to ensure that the drop of a DOE HLW canister onto a DOE SNF canister does not cause a Category 1 or Category 2 breach of the DOE SNF canister. In addition, the lift-height limits allow an appropriate source term to be chosen for releases due to breached HLW canisters. The distances above the cell floor and floors of containers provide an implied maximum lift height above a DOE SNF canister inside a cask, WP, staging rack, or staging pit. The requirement is achievable because design features can limit lift heights.

5.1.1.25 DOE SNF Canisters Withstand Impact from Dropped HLW Canister

Assumption: A design requirement will ensure that a DOE SNF canister in a cask, WP, staging rack, or staging pit will withstand without breach the drop of a DOE HLW canister onto the top of the DOE SNF canister from within the following heights:

- 23 ft (7 m) above the floor of the cask, WP, staging rack, or staging pit
- 2 ft (0.6 m) above the floor of the transfer cell.

Rationale: This assumption is required to prevent breach of a DOE SNF canister if a DOE HLW canister is dropped onto a DOE SNF canister that is not defective. It is based on the lift height limits given in Assumption 5.1.1.24.

5.1.1.26 Prevention of a Drop of a CSNF Assembly into a WP or MSC Loaded with DOE Canisters

Assumption: An operational requirement will render drop of a CSNF assembly into a WP or MSC loaded with DOE canisters Beyond Category 2. **Rationale:** This assumption is required to implement the approach that breach of DOE SNF canisters is a Beyond Category 2 event. It is achievable because the implementing procedures could be designed to provide the required reliability.

5.1.1.27 Prevention of Drop of a DOE Canister into a WP or MSC Loaded with CSNF Assemblies

Assumption: An operational requirement will render drops of DOE canisters into a WP or MSC loaded with CSNF assemblies Beyond Category 2. **Rationale:** This assumption is required to implement an approach that breach of a DOE SNF canister is Beyond Category 2. It is achievable because the implementing procedures could be designed to provide the required reliability.

5.1.1.28 DOE SNF Canisters Dropped on Other DOE SNF Canisters

Assumption: A design requirement is assumed to ensure that standardized DOE SNF canisters will withstand without breach a drop of another standardized DOE SNF canister and that MCOs

will withstand without breach a drop of another MCO dropped from within the most limiting height as follows:

- 23 ft (7 m) above the floor of a cask, WP, staging rack, or staging pit (as applicable).
- 2 ft (0.6 m) above the floor of the transfer cell.

Rationale: This assumption is required to prevent breach of a standardized DOE SNF canister or MCO that is not defective. The requirement is achievable because DOE SNF canisters are designed to withstand more challenging impacts without breach. That is, the impacts described in Section 4.1.18 assume a drop onto an essentially unyielding surface from a maximum height of 23 ft, whereas for the drops under consideration here,

- Impact energy would be absorbed by the canister already in place.
- The drop height of one canister upon another is at most 23 ft minus the length of the canister already in place.

5.1.1.29 DOE SNF Canisters Dropped onto a Structural Corner

Assumption: A design requirement will ensure that a standardized DOE SNF canister or MCO (as applicable) will not breach if dropped onto the edge of a WP, staging-pit or load-port edge, or WP internal baffle from the most limiting height as follows:

- 23 ft (7 m) above the floor of the cask, WP, staging rack, or staging pit (for standardized canisters)
- 23 ft (7 m) above the floor of the cask or WP (for MCOs)
- 2 ft (0.6 m) above the floor of the transfer cell (for standardized and MCO canisters).

Rationale: This assumption is required to prevent breaches of DOE SNF canisters that are not defective. It is based on the lift height limits given in Assumptions 5.1.1.14 and 5.1.1.15. The requirement is achievable because DOE SNF canisters are robust and only modest lifts of DOE SNF canisters are required for operational purposes.

5.1.1.30 Use of Equipment Over or Near Casks or MSCs

Assumption: Operational requirements for cask preparation and handling will ensure that a drop of or collision involving equipment would not breach a transportation cask, transfer cask, or an MSC. **Rationale:** The requirements may establish maximum lift heights or travel speeds and will affect operations only. This assumption is needed to dispense with potential events with little potential to initiate an event sequence. The requirements are achievable because transportation casks and MSCs are rugged containers and lifts of equipment high above the cask and rapid travel speeds are not needed for operational reasons.

5.1.1.31 Handling Equipment Drops from Limited Height Incapable of Breaching a DOE SNF Canister

Assumption: An operational requirement will ensure the establishment of a maximum lift height limit for handling equipment suspended above DOE SNF canisters. The lift-height limit will be set to the minimum required for operational purposes. A design requirement will ensure that the handling equipment is not capable of causing an event sequence due to a breach of a DOE SNF canister if dropped from within the lift-height limit. **Rationale:** This assumption is needed to ensure that breach of DOE SNF canisters is Beyond Category 2. The requirements are achievable because DOE SNF canisters are rugged containers and lifts of the handling equipment high above the canister are not needed for operational reasons.

5.1.1.32 Drop of Miscellaneous Tools and Equipment onto a Transportation Cask, Transfer Cask, or MSC with Outer Lid Removed and Inner Lid In Place but Unbolted or with an Exposed DPC

Assumption: An operational requirement is assumed to limit lift heights for tools and equipment associated with transportation cask, transfer cask, MSC, and DPC handling and preparation to the minimum necessary for operational purposes. The operational requirement will ensure that tools and equipment, including handling equipment, if dropped from the height limit, will not initiate an event sequence if dropped onto or collided against a transportation cask or MSC with outer lid removed and inner lid in place but unbolted, with an exposed sealed DPC, or with a DPC with its severed lid in place. **Rationale:** This assumption is needed to render the likelihood of these events to Beyond Category 2. The requirements are achievable because operational needs are accommodated and the tools and equipment are not massive structures that could cause a deformation of the inner lid.

5.1.1.33 Heavy Loads Not Lifted Over or Near Transportation Casks, Transfer Casks, or WPs

Assumption: An operational requirement will ensure that heavy loads that could potentially initiate an event sequence if dropped onto a transportation cask, transfer cask, or WP will not be lifted over or near a transportation cask, transfer cask, or WP, except as needed for transfer and closure operations (which are necessary operational sequences whose hazards are appropriately addressed in Section 6). **Rationale:** Lifts that are necessary for transfer and closure operations are not addressed by this assumption and are categorized as appropriate in other sections. This assumption is needed to eliminate Category 1 or Category 2 event sequences that can be precluded by operational rules. The requirement is achievable because it does not affect the operations that are necessary for transfer and closure operations.

5.1.1.34 Numbers of Assemblies per Transportation Cask or MSC

Assumption: Transportation casks, transfer casks, DPCs, or MSCs containing CSNF assemblies contain at most 74 BWR or 36 PWR assemblies. A design requirement will ensure that MSCs have equal or lower capacities. **Rationale:** The BNFL Fuel Solutions TS-125 cask can hold 74 BWR assemblies. The NAC-STC cask can hold 36 PWR assemblies. Other licensed casks have lower capacities (BSC 2003 [DIRS 166015], Table 2-4).

5.1.1.35 SRTC Carrying a Cask or an MSC will Not Derail

Assumption: A design requirement will ensure that an SRTC carrying a cask without impact limiters (typically only within structures) or an MSC will not derail and the cask or MSC will not fall from the SRTC under normal operating conditions or as the result of a collision. **Rationale:** This assumption is needed to prevent breaching the MSC and the DOE SNF canisters that may be inside the MSC. The requirement is achievable because passive features that prevent tilting and derailment can be incorporated into the design of the SRTC and the rails.

5.1.1.36 Stability of Transfer Trolleys

Assumption: A design requirement will ensure that loaded transfer trolleys will not derail or drop their loads. Design requirements will apply to trolleys for casks, WPs, MSCs, and DPCs. **Rationale:** This assumption is needed to prevent a release from the DOE SNF canisters that may be inside the WP, MSC, or cask on the trolley. For DPCs, this assumption is used for defense-in-depth purposes. The requirement is achievable because passive features that prevent tilting and derailment can be incorporated into the design of the trolley and the rails.

5.1.1.37 Consideration of 2-Over-1 Events

Assumption: Portions, parts, subparts, or subsystems, of a non-ITS SSC which, upon failure, could adversely interact with an ITS SSC and prevent its safety function from being performed shall be classified as ITS or redesigned to eliminate the potential unacceptable interaction with the identified ITS SSC. For seismic interactions, portions, parts, subparts, or subsystems, of an otherwise non-ITS structure, system, or component (SSC) shall be classified as ITS and shall be designed to the same seismic DBGM as the ITS SSCs subjected to the potential unacceptable interaction, or the non-ITS SSC may be redesigned to eliminate the potential unacceptable interaction. **Rationale:** Within the commercial nuclear power industry, the accepted practice is to include design features that prevent or mitigate the adverse impact of a non-safety related SSC on a safety related SSC. This allowance is in conformance with Regulatory Guide 1.29, ([DIRS 103311], Section C.2) and 10 CFR 100 ([DIRS 173162], Appendix A, Section VI). This interaction is generally referred to as "2-over-1." This assumption provides for either removing the adverse impact by redesigning the affected portion of the non-ITS SSC or by making the affected portion of the SSC ITS based on its function to prevent or mitigate the adverse impact on an ITS SSC.

5.1.1.38 Speed Limits for SRTCs and MSC Transporters

Assumption: Design and operational requirements will establish speed limits such that a collision with shield or airlock doors or other heavy objects would not overturn an SRTC or MSC transporter or cause it to lose its load. **Rationale:** This assumption is needed to prevent a release from the DOE SNF canisters that may be inside the cask on the conveyance. Design calculations will establish maximum speeds for conveyances. The requirement is achievable because low speeds are preferable for effective normal operations, the conveyances can be provided with collision-mitigation features such as bumpers, and because the loads can be attached securely to the conveyances.

5.1.1.39 Collision of a WP Transporter with WP on Turntable does not Breach the WP

Assumption: Design and operational requirements will ensure that the WP transporter or its bedplate will not collide with a WP on the turntable and cause a WP breach. **Rationale:** This assumption is needed to prevent a release from the DOE SNF canisters that may be inside a WP or cask on the conveyance. Design calculations will establish maximum speeds for conveyances. The requirement is achievable because low speeds are preferable for effective normal operations, the transporter can be provided with collision-mitigation features such as bumpers, and because the WP can be attached securely to the turntable.

5.1.1.40 Load Paths Kept Free of Puncture Hazards and Curbs

Assumption: Design and operational requirements will ensure that surfaces in the load paths through which WPs, DOE SNF canisters, naval canisters, DPCs, transportation casks, transfer casks, or MSCs are transferred by crane are kept free of structures, such as posts and curbs, that could puncture a container in case of a drop. An operational requirement will ensure that the load paths are kept free of movable puncture hazards. **Rationale:** This assumption is needed to prevent event sequences that would damage waste forms in a way that would cause drop-height limits to be ineffective at preventing breach or would violate the conditions that were assumed to develop source terms for consequence calculations. The requirement is achievable because the facility can be designed to avoid the need for objects that could cause a puncture in case of a drop. Procedural controls can ensure that temporary or transient items are removed prior to commencement of operations.

5.1.1.41 Operating Requirements for Portable Platforms, Access Platforms, Mobile Elevated Platforms, and Forklifts

Assumption: Operational requirements will ensure that the portable platforms, access platforms, mobile elevated platforms, and forklifts operated in the facility are not operated in a manner that could breach or overturn a loaded transportation cask or MSC. **Rationale:** These operational requirements are needed to prevent event sequences initiated by inappropriate operation of mobile equipment.

5.1.1.42 Lift-Height Limits for Naval Canisters

Assumption: A design requirement will limit lift heights for naval canisters in vertical orientation to less than 28 ft (8.5 m) above the floor of a cask or WP; and 2 ft (0.6 m) above the floor of the transfer cell where orientation is not constrained to vertical. **Rationale:** The lift height for the naval canister is based on drop scenarios provided to the U.S. Navy (Cogema 2004 [DIRS 169064], Section 5.3 and Attachment 2). The naval canister is considered to breach as a result of a drop. The requirement is needed to preserve the validity of the source terms provided by the Navy.

5.1.1.43 Lift-Height Limits for DPCs

Assumption: A design requirement will limit lift heights for DPCs to less than 23 ft (7 m) above the floor of a transportation cask, transfer cask, or MSC and 2 ft (0.6 m) above the floor of the transfer cell. **Rationale:** This assumption is made to ensure that lift heights are kept within

reasonable limits consistent with lift-height limits for standardized DOE SNF canisters (Section 4.1.18). This allows appropriate source terms for the breach of a DPC to be chosen for the consequence analysis. The requirement is achievable because design features can limit lift heights.

5.1.1.44 Drop of Outer Lid onto Inner Lid of Cask does not Breach DOE SNF Canister Inside

Assumption: Operational requirements will establish permissible lift heights to ensure that a drop of a cask outer lid onto the inner lid of a loaded DOE SNF transportation cask or MSC will not breach a DOE SNF canister inside. Canisters included are standardized DOE SNF canisters and MCOs. **Rationale:** This assumption is needed to ensure that DOE SNF canisters are not breached. The requirement is achievable because:

- Only modest lift heights are operationally required for the lid
- The inner lid and the basket structure inside the cask protect the contents of the cask.

5.1.1.45 Allowable Temperature Limits for Waste Forms in Air

Assumption: Allowable temperature limits will be established for waste forms for a loss of HVAC, including Surface Nuclear and Surface Industrial HVAC systems, for up to 30 days in areas where SNF or HLW is handled or staged. **Rationale:** Temperature limits that are given in existing requirements documents may not provide adequate protection against oxidation for CSNF assemblies with perforated cladding in air. A thorough consideration of the consequences of exposure of CSNF to air for prolonged periods may result in new temperature limits or new approaches to prevent radiological releases in excess of those considered in the consequence analysis for normal operations. If temperature restrictions alone are unable to suitably limit oxidation, it may be necessary to change the design to introduce inerting in areas where SNF is handled or staged. However, inerting is not described in the design that forms the basis for this analysis. Other waste forms (naval SNF, DOE SNF, and HLW) are not exposed directly to air, but temperature limits are still required to ensure containment within the canisters. Temperature limits from existing requirements documents are expected to be adequate for waste forms other than uncanistered CSNF. Time periods beyond 30 days need not be considered because ventilation can be reliably restored within that time by bringing in alternate sources of power or installing replacement parts.

5.1.1.46 Lift-Height Limits for CSNF Assemblies

Assumption: A design requirement will limit lift heights for CSNF assemblies to less than 28 ft (8.5 m) above an essentially unyielding surface. **Rationale:** This assumption provides a basis for choosing a source term for the consequence calculations. The requirement is achievable because design features can limit lift heights.

5.1.1.47 HEPA Filter Maintenance Prevents Filter Fire

Assumption: Operational requirements will ensure that the operating surface temperatures of all high-efficiency particulate air (HEPA) filters will be maintained such that they will not catch fire

under normal operation or in the event of a shutdown of the HVAC systems. **Rationale:** This assumption is needed to ensure that HEPA filters do not catch fire and disperse accumulated radioactive material. The requirement is achievable by normal filter maintenance in areas where high radioactive loads will not be encountered. In the primary confinement areas of the DTF and FHF additional assurance is provided that the requirement is achievable by the requirement that normal operations will not be conducted unless the Surface Nuclear HVAC system is confirmed to be working properly (Assumption 5.1.1.48). Confirmation of proper operation of the HEPA filters does not allow the filters to become overly burdened with radioactive material.

5.1.1.48 Availability of HVAC Including HEPA Filtration

Assumption: A design requirement will ensure that the probability that the Surface Nuclear HVAC system, including HEPA filtration, which serves the primary confinement areas of the DTF and FHF becomes unavailable during a 4-h mission time (that is, the 4-h period following an arbitrarily timed event) is 0.01 or less without credit for backup electrical power. An operational requirement will ensure that the Surface Nuclear HVAC System is working properly before normal operations begin, that the system is monitored for proper operation, including HEPA filter condition, during normal operations, and that normal operations are suspended if the system becomes unavailable. **Rationale:** This assumption is needed to ensure that the HVAC system is working during and after Category 1 drops and collisions involving CSNF assemblies. A 4-h period is selected as a reasonable amount of time for HVAC circulation to clean the air in the cell. The requirement is reasonable because the hourly HVAC failure rate corresponds to $0.01/4 \text{ h} = 2.5 \times 10^{-3} \text{ h}^{-1}$, which can be met with ordinary HVAC technology without credit for backup power, as shown in the following scoping assessment. Dominant causes of a HVAC failure are mechanical failure and a loss of power. The frequency of a loss of offsite power is conservatively taken at 0.1 offsite power loss/year based on Assumption 5.2.2.1. This corresponds to an hourly failure rate of $(0.1 \text{ y}^{-1})/(365 \text{ day/year})/(24 \text{ h/day}) = 1.1 \times 10^{-5} \text{ h}^{-1}$. Another cause of unavailability of power to the HVAC system is the failure of the electrical supply system that makes the connection between offsite power and the powered HVAC equipment. The dominant failure mode in that case is a spurious operation of an electrical component such as a switch, a circuit breaker or a relay. Eide and Calley (1993 [DIRS 146564], Table 2) report a failure rate associated with this failure mode of 10^{-6} h^{-1} . Therefore, it is reasonable to consider that the contribution of spurious operations of electrical components to the global failure rate of the electrical supply of the HVAC will remain lower or at most comparable to the frequency of loss of offsite power. The failure rate of the electrical system supporting the HVAC will be a small fraction of the $2.5 \times 10^{-3} \text{ h}^{-1}$ that is acceptable for the HVAC system. Concerning the mechanical failure of the HVAC system, typical failures would involve ventilators failing to run, or dampers operating spuriously. Eide and Calley (1993 [DIRS 146564], Table 1) indicate that the failure rate for a ventilator is typically 3.0×10^{-5} per hour, and that dampers operate spuriously at a rate of 3.0×10^{-7} per hour. Here also, it is seen that these failure rates represent a small fraction of the $2.5 \times 10^{-3} \text{ h}^{-1}$ that is acceptable for the HVAC system. Therefore, the reliability requirement for the HVAC system can be met without taking credit for backup power to the HVAC system.

5.1.1.49 No Normal Operations When Offsite Power Is Unavailable

Assumption: An operational requirement will ensure that offsite power is available before normal operations begin and that normal operations are suspended if offsite power becomes unavailable. **Rationale:** This assumption is needed to prevent dependence on emergency power, which is not credited in the safety analysis. Because emergency power is not credited in determining the availability of the HVAC system that serves the primary confinement areas of the DTF and FHF (Assumption 5.1.1.48), its availability cannot be relied upon for normal operations. Therefore, normal operations may not take place without the availability of offsite power.

5.1.1.50 Restriction on Carrying Empty Casks or MSCs in the DTF Remediation Pool

Assumption: An operational requirement will prohibit carrying an empty cask in the DTF remediation pool above a transportation cask, MSC, or basket that contains CSNF. **Rationale:** There is no operational need to carry an empty cask as described.

5.1.1.51 Hydrogen Accumulation From Batteries for Powering Heavy Equipment Insufficient for an Explosion

Assumption: Operational controls pertaining to batteries for powering heavy equipment will prevent the generation or accumulation of enough hydrogen gas to cause an explosion that could breach a transportation cask, MSC, or WP. **Rationale:** This requirement is needed to prevent explosions leading to radiological releases.

5.1.1.52 Lift-Height Limits for Unsealed WPs

Assumption: Design and operational requirements specify lift height limits for unsealed WPs wherever unsealed WPs are transferred. If the limit cannot be met, impact absorbers may be used. The impact absorbers shall limit the impact energy for a dropped unsealed WP to be less than or equal to the impact energy associated with a dropped unsealed WP on an unyielding surface from the maximum specified drop height. The allowable lift height above an essentially unyielding surface depends on the nature of the drop and the contents of the WP as follows:

- Drops for which the WP may topple and overturn or slap down2 ft (0.6 m)
- *Flat-bottom drops* (e.g., in a WP loading pit) where WP remains upright
 - Naval SNF or CSNF 28 ft (8.5 m)
 - HLW Canisters or DOE SNF canisters 23 ft (7 m)

For MCO canisters, a *flat-bottom drop* is defined as an impact on a horizontal surface for which the axis of the canister is within 3 degrees of vertical (Section 4.1.18). For waste forms other than MCOs, a *flat-bottom drop* means that the WP must remain upright after the impact. For WPs that contain canisters, the WP and the basket structure within the WP must prevent stresses on the canisters in excess of the stresses imposed by a drop of a canister alone.

Rationale: The 2-ft limit for lifts where toppling and overturning are possible is based on limits given in Assumption 5.1.3.11 and Section 4.1.18 and also provides a specification that the device

to prevent spilling of WP contents must meet (Assumption 5.1.3.11). The 28-ft limit for naval WPs is based on the limit for canister drops given in Assumption 5.1.1.42. The 28-ft limit for CSNF WPs is based on the limit given in Assumption 5.1.1.46. The 23-ft limit for WPs that contain DOE SNF is derived from the structural capabilities of DOE SNF canisters (Section 4.1.18). The 23-ft limit for WPs that contain HLW is based on the limit given in Assumption 5.1.1.24.

5.1.1.53 Prevention of Backward Slapdowns Associated with the Tilting Machine for WPs

Assumption: A design requirement will prevent backward slapdowns associated with the tilting machine for WPs. The design requirement for the tilting machine will include measures to prevent movement or release of the lock on WP trunnions while the WP is being lowered onto the emplacement pallet. **Rationale:** This assumption is needed to dispense with a potential event that is unlikely to occur but could result in a waste-package breach. The requirement is achievable because it can be prevented with passive design features. See Section 5.1.3.12 for additional drops and tipover events.

5.1.1.54 Handling Equipment Collision with a CSNF Assembly

Assumption: A design requirement will ensure that the spent fuel transfer machine, fuel handling machine, and other equipment designed to handle individual CSNF assemblies are not capable of lateral movements of handling equipment at a speed that could breach a CSNF assembly as a result of collision. **Rationale:** The requirement is achievable because the low transfer speeds are preferable for effective normal operations. Collisions resulting from rapid descent of the equipment are considered drops. A collision that does not cause breach could dislodge radioactive crud from the surface of the assembly. The dislodgement of crud is considered part of normal operations (Section 7.4).

5.1.1.55 Suspension of a Lid Grapple Above an Open WP or DPC

Assumption: An operational requirement will prohibit suspending a lid grapple above an open WP or DPC unless the lid is in place or is being lifted. **Rationale:** There is no operational need to suspend a lid grapple above a WP or DPC unless the lid is in place or is being removed.

5.1.1.56 Suspension of an Empty Canister for CSNF in the DTF Remediation Pool

Assumption: An operational requirement will prohibit suspending an empty single-element canister for CSNF above an open cask, MSC, or CSNF basket that contains CSNF. **Rationale:** There is no operational need to suspend an empty canister as described.

5.1.1.57 Prevention of Inadvertent Actuation of Shield Doors and Pit Covers

Assumption: Design and operational requirements will ensure that exposure of workers due to inadvertent actuation of shield doors or pit protective covers will not be Category 1. **Rationale:** This assumption is needed to account for inadvertent worker exposures that could occur as a result of operational errors or equipment malfunctions. The requirement is achievable because

design features such as interlocks and provisions in operating procedures such as checkoffs and redundancies can ensure low probability of failure.

5.1.1.58 Sampling and Purging To Preclude Hydrogen Explosion

Assumption: Operational requirements will provide reasonable assurance in accordance with 10 CFR 63.102(f) [DIRS 158535] that hydrogen explosions will not occur during sampling and purging operations in association with opening (a) DPCs or (b) transportation casks, MSCs, or WPs that contain bare CSNF assemblies. **Rationale:** Section 4.3.6 specifies requirements for sampling and purging transportation casks, DPCs, and WPs. Similar, and possibly more explicit, requirements can be established for sampling and purging transportation casks, DPCs, WPs, and MSCs to avoid hydrogen explosions. Because hydrogen explosions will not be possible where canisters provide containment within the cask, MSC, or WP, there is no need for sampling and purging when canisters provide containment.

5.1.1.59 Response to Loss of Confinement Prevents Significant Exposure to Radioactivity

Assumption: Operating procedures will ensure that a loss of confinement in the CHF, DTF, FHF, or subsurface during otherwise normal operations will not cause individuals to be exposed to significant amounts of radioactivity. **Rationale:** The loss of confinement during otherwise normal operations poses a threat of increases in worker exposure, but negligible increases in public exposure. This assumption is suitable for use because operating procedures will provide for responses such as suspension of normal operations until confinement is restored and evacuation of adjoining areas as required until confinement is restored. With appropriate operating procedures in place, a loss of confinement during otherwise normal operations will not expose individuals to radiation doses in excess of operational limits.

5.1.1.60 Not used

5.1.1.61 Prevention of Trolley Load Drops Due to Collisions

Assumption: A design requirement will limit the speed of trolley movements such that a collision at the speed limit would not cause the trolley to drop its load. **Rationale:** Design calculations will establish maximum speeds for trolley movements. The requirement is achievable because passive features of the trolley design may be used to preclude high speeds.

5.1.1.62 Not used

5.1.1.63 Not used

5.1.1.64 Collection of Radioactive Contamination From Cleanup Activities

Assumption: An operational requirement will ensure that radioactive contamination that is collected during cleanup activities in transfer cells is handled in a manner that precludes nuclear criticality. **Rationale:** Normal operations of the facility will include some release of particles of CSNF from failed cladding. Careless handling of the waste generated during cleanup activities could result in an accumulation of fissile material with the potential for criticality. The assumed

requirement will ensure that the potential for criticality is recognized and avoided. The requirement is achievable because procedures for handling fissile material are commonly used in facilities with similar risks.

5.1.1.65 Durations of the Preclosure Period and of Emplacement Activities

Assumption: An operational requirement will limit the duration of the preclosure period to 100 years or less and the duration of emplacement activities to 50 years or less. **Rationale:** A preclosure period of 100 years duration accommodates forced ventilation of the repository for 50 years following a period of waste emplacement of up to 50 years. 50 years is a reasonable upper limit for the useful life of applicable surface structures and allows ample time for waste emplacement. Should a decision be made to retrieve waste, operate the surface facility for more than 50 years, or operate the subsurface facility for more than 100 years, the appropriate preclosure safety analyses would be revised and necessary approvals from the U. S. Nuclear Regulatory Commission would be sought.

5.1.2 Assumptions Related to External Hazards

5.1.2.1 Cranes, Gantries, and Spent Fuel Transfer Machines, and Fuel Handling Machines Stop and Retain Load on Loss Of Power

Assumption: A design requirement will ensure that cranes, spent fuel transfer machines, fuel handling machines, and gantries that are used for handling waste forms following a loss of power will stop, retain their loads, and enter a locked mode; upon a restoration of power, cranes shall stay in the locked mode until operator action is taken. **Rationale:** This assumption is needed to prevent Category 1 or Category 2 event sequences initiated by loss of power. The requirement is achievable because such features are available on current crane designs.

5.1.2.2 Trolleys and Transporters Stop and Retain Load on Loss of Power

Assumption: A design requirement will ensure that trolleys and transporters that are used for handling HLW or SNF are designed to stop, retain the load, and enter a locked mode; upon a restoration of power, they shall stay in the locked mode until operator action is taken. **Rationale:** This assumption is needed to prevent Category 1 or Category 2 event sequences initiated by loss of offsite power. The requirement is achievable because such features are available on current designs of similar equipment.

5.1.2.3 Adequacy of Transportation Casks and Transfer Casks for Staging and Movement on Site

Assumption: Transportation casks and transfer casks on the repository site provide adequate protection against external hazards. **Rationale:** Functions of the transportation casks are credited to prevent or mitigate event sequences. The certification process for transportation casks under 10 CFR Part 71 [DIRS 171308] considers severe transportation accident conditions and conditions of normal transport. Transfer casks are expected to be similar to transportation casks (BSC 2004 [DIRS 171161] Section 4.1.1.2). The precedent that licensed casks provide adequate protection against all hazards that apply during the transportation phase establishes the basis that transportation casks and transfer casks will provide adequate protection against external hazards on site at the repository.

5.1.2.4 Thermal Response of Waste-Handling Areas to a Loss of HVAC

Assumption: A design requirement will ensure that a loss of HVAC, including Surface Industrial and Surface Nuclear HVAC Systems, for up to 30 days in areas where SNF or HLW is handled or staged would not cause waste-form temperatures to exceed allowable limits. **Rationale:** Allowable temperature limits will be established for a loss of HVAC for up to 30 days (Assumption 5.1.1.45). Temperature limits are needed to ensure that a ventilation loss would not cause radiological releases in excess of those considered in the consequence analysis for normal operations. Time periods beyond 30 days need not be considered because ventilation can reliably be restored within that time by bringing in alternate sources of power or installing replacement parts.

5.1.2.5 Loss of Pool Water

Assumption: A design requirement will ensure that the pool and pool area in the remediation system are designed such that any lost water can be replaced with make-up water until the cause of the loss is corrected or waste forms are removed from the pool. The minimum available rate of make-up water shall be sufficient to replenish evaporation and the maximum potential leakage in the event of the failure of the recirculating cooling system over the minimum time period required to remove waste forms from the pool. The rate shall also be sufficient to prevent the uncovering of the waste forms over this same period. **Rationale:** This assumption is needed to prevent initiation of Category 1 or Category 2 event sequences due to malfunctions involving the water supply and recirculation system. Loss of pool inventory could be caused by gross pool leakage or pump out (or siphon loss caused by failure of the siphon breakers) due to a failure of the recirculating cooling system. Minor pool leakage would be made up by the make-up system or by operator action. Due to the large pool inventory and age of the CSNF assemblies (i.e., greater than 5 years), long times would be available to provide make-up water. The requirement is achievable because passive design features such as locating pool outlets near the top of the pool could be used to prevent rapid loss of water.

5.1.2.6 Prevention of Puncture of the Pool Liner

Assumption: Design and operational requirements will ensure that the remediation pool is designed with the appropriate impact-absorbing capability and limitations on heavy load carrying cranes to prevent loss of pool integrity, given a drop of the most challenging transportation cask or MSC into the pool. **Rationale:** The requirement is achievable because lift-height limits and passive design features such as impact-absorbing material lining the bottom of the pool could be used to prevent puncture of the liner.

5.1.2.7 Ash Fall

Assumption: A design requirement will ensure that the surface facilities, including the SNF Aging System, where SNF and HLW are handled or stored are designed to withstand the effects of ash fall from a regional volcanic eruption without loss of capability to perform their safety function (BSC 2004 [DIRS 167266], Section 6.4.53). **Rationale:** This assumption is needed to provide assurance in accordance with 10 CFR 63.102(f) [DIRS 158535] that ash fall will not initiate an event sequence. The roof live load requirement of 21 lb/ft² (BSC 2004 [DIRS 167266], Section 6.4.53) is achievable by design.

5.1.2.8 Not used

5.1.2.9 Inspection of Vent Paths of SNF Aging Casks

Assumption: An operational requirement will ensure that filters or natural circulation vent paths of SNF aging casks (including MSCs and HAMs) that could be clogged as a result of a sandstorm or other events or chronic conditions are inspected and maintained in an operable condition. Clogging found will be removed before the design basis thermal response of the casks are exceeded. **Rationale:** This assumption is needed to prevent Category 1 or Category 2 event sequences. These openings are inspected and maintained in an operable condition. The

requirement is achievable because similar operational and procedural directives are commonplace in installations that are comparable to the repository.

5.1.3 Assumptions Related to WPs

5.1.3.1 No Criticality in Sealed WP

Assumption: A design requirement will ensure that sealed WPs are designed such that drops, collisions, and other handling impacts within their design bases (allowing for rearrangement of container internals, proximity of other sealed waste packages, and without credit for burnup) cannot lead to a nuclear criticality. **Rationale:** This assumption is required to ensure criticality safety in sealed WPs. Loading restrictions based on burnup and enrichment provide defense in depth for preclosure safety. The requirement is achievable because moderator is excluded by maintaining the integrity of the WP.

5.1.3.2 No Criticality in Open WP

Assumption: A design requirement will ensure that WPs are designed such that, with credit for moderator control (Assumption 5.1.1.21) and without credit for burnup:

- WPs configured for CSNF can be loaded with any combination of CSNF assemblies that are acceptable for disposal without leading to a preclosure nuclear criticality.
- DOE codisposal WPs can be loaded with any combination of DOE canisters (including standardized DOE SNF canisters, MCOs, and HLW canisters) that will fit in the basket positions without leading to a preclosure nuclear criticality.
- Naval WPs can be loaded with a naval SNF canister without leading to a preclosure nuclear criticality.

The demonstration of criticality safety must account for the bowing of fuel rods or other rearrangement of fissile material that may occur due to a drop or other handling incident.

Rationale: This assumption is required to ensure criticality safety in unsealed WPs. Its purpose is to prevent preclosure criticality in WPs without reliance on loading restrictions based on burnup and enrichment.

5.1.3.3 Drop or Collision of Equipment onto a WP or Partially Sealed WP (Including WP with a Known Weld Defect)

Assumption: Operational requirements will establish lift-height limits for handling equipment and other equipment associated with the WP, including lifting collars (or trunnion collars), yokes, docking rings, and WP-closure equipment. The lift-height limits will ensure that the handling equipment will not breach a sealed WP if the equipment is dropped onto or collided into the WP from within the lift-height limit. Furthermore, the lift-height limits will be established such that a drop of equipment from within the lift-height limit will not breach a waste form if the WP inner lid is in place, but unsealed. An operational requirement will ensure that the inner lid, once set in place, is not removed from the WP except in a remediation situation.

Rationale: This assumption is needed to dispense with possible events with little potential to initiate an event sequence. The requirements are achievable because WPs are rugged containers and lifts of handling equipment high above the WP are not needed for operational reasons.

5.1.3.4 Not used

5.1.3.5 Not used

5.1.3.6 Fraction of WPs Requiring Remediation

Assumption: No more than 10 percent of WPs will require remediation in the Remediation Facility due to unsuccessful closure, handling incident, or other reason. **Rationale:** This assumption is needed to reduce the likelihood of breaches of DOE SNF canisters to Beyond Category 2 when unsealed WPs are dropped in the Remediation Facility. This assumption is achievable because a 10 percent rate of defective, damaged, or otherwise suspect WPs would be considered unacceptable with respect to repository operations. If such a rate were experienced, it is reasonable to believe that design or operational changes would be implemented to reduce the fractions processed through the dry remediation area to below 10 percent. Therefore, 10 percent is a bounding fraction for the categorization calculations.

5.1.3.7 Not used

5.1.3.8 Lift-Height Limit for WP on an Emplacement Pallet

Assumption: Design and operational requirements will ensure that WPs in horizontal orientation on the emplacement pallet will not be lifted such that the bottom of the pallet is higher than 6.5 ft (2.0 m) above an essentially unyielding surface. **Rationale:** This assumption is provided to avoid breaching the sealed WP. The requirement is achievable because the facility has been designed to accommodate the maximum lift height for WPs (Assumption 5.1.3.12).

5.1.3.9 Lift-Height Limit for Sealed WP in Vertical Orientation

Assumption: Design and operational requirements will ensure that sealed WPs in vertical orientation will not be lifted higher than 3.3 ft (1.0 m) (for naval long WP) or 6.5 ft (2.0 m) (for other WPs) above an essentially unyielding surface (as measured from the bottom of the WP). The heights may be exceeded where impact absorption by crush pads or other features is credited. The crush pads shall limit the impact energy for a dropped WP to be less than or equal to the impact energy associated with a dropped WP on an unyielding surface from the maximum specified drop height. **Rationale:** This assumption is needed to prevent breaching the sealed WP. The requirement is achievable because the design may either meet the maximum lift heights for WPs (Assumption 5.1.3.12) or provide a means of impact absorption, such as crush pads, wherever the limits cannot be met. Analyses will confirm that sealed WPs will withstand drops onto energy absorbing crush pads without breaching.

5.1.3.10 Impact or Collision of Trunnion Collar Removal Machine, WP Turntable, or WP Tilting Machine with WP Will Not Breach WP

Assumption: A design or operational requirement will ensure that an impact or collision between the trunnion collar removal machine, WP turntable, or WP tilting machine and a WP will not breach the WP or cause it to fall off the emplacement pallet. **Rationale:** This assumption is needed to dispense with a low-energy collision event that will not initiate an event

sequence. The requirement is achievable because the speed of the trunnion collar removal machine and the WP turntable can be limited to preclude waste-package breach.

5.1.3.11 Dropped Unsealed WP Does Not Spill its Contents

Assumption: A design requirement will ensure that an unsealed WP that is dropped onto an essentially unyielding surface from within its lift-height limits (Assumption 5.1.1.52) will not spill its contents. **Rationale:** This assumption is needed to prevent a reconfiguration of fissile material that is unanalyzed in the criticality safety calculations and to prevent fuel damage that is not consistent with the radiological source terms to be used in the consequence calculations. The requirement is achievable because installation of the inner lid and spread ring, possibly with auxiliary measures such as a mechanical locking fixture, could keep the contents in place when the waste package is unsealed.

5.1.3.12 Design Requirements for WP Drops and Tipover

Assumption: Design requirements will ensure that WPs (except as noted) will withstand without breaching the following drops:

- Free drop of 7.8 ft (2.4 m) onto a horizontal surface from horizontal orientation. (trunnion collars installed)
- Free drop of 6.5 ft (2.0 m) onto a horizontal surface from vertical orientation. The height limit for the naval long WP is 3.3 ft (1.0 m). (trunnion collars installed)
- Free drop of WP and emplacement pallet onto a horizontal surface from horizontal orientation with the initial condition that the bottom of the emplacement pallet is 6.5 ft (2.0 m) above the horizontal surface. (trunnion collars not installed)
- Tipover onto a horizontal surface from a 6.5 ft (2.0 m) elevated surface. The height limit for the naval long WP is 1.6 ft (0.5 m). (trunnion collars installed)
- Tipover during placement onto the tilting machine, including contact with trunnion cradles or the floor. (trunnion collars installed)

Drop and tipover event sequences are evaluated for the most damaging credible, conditions including initial orientation and weight of contents. An unyielding, flat horizontal surface may be used to bound consequences of an event, or credible countermeasures may be used to mitigate consequences of a drop. Drops include attendant swingdown or slapdown from the indicated orientation.

Rationale: The requirement to survive a slapdown into the tilting machine is achievable because design of tilting machine can be made to accommodate the event without breaching the WP. The other requirements are achievable because these events are considered in the design of the WP (BSC 2004 [DIRS 172035], Section 3). See Section 5.1.1.53 for backward slapdowns.

5.1.4 Assumptions Related to the DTF (Excluding Remediation and DPC Cutting)

5.1.4.1 Preclusion of Contact Between CSNF Assemblies and Staged Canisters

Assumption: An operational requirement will preclude contact between a CSNF assembly and a staged canister. **Rationale:** This assumption is credited to avoid the need to consider the consequences of dropping a CSNF assembly into a canister staging rack. The requirement is achievable because some means of preventing contact, such as limiting the range of motion of the spent fuel transfer machine or requirements to cover staging tubes, can be used.

5.1.4.2 Criticality Safety for Dry CSNF Assembly Staging Racks (Normal Operation)

Assumption: A design requirement will ensure criticality safety for CSNF assembly staging racks loaded to capacity with the most reactive CSNF assembly accepted at the repository with moderator control in effect. **Rationale:** The requirement is achievable because CSNF assemblies are designed for water-cooled reactors in which water is essential to achieve criticality. Criticality calculations will determine which features, if any, of the rack design are required to maintain criticality safety with moderator control in effect.

5.1.4.3 Criticality Safety for Dry CSNF Assembly Staging Racks (Given a Drop)

Assumption: A design requirement will ensure criticality safety for CSNF assemblies dropped into or onto a CSNF assembly staging rack with moderator control in effect. **Rationale:** The requirement is achievable because CSNF assemblies are designed for water-cooled reactors in which water is essential to achieve criticality. Criticality calculations will determine which features, if any, of the rack design are required to maintain criticality safety for dropped fuel elements with moderator control in effect.

5.1.4.4 No Lifting Canisters Above Staged CSNF Assemblies

Assumption: An operational requirement will prohibit carrying DOE HLW canisters or DOE SNF canisters over or near the staging racks for CSNF. **Rationale:** This assumption is needed to avoid having to consider the consequences of drops or collisions of canisters into the CSNF assembly staging racks. The requirement is achievable because there is no operational need to carry canisters over the staging racks for CSNF.

5.1.5 Assumptions Related to Remediation and DPC Cutting

5.1.5.1 Limits on the Range of Motion of the Remediation-Pool Crane

Assumption: An operational requirement will prohibit carrying a cask or MSC over or near the CSNF assembly staging rack in the pool. **Rationale:** This assumption is credited to prevent the need to consider the consequences of dropping a cask or MSC onto the CSNF assembly staging rack. The requirement is achievable because there is no operational need to carry casks or MSCs over or near the CSNF assembly staging rack.

5.1.5.2 WP Lid-Cutting Machine Does Not Cause Radiological Release from the Unsealed WP

Assumption: The lid-cutting machine shall be designed to preclude a radiological release due to damage inflicted upon the WP contents during the lid-cutting process. **Rationale:** This assumption is needed to dispense with identified events that may occur but have little potential to initiate an event sequence. The requirement is achievable because there is no operational need to lift the cutting machine above the WP, because the inner lid protects the contents of the WP, and because passive restraints on the range of motion of the cutting surfaces can be provided.

5.1.5.3 DPC Survives Drop of Canister Cutting Machine

Assumption: A design requirement will ensure that the mass, potential drop height, and other characteristics of the canister cutting machine are such that the DPC lid will prevent damage to the CSNF assembly resulting in a radiological release should the cutting machine fall onto or make contact with the DPC. **Rationale:** This assumption is needed to ensure that collision events involving the cutting machine will not initiate an event sequence. The requirement is achievable because the DPC lid will protect the waste from damage that could result in a radiological release.

5.1.5.4 Canister Cutting Machine Does Not Cause a Radiological Release as a Result of Damage to the Contents of a DPC

Assumption: The canister cutting machine shall be designed to preclude a radiological release due to damage inflicted upon the DPC contents during the cutting process. **Rationale:** This requirement is needed to preclude an unlikely event that could lead to a radiological release. It is achievable because the cutting surfaces can be limited in size such that they cannot penetrate far enough into the DPC to contact fuel assemblies.

5.1.5.5 Drop or Collision of Canister Cutting Machine

Assumption: An operational requirement will ensure that the canister cutting machine is not suspended over the open DPC after the lid is removed. **Rationale:** This assumption is needed to dispense with an identified event that may occur but has little potential to initiate an event sequence. The requirement is achievable because there is no operational need to suspend the cutting machine above the open DPC after the lid is removed.

5.1.5.6 Characteristics of Lid-Bolt Detorque Machine in the Remediation Area

Assumption: An operational requirement is assumed to ensure that the lift heights permitted for the lid-bolt detorque machines in the dry-handling cell and the pool area are such that the lid of the transportation cask or MSC (without credit for the bolts) will be able to prevent damage to the waste form resulting in a radiological release should the detorque machine fall onto or collide with the transportation cask. **Rationale:** This assumption is needed to dispense with an identified event that may occur but has little potential to initiate an event sequence. The requirement is achievable because the detorque machine is not a massive structure that could cause a deformation of the inner lid.

5.1.5.7 Drop or Collision of an Empty CSNF Assembly Basket or Basket Grapple into or Against a Loaded Cask in the Pool

Assumption: Operational requirements will ensure that a CSNF assembly basket or basket grapple dropped or collided against another basket or a cask in the pool will not damage CSNF assemblies in the basket or cask already in place. **Rationale:** This assumption is needed to limit the material at risk from a dropped basket to the contents of the dropped basket. The requirements are achievable because operational rules can be used to avoid the configurations from which the postulated events could occur.

5.1.5.8 Criticality Safety for Baskets on Trolleys in Dry Remediation

Assumption: An operational requirement will establish limited lift heights of heavy equipment above a CSNF assembly, a DOE SNF or HLW canister, or a DPC in a fuel basket on a trolley in the dry remediation area such that criticality as the result of equipment drop is precluded with moderator control (Assumption 5.1.1.21) in effect. **Rationale:** Design analysis will demonstrate criticality safety for fuel reconfigurations that could result from drops from the established lift heights. The requirement is achievable because moderator control will preclude criticality.

5.1.5.9 Criticality Safety for CSNF Assembly Baskets and Staging Racks in the Pool

Assumption: Design and operational requirements will ensure that:

- Fully loaded baskets in staging racks are designed to be subcritical when fully flooded with pure water (i.e., no credit for neutron absorbers dissolved in the water)
- Baskets are designed to have sufficient nuclear criticality controls to remain subcritical even if a handling incident causes a reconfiguration of the spent fuel.
- Baskets are closed during handling. A closed basket being transferred in the pool will not spill CSNF assemblies into the pool if the basket is dropped.

Rationale: This assumption is needed to ensure criticality safety in case of handling incidents in the pool. Design analysis will evaluate the criticality potential of baskets with variations in fuel assembly pitch that could be caused by handling incidents. The design of baskets or racks will provide geometry and neutron absorber to maintain subcritical conditions. The closure

mechanism for the basket can be made to prevent CSNF assemblies sliding out if the basket is dropped.

5.1.5.10 Quenching Operations for Casks and MSCs

Assumption: An operational requirement will ensure that quenching operations involving casks or MSCs holding CSNF are conducted to prevent radiological releases due to induced thermal stresses or steam explosion due to insufficient cooling. **Rationale:** This assumption is required to dispense with event sequences that pose little risk of initiating an event sequence. The requirement is achievable because quenching can be performed gradually such that it will not result in a loss of integrity.

5.1.6 Assumptions Related to the CHF

5.1.6.1 Shield Plugs for Canister Staging Pits or Racks Do Not Fit into the Opening

Assumption: A design requirement will ensure that the shield plugs for the canister staging pits or racks will not fit far enough into the opening to breach a canister inside if the shield plug is dropped. **Rationale:** This assumption is needed to dispense with incidents with little potential to initiate an event sequence. The requirement is achievable because tapering the plug and the hole can ensure that the plug will not fit through the opening.

5.1.6.2 Loaded WP not Carried Over a Loaded MSC/WP Loading Pit

Assumption: An operational requirement will ensure that a loaded WP is not carried over or near a loaded MSC/WP loading pit. **Rationale:** This assumption is needed to dispense with an incident that could occur but can be rendered Beyond Category 2 by an operational requirement. It is achievable because there is no operational need to carry a WP over a loaded pit. Controls can be implemented to establish appropriate load paths for loaded WPs.

5.1.6.3 Replacement of Waste-Package and MSC Pit Covers

Assumption: An operational requirement will ensure that covers for the waste-package and MSC pits are replaced whenever individual waste-form handling operations are suspended unless loading operation in that particular pit is complete and the next operation involving the overhead crane is to remove the WP or MSC from the pit. **Rationale:** This assumption is needed to dispense with potential events that could occur but can be rendered Beyond Category 2 by operational requirements. The requirement is achievable because there is no operational need to keep pits open while moving loaded WPs.

5.1.6.4 WP Trolley Kept in Positioning Cell When Opposite Trolley Is Out of Its Positioning Cell

Assumption: An operational requirement will ensure that, whenever a waste-package is being loaded onto a trolley or is already on the trolley but not in the WP positioning cell, the opposite waste-package trolley remains in its positioning cell or otherwise out of the way. **Rationale:** This assumption is needed to dispense with potential events that could occur but can be rendered Beyond Category 2 by an operational requirement. The requirement is achievable because there is no operational need to have a loaded trolley present while loading the trolley from the other cell.

5.1.6.5 Not used

5.1.6.6 Sturdy Waste-Package and MSC Pit Covers

Assumption: A design requirement will ensure that pit covers for the waste-package and MSC pits are sturdy enough to prevent a WP or MSC that is dropped onto the pit cover from penetrating the pit cover and falling into the pit. **Rationale:** This assumption is needed to dispense with potential events that could occur but can be rendered Beyond Category 2 by design and operational requirements. The requirement is achievable by designing thick pit covers.

5.1.7 Assumptions Related to the WP Transporter

5.1.7.1 Vehicle Crossings of the Railway Used by WP Transporter

Assumption: An operational requirement will ensure that vehicle crossings of the railway will be controlled to ensure that the potential for collisions between vehicles and the WP transporter carrying a loaded WP is minimized. **Rationale:** It is reasonable to expect that enforceable rules for use of the roads will ensure that the potential for a surface vehicle to hit a loaded transporter in a manner such that a waste package breach may occur is Beyond Category 2.

5.1.7.2 Speed Limitations on Transporter Shielded Enclosure Doors

Assumption: A design requirement will ensure that movement of the transporter shielded enclosure doors will not breach the WP or cause it to fall from the bedplate of the transporter. **Rationale:** This assumption is needed to dispense with incidents with little potential to initiate an event sequence. The requirement is achievable by, for example, limiting the power of the engine that closes the doors.

5.1.7.3 No WP Breach in Case of Derailment or Collision Involving Transporter (excluding Tipover)

Assumption: A design requirement will ensure that the WP transporter transports the WP in a manner such that if a collision or derailment (excluding tipover) occurs, the WP impact energy will be low enough to preclude a WP breach. This translates into a maximum transporter speed of 15 mph. **Rationale:** This assumption is needed to limit the severity of potential derailments and collisions in which the WP transporter can be involved. The reliability analysis performed in *Waste Package Transporter Preclosure Safety Analysis* (BSC 2004 [DIRS 169554]) shows that it is possible to effectively prevent the transporter from exceeding allowable speeds. Limiting speed limits the impact energy of the WP in case of a derailment or a collision. The maximum speed value (15 mph) is based on Anderson (2005 [DIRS 172857]).

5.1.7.4 Prevention of WP Ejection from Transporter

Assumption: The restraints used to immobilize the bedplate inside the shielded compartment of the transporter and the mechanism for locking the doors of the shielded compartment shall withstand a collision or derailment (including tipover) of the transporter without resulting in a Category 1 or Category 2 event sequence. **Rationale:** This assumption is needed to ensure that a collision or derailment (including tipover) of the transporter will not cause the WP to be ejected out of the transporter. The requirement is achievable because credible derailments or collisions occur at a speed below the maximum allowable speed. Limiting speed limits the severity of potential impacts, which the bedplate restraints and door locking mechanisms can be designed to withstand without failing.

5.1.7.5 Average Time Spent Underground by Transporter Carrying WP inside Shielded Compartment

Assumption: An operating requirement will ensure that the average time during which the transporter carrying the WP inside the shielded compartment is underground does not exceed 6

hours per WP. **Rationale:** This assumption is used in the probability calculation of the mass of the bounding rockfall that could hit the shielded compartment of the transporter (Section 6.3.6.1.9). The 6-hour duration is based on a conservative evaluation given in BSC (2004 [DIRS 168508], Section 6.3.1), and yields an upper average value for the time spent by the transporter carrying the WP underground. The assumption therefore appears to be reasonable. Should, in practice, the average duration prove to exceed 6 hours, the bounding mass of the credible rockfalls that can impact the shielded compartment of the transporter would need to be re-evaluated.

5.1.7.6 Prevention of Spurious or Operator-Induced Opening of Shielded Compartment

Assumption: Spurious or operator-induced opening of the WP shielded compartment followed by a bedplate roll-out shall be precluded when the transporter is in motion. **Rationale:** This assumption is used to prevent unfolding of scenarios where the WP carried by the transporter can be ejected out of the shielded compartment. The evaluation performed in Section 6.3.6.1.12 shows that this requirement is achievable, for example, by using protection signals.

5.1.7.7 No WP Breach in Case of Derailment or Collision Involving Transporter and Causing a Tipover

Assumption: A design requirement will ensure that the WP transporter transports the WP in a manner such that if a collision or derailment leading to a transporter tipover occurs, the WP impact energy will be low enough to preclude a WP breach. **Rationale:** This assumption is needed to limit the severity of tipover events in which the WP transporter might be involved. The WP transporter may be designed such that in case of a collision or derailment resulting in a tipover, the maximum drop height of the WP will be limited to allowable heights.

5.1.8 Assumptions Related to the WP Emplacement Gantry, Drip Shield Emplacement Gantry, and Emplacement Drifts

5.1.8.1 Drop rate for WP Emplacement Gantry

Assumption: Design and operational requirements on the WP Emplacement Gantry will ensure that the drop rate is less than or equal to 10^{-5} drops/transfer. Handling incidents are included regardless of cause; they may be caused by equipment failure, human error, or some combination of the two. **Rationale:** No operating experience of the emplacement gantry is available at this time. However, the emplacement gantry can be made by design as reliable as the cranes that handle waste forms, for which a failure rate of 10^{-5} drops/transfer is used, based on Assumption 5.1.1.10.

5.1.8.2 Average Exposure Time for WP Transit from Transporter Bedplate to Emplacement Drift Entrance

Assumption: An operating requirement will ensure that the average exposure time of a WP transiting from the rolled out bedplate to the entrance of the emplacement drift does not exceed 4 hours. **Rationale:** This assumption is required to ensure that the event sequence where rockfalls in the emplacement drift turnouts cause the structural failure of the WP can be rendered Beyond Category 2. The value of 4 hours is supported by Attachment II.

5.1.8.3 Protection Against WP Emplacement Gantry Running Off the End of Emplacement Drift or Transfer Dock Rails

Assumption: A design requirement will ensure that the WP Emplacement Gantry, carrying a WP, is not capable of running off the end of the emplacement drift or transfer dock rails. **Rationale:** This assumption is needed to preclude scenarios that could challenge the structural integrity of the WP and result in a Category 1 or Category 2 event sequence. The analysis performed in Sections 6.3.6.1.16 and 6.3.6.1.17 shows that this requirement is achievable.

5.1.8.4 Not used

5.1.8.5 Not used

5.1.8.6 No WP Breach Following WP Emplacement Gantry Falling on Transporter

Assumption: Design and operational requirements will ensure that if the gantry were to fall on the transporter and impact the WP, it would not cause the WP to be breached. **Rationale:** This requirement is achievable because the shape of the gantry prevents it from breaching the WP. The gantry features a hollowed-out space big enough to surround the WP in order to lift it. The lift hooks that engage under the pallet overhangs ensure that the WP is properly positioned inside that hollowed-out space. The distance between the overhangs and the bottom of the pallet is around 46 cm (BSC 2003 [DIRS 165731]). Therefore, the drop height of the gantry will be less than this distance. A gantry falling on the transporter bedplate is not likely to impact the WP; if it does, the impact will not be enough to jeopardize its structural integrity.

5.1.8.7 Prevention of WP Breach Due to Collisions Involving the WP Emplacement Gantry

Assumption: A design requirement will ensure that the WP Emplacement Gantry will be limited in speed such that it cannot cause a waste-package breach in case of a collision. The maximum allowable speed of the gantry is 15 mph. **Rationale:** The maximum speed is based on Anderson (2005 [DIRS 172857]). The requirement is achievable because passive features can be used to limit speed.

5.1.8.8 Not used

5.1.8.9 Not used

5.1.8.10 Probability of Exceeding the WP Emplacement Gantry lift height limit

Assumption: Design and operational requirements for the WP Emplacement Gantry will ensure that the conditional probability of having exceeded the WP lift height limit given that a drop occurred, is 10^{-4} or less. **Rationale:** Where the lift height limit is credited in the analysis, this assumption is needed to calculate the number of drops in excess of the height limit. Stating the design requirement in this way allows for the possibility that exceeding the height limit and dropping a WP are not statistically independent. The requirement is achievable because passive safety features on the WP Emplacement Gantry and procedural controls can be used to drive the conditional probability into the required range.

5.1.9 Assumptions Related to the Transportation Cask Receipt and Return Facility (TCRRF)

5.1.9.1 Lift-Height Limits for Transportation Casks With Impact Limiters and Transfer Casks With Impact Limiters

Assumption: A design requirement will ensure that cranes for lifting transportation casks with impact limiters and transfer casks with impact limiters are not capable of lifting a cask more than 30 ft (9 m) above the floor. **Rationale:** Transportation casks with impact limiters are designed and tested to withstand, without breaching, a 30-ft drop onto an unyielding surface (Section 4.2.1). Transfer casks are similar to transportation casks (BSC 2005 [DIRS 171161] Section 4.1.1.2). This assumption is needed to preclude Category 1 or Category 2 event sequences that breach DOE SNF canisters that may be inside the cask. The requirement is achievable because there is no operational need to lift casks higher than 30 ft.

5.1.10 Assumptions Related to Construction

5.1.10.1 Isolation of Construction and Operations

Assumption: Operational requirements will ensure that construction operations are sufficiently isolated from surface and subsurface repository operations to preclude interactions with waste receipt, handling, emplacement, or retrieval operations. **Rationale:** This assumption is needed to prevent potential hazards that are not considered in detail in this analysis. The requirements

are achievable because it is common practice to isolate construction activities for the protection of other activities nearby.

5.2 ASSUMPTIONS THAT ESTABLISH INPUTS

5.2.1 General Assumptions

5.2.1.1 Number of Times Each Individual Fuel Assembly Is Transferred in the DTF or FHF

Assumption: Each CSNF assembly is transferred up to four times. **Rationale:** An assembly could be transferred as many as four times as follows:

1. From the transportation cask and placed in a staging rack in the shielded waste transfer cell
2. From the staging rack to an MSC to be aged in the SNF Aging System
3. After aging, from the MSC to a staging rack in the shielded waste transfer cell; and, finally
4. From the staging rack to a WP.

The FHF has no staging racks, but assemblies may be staged in MSCs, so the number of transfers there is limited to two. In the DTF, one or both of the trips to the staging rack or the trip to the SNF Aging System could be skipped, resulting in anywhere from one to three transfers per assembly. To avoid placing restrictions on operations in the DTF, four transfers per assembly are assumed. This is a conservative assumption that bounds the actual number of transfers per CSNF assembly.

5.2.1.2 Average Number of Times a DOE, Naval, or DPC Canister is Transferred

Assumption: Canisters, including DOE, naval, and DPC canisters, are transferred an average of two times. **Rationale:** With both staging and aging, DOE canisters, like CSNF assemblies (Assumption 5.2.1.1), could be transferred up to four times. However, thermal management is not required for DOE canisters, so aging is not required. HLW canisters, which come five to a cask (Assumption 5.2.1.13), presumably will normally be transferred directly to a WP, which also holds five canisters (Section 4.1.1). Staging will often, but not always, be required for standardized DOE SNF canisters because each codisposal waste package can only hold one standardized canister. Neither MCOs nor naval canisters will be staged (Assumption 5.2.1.20). Therefore, it is conservative to assume that each DOE canister will go to a staging rack, which makes two transfers for each DOE canister. In the usual case, DPCs are transferred once in the DTF (from the cask to the cutting station) and again after being cut open. In the less common case, DPCs may be handled initially in the CHF or FHF. In that case, they will undergo an additional transfer (to an MSC before being sent to the aging pad). Therefore, the average number of transfers will be close to two for DPCs. The assumption is conservative for naval canisters and MCOs because they will not be staged or aged (Assumption 5.2.1.20). Assuming an average of two transfers per canister is more accurate than assuming four transfers, but still conservative.

5.2.1.3 Number of CSNF Assemblies Breached By Drops and Collisions of Individual Assemblies

Assumption: Two assemblies are breached by an assembly drop; one assembly is breached by an assembly collision. **Rationale:** A collision would affect the assembly being moved and the other object involved in the collision. Because only one assembly is moved at a time in a given waste transfer cell, only one assembly would be affected by a collision. For the event sequences initiated by dropping an assembly, the location of the drop determines the number of assemblies affected. If the drop occurs over the waste transfer cell floor, only one assembly would be affected. A drop into a cask, WP, or staging rack could affect one or more assemblies. One assembly would be affected if the assembly location of the drop were into an empty basket position. Two assemblies could be affected if the location of the drop were a basket position that is occupied by another assembly. This assumption requires further verification (TBV-7105).

5.2.1.4 Inventory of CSNF Assemblies

Assumption: The number of CSNF assemblies received over the lifetime of the repository is assumed to be 221,000. **Rationale:** The assumed number is rounded up from the number calculated from the information in Section 4.1.1 as presented in Table 5 (220,810).

Table 5. Number of CSNF Assemblies

WP Configuration	Number of Assemblies Per WP	Number of WPs	Number of Assemblies
21 PWR Absorber Plate	21	4,299	90,279
21 PWR Control Rod	21	95	1,995
12 PWR Absorber Plate Long	12	163	1,956
44 BWR Absorber Plate	44	2,831	124,564
24 BWR Absorber Plate	24	84	2,016
Sum			220,810

NOTE: Column 4 is calculated as the product of Columns 2 and 3.

5.2.1.5 Inventory of DOE SNF canisters

Assumption: The number of standardized DOE SNF canisters received over the lifetime of the repository is nominally 3,203. **Rationale:** This number is derived as follows from Section 4.1.1. Each of the DOE SNF WP configurations, except the MCO configuration, contains a single DOE SNF canister. Leaving out the MCOs, there are 1,403 that contain five short HLW canisters and one short standardized DOE SNF canister, 1,608 that contain five long HLW canisters and one long standardized DOE SNF canister, and 192 that contain three long HLW canisters and one standardized wide DOE SNF canister, for a total of 3,203 standardized DOE SNF canisters.

5.2.1.6 Receipt of DOE MCO canisters

Assumption: The number of DOE MCO canisters received over the lifetime of the repository is nominally 404. **Rationale:** This assumption is derived as follows from Section 4.1.1. There are nominally 202 MCO WPs, each containing two MCOs, for a total of 404 MCOs.

5.2.1.7 Receipt of CSNF casks

Assumption: The number of CSNF cask shipments received is nominally 9,508; these are divided among bare CSNF assembly shipments and DPC shipments with one DPC per cask.

Rationale: This number is the sum from *2002 Operational Waste Stream Assumptions* (BSC 2002 [DIRS 162182], Table 5-2) of the number of CSNF truck shipments, 2,271; the number of bare CSNF rail shipments, 6,768; and the number of DPC rail shipments, 469.

5.2.1.8 Receipt of HLW Canisters

Assumption: The total number of HLW canisters received over the lifetime of the repository is nominally 16,070. **Rationale:** This assumption is derived as follows from Section 4.1.1. There are 1,403 waste packages that each contain five short HLW canisters and one short standardized DOE SNF canister, 1,608 that contain five long HLW canisters and one long standardized DOE SNF canister, 192 that contain three long HLW canisters and one standardized wide DOE SNF canister, 7 that contain five HLW canisters and no DOE SNF canisters, and 202 that contain two HLW canisters and two MCOs. This gives 16,070 HLW canisters.

5.2.1.9 Receipt of Naval SNF Canisters

Assumption: The total number of naval SNF canisters received over the lifetime of the repository is nominally assumed to be 300. **Rationale:** This number is the sum of 144 short naval WPs plus 156 long naval WPs, each of which contains one naval canister (Section 4.1.1).

5.2.1.10 Receipt of Transportation Casks

Assumption: The number of transportation-cask receipts is assumed to be 13,479. **Rationale:** This number is the sum of the numbers of casks from the various types as presented in Section 6.3. The number bounds 12,041, which is given in *2002 Operational Waste Stream Assumptions* (BSC 2002 [DIRS 162182], Table 5-2).

5.2.1.11 One Assembly Breached by Dropped Handling Equipment from the Spent Fuel Transfer Machine

Assumption: A drop of handling equipment from a spent fuel transfer machine or fuel handling machine would not breach more than one CSNF assembly. **Rationale:** The grapples on the spent fuel transfer machine and fuel handling machine are not massive structures that could breach more than one assembly. In fact, the damage done to the assembly affected by a drop would probably be less than would occur from a drop of the assembly itself.

5.2.1.12 Not used.

5.2.1.13 Capacities of Transportation Casks for Naval SNF and DOE Owned Waste

Assumption: Capacities of rail-based transportation casks for DOE owned waste are assumed as follows:

• HLW canisters	5 canisters shipped together per cask
• Standardized DOE SNF canisters:	9 canisters shipped together per cask
• DOE MCO canisters	4 canisters shipped together per cask
• Naval canisters	1 per cask

Rationale: These are the assumptions made for transportation casks in *2002 Operational Waste Stream Assumptions* (BSC 2002 [DIRS 162182], Section 4.2). The capacities for DOE waste are different for truck and rail casks. Because rail is expected to be the dominant mode of transportation to the repository, this assumption pertains to rail-based casks. If truck casks are used, the capacities would be smaller and the required number of shipments greater. The uncertainty in the capacity of transportation casks is not addressed directly but is addressed by the factor of conservatism presented in Section 6.1.4.

5.2.1.14 Fraction of Fuel Assemblies Requiring Individual Canisterization

Assumption: No more than 1 percent of bare fuel assemblies will arrive so severely damaged that they must be canisterized. **Rationale:** Because the categorization results (Section 6.3.1.15) are insensitive to the precise value of this number, it is adequate for its intended purpose.

5.2.1.15 Not used

5.2.1.16 Not used

5.2.1.17 Not used

5.2.1.18 Not used

5.2.1.19 Criticality Safety for HLW Canisters

Assumption: The fissile content of HLW canisters is such that there is no potential for criticality. **Rationale:** HLW is the waste product from processes that remove fissile components from spent nuclear fuel. Therefore, HLW canisters do not contain sufficient quantities of fissile material to pose a risk of criticality.

5.2.1.20 Staging and Aging of Canisters

Assumption: Neither naval canisters nor MCOs will be staged in staging racks or MSCs or placed on the aging pads. They will be transferred directly from a transportation cask into a WP. The analysis assumes that standardized DOE SNF canisters and HLW canisters may be staged at an aging pad. **Rationale:** Staging of the naval canister is not needed because there is one

canister per cask and one canister per WP. Thermal management does not require aging of DOE MCO canisters. Although thermal management is not required for standardized DOE SNF canisters or HLW canisters, they may occasionally be staged on aging pads for throughput management.

5.2.2 Assumptions Related to External Hazards

5.2.2.1 Frequency of Loss of Offsite Power

Assumption: Loss of offsite power occurs at a frequency of 0.1 time per year. **Rationale:** This assumption is needed for estimating the availability of the HVAC system in the primary and secondary confinement areas of the DTF and FHF. This frequency value is based on the following assessment.

EPRI (2002 [DIRS 168640], p. 1-2) analyzed the operating experience for losses of offsite power at U.S. nuclear power plants over the 1990 through 2001 period and gives a range of 0.03 to 0.04 loss per generating unit year. More precisely, a best estimate value of 0.031 loss per generating unit year (national average) is found (EPRI 2002 [DIRS 168640], p. 1-1). This frequency accounts for a true unavailability of offsite power, which means that no alternate offsite source of power is available.

Other events occur at nuclear power plants that are in some way related to loss of offsite power. These events are also considered by EPRI (2002 [DIRS 168640], p. 2-3) and include:

1. Loss of offsite power but the main generator remains connected and the plant receives power from the unit transformer. This class of event should also be counted in the frequency of total loss of offsite power at the repository (since the function of the repository is not to generate its own energy). The corresponding frequency is evaluated at 0.013 loss per generating unit year (EPRI 2002 [DIRS 168640], Table 2-5).
2. Unit trips but offsite power remains available. These events are not relevant to the repository.
3. Off-site power loss occurs during cold shutdown as a result of shutdown testing and maintenance operations that are not representative of what would occur during normal operations (i.e., when the unit generates power). This class of event is not relevant to the repository.

Therefore, the total frequency of loss of offsite power, resulting from events applicable to the repository, does not exceed $0.031 + 0.013 = 0.044$ losses per generating unit year.

A greater frequency of loss of offsite power equal to 0.1 loss per year is assumed for the repository. The reason for this is that the frequency of 0.044 loss per generating unit year found previously accounts for outages due to weather conditions typical of the eastern seaboard, that are not expected in the area near the repository. In Table 2-9 of EPRI (2002 [DIRS 168640]), 13 weather-related losses of offsite power occurred in 1271.2 generating unit years, which translates in a frequency of 0.01 loss per generating unit year. Of these 13 events, 4 lasted more than 4 hours and occurred at plants on the eastern seaboard (EPRI 2002 [DIRS 168640], p. 2-18). This means that in the total frequency of 0.044 loss per generating unit year, the contributive frequency of $4/1271.2=0.003$ loss per generating year is not relevant for the repository. This yields an adjusted frequency of $0.044-0.003=0.041$ loss per generating unit year. The frequency of 0.1 loss per year used for the repository is more than 2.4 times greater than this value.

Further information on the frequency of loss of offsite power is found in NUREG-1784 (Raughley and Lanik 2003 [DIRS 172451]). In that study, loss of offsite power events at U.S. nuclear power plants are not defined in the same way as in the EPRI report. Events that involve a degradation of the grid condition, including plant-centered conditions such as a turbine trip resulting in the plant disconnecting from the grid and a grid voltage decrease, are considered as grid-related loss of offsite power events (Raughley and Lanik 2003 [DIRS 172451], p. 10). Also, events that do not result in a reactor trip are not considered as loss of offsite power events (Raughley and Lanik 2003 [DIRS 172451], p. 10). Finally, the operating experience gained from U.S. nuclear power plants is investigated for two phases: from 1994 to 1996 (period before deregulation of the electrical industry), and from 1997 to 2001 (period after deregulation of the electrical industry). For all these reasons, the calculated frequency of loss of offsite power is not the same as that of the EPRI report. Namely, a frequency of 0.05 loss of offsite power per reactor year is found for the period 1994 to 1996, and a frequency of 0.014 loss of offsite power per reactor year is found for the period 1997 to 2001 (Raughley and Lanik 2003 [DIRS 172451], Table 2). In comparison, the value of 0.1 loss of offsite power per year used at the repository is greater by a factor 2 and a factor 7.1 respectively.

It is recognized that the repository is not a nuclear power plant. Therefore, the frequencies of loss of offsite power obtained from operating experience at U.S. nuclear power plants are not directly applicable to the repository. Nonetheless, based on the previous assessment, it can be concluded that the frequency of 0.1 loss of offsite power per year is achievable. It is expected that the grid at the repository will have such a reliability. This assumption, however, needs to be verified (TBV-7100).

5.2.3 Assumptions Related to Remediation

5.2.3.1 Fraction of Waste Forms Subject to Dry Remediation

Assumption: No more than 10 percent of the SNF and HLW to be emplaced is subject to dry remediation. **Rationale:** This assumption is needed to assess drops and collisions of CSNF assemblies in the DPC cutting/WP dry remediation cell. The normal process of DPC cutting is not covered by this assumption. The handling of CSNF assemblies in the DPC cutting/WP dry remediation cell is not a normal part of the processing stream. Waste may be transferred from defective, damaged, or otherwise suspect MSCs, casks, or WPs. Only a small fraction of the waste to be emplaced requires remediation. A 10 percent rate of defective, damaged, or otherwise suspect casks or WPs would be considered unacceptable with respect to operational safety. If such a rate were experienced, it is reasonable to believe that design or operational changes would be implemented to reduce the fraction processed through the dry remediation area to below 10 percent. Therefore, 10 percent is a bounding fraction for the categorization calculations.

5.2.3.2 Fraction of Waste Forms Handled in the DTF Cask Wet Remediation/Laydown Area

Assumption: No more than 10 percent of the waste inventory is handled in the cask wet remediation/laydown area. For casks, 10 percent of the total number of transportation cask receipts and an equal number of MSCs will be handled. **Rationale:** Remediation is not a normal

part of the processing stream. It is reasonable to suppose that a 10 percent remediation rate would be viewed as unacceptable and that the processing operations would be investigated and improved to reduce the remediation rate. Therefore, 10 percent is a bounding fraction for the categorization calculations.

5.2.3.3 Capacity of CSNF Assembly Basket in the Remediation Pool

Assumption: The capacity of the CSNF assembly basket in the remediation pool will be sixteen BWR assemblies or nine PWR assemblies. **Rationale:** The baskets are designed to hold the stated numbers of assemblies per basket (Cogema 2003 [DIRS 167153]). For the calculations that determine the category of the event sequences, CSNF assemblies are treated generically. The lower number is conservative for categorization because it implies a greater number of basket movements. The higher number is conservative when stating material at risk because it provides a higher source term.

5.2.3.4 Number of Crane Transfers Required After WP Closure To Transfer a WP to the DPC Cutting/WP Dry Remediation Cell and Then to the Transfer Trolley

Assumption: Three crane transfers are assumed to be required after welding to transfer a WP to the DPC cutting/WP remediation cell and, after cutting, to the trolley. **Rationale:** This number is consistent with the internal hazards analysis (BSC 2005 [DIRS 171428], Section 6.6.3.12).

5.2.4 Assumptions Related to the SNF Aging System

5.2.4.1 MSC Capacities are Similar to Transportation Cask Capacities

Assumption: It is assumed that MSCs may be loaded with up to five HLW canisters and that the CSNF capacities of MSCs and transportation casks are approximately the same, on average.

Rationale: MSCs hold approximately 10 MTHM of spent fuel (1,000 MTHM per unit divided by $80+20=100$ casks per unit [BSC 2004 {DIRS 171161}, Section 4.1.1.1]). The primary purpose of MSCs is to age CSNF. CSNF transportation casks hold on average 63,000 MTHM (Section 4.3.1) divided by 9,508 casks (Table 8), that is, about 7 MTHM. Thus, the capacity of MSCs is similar to that of transportation casks. Transportation casks are assumed to hold five HLW canisters (Assumption 5.2.1.13).

5.2.5 Assumptions Related to the WP Transporter

5.2.5.1 Human Error Probability for Premature Actuation of Bedplate Rollout Mechanism or Premature Transporter Departure

Assumption: The probability of the operator attempting to prematurely actuate the bedplate rollout mechanism is estimated at 0.01. The same value is used for the probability of the operator prematurely ordering the transporter to depart the emplacement drift transfer dock.

Rationale: This human error probability value is based on the estimate provided by Swain and Guttman (1983 [DIRS 139383], Table 20-6), to characterize the failure to use written operation procedures under normal operating conditions. The operator prematurely actuating the bedplate rollout mechanism or transporter departure are represented by the human error failure to use a written procedure, because the proper conduct of WP transporter operations will be described in a procedure that the operator will be required to follow. However, the transporter operations will also be monitored and controlled by the digital control and management information system (BSC 2004 [DIRS 171251], Table 2). Therefore, the operator will not have the latitude to initiate actions that could fall outside of the framework of normal operations, as easily as he or she could if only written procedures were used. Thus, the 0.01 probability considered in this assumption is conservative. As mentioned in Swain and Guttman (1983 [DIRS 139383], p. 2-18), the probabilities given for human errors represent median values of lognormal distributions. No conversion to the mean was done. This is because such a conversion would yield a probability value greater than 0.01. Making an adjustment to the mean is not useful for the preliminary scoping calculations performed in this analysis because the 0.01 probability value is already conservative.

5.2.5.2 Failure Rate of a Process Switch

Assumption: The spurious operation rate of a process switch used to control WP transport operations in the subsurface facilities is assumed to be in the order of magnitude of 10^{-6} per hour.

Rationale: This failure rate is based on the compilation by Eide and Calley (1993 [DIRS 146564], Table 2), which gathers a database of generic failure rates developed for light water reactor probabilistic risk assessments (Eide and Calley (1993 [DIRS 146564], Abstract). The controlled environment of nuclear power plants is deemed comparable to the conditions under which the transport operations of the WP will be carried out, thus the 10^{-6} order of magnitude for

the hourly failure rate of the process switch is considered to be adequate for use in the present calculation.

5.2.5.3 Failure Probability of a Speed Transducer

Assumption: The failure probability of a speed transducer used on the transporter carrying a WP is in the 10^{-5} order of magnitude. **Rationale:** Based on Eide and Calley (1993 [DIRS 146564], Table 2), the failure rate for a speed transducer is 1.0×10^{-6} per hour. This failure rate, which was initially developed for performing probabilistic risk assessments of nuclear power plants, is appropriate for evaluating the reliability of components operating in a strictly controlled environment such as that in which the WP transport operations will be performed. Based on that hourly failure rate, the failure probability of the speed transducer is estimated. To do that, it is necessary to know the mission time of the speed transducer. The architecture of the control system of the WP transporter is not known at this time, but it is reasonable to expect that the failure of a speed transducer could be identified. Therefore, the mission time for a speed transducer can be taken as the time during which the transporter carrying a WP travels underground. The time spent underground is conservatively estimated at six hours (BSC 2004 [DIRS 168508], Section 6.3.1). Consequently, the failure probability of a speed transducer can be evaluated at $6 \text{ h} \times 1.0 \times 10^{-6} \text{ per h} = 6.0 \times 10^{-6}$. Therefore, the 10^{-5} order of magnitude of this assumption is acceptable.

5.2.6 Assumptions Related to the Emplacement Gantry and Emplacement Drifts

5.2.6.1 Human Error Probability for Inadvertently Ordering the Gantry Carrying the WP Back to the Emplacement Drift Transfer Dock

Assumption: The probability of the operator inadvertently ordering the emplacement gantry carrying the WP back to the emplacement drift transfer dock is estimated at 0.01. **Rationale:** This human error probability value is the same as that used in Assumption 5.2.5.1, and is based on the probability of failing to follow a written procedure. The probability of an inadvertent actuation of a control may be more appropriately described by the operator selecting a wrong control on a panel from an array of similar-appearing controls, which Swain and Guttman (1983 [DIRS 139383], Table 20-12) assign a nominal probability of at most 0.003. Nevertheless, the 0.01 value was kept in the present assessment because it is used for a scoping evaluation and because it provides some conservatism.

5.2.6.2 Human Error Probability for Sending Improper Order to the Gantry

Assumption: The probability of the operator improperly ordering the gantry carrying the WP to go past the designated emplacement location of the WP is estimated at 0.01. **Rationale:** The rationale for this probability estimate is similar to that of Section 5.2.5.1. The operator error is represented by the failure to use a written procedure under normal operating conditions, which has a probability of 0.01 (Swain and Guttman 1983 [DIRS 139383], Table 20-6).

6 ANALYSIS

6.1 METHODS

6.1.1 Categorization Methods

6.1.1.1 Categorization of Event Sequences Based on Expected Number of Occurrences

Some event sequences may be categorized without considering the time span during which the event sequence may occur. Consider, for example, dropping an individual spent fuel assembly during a transfer from one container to another. To decide whether the event sequence meets the definition of Category 1 (Section 1), it is necessary to know whether one or more drops during the preclosure period of the repository are expected. If the expected number of drops per transfer is fixed and the number of transfers required is known, then the expected number of drops over the lifetime of the repository may be calculated without knowing the duration of operations. To be more precise, assume that x assemblies are to be accepted for disposal, the number of times each assembly must be transferred is y transfers/assembly, and the drop rate is z drops/transfer, then the total number of transfers is xy and the expected number of drops for the lifetime of the repository is xyz drops. If $xyz \geq 1$ the event is Category 1.

An event sequence that is not Category 1 may be Category 2. However, the definition of Category 2 (Section 1) depends on the probability of one or more events during the lifetime of the facility rather than the expected number of events. For example, the probability of dropping an assembly during a single transfer is equal to the expected number of drops per lift, z . Therefore, the probability that no drop occurs during a single transfer is $1 - z$. If each drop is independent of other drops, the probability that there are no drops for xy transfers (the total expected during the life of the facility) is $(1 - z)^{xy}$. Finally, the probability that there are one or more drops during the life of the facility is $1 - (1 - z)^{xy}$. An application of l'Hospital's rule (Mood et al. 1974 [DIRS 122506], Appendix A, Section 3.1) shows that the probability $1 - (1 - z)^{xy}$ is approximately equal to the expected number of drops, xyz , when $z \ll 1$. To show the approximate equality, apply l'Hospital's rule as follows.

$$\begin{aligned} \lim_{z \rightarrow 0} \frac{xyz}{1 - (1 - z)^{xy}} &= \lim_{z \rightarrow 0} \frac{\frac{d}{dz}(xyz)}{\frac{d}{dz}[1 - (1 - z)^{xy}]} \\ &= \lim_{z \rightarrow 0} \frac{xy}{xy(1 - z)^{xy-1}} \\ &= 1. \end{aligned}$$

Therefore, the following rules are used to categorize event sequences (M is the expected number of occurrences of an event sequence before permanent closure of the repository):

$M \geq 1$	Category 1
$10^{-4} \leq M < 1$	Category 2
$M < 10^{-4}$	Beyond Category 2.

In some cases, the expected number of occurrences of an event sequence is so low that the event sequence may be said to be prevented or precluded, without specifying or calculating an expected number of occurrences. A numerical interpretation of such claims is that the expected number of occurrences over the operational life of the facility is much less than 10^{-4} .

6.1.1.2 Categorization of Event Sequences Based on Frequency of Occurrence

For some events, it is convenient to categorize based on annual frequency of occurrence. An example is the possibility of accidental aircraft crash into the surface facility. The longer the surface facility operates, the longer the exposure time, and the greater the likelihood of a crash. For a given annual crash frequency, the probability of a crash is proportional to the duration of surface operations. In such cases, the annual frequency of occurrence is compared to threshold frequencies derived from the definitions of Categories 1 and 2. The frequency thresholds for Categories 1 and 2 depend on the applicable time spans for the potentially affected activities (Table 6).

Table 6. Frequency Thresholds for Categories 1 and 2

When Event Sequence May Occur	Applicable Time Span (y)	Applicable Category 1 Frequency Threshold (y^{-1})	Applicable Category 2 Frequency Threshold (y^{-1})
Only during emplacement operations	50	2×10^{-2}	2×10^{-6}
Any time before permanent closure	100	1×10^{-2}	1×10^{-6}

NOTE: The Category 1 thresholds are calculated as 1 event divided by the applicable time span. The Category 2 thresholds are calculated as $1/10,000$ divided by the applicable time span. See Assumption 5.1.1.65 for applicable time spans.

6.1.2 Methods for Estimating Frequencies

Annual frequencies of Category 1 event sequences are needed as inputs to analyses that will assess the frequency-weighted radiological consequences and the normal operating doses. To comply with 10 CFR 63.21(c)(5) [DIRS 158535], annual frequencies of Category 1 event sequences are estimated at the maximum anticipated rate of receipt of radioactive waste. Calculations to ensure that normal operating doses are as low as reasonably achievable also require frequencies for Category 1 event sequences. Annual frequencies of Category 2 event sequences are not calculated.

6.1.3 Methods for Estimating the Amounts of Material at Risk

This analysis does not estimate radiological consequences of event sequences. However, it does estimate the quantity of SNF or HLW that is available to produce radiological consequences as the result of an event sequence. This quantity is called the amount of material at risk. The amount of material at risk is stated in terms of numbers of CSNF assemblies, HLW canisters, naval SNF canisters, or DOE SNF canisters. The amount of material at risk is an output of this analysis and feeds the consequence analyses. Consideration of the source terms that correspond to the material at risk is beyond the scope of this analysis.

6.1.4 Treatment of Uncertainty

Uncertainties in categorization and frequency estimation are addressed by using conservative inputs and a factor of conservatism of 1.1 for the categorization calculations. For example, the expected number of canister drops from cranes depends directly on the number of canisters transferred, the number of times each canister is transferred, and the drop rate per transfer. The number of canisters handled is taken to be the nominal number to be handled. The number of times each canister is transferred is conservatively taken to be the maximum reasonable number of transfers. That is, whenever there is a reasonable opportunity for staging or aging, it is used. Thus, the minimum case involving the transfer of a canister from a transportation cask directly to a WP requires only one transfer. The maximum reasonable case allows for (1) a transfer to staging, (2) a transfer to an MSC, (3) after the aging period, a transfer to a staging rack, and, finally, (4) a transfer to the WP. Unreasonable opportunities for staging or aging, such as repeated transfers to and from staging areas and repeated trips to the aging pads, are not used. Taking the maximum reasonable number of transfers (four) as opposed to the minimum number (one) is conservative by up to a factor of 4, depending on operational details that eventually emerge. The maximum drop rates are specified as design requirements. Conservatism in the categorization calculations ensures that discrepancies, if any, between the categorization calculations and what would be observed in reality would result in improperly assigning Category 1 when Category 2 should apply, or Category 2 when Beyond Category 2 should apply.

Uncertainties in the outcomes of event sequences are addressed by using the worst outcome for each event sequence. Conservatism is used throughout the analysis to ensure that estimates of the outcomes of event sequences overstate the amount of material at risk.

6.2 CATEGORIZATION OF EXTERNAL EVENT SEQUENCES

The following hazards are applicable to the Yucca Mountain repository (Section 4.1.4).

- Aircraft crash
- Rainstorm and flooding
- Range fire
- Loss of offsite or onsite power
- Nearby industrial or military activities
- Seismic activity
- Tornado or extreme wind
- Lightning
- Ash fall due to volcanism
- Drift degradation
- Extreme weather (temperature) fluctuation
- Sandstorm

The strategy for categorization of event sequences initiated by external hazards is to demonstrate that at least one of the following is true:

- The event frequency is Beyond Category 2
- Engineered features of the repository that are needed to meet the performance objectives in 10 CFR 63.111 [DIRS 158535] can withstand the event
- Protection is provided against reasonable initiating events consistent with precedents adopted for nuclear facilities with comparable or higher risks (in accordance with 10 CFR 63.102(f) [DIRS 158535]).

This strategy ensures that external events do not initiate Category 1 or Category 2 event sequences that exceed the performance objectives of 10 CFR Part 63 [DIRS 158535].

6.2.1 Aircraft Crash

An event sequence initiated by aircraft crash is Beyond Category 2 provided operational and design requirements credited in the crash frequency analysis are observed (Section 4.1.12).

6.2.2 Rainstorm and Flooding

Rainstorm has been identified as a potential external hazard (BSC 2004 [DIRS 167266], Section 6.4.34). Consistent with regulatory precedent, initiation of event sequences due to precipitation (including rainstorm) during the preclosure period is prevented by compliance with design criteria that specify reasonable maximum annual, daily, and hourly precipitation rates that the repository is designed to withstand while operating (Section 4.3.2).

6.2.3 Range Fire

Compliance with regulatory requirements and adherence to fire protection codes and standards will ensure that range fires are mitigated before they pose a hazard that could involve a release of radioactive material (Section 4.1.15). Thus, consistent with regulatory precedent, range fire is screened out as an initiating event.

6.2.4 Loss of Offsite or Onsite Power

Surface facilities are designed such that a loss of offsite or onsite electrical power will not initiate an event sequence. This design and operational philosophy requires certain design features of the facilities and the equipment that require power from the offsite electrical grid for normal operation. To identify those requirements, this section reviews electrical equipment that may be relied upon to fulfill a safety function.

6.2.4.1 Cranes, Gantries, Spent Fuel Transfer Machines, and Fuel Handling Machines

Electrically powered cranes are used for lifting and transferring SNF and HLW in the TCRRF, the DTF, CHF, and the FHF. An electrically powered spent fuel transfer machine transfers CSNF assemblies in the FHF and dry transfer cell of the DTF. An electrically powered fuel handling machine transfers CSNF assemblies in the remediation pool. An electrically powered gantry is used for lifting and emplacing WPs in the emplacement drifts. To prevent the possibility of dropping a canister, CSNF assemblies, a WP, or a transportation cask upon loss of offsite power, cranes, gantries, spent fuel transfer machines, and fuel handling machines must be designed to stop and retain their loads upon loss of power (Assumption 5.1.2.1)

6.2.4.2 Trolleys and Transporters

Electrically powered trolleys are used for moving waste within the surface facilities, and an electrically powered transporter is used for moving WPs from the surface to the emplacement transfer dock. To prevent the possibility that a loss of offsite power could lead to dropping a canister, WP, or transportation cask from higher than its design basis drop height or to an uncontrolled glide ending in collision, trolleys and transporters must be designed to stop and retain their loads upon loss of power (Assumption 5.1.2.2).

6.2.4.3 Instrumentation and Control Systems

Much of the equipment to be used for handling and moving SNF and HLW, such as cranes, gantries, trolleys, and transporters, is remotely operated. To prevent the initiation of Category 1 or Category 2 event sequences upon loss of power, the remotely operated equipment must be designed to fail safe upon loss of power such that the systems being controlled are left in a safe state (Assumption 5.1.2.1). To ensure the ability to restore safe operation after a loss of power, the equipment must stay in the locked mode until operator actions are taken during equipment restoration (Assumption 5.1.2.1).

6.2.4.4 Monitoring Equipment

Monitoring equipment is in operation throughout the facility to alert operators to Category 1 or Category 2 event sequences or abnormal conditions such as radiological releases, excessive radiation, and excessive temperatures. The failure of monitoring equipment upon loss of power may cause a failure to detect or monitor the consequences of a radiological release or exposure, but the failure cannot cause a release or exposure. Although monitoring equipment may help keep normal operating exposures as low as reasonably achievable, it is not relied upon to prevent or mitigate Category 1 or Category 2 event sequences.

6.2.4.5 Lighting

Electrical lighting is necessary for the normal operation and security of repository facilities. The failure of lighting upon loss of power may cause the operator to suspend normal operations, but it cannot initiate an event sequence or exposure.

6.2.4.6 Electrically Controlled Seals

Electrical power may be required to establish seals at the docking ports where transportation casks, MSCs, and WPs mate with the waste handling cells. Waste handling cells may also have other electrically controlled seals. However, even if a loss of power could lead to seal failure and a simultaneous loss of confinement ventilation, operational procedures will ensure that there is no potential to expose individuals to significant amounts of radioactivity (Assumption 5.1.1.59).

6.2.4.7 Heating, Ventilation, and Air-Conditioning

6.2.4.7.1 Ambient Air Temperature Control

6.2.4.7.1.1 Transportation Cask Receipt/Return Facility

SNF and HLW is contained in transportation casks in the TCRRF. The transportation casks are designed to contain SNF without active cooling if the cask lid is not removed. Therefore, loss of HVAC will not cause the initiation of a Category 1 or Category 2 event sequence.

6.2.4.7.1.2 Transportation Cask Staging Areas and the Aging Pads

These areas are open-air facilities and are not provided with HVAC. Therefore, a loss of power that shuts down HVAC systems will not affect these areas.

6.2.4.7.1.3 DTF

In the cask and MSC receipt area of the DTF, SNF and HLW are contained in inerted transportation casks or canisters that are inerted with gases with high thermal conductivity. Similarly, WPs in the WP loadout cell, the WP transporter vestibule, and the exit vestibule, are sealed and inerted. Even if ventilation is lost in these areas, no radiological release will occur because containment within the cask or MSC is maintained.

Other areas of the DTF include handling and staging areas for individual CSNF assemblies and canisters of HLW and SNF. If ventilation is lost in these areas, no radiological release will occur from canisters because containment within the canister is maintained. The design of the staging area for CSNF assemblies provides adequate passive cooling such that a loss of ventilation would not cause radiological releases in excess of those considered in the consequence analysis for normal operations (Assumptions 5.1.2.4 and 5.1.1.45).

6.2.4.7.1.4 FHF

The main transfer room, fuel transfer room, and preparation room of the FHF are designed and operated such that a loss of ventilation would not cause radiological releases in excess of those considered in the consequence analysis for normal operations (Assumptions 5.1.2.4 and 5.1.1.45).

6.2.4.7.1.5 CHF

In the CHF, SNF is contained in sealed canisters that are inerted with gases with high thermal conductivity. HLW is contained in sealed canisters. Even if forced ventilation is lost in these areas, no radiological release will occur because containment within the canister is maintained.

6.2.4.7.1.6 Central Control Center Facility and Control Areas

Remote control of certain processes will be conducted from a Central Control Center Facility or from control areas in the various process buildings. If the HVAC system in the control areas of process buildings shuts down, workers may be forced to temporarily vacate these work areas if temperatures rise or fall excessively. However, the preclosure safety analysis does not take credit for human intervention from the control center or other control areas to prevent or mitigate Category 1 or Category 2 event sequences.

6.2.4.7.1.7 Subsurface

Underground ventilation could be lost due to a loss of offsite power. This would cause the temperature of the WP to increase. Provided that the WP temperature remains below temperatures that could jeopardize the structural integrity of the WP, there will be no radioactive release. A temperature of 300°C is acceptable for the phase stability of the WP (BSC 2004 [DIRS 169885], Table 9). Although much higher temperatures may be acceptable for short-term structural integrity, it is apparent that the WP will maintain structural integrity if the phase structure is unchanged. In a calculation that investigates the increases in temperature due to a loss of subsurface ventilation, it is shown that approximately seven years or more is required for the surface temperature of the waste package to reach 300°C (BSC 2004 [DIRS 172176], Figure

6.3-3). Because it is reasonable to expect that forced ventilation can be restored in less than seven years, it can be concluded that a loss of subsurface ventilation will not cause a radioactive release.

6.2.4.7.2 HVAC Confinement

The loss of a confinement due to shutdown of the ventilation system will not initiate an event sequence, as explained in Section 6.3.1.25.

6.2.4.8 Pool-Water Cooling and Make-up Water Systems

A loss of offsite power could cause the pool-water cooling system and the make-up water system to shut down. With the cooling system shut down, decay heat from SNF in the pool would cause the pool temperature to rise. Given enough time, and no make-up water, evaporation of pool water could reduce the depth of the pool water. A reduction in the depth of pool water could pose an increased risk of radiation exposure to workers.

Loss of pool cooling would occur if the recirculating cooling system became unavailable due to loss of power. An analysis was done to determine the time available to restore pool cooling before the pool water reached boiling temperature (BSC 2004 [DIRS 167860]). The analysis showed that at least 3,000 h (125 days) would be required to raise the pool water temperature to the boiling point after loss of cooling (BSC 2004 [DIRS 167860], p. 28). This analysis used several conservative assumptions, as follows:

- Heat losses due to evaporation were not considered (maximum evaporative heat losses would remove 71 percent of the maximum decay heat load).
- The decay heat load was assumed to be the maximum possible (all rack positions filled and fuel at maximum decay heat generation).
- Heat losses due to conduction through walls and floor not considered.

Before radioactive exposure could occur, the pool water would have to evaporate down significantly. It is concluded that ample time would be available to restore cooling to the pool, or makeup water, before the power loss would result in exposure of individuals to radiation. Therefore, an event sequence initiated in the pool by loss of power is Beyond Category 2.

6.2.5 Nearby Industrial and Military Facilities

There are no known military or industrial activities (existing or planned) that initiate event sequences with radiological consequences to offsite individuals or workers during the preclosure period (Section 4.1.4). See Section 6.2.1 for discussion of aircraft hazards.

6.2.6 Seismic Activity

Facilities will be designed such that seismic events will not initiate Category 1 or Category 2 event sequences that lead to doses to workers or the public that exceed the performance objectives of 10 CFR 63.111 [DIRS 158535] or that lead to a criticality condition (Section

4.1.14, Assumption 5.1.1.37). The application of the seismic design bases precludes the occurrence of any seismically initiated event sequence having a mean annual probability of 10^{-3} or greater and, therefore, precludes the occurrence of a Category 1 seismically initiated event sequence (BSC 2004 [DIRS 170564], Section 2.1). Seismically initiated event sequences that are mitigated or prevented by the use of a DBGM-1 assignment to a SSC are less probable than the Category 1 occurrence criterion (BSC 2004 [DIRS 171470], Section 6.1.1.); implicitly, such event sequences are Category 2. Similarly, a DBGM-2 assignment provides reasonable assurance in accordance with 10 CFR 63.102(f) [DIRS 158535] that the corresponding seismically initiated event sequences are Beyond Category 2 (BSC 2004 [DIRS 170564], Section 3.3.2). Therefore, the seismically initiated event sequence of concern for the categorization analysis is the Category 2 event sequence involving the earthquake-induced failure of SSCs that are designed to DBGM-1. Because there is no regulatory dose limit for on-site personnel associated with Category 2 event sequences, only SSC failures with potential dose to the off-site public are of concern. The seismically initiated Category 2 event sequence of concern is described in Table 7.

Table 7. Description of the Category 2 Seismic Event Sequence

SSC	Description of SSC Failure and Bounding Material at Risk
Permanent shielding (CHF, DTF, FHF)	N/A ^a
Cask pit protective cover (Cask Preparation)	N/A ^a
WP pit protective cover (WP Preparation)	N/A ^a
MSC pit protective cover (WP Preparation)	N/A ^a
HLW canister	Breach of HLW canisters due to earthquake would be Category 2 with a DBGM-1 classification (Section 4.1.14). Because HLW canisters as currently designed and fabricated are expected to be able to withstand a DBGM-2 earthquake without breach, the seismic classification is upgraded to DBGM-2. Therefore, a breach of HLW canisters due to a seismic event is Beyond Category 2.
WP transporter	N/A ^a
Fuel Handling Machine and grapples (Wet Remediation)	Failure of the Fuel Handling Machine during a seismic event, leading to a dropped fuel assembly or a basket loaded with fuel assemblies. A bounding material at risk for this SSC failure corresponds to the case in which the Fuel Handling Machine is transferring a basket full of sixteen BWR or nine PWR assemblies in the remediation pool (Assumption 5.2.3.3) when the seismic event occurs.
Spent Fuel Transfer Machine (Dry Transfer)	Failure of the Spent Fuel Transfer Machine during a seismic event, leading to dropped fuel assemblies. A bounding material at risk for this SSC failure corresponds to the case in which all spent fuel transfer machines in DTF and FHF are suspending a CSNF fuel assembly above another CSNF fuel assembly when the seismic event occurs. Each assembly dropped is itself assumed to breach along with the assembly it falls upon (Assumption 5.2.1.3). Given that there is one spent fuel transfer machine in each of the two DTFs (BSC 2005 [DIRS 171428], Section 6.6.3.7) and one spent fuel transfer machine in the FHF (BSC 2005 [DIRS 171428], Section 6.6.4.4), at most three drops breaching six assemblies could occur.
Inlet and outlet dampers and ducting for fuel element staging areas (DTF only, Surface Industrial HVAC)	Failure of dampers and ducting required for passive airflow. Interruption of airflow would not initiate an event sequence (Section 6.3.1.26)
Stack for fuel element staging areas (DTF only, Surface Industrial HVAC)	Interruption of HVAC due to a collapse of the stack in an uncontrolled manner. Interruption of airflow would not initiate an event sequence (Section 6.3.1.26)
HEPA filters (Primary Surface Nuclear HVAC, accumulate radioactive material)	Failure of HEPA filters leading to discharge of accumulated radioactive material. Source term has not been estimated, but may be negligible compared to releases from breached fuel assemblies.
Exhaust ducting and dampers (Primary Surface Nuclear HVAC, accumulate radioactive material)	Failure of ducting and dampers leading to discharge of accumulated radioactive material. Source term has not been estimated, but may be negligible compared to releases from breached fuel assemblies.

NOTE: ^aN/A (not applicable) because there is negligible offsite exposure.

6.2.7 Tornado and Extreme Wind

Tornado missiles and tornado winds are addressed in a separate calculation, which generates design requirements as described in Section 4.1.13. Transportation casks used for shipping SNF and HLW to the repository are large, heavy, robust, sealed metal containers that are certified by

the NRC in accordance with 10 CFR Part 71 [DIRS 171308]. They provide shielding from radiation and protection from hazards to ensure public health and safety during transportation. The certification process of transportation casks under 10 CFR Part 71 [DIRS 171308] yields adequately robust casks for their intended use and handling at the repository (Assumption 5.1.2.3).

6.2.8 Lightning

Loss of power due to any cause, including lightning strikes will not initiate an event sequence for the reasons given in Section 6.2.4. Direct initiation of event sequences due to lightning, for example by voltage surges that affect equipment operation, is prevented by compliance with design criteria that specify design features that mitigate the effects of lightning (Section 4.3.4). This provides reasonable protection against direct initiation of event sequences by lightning striking elevated structures. The design criteria specified may not cover transportation casks and aging casks (including MSCs and HAMs) being staged or moved on site. For transportation casks and transfer casks, the certification process for transportation casks under 10 CFR Part 71 [DIRS 171308] is assumed to ensure that transportation casks and transfer casks provide adequate protection against external hazards (Assumption 5.1.2.3). For aging casks, safety strategies have been identified to ensure that there are no Category 1 or Category 2 event sequences initiated by lightning (Section 4.1.11).

6.2.9 Volcanism-Ash Fall

Ash fall could occur due to a regional volcanic eruption. A design requirement will ensure that the surface facilities where SNF and HLW are handled or stored are designed to withstand ashfall from a regional volcanic eruption (Assumption 5.1.2.7).

6.2.10 Drift Degradation

Drift degradation is the partial or complete collapse of main, turnout, or emplacement drifts as a result of rockfall. Rockfalls are discussed in Sections 6.3.6.1.9, 6.3.6.1.20 and 6.3.6.1.21, which conclude that rockfalls will not initiate a Category 1 or Category 2 event sequence.

6.2.11 Extreme Weather Fluctuation-Temperature

SNF aging casks (including MSCs and HAMs) on the aging pads and transportation casks or transfer casks staged on site could be affected by extended periods of exposure to high temperature and high solar radiation. Safety strategies to address this hazard for SNF aging casks have been developed (Section 4.1.11). To be licensed, transportation casks must be evaluated under normal conditions of transport, which include high and low ambient temperatures and insolation, and under hypothetical accident conditions (Section 4.2.1). Transfer casks are expected to be substantially similar to transportation casks (BSC 2005 [DIRS 171161] Section 4.1.1.2). Therefore, the requirements of 10 CFR 71 [DIRS 171308] provide assurance in accordance with 10 CFR 63.102(f) [DIRS 158535] that transportation casks will not be breached by extreme weather fluctuations.

6.2.12 Sandstorm

Filters or natural circulation vent paths of SNF aging casks (including MSCs and HAMs) could be clogged as a result of a sandstorm. An operational requirement will ensure that no event sequences are initiated by sandstorms (Assumption 5.1.2.9).

6.3 CATEGORIZATION OF INTERNAL EVENT SEQUENCES

Internal Hazards Analysis for License Application (BSC 2005 [DIRS 171428]) identifies internal events and describes the facilities and operations to which the internal events apply (see Section 4.1.5 of this document). The present section categorizes each of the internal events that are identified in *Internal Hazards Analysis for License Application*. Because the design and operational descriptions are not repeated here, the reader should consult *Internal Hazards Analysis for License Application* whenever a more complete understanding of an event is needed.

The following six types of potential internal hazards that can initiate an event sequence are discussed:

- Collision-Crushing
- Chemical Contamination-Flooding
- Explosion-Impllosion
- Fire-Thermal
- Radiation
- Fissile

The expected number of occurrences of an event sequence determines whether it is categorized as Category 1, Category 2, or Beyond Category 2. The analysis relies on assumptions when repository design and operating details that are needed to perform the categorization calculations are not available. Wherever assumptions call for particular design or operational details to prevent or reduce the frequency of an event sequence, the assumption becomes the basis for a design or operational requirement.

The “2-over-1 phenomenon” where a structure, system, or component (SSC) may not perform a safety function by itself, but its failure may adversely affect the safety function of another SSC, will be considered in the facility design (Assumption 5.1.1.37). System interaction that includes the adverse effects of failure of a lower seismic design category SSC on the safety function of a higher seismic design category SSC will be considered in the design (Assumption 5.1.1.37). This analysis considers many specific 2-over-1 events. However, more such events will probably be identified as the design evolves.

This analysis treats DOE SNF canisters differently from other canisters and uncanistered CSNF assemblies. For DOE SNF canisters, lift heights are restricted. The canisters are required to withstand drops from the allowable heights without causing a Category 1 or Category 2 event sequence. Radiological releases from naval canisters, HLW canisters, DPCs, and individual CSNF assemblies are presumed whenever there is a drop from any height. The corresponding event sequences are categorized according to the expected number of drops over the life of the facility.

As shown in Figure 2, the repository includes a TCRRF, where the transportation cask is removed from the commercial cask transporter, and three different processing building designs (CHF, DTF, and FHF) where waste can be transferred from transportation casks into canisters or WPs, with possible intermediate transfers into staging racks or the SNF Aging System (BSC 2005 [DIRS 171428], Section 6.6.1). The commercial transporter can be a legal-weight truck

(LWT), a overweight truck (OWT), or a rail car (BSC 2005 [DIRS 171428], Section 6.6.1). Table 8 summarizes the numbers of waste-form units that are assumed for this calculation.

Figure 2. Waste Flow

Table 8. Assumed Numbers of Waste-Form Units to Be Received Over the Life of the Repository

Waste Form Unit	Number To Be Received ^a	Assumption Reference for Number Received	Assumed Number of Items per Transportation Cask	Number of Associated Transportation Casks ^b
Bare CSNF assemblies	221,000	5.2.1.4	NA	≤ 9,508 ^c
DPCs	≤ 9,508	5.2.1.7	1 ^d	≤ 9,508
Standardized DOE SNF canisters	3,203	5.2.1.5	9 ^e	356
MCO canisters	404	5.2.1.6	4 ^e	101
HLW canisters	16,070	5.2.1.8	5 ^e	3,214
Naval SNF canisters	300	5.2.1.9	1 ^e	300

NOTES: ^aThese numbers are used for event sequence categorization calculations. They are conservative and are not intended to reflect the actual numbers to be received. CSNF assemblies shipped in DPCs are included in the quoted number of bare CSNF assemblies.

^bColumn 2 divided by Column 4. The number of casks in the first two rows are mutually exclusive maximums. The first number assumes no CSNF assemblies come in DPCs and the second assumes that all CSNF casks contain assemblies packaged in DPCs. Accounting for the redundancy in the first two rows, the sum of the column is 13,479.

^cAssumption 5.2.1.7.

^dThe design analyzed does not consider the possibility of more than one DPC per cask (BSC 2005 [DIRS 171428], Section 6.6.3.15).

^eAssumption 5.2.1.13.

6.3.1 Generalized Event Sequence Analyses

Beginning with Section 6.3.2, each third-level subsection of Section 6.3 pertains to a functional area defined in *Internal Hazards Analysis for License Application* (BSC 2005 [DIRS 171428]). In some cases, a number of specific events that were separately identified in *Internal Hazards Analysis for License Application* are generalized and presented in this section. Event trees that are developed in this section are designated by "GET" for generalized event tree and numbered sequentially, for example, "GET-01." Each event tree designation is appended parenthetically to the title of the section where it is developed.

6.3.1.1 Drop of a transportation or transfer cask (without impact limiters) or MSC from an overhead crane (GET-01)

6.3.1.1.1 Transportation or transfer cask drop (including slapdown)

This section considers drop (including slapdown) of transportation casks without impact limiters and of transfer casks without impact limiters. The transfers may take place in the TCRRF, DTF, CHF, or FHF.

Casks that are bound for the DTF or CHF undergo two or three crane transfers as follows. The Transportation Cask Receipt and Return Area overhead bridge crane, which is located in the TCRRF, lifts each transportation cask for transfer to an SRTC. No credit is taken here for impact limiters, which may or may not be in place on the transportation casks during the initial crane transfers (BSC 2005 [DIRS 171428], Section 6.6.1). A second crane transfer is required in the DTF or CHF. In the CHF, the cask is transferred to a cask preparation pit (BSC 2005 [DIRS 171428], Section 6.6.2.2). In the DTF, the cask is transferred to a trolley (BSC 2005 [DIRS 171428], Section 6.6.3.1). An additional crane transfer is required for a transportation cask containing a horizontal DPC that has been selected for transfer to a HAM; each such cask will undergo a crane transfer to a horizontal cask transfer trailer for the transfer to an aging pad. Upon return from aging in a transfer cask, two crane transfers are required, as is the case for incoming transportation casks (BSC 2005 [DIRS 171428], Section 6.6.1).

Casks that are bound for the FHF undergo two or three crane transfers as follows (BSC 2005 [DIRS 171428], Section 6.6.4). Casks with uncanistered SNF are transferred (1) from the conveyance to an import-export trolley, and (2) from there to a transfer trolley (two transfers). Casks with canistered waste are transferred (1) from the conveyance to an import-export trolley, and (2) from there to a position on the floor of the transfer cell (two transfers). HI-STAR casks, which contain a DPC canister, must be tilted in a separate fixture, which introduces a third transfer.

Although at most three crane transfers per cask are required, four transfers per cask are conservatively used for the categorization calculation. Figure 3 illustrates the logic for the categorization calculations. The probabilities of each branch are estimated in Table 9. Categorization calculations are presented in Table 10. The approach taken to prevent Category 1 and Category 2 event sequences involving DOE SNF canisters is discussed in Section 4.1.18. The height limit depends on the contents of the cask (Assumption 5.1.1.18). For casks that

contain MCO canisters, credit may be taken for impact absorption by structural features other than the MCO canisters (Assumption 5.1.1.18).

Number of drops of transportation casks or transfer casks without impact limiters	Cask contains CSNF, naval SNF, or HLW	Lift-height limit respected	Canister meets specifications	Categorization formula
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NOTE: ^a "No" here indicates that the cask contains DOE SNF.

Figure 3. GET-01: Logic for Drop of a Transportation Cask or Transfer Cask without Impact Limiters

Table 9. Inputs for Drop of a Transportation Cask or Transfer Cask without Impact Limiters

Item	Description and Calculation (if applicable)	Value	Cross Reference
<i>C</i>	Factor of conservatism.	1.1	Section 6.1.4
<i>N</i>	The expected number of dropped transportation or transfer casks is given by the number of casks (13,479) the number of times each cask is transferred (4) times the crane load-drop rate (1E-05 drops/transfer).	5.4E-01	Assumptions 5.2.1.10 and 5.1.1.10
<i>p</i> ₁	Fraction of casks that are DOE SNF casks (457/13,479).	3.39E-02	Table 8
<i>p</i> ₂	The conditional probability of exceeding the lift-height limit given that a drop occurred.	1.0E-04	Assumptions 5.1.1.12 and 5.1.1.18.
<i>p</i> ₃	The probability that one or more of the DOE canisters in the cask is defective such that it may breach if dropped from within the lift-height limit. The probability that a given canister is defective is 2.3E-04. Each DOE cask may contain up to 9 canisters. The probability that the cask contains one or more defective canisters is given by $1 - (1 - 2.3E-04)^9$. The resulting probability is conservative for MCO casks, which only contain 4 MCOs.	2.1E-03	Section 4.1.18. Table 8.

Table 10. Categorization Calculations for Drop of a Transportation Cask or Transfer Cask without Impact Limiters

Event ID	Contents of Cask (Material at Risk)	Categorization Formula	Expected Number of Events	Category	Features Credited in the Categorization Calculation or to Prevent Exposure
A	74 BWR or 36 PWR assemblies, 5 HLW canisters, or 1 naval canister.	$CN(1-p_1)$	5.7E-01	Category 2	Number of transportation cask receipts. Fraction that are not DOE SNF. Crane-load drop rate.
B	DOE SNF canisters	NA	NA	No breach	Lift height limit respected. Canister meets specifications.
C	DOE SNF canisters	CNp_1p_3	4.2E-05	Beyond Category 2	Numbers of DOE SNF casks. Crane load-drop rate. Canister defect rate.
D	DOE SNF canisters	CNp_1p_2	2.0E-06	Beyond Category 2	Numbers of DOE SNF canister casks. Crane load-drop rate. Crane lift-height reliability.

6.3.1.1.2 MSC drop (including slapdown)

The expected number of transportation cask drops determined for the cask-drop event in Section 6.3.1.1.1 bounds the corresponding number for a MSC-drop event because the parameters needed for the MSC-drop event are less than or equal to the corresponding parameters in the transportation-cask event:

- The number of MSCs handled is less than the number of transportation cask receipts. MSCs are similar to transportation casks and will hold approximately the same amount of waste (Assumption 5.2.4.1). However, not all waste will be placed into MSCs and sent to an aging pad. Waste that is not in need of aging (including standardized DOE SNF canisters, HLW canisters, and low-heat CSNF assemblies) will only be sent to the aging pads if staging is required (Assumption 5.2.1.20). Furthermore, naval SNF and MCOs will not be sent to the aging pads (Assumption 5.2.1.20).
- The assumed drop rate for the crane is the same in each case.
- There are no more than four transfers associated with the MSC drop. The bounding case occurs when an MSC is both loaded and unloaded at the FHF. After an MSC is loaded at the FHF, it is transferred by crane (1) from the transfer trolley to the import-export trolley and from there (2) to a position on the floor for pickup by the MSC transporter (two transfers). An MSC that arrives at the FHF for unloading is transferred (3) from its position on the floor to the import-export trolley, and (4) from there to the transfer trolley (two transfers). This is the same number of transfers used for the transportation-cask drop.
- The conditional probability, given a drop, of exceeding the lift-height requirement is the same in each case.

- There is no need to age DOE SNF, and DOE SNF will only be sent to the aging pad if staging is required.

The consequences are approximately the same in each case because it is assumed that the capacities of MSCs are approximately the same as those of transportation casks (Assumption 5.2.4.1). Given that the drop of a transportation cask will at most lead to a Category 2 event sequence (see Section 6.3.1.1.1), it is therefore concluded that the drop of an MSC is also, at most, a Category 2 event sequence whose consequences are not more severe than those of a transportation cask drop.

6.3.1.2 Drop or collision of the inner lid of a transportation or transfer cask, MSC, or WP into an open transportation cask, MSC, or WP (GET-02)

This section considers lid drops into open transportation casks, MSCs, and WPs. Because the lid must enter from the top, only collisions resulting from drops are considered. Lid drops that affect DOE or naval canisters may occur in CHF, DTF, or FHF. Lid drops that affect bare CSNF may only occur in DTF or FHF. After the inner lid of a transportation cask or MSC is removed, the lid could be dropped back into the opening of the cask. If the lid rotates before impact, its edge could strike the contents of the cask. A similar event sequence could unfold just prior to placing the inner lid on a WP or MSC. The maximum number of opportunities for this event corresponds to the case in which the contents of a transportation cask are first transferred to an MSC, and after a period of aging, from the MSC to a WP. The opportunities for a lid drop in this conservatively selected scenario are as follows:

1. Drop into a transportation cask before unloading
2. Drop into an MSC after loading
3. Drop into an MSC before unloading
4. Drop into a WP after loading.

Thus, there are at most four opportunities for the event for each transportation cask received.

DOE SNF canisters are assumed to withstand a lid drop up to a specified height without breach (Assumption 5.1.1.22). Naval canisters, HLW canisters, DPCs, and individual CSNF assemblies may breach as a result of lid drop from any height. A simplified calculation can be performed if the numbers of MSCs and WPs are taken to be equal to the assumed number of cask shipments (Assumption 5.2.1.10). This approach is conservative because the number of transportation cask receipts (13,479, Assumption 5.2.1.10) is greater than or equal to the number of WPs (11,184, Section 4.1.1). Naval canisters will not be staged or sent to the aging pads and DOE canisters are not expected to be sent to the aging pads (Assumption 5.2.1.20). The scenario modeled here conservatively includes a trip to a staging rack for naval and DOE canisters (Assumption 5.2.1.2). Figure 4 illustrates the logic for the categorization calculations. The probabilities of each branch are estimated in Table 11. The categorization calculations are presented in Table 12.

In the absence of structural evaluations that could determine the maximum amount of material at risk, the maximum capacities of transportation casks may be used as bounding. Thus, 74 BWR

assemblies or 36 PWR assemblies (Assumption 5.1.1.34), 5 HLW canisters (Assumption 5.2.1.13), or 1 naval canister (Assumption 5.2.1.13) may be affected.

The following considerations ensure that the expected number of drops with the potential for exposure of individuals to radiation has been calculated conservatively:

- The lid may fall onto the floor.
- The lid may fall into the cask or WP but fail to rotate into a position that could damage the fuel.
- For bare CSNF assemblies, the basket structure within the WP or cask would absorb energy.
- Transportation or transfer casks that contain DPCs have been included with no credit for the canisters.
- The lid would not penetrate the opening farther than one radius of the lid, which would spare much of the contents from the impact.
- An aging step has been allowed for CSNF, but only a fraction of the CSNF would be aged.

Number of cask receipts	Cask contains CSNF, HLW, or naval SNF	Lid retained by crane	Lift-height limit for lids above DOE SNF canisters respected	Canister meets specifications	Categorization formula
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NOTE: ^a "No" here indicates that the cask contains DOE SNF.

Figure 4. GET-02: Logic for Drop of an Inner Lid into a Transportation or Transfer Cask, WP, or MSC

Table 11. Inputs for Inner-Lid Drop on a Canister in a Transportation or Transfer Cask, WP, or MSC

Item	Description and Calculation (if applicable)	Value	Cross Reference
C	Factor of conservatism.	1.1	Section 6.1.4
N	Number of cask receipts.	13,479	Table 8
p_1	Fraction of transportation cask receipts that contain DOE SNF canisters.	3.39E-02	Table 8
p_2	Probability of a lid drop is given by the number of opportunities for a drop (4) times the drop rate (10^{-5} drops per opportunity).	4E-05	See discussion above in this section. Assumption 5.1.1.10.
p_3	The conditional probability of exceeding the specified maximum lift height given a drop.	1E-04	Assumption 5.1.1.12, Assumption 5.1.1.22.
p_4	The probability that a DOE SNF canister is defective and would breach if dropped from within the lift-height limit.	2.3E-04	Section 4.1.18

Table 12. Categorization of Inner-Lid Drop into a Transportation or Transfer Cask, WP, or MSC

Event ID	Material at Risk	Categorization Formula	Expected Number of Events	Category	Features Credited in the Categorization Calculation or to Prevent Exposure
A	74 BWR or 36 PWR assemblies, 5 HLW canisters, or 1 naval canister	NA	NA	No drop	Crane reliability
B	74 BWR or 36 PWR assemblies, 5 HLW canisters, or 1 naval canister	$CN(1-p_1)p_2$	5.7E-01	Category 2	Numbers of casks. Crane load-drop rate.
C	DOE SNF canister	NA	NA	No drop	Crane reliability
D	DOE SNF canister	NA	NA	No breach	Lift height limits respected. Canister meets specifications. Structural capabilities of canister.
E	DOE SNF canister	$CNp_1p_2p_4$	4.6E-06	Beyond Category 2	Numbers of canisters. Crane load-drop rate. Canister defect rate. Lid lift-height requirement
F	DOE SNF canister	$CNp_1p_2p_3$	2.0E-06	Beyond Category 2	Numbers of canisters. Crane load-drop rate. Crane lift-height reliability. Lid lift-height requirement.

6.3.1.3 Drops and collisions of CSNF assemblies during transfer (GET-03)

This section considers assembly-drop and assembly-collision events in the DTF (except as associated with remediation activities) and FHF as generalized drop and collision events. Credit is taken for mitigation of radiological releases by the Surface Nuclear HVAC System for 4 h after an assembly drop or collision. The logic for categorization of drop and collision events is presented in Figure 5. The probabilities of each branch are estimated in Table 13. The categorization calculations are presented in Table 14. Assembly drops could involve one CSNF assembly falling onto another, so two assemblies are at risk from an assembly drop. For a collision of an assembly with an object during transfer, only one assembly is at risk.

The event sequences involving drops (and the event sequences involving collisions) of a CSNF assembly followed by a failure of the Surface Nuclear HVAC system, including HEPA filtration, is kept below the Category 1 event sequence threshold by specifying a required HVAC reliability. Based on the 0.01 probability, p_3 in Table 13, which renders the event sequence a Category 2, an hourly failure rate of $0.01/4 \text{ h} = 2.5 \times 10^{-3} \text{ h}^{-1}$ or less is adopted as a design requirement for the HVAC system (Assumption 5.1.1.48). Emergency power is not credited. Normal operations would be suspended if offsite power were to become unavailable (Assumption 5.1.1.49).

Number of CSNF assemblies	Assembly retained during transfer	Assembly collision avoided	HVAC, including HEPA, functions for at least 4 h after handling event	Categorization formula
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Figure 5. GET-03: Logic for Drops and Collisions of CSNF Assemblies

Table 13. Inputs for Drops and Collisions of CSNF Assemblies

Item	Description and Calculation (if applicable)	Value	Cross Reference
C	Factor of conservatism.	1.1	Section 6.1.4
N	Number of CSNF assemblies.	221,000	Assumption 5.2.1.4
p_1	Probability of a drop of a CSNF assembly is given by the maximum number of transfers (4) times the assembly-drop rate of the spent fuel transfer machine (10^{-5}).	4E-05	Assumptions 5.2.1.1 and 5.1.1.7
p_2	Probability of a collision of a CSNF assembly is given by the maximum number of transfers (4) times assembly-collision rate of the spent fuel transfer machine (10^{-5}).	4E-05	Assumptions 5.2.1.1 and 5.1.1.8
p_3	Probability that HEPA filtration becomes unavailable within 4 h of a handling event due to loss of offsite power or failure of the HVAC system.	1E-02	Assumption 5.1.1.48

Table 14. Categorization Calculations for Drops and Collisions of CSNF Assemblies

Event ID	Material at Risk	Categorization Formula	Expected Number of Events	Category	Features Credited in the Categorization Calculation or to Prevent Exposure
A	No event	NA	NA	No collision	Transfer operation reliability
B	1 assembly (Assumption 5.2.1.3)	$C N p_2$	9.7 collisions	Category 1	Numbers of assemblies. Collision rate. Availability of HEPA filtration for 4 h.
C	1 assembly	$C N p_2 p_3$	9.7E-02 collisions	Category 2	Numbers of assemblies. Collision rate.
D	2 assemblies	$C N p_1$	9.7 drops	Category 1	Numbers of assemblies. Drop rate. Availability of HEPA filtration for 4 h.
E	2 assemblies	$C N p_1 p_3$	9.7E-02 drops	Category 2	Numbers of assemblies. Load drop rate.

For the radiological consequence analysis, it is necessary to determine the annual frequency of Category 1 event sequences corresponding to the maximum anticipated rate of receipt of radioactive waste (Section 6.1.2). Given a maximum receipt rate of 3,600 MTHM/y (Assumption 5.1.1.1), a total receipt of 63,000 MTHM (Section 4.3.1), and a total of 221,000 assemblies (Assumption 5.2.1.4), the maximum number of assemblies processed in a single year is estimated to be:

$$(221,000 \text{ assemblies}) (3,600 \text{ MTHM/y}) / (63,000 \text{ MTHM}) = 12,628 \text{ assemblies/y.}$$

Given a drop rate of 10^{-5} drops per transfer (Assumption 5.1.1.7), and a collision rate of 10^{-5} collisions per transfer (Assumption 5.1.1.8), the annual frequencies of drops or collisions in the maximum year are:

$$(12,628 \text{ assemblies/y}) (10^{-5} \text{ events/transfer}) (4 \text{ transfers/assembly}) = 0.5 \text{ events/y.}$$

6.3.1.4 Drop or collision of handling equipment onto or against a CSNF assembly in the DTF or FHF (GET-04)

This section considers events involving equipment drop or collision onto or against CSNF assemblies in the DTF or FHF. During transfer operations, handling equipment from the spent fuel transfer machine could impact a CSNF assembly. Handling equipment from the spent fuel transfer machine may strike a CSNF assembly in a staging rack, WP, MSC, or transportation cask.

The logic for categorization is presented in Figure 6. The probability of the event sequence is estimated in Table 15. The categorization calculation is presented in Table 16. No more than one assembly will be breached as a result of this event sequence (Assumption 5.2.1.11).

Figure 6. GET-04: Logic for Drop or Collision of Handling Equipment onto or against CSNF Assemblies

Table 15. Inputs for Drops or Collision of Handling Equipment onto or against CSNF Assemblies

Item	Description and Calculation (if applicable)	Value	Cross Reference
C	Factor of conservatism.	1.1	Section 6.1.4
N	Number of CSNF assemblies.	221,000	Assumption 5.2.1.4
p_1	Probability of a drop or collision of handling equipment is given by the maximum number of transfers (4) times the rate of drop or collision of handling equipment of the spent fuel transfer machine (10^{-7}).	4E-07	Assumptions 5.2.1.1 and 5.1.1.9.

Table 16. Categorization Calculations for Drop or Collision of Handling Equipment onto or against CSNF Assemblies

Event ID	Material at Risk	Categorization Formula	Expected Number of Events	Category	Features Credited in the Categorization Calculation or to Prevent Exposure
A	No event	NA	NA	No drop or collision	Fuel transfer machine reliability
B	1 assembly	$CN p_1$	9.7E-02	Category 2	Number of assemblies. Load-drop rate.

6.3.1.5 Drop (including slardown) of a DOE, naval, or DPC canister (GET-05)

This section considers the drop (including slardown) of DOE, naval, and DPC canisters during handling by crane in CHF, DTF, or FHF. Standardized DOE SNF canisters, DOE MCO canisters, HLW canisters, naval canisters, and DPCs will be transferred by overhead bridge crane. A scenario that includes staging of canisters is used for the categorization calculations. Canisters are assumed to be transferred two times on average (Assumption 5.2.1.2). Figure 7 illustrates the logic. The probabilities of each branch are estimated in Table 17. Table 18 presents the categorization calculations. Table 19 covers drops of one canister onto another canister.

Although breach of the naval canister is presumed with a drop from any height, the source term for releases from the naval canister is based on drop scenarios provided to the U.S. Navy (Assumption 5.1.1.42). Similarly, DPCs and HLW canisters are assumed to breach as a result of a drop from any height. To allow appropriate source terms to be chosen for the consequence analysis, a lift-height limit is assumed for DPCs (Assumption 5.1.1.43) and HLW canisters (Assumption 5.1.1.24). To avoid overly complicating the event tree, the remote possibility of drops from above the maximum lift heights are not shown for lifts of naval SNF, DPCs, and HLW canisters.

NOTE: ^a "No" here indicates that the canister contains DOE SNF.

Figure 7. GET-05: Logic for Canister Drop

Table 17. Inputs for Drop of a Canister

Item	Description and Calculation (if applicable)	Value	Cross Reference
C	Factor of conservatism.	1.1	Section 6.1.4
N	Number of DOE, naval, and DPC canisters handled (because CSNF assemblies arrive in DPCs).	29,485	Table 8
p_1	Fraction of canisters that are DOE SNF canisters	1.22E-01	Table 8
p_2	Probability of a crane drop is estimated as the number of transfers (2) times the crane load-drop rate (10^{-5}).	2E-05	Assumptions 5.2.1.2 and 5.1.1.10
p_3	The conditional probability of exceeding the lift height given a drop.	1E-04	Assumptions 5.1.1.12, 5.1.1.14, and 5.1.1.15
p_4	The probability that a DOE SNF canister is defective and would breach if dropped from within the lift-height limit.	2.3E-04	Section 4.1.18.

Table 18. Categorization Calculations for Canister Drop

Event ID	Material at Risk	Categorization Formula	Expected Number of Events	Category	Features Credited in the Categorization Calculation or to Prevent Exposure
A	No drop	NA	NA	No drop	Crane reliability
B	2 HLW canisters (Table 19, Row 1), 1 naval canister or 1 DPC	$C N (1 - p_1) p_2$	5.7E-01	Category 2	Numbers of canisters. Crane load-drop rate.
C	No drop	NA	NA	No drop	Crane reliability
D	DOE SNF canister	NA	NA	No breach	Numbers of canisters. Crane load-drop rate. Ability of canisters to withstand drop (Section 4.1.18). Crane lift-height restrictions (Assumptions 5.1.1.14 and 5.1.1.15).
E	DOE SNF canister	$C N p_1 p_2 p_4$	1.8E-05	Beyond Category 2	Numbers of canisters. Crane load-drop rate. Canister defect rate.
F	DOE SNF canister	$C N p_1 p_2 p_3$	7.9E-06	Beyond Category 2	Numbers of canisters. Crane load-drop rate. Crane lift-height reliability.

Table 19. Categorization Comments for Drops of One Canister onto Another Canister

Row	Canister Dropped	Canister Hit	Categorization Comment
1	HLW	HLW	Both canisters breach. This event is covered in Table 18, Event B. The material at risk is two HLW canisters for this event. This sets the bounding material at risk in Table 18, Event B.
2	HLW	Standardized DOE SNF	HLW canister breaches, SNF canister does not breach (Assumptions 5.1.1.24 and 5.1.1.25). This event is covered in Table 18, Event B.
3	HLW	MCO	HLW canister breaches, but the MCO does not breach (Assumptions 5.1.1.24 and 5.1.1.25). This event is covered in Table 18, Event B.
4	Standardized DOE SNF	Standardized DOE SNF	Beyond Category 2. Standardized DOE SNF canisters will not breach if dropped on each other (Assumptions 5.1.1.28).
5	Standardized DOE SNF	MCO	This combination is not applicable because standardized DOE SNF canisters and MCOs are not shipped together (Table 8) or disposed of together (Table 1) and MCOs are not staged (Assumption 5.2.1.20).
6	Standardized DOE SNF	HLW	Rendered Beyond Category 2 by an operational requirement not to transfer a standardized DOE SNF canister into a WP if there are one or more HLW canisters present in the WP or MSC (Assumption 5.1.1.23).
7	MCO	Standardized DOE SNF	See Row 5.
8	MCO	MCO	Beyond Category 2. MCOs will not breach if dropped on each other (Assumption 5.1.1.28).
9	MCO	HLW	Rendered Beyond Category 2 by an operational requirement not to transfer a standardized DOE SNF canister into a WP if there are one or more HLW canisters present in the WP or MSC (Assumption 5.1.1.23).

6.3.1.6 Drop or collision of handling equipment onto or against a DOE, naval, or DPC canister (GET-06)

This section considers drop or collision of handling equipment onto DOE, naval, and DPC canisters in the DTF, CHF, or FHF. (Note that MCOs are not handled in the FHF.) During transfer operations, handling equipment could strike a canister inside a cask or WP or in a staging rack. In this potential event, a drop has to occur to cause a collision because the equipment will be suspended above the canister. This event only applies to canister transfers because the overhead bridge crane is not used to transfer individual fuel assemblies. On average, each canister is assumed to be transferred two times (Assumption 5.2.1.2). Each transfer could result in an equipment drop onto the canister intended for transfer or another canister of the same type (Assumption 5.1.1.11). Figure 8 illustrates the logic for the categorization calculations. The probabilities of each branch are provided in Table 20. Table 21 presents the categorization calculations.

Number of DOE SNF, HLW, naval, and DPC canisters	Canister is a DPC, HLW, or naval canister	Handling equipment retained	Lift-height limit above DOE SNF canisters respected	DOE SNF canister meets specifications	Categorization formula
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NOTE: ^a "No" here indicates that the canister contains DOE SNF.

Figure 8. GET-06: Logic for Handling-Equipment Drop onto a Canister

Table 20. Inputs for Handling-Equipment Drop onto a Canister

Item	Description and Calculation (if applicable)	Value	Cross Reference
C	Factor of conservatism.	1.1	Section 6.1.4
N	Number of DOE, naval, and DPC canisters handled.	29,485	Table 8
p_1	Fraction of canisters that are DOE SNF canisters	1.22E-01	Table 8
p_2	Probability of a handling-equipment drop onto a canister is estimated as the number of transfers (2) times the handling-equipment drop rate per transfer (10^{-5}).	2.E-05	Assumptions 5.2.1.2 and 5.1.1.11.
p_3	The conditional probability of exceeding the lift height given a drop.	1.E-04	Assumptions 5.1.1.12 and 5.1.1.31.
p_4	The probability that a DOE SNF canister is defective and would breach if dropped from within the lift-height limit.	2.3E-04	Section 4.1.18.

Table 21. Categorization of Handling-Equipment Drop onto a Canisters

Event ID	Canister Affected (Material at Risk)	Categorization Formula	Expected Number of Events	Category	Features Credited in the Categorization Calculation or to Prevent Exposure
A	HLW, naval, or DPC canister	NA	NA	No drop	Crane reliability.
B	HLW, naval, or DPC canister	$C N (1 - p_1) p_2$	5.7E-01	Category 2	Numbers of canisters. Number of transfers. Crane load-drop rate.
C	DOE SNF canister	NA	NA	No drop	Crane reliability
D	DOE SNF canister	NA	NA	No breach	Numbers of canisters. Number of transfers. Crane load-drop rate. Structural capabilities of canister.
E	DOE SNF canister	$C N p_1 p_2 p_4$	1.8E-05	Beyond Category 2	Number of DOE SNF canisters. Number of transfers. Crane load-drop rate. Canister defect rate.
F	DOE SNF canister	$C N p_1 p_2 p_3$	7.9E-06	Beyond Category 2	Number of DOE SNF canisters. Number of transfers. Crane load-drop rate. Crane lift-height reliability.

6.3.1.7 Drop (including slapdown) of a loaded, unsealed WP from an overhead crane (GET-07)

This section considers drops (including slapdown) of unsealed WPs prior to closure of the WP in CHF, DTF, or FHF. (Note that individual CSNF assemblies are not handled in the CHF and that MCOs are not handled in the FHF.) The unsealed WP could fall back into a loading pit, onto the floor, onto the edge of a WP pedestal, trolley, or loading pit, and could slap down onto the floor, a wall, or the edge of a loading pit. For drops onto a pit edge, the WP may slap down across the pit and strike the opposite edge of the pit. The question arises whether a DOE SNF canister inside the unsealed WP would withstand the secondary impact of the WP into the opposite edge of the pit. The canister itself does not hit the opposite edge of the pit; rather, the canister hits either the side of the WP or the internal basket structure of the WP. MCO canisters can withstand 2-ft (0.6-m) drops in any orientation with slapdown; standardized DOE SNF canisters can withstand much higher drops (Section 4.1.18). The secondary impact of the canister into the side of the WP or WP basket structure when the WP hits the opposite edge is bounded by a canister slapdown due to the fact that the impact occurs before the WP is horizontal and because the WP and the WP basket structure absorb much of the impact energy. Therefore, the DOE SNF canister will not breach given a drop of an unsealed WP onto the edge of a pit.

Figure 9 illustrates the logic for the categorization calculations. The probabilities of each branch are estimated in Table 22. The categorization calculations are presented in Table 23.

Drops of unsealed WPs from any height are assumed to breach naval SNF, CSNF, and HLW canisters that may be inside. Lift-height limits are specified so that the appropriate source terms can be selected for the consequence calculations (Assumption 5.1.1.52). The categorization calculations do not address the unlikely scenarios in which those limits are exceeded.

Number of WPs	Crane retains unsealed WP	WP contains CSNF assemblies, HLW, or naval SNF (and no DOE SNF)	Lift-height limit respected	DOE SNF canister meets specifications	Categorization formula
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NOTE: ^a "No" here indicates that the WP contains DOE SNF.

Figure 9. GET-07: Logic for Dropping an Unsealed WP

Table 22. Inputs for Drop of an Unsealed WP

Item	Description and Calculation (if applicable)	Value	Cross Reference
C	Factor of conservatism.	1.1	Section 6.1.4
N	Number of WPs.	11,184	Section 4.1.1
p_1	The load-drop rate for the crane (10^{-5} per transfer) times the number of transfers per unsealed WP (1).	1E-05	Assumption 5.1.1.10
p_2	The ratio of the number of WPs that contain DOE SNF to the total number of WPs.	0.304	Section 4.1.1
p_3	The conditional probability of having exceeded the lift-height limit for WPs that contain DOE SNF given that a drop occurred. Crush pads protect the WP in case of a fall onto the floor.	1E-04	Assumptions 5.1.1.12 and 5.1.1.52.
p_4	The probability that the WP contains a defective DOE SNF canister that would breach if the WP is dropped from within the lift-height limit. The probability that an individual DOE SNF canister is defective is $2.3\text{E-}04$. A codisposal WP could contain 2 MCOs. The probability p_4 is taken to be the probability that a codisposal WP containing two DOE SNF canisters contains one or more defective DOE SNF canisters: $1 - (1 - 2.3\text{E-}04)^2$. The computed probability is conservative for WPs containing standardized DOE SNF canisters because they only contain one SNF canister.	4.6E-04	Section 4.1.18. Table 1

Table 23. Categorization Calculations for Drop of an Unsealed WP

Event ID	Contents of WP	Categorization Formula	Expected Number of Events	Category	Features Credited in the Categorization Calculation or to Prevent Exposure
A	Any waste form	NA	NA	No drop	Crane reliability
B	44 BWR or 21 PWR assemblies, 1 naval canister, or 5 HLW canisters	$C N (1 - p_2) p_1$	8.6E-02	Category 2	Load-drop rate of crane.
C	Standardized DOE SNF canister or MCO	NA	NA	No waste-form breach	Load-drop rate of crane. Lift-height restriction for crane. Ability of canisters to withstand drop without breach. Ability of crush pads to prevent waste-form breach.
D	Standardized DOE SNF canister or MCO	$C N p_1 p_2 p_4$	1.7E-05	Beyond Category 2	Load-drop rate of crane. Lift-height restriction for crane. Fraction of DOE SNF canisters. Defect fraction for DOE SNF canisters.
E	Standardized DOE SNF canister or MCO	$C N p_1 p_2 p_3$	3.7E-06	Beyond Category 2	Load-drop rate of crane. Lift-height restriction for crane. Conditional probability of violating lift-height restriction given a drop. Fraction of DOE SNF WPs.

6.3.1.8 Drop of a loaded, sealed WP from an overhead crane (GET-08)

This section considers drops of sealed WPs from bridge cranes in CHF, DTF, or FHF. The WP is assumed to survive a slapdown after a drop from within the allowable lift height without breach (Assumption 5.1.3.12) and a backwards slapdown associated with the tilting machine (Assumption 5.1.3.12).

After closure operations are complete, the WP is considered sealed. The sealed WP is transferred by crane to the survey station where it is surveyed for radioactive contamination (first crane transfer). If necessary, the WP is transferred by crane from the survey station to the trolley leading to the decontamination station (second crane transfer). After decontamination, the WP may then be staged to await authorization for emplacement (third crane transfer). Once emplacement is authorized, the staged WP is transferred by crane to the trolley leading to the WP loadout cell (fourth crane transfer). In the WP loadout cell, the WP is transferred by crane from the trolley to the WP Tilting Station (fifth crane transfer). A sixth and final transfer by crane is needed to place the WP and emplacement pallet onto the bedplate of the waste-package transporter. Thus, at most six crane transfers are needed to move the WP from the WP positioning cell to the WP transporter. Figure 10 provides the logic for a drop of a sealed WP. WPs are assumed to survive, without breach, the impacts described in Assumption 5.1.3.12. A WP that is dropped from above the height limits specified in Assumption 5.1.3.12 is assumed to breach (Assumptions 5.1.3.9 and 5.1.3.8). Figure 10 illustrates the logic for the categorization calculations. The probabilities of each branch are estimated in Table 24. The categorization calculations are presented in Table 25.

In contrast to what was done for the DOE SNF canisters, the fact that a WP may be defective is not considered in the categorization of sealed WP drops. A defective WP designates a WP with a manufacturing defect that may lead to its early failure. An early failure is defined as a through-wall penetration occurring at a time earlier than would be predicted by mechanistic degradation models for a defect-free WP. As pointed out in Section 6.3.6.5.2, defective WPs have a low probability of occurrence. Moreover, the same section indicates that no significant degradation of a WP is expected to take place during the preclosure period. Although a defective WP may have weld or base-metal flaws that are significant for postclosure performance, dropping a defective WP will not cause its failure. The reason for this is that the outer boundary of the WP is made of Alloy 22, a material with a high ductility for which brittle fracture is not anticipated at the temperatures experienced after waste loading (BSC 2004 [DIRS 169766], p. 84).

As a part of closure operations, the WP closure welds are nondestructively examined. If a WP does not pass the nondestructive examination, then the WP is sent to the remediation system. Transfers of WPs with defective closure welds are considered in Section 6.3.1.9.

Figure 10. GET-08: Logic for Drop of a Sealed WP

Table 24. Inputs for Drop of a Sealed WP

Item	Description and Calculation (if applicable)	Value	Cross Reference
C	Factor of conservatism.	1.1	Section 6.1.4
N	Number of WPs.	11,184	Section 4.1.1
p_1	The probability of a drop is given by the maximum number of times each WP is transferred by crane (6) times the drop rate (10^{-5}).	6.E-05	Assumption 5.1.1.10
p_2	A design requirement limits the conditional probability of a lift above a specified limit given that a drop has occurred.	1.E-04	Assumption 5.1.1.12

Table 25. Categorization Calculations for Drop of a Sealed WP

Event ID	Contents of WP	Categorization Formula	Expected Number of Events	Category	Features Credited in the Categorization Calculation or to Prevent Exposure
A	Any waste form	NA	NA	No drop	Crane reliability
B	Any waste form	NA	NA	No breach	Number of WPs. Load-drop rate for the crane. Lift-height limit (Assumptions 5.1.3.9 and 5.1.3.8), structural capabilities of WPs (Assumption 5.1.3.12).
C	Any waste form	$C N p_1 p_2$	7.4E-05	Beyond Category 2	Number of WPs. Load-drop rate for the crane. Conditional probability that lift-height limit is exceeded given a drop.

6.3.1.9 Drop of a loaded WP with a defective closure weld (GET-09)

This section considers handling of WPs with defective closure welds, including handling after removal of the lids. An unsuccessful attempt to seal a waste package may occur in the CHF, DTF, or FHF. Although the specific potential event sequences do not specify closure welds, this is implied because waste packages are not fabricated on site and will be inspected for defects before use (BSC 2005 [DIRS 171428], Section 6.4). Note that waste packages with defective closure welds should not be confused with the "defective WPs" mentioned in Section 6.3.1.8. Only the WPs for which a significant defect in the closure welds has been detected and deemed to require remediation are considered in this section. Figure 11 illustrates the logic for the categorization calculations. The probabilities of each branch are estimated in Table 26. Some of the branch points identified in Figure 11 involve events in areas other than the dry remediation area of the DTF, such as transfer cells in the DTF, CHF, or FHF. The categorization calculations are presented in Table 27.

Number of WPs	Successful WP closure	Successful WP transfer	WP contains CSNF, HLW, or naval SNF (and no DOE SNF)	Lift-height limit for DOE SNF canister respected	DOE SNF canister meets specifications	Categorization formula
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NOTE: ^a "No" here indicates that the WP contains DOE SNF.

Figure 11. GET-09: Logic for Drop of a WP with a Defective Closure Weld

Table 26. Inputs for Drop of a WP with a Defective Closure Weld

Item	Description and Calculation (if applicable)	Value	Cross Reference
C	Factor of conservatism	1.1	Section 6.1.4
N	Number of WPs	11,184	Section 4.1.1
p_1	Fraction of WPs that require remediation.	1.0E-01	Assumption 5.1.3.6
p_2	The probability of dropping a WP in the Remediation Facility is given by the number of times a WP with defective closure welds is transferred by crane after welding (3) times the crane load-drop rate (10^{-5}).	3E-05	Assumptions 5.2.3.4 and 5.1.1.10
p_3	The ratio of the number of WPs that contain DOE SNF to the total number of WPs.	0.304	Section 4.1.1
p_4	The conditional probability of exceeding the lift height given a drop.	1.0E-04	Assumption 5.1.1.12
p_5	The probability that the WP contains a defective DOE SNF canister that would breach if the WP is dropped from within the lift-height limit. The probability that an individual DOE SNF canister is defective is 2.3E-04. A codisposal WP could contain 2 MCOs. The probability p_5 is taken to be the probability that a codisposal WP containing two DOE SNF canisters contains one or more defective DOE SNF canisters: $1 - (1 - 2.3E-04)^2$. The computed probability is conservative for WPs containing standardized DOE SNF canisters because such WPs only contain one SNF canister.	4.6E-04	Section 4.1.18, Table 1

Table 27. Categorization Calculations for Drop of a WP with a Defective Closure Weld

Event ID	Contents of WP	Categorization Formula	Expected Number of Events	Category	Features Credited in the Categorization Calculation
A	44 BWR assemblies, 21 PWR assemblies, 1 naval canister, or 5 HLW canisters	NA	NA	No defect	Proper weld.
B	44 BWR assemblies, 21 PWR assemblies, 1 naval canister, or 5 HLW canisters	NA	NA	No drop	Crane reliability.
C	44 BWR assemblies, 21 PWR assemblies, 1 naval canister, or 5 HLW canisters	$CN p_1 p_2 (1 - p_3)$	2.6E-02	Category 2	Fraction of defective welds, Remediation crane load-drop rate.
D	DOE SNF canister	NA	NA	No breach	Fraction of defective welds, Remediation crane load-drop rate. Structural capabilities of the DOE SNF canisters (Section 4.1.18). Crush pads and lift height limits for DOE SNF WPs (Assumption 5.1.1.52)
E	DOE SNF canister	$CN p_1 p_2 p_3 p_5$	5.2E-06	Beyond Category 2	Fraction of defective welds, Remediation crane load-drop rate, Fraction of DOE SNF canisters, Canister defect rate.
F	DOE SNF canister	$CN p_1 p_2 p_3 p_4$	1.1E-06	Beyond Category 2	Fraction of defective welds, Remediation crane load-drop rate, Fraction of DOE SNF canisters, Lift-height limit reliability.

6.3.1.10 Drop or collision of CSNF assemblies during dry remediation activities (GET-10)

This section includes drops and collisions of CSNF assemblies during dry remediation activities in the DTF. Similar events that occur during normal handling of assemblies from DPCs are not covered here; those are covered in Section 6.3.1.3. Waste may be transferred from defective, damaged, or otherwise suspect transportation or transfer casks, MSCs, or WPs. Remediation is required for only a small fraction of the total number of assemblies to be emplaced. It is not possible to reliably predict the fraction, but this analysis conservatively allows 10 percent to be processed in the dry remediation area (Assumption 5.2.3.1). Each assembly must be transferred twice: (1) from the defective or suspect container to a basket on a trolley and (2) from the basket on the trolley into an MSC, staging rack, or WP. Any subsequent transfers that may take place from staging to a WP are not considered here, but are included implicitly in the under normal handling operations as part of the uncertainty in numbers of canisters. Some of the transfers are performed by the spent fuel transfer machine and others are performed by an overhead crane. The same drop rate applies in either case (Assumptions 5.1.1.7 and 5.1.1.10). Figure 12

illustrates the logic for the categorization calculations. The probabilities of each branch are estimated in Table 28. The categorization calculations are presented in Table 29.

Figure 12. GET-10: Drop or Collision of a CSNF Assembly during Dry Remediation Activities

Table 28. Inputs for Drop or Collision of CSNF Assemblies during Dry Remediation Activities

Item	Description and Calculation (if applicable)	Value	Cross Reference
<i>C</i>	Factor of conservatism.	1.1	Section 6.1.4
<i>N</i>	The number of CSNF assemblies handled in dry remediation is 10 percent of the total.	22,100	Assumptions 5.2.1.4 and 5.2.3.1
<i>p₁</i>	Probability of a drop of a CSNF assembly is given by the maximum number of transfers (2) times the drop rate of the crane or spent fuel transfer machine (10 ⁻⁵).	2E-05	Assumptions 5.2.1.1, 5.1.1.7, and 5.1.1.10
<i>p₂</i>	Probability of a collision of a CSNF assembly is given by the maximum number of transfers (2) times assembly-collision rate of the crane or spent fuel transfer machine (10 ⁻⁵).	2E-05	Assumptions 5.2.1.1 and 5.1.1.8

Table 29. Categorization of Drop or Collision of CSNF Assemblies during Dry Remediation Activities

Event ID	Bounding Material at Risk	Categorization Formula	Expected Number of Events	Category	Features Credited in the Categorization Calculation or to Prevent Exposure
A	1 assembly (Assumption 5.2.1.3)	NA	NA	No drop	Crane and spent fuel transfer machine reliability.
B	1 assembly (Assumption 5.2.1.3)	$C N p_2$	4.9E-01 collisions	Category 2	Numbers of assemblies. Collision rate.
C	2 assemblies	$C N p_1$	4.9E-01 drops	Category 2	Numbers of assemblies. Load-drop rate.

6.3.1.11 Drop of a canister from a crane during WP remediation or dry remediation activities in the DTF (GET-11)

This section considers canister drops during WP remediation or dry remediation activities in the DTF, including WPs, transportation or transfer casks, and MSCs. The overhead bridge crane

transfers standardized DOE SNF canisters, MCOs, HLW canisters, and naval canisters. The generalized canister-drop event sequence includes drop of a canister into a WP, staging rack, MSC, basket on a trolley, or onto the floor of the transfer cell.

Canisters taken from a cask in need of remediation may be transferred twice as follows:

1. From the cask to a basket on a trolley
2. From the basket to a WP, staging rack, or MSC (as applicable, Assumption 5.2.1.20).

DPCs taken from a cask in need of remediation will undergo a transfer to the DPC cutting machine and another transfer after the lid-cutting operation. Canisters taken from a WP in need of remediation will undergo only one transfer because they will go directly from the WP to a new WP, staging rack, or MSC (as applicable, Assumption 5.2.1.20). The few subsequent transfers that may take place from staging to a WP are not considered here, but are included implicitly in the under normal handling operations as part of the uncertainty in numbers of canisters.

Figure 13 illustrates the logic for the categorization calculations. The probabilities of each branch are estimated in Table 30. The categorization calculations are presented in Table 31. Table 32 covers drops of one canister onto another canister.

NOTE: ^a "No" here indicates that the canister contains DOE SNF.

Figure 13. GET-11: Logic for Canister Drop During Dry Remediation or WP Remediation Activities

Table 30. Inputs for Drop of a Canister During Dry Remediation or WP Remediation Activities

Item	Description and Calculation (if applicable)	Value	Cross Reference
C	Factor of conservatism.	1.1	Section 6.1.4
N	Number of DOE, naval, and DPC canisters handled.	2,949	Table 8; Assumption 5.2.3.1.
p_1	Fraction of canisters that are DOE SNF canisters	1.2E-01	Table 8
p_2	Probability of a crane drop is given by the conservatively estimated number of transfers (2) times the crane load-drop rate (10^{-5}).	2.0E-05	See discussion above in this section. Assumption 5.1.1.10
p_3	The conditional probability of exceeding the lift height given a drop.	1.0E-04	Assumption 5.1.1.12
p_4	The probability that a DOE canister is defective and would breach if dropped from within the lift-height limit.	2.3E-04	Section 4.1.18

Table 31. Categorization Calculations for Canister Drop During Dry Remediation or WP Remediation Activities

Event ID	Bounding Material at Risk	Categorization Formula	Expected Number of Events	Category	Features Credited in the Categorization Calculation or to Prevent Exposure
A	2 HLW (Table 32, Row 1), 1 naval, or 1 DPC canister (74 BWR or 36 PWR assemblies, Assumption 5.1.1.34)	NA	NA	No drop	Crane reliability.
B	2 HLW (Table 32, Row 1), 1 naval, or 1 DPC canister (74 BWR or 36 PWR assemblies, Assumption 5.1.1.34)	$C N (1 - p_1) p_2$	5.7E-02	Category 2	Numbers of canisters. Crane load-drop rate.
C	1 DOE SNF canister	NA	NA	No drop	Crane reliability.
D	1 DOE SNF canister	NA	NA	No breach	Numbers of canisters. Crane load-drop rate. Structural capabilities of canisters.
E	1 DOE SNF canister	$C N p_1 p_2 p_4$	1.8E-06	Beyond Category 2	Numbers of canisters. Crane load-drop rate. Canister defect rate.
F	1 DOE SNF canister	$C N p_1 p_2 p_3$	7.9E-07	Beyond Category 2	Numbers of canisters. Crane load-drop rate. Crane lift-height reliability.

Table 32. Categorization Comments for Canister Drops Involving Two Canisters During Dry Remediation or WP Remediation Activities

Row	Canister Dropped	Canister Hit	Categorization Comment
1	HLW	HLW	Both canisters breach. This event is covered in Table 31, Event B. The material at risk is two HLW canisters for this event. This sets the bounding material at risk in Table 31, Event B.
2	HLW	Standardized DOE SNF	HLW canister breaches, SNF canister does not breach (Assumptions 5.1.1.24 and 5.1.1.25). This event is covered in Table 31, Event B.
3	HLW	MCO	HLW canister breaches, but the MCO does not breach (Assumptions 5.1.1.24 and 5.1.1.25). This event is covered in Table 31, Event B.
4	Standardized DOE SNF	Standardized DOE SNF	Beyond Category 2. Standardized DOE SNF canisters will not breach if dropped onto each other (Assumptions 5.1.1.28).
5	Standardized DOE SNF	MCO	This combination is not applicable because standardized DOE SNF canisters and MCOs are not shipped together (Table 8) or disposed of together (Table 1) and MCOs are not staged (Assumption 5.2.1.20).
6	Standardized DOE SNF	HLW	Rendered Beyond Category 2 by an operational requirement not to transfer a standardized DOE SNF canister into or out of a WP if there are one or more HLW canisters present in the WP or MSC (Assumption 5.1.1.23).
7	MCO	Standardized DOE SNF	See Row 5.
8	MCO	MCO	Beyond Category 2. MCOs will not breach if dropped onto each other (Assumption 5.1.1.28).
9	MCO	HLW	Rendered Beyond Category 2 by an operational requirement not to transfer a standardized DOE SNF canister into or out of a WP if there are one or more HLW canisters present in the WP or MSC (Assumption 5.1.1.23).

6.3.1.12 Drop or collision of CSNF assembly transfer/handling equipment onto or against CSNF assemblies in the remediation pool (GET-12)

This section covers drops and collisions of handling equipment used for CSNF assembly transfers during wet remediation activities in the DTF remediation pool. Collisions with breach are considered Beyond Category 2 because the maximum speed of handling equipment movements will be below speeds that could initiate an event sequence upon collision with a CSNF assembly (Assumption 5.1.1.54). A handling-equipment drop results in a release. It is assumed that no more than 10 percent of fuel assemblies are handled in the wet remediation area (Assumption 5.2.3.2). Each assembly may be transferred twice: (1) from the defective or suspect container to a basket or rack and (2) from the basket or rack into an MSC. Figure 14 illustrates the logic for the categorization calculations. The probabilities of each branch are estimated in Table 33. The categorization calculations are presented in Table 34.

Number of CSNF assemblies	Handling equipment retained during assembly transfer	Categorization formula
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Figure 14. GET-12: Logic for Drop of Handling Equipment onto CSNF Assemblies During Wet Remediation

Table 33. Inputs for Drops of Handling Equipment onto CSNF Assemblies During Wet Remediation

Item	Description and Calculation (if applicable)	Value	Cross Reference
C	Factor of conservatism.	1.1	Section 6.1.4
N	The number of CSNF assemblies handled in wet remediation is 10 percent of the total.	22,100	Assumptions 5.2.1.4 and 5.2.3.2
p_1	Probability of a drop of a handling equipment is given by the maximum number of transfers (2) times the rate of drop or collision of handling equipment of the fuel handling machine (10^{-7}).	2E-07	Assumption 5.1.1.9

Table 34. Categorization Calculations for Drop of Handling Equipment onto CSNF Assemblies During Wet Remediation

Event ID	Material at Risk	Categorization Formula	Expected Number of Events	Category	Features Credited in the Categorization Calculation or to Prevent Exposure
A	1 assembly	NA	NA	No drop	Fuel transfer machine reliability.
B	1 assembly	$C N p_1$	4.9E-03	Category 2	Numbers of assemblies. Load-drop rate.

6.3.1.13 Drop of a loaded transportation or transfer cask or MSC in the wet remediation area (GET-13)

DOE casks, transfer casks, or naval casks will not be processed in the DTF remediation pool. However, they may be decontaminated in the cask pit. A drop or collision into the CSNF assembly staging rack in the pool is prevented by an operational requirement that prohibits carrying a cask or MSC over or near the CSNF assembly staging rack in the pool (Assumption 5.1.5.1). Four transfers are required for each cask that is placed in the pool:

1. From the trolley to the pit
2. From the pit to the pool
3. From the pool to the pit
4. From the pit to the trolley.

Four transfers per cask is conservative because not all transportation casks or MSCs are placed in the pool. Figure 15 illustrates the logic for the categorization calculations. The probabilities of each branch are estimated in Table 35. The categorization calculations are presented in Table 36.

NOTE: ^a "No" here indicates that the cask or MSC contains DOE SNF.

Figure 15. GET-13: Drop of Transportation Cask or MSC During Wet Remediation

Table 35. Inputs for Drop of a Transportation Cask or MSC During Wet Remediation

Item	Description and Calculation (if applicable)	Value	Cross Reference
C	Factor of conservatism.	1.1	Section 6.1.4
N	The number of dropped transportation casks or MSCs. Ten percent of the transportation casks or transfer casks and an equal number of MSCs will be unloaded in the pool. 10 percent of 13,479 transportation casks gives 1,348 transportation casks. Adding an equal number of MSCs gives 2,696. The expected number of dropped transportation casks or MSCs is given by 2,696 times the number of transfers per cask (4) times the crane load-drop rate (1E-05 drops/transfer).	1.08E-01	Assumptions 5.2.3.2, 5.2.1.10, and 5.1.1.10
p_1	Fraction of casks that are DOE SNF casks (457/13,479).	3.39E-02	Table 8
p_2	The conditional probability of exceeding the lift-height limit given that a drop occurred.	1.0E-04	Assumptions 5.1.1.12 and 5.1.1.18.
p_3	The probability that one or more of the DOE canisters in the cask is defective such that it may breach if dropped from within the lift-height limit. The probability that a given canister is defective is 2.3E-04. Each DOE cask may contain up to 9 canisters. The probability that the cask contains one or more defective canisters is given by $1 - (1 - 2.3E-04)^9$. The resulting probability is conservative for MCO casks, which only contain 4 MCOs.	2.1E-03	Section 4.1.18. Table 8.

Table 36. Categorization Calculations for Drop of a Transportation Cask or MSC During Wet Remediation

Event ID	Contents of Cask (Material at Risk)	Categorization Formula	Expected Number of Events	Category	Features Credited in the Categorization Calculation or to Prevent Exposure
A	74 BWR or 36 PWR assemblies, 5 HLW canisters, or 1 naval canister. For conservatism in the consequence calculation, it should be assumed that the drop occurs out of the pool.	$C N (1 - p_1)$	1.1E-01	Category 2	Number of transportation cask receipts. Fraction that are not DOE SNF. Crane-load drop rate.
B	DOE SNF canisters	NA	NA	No breach	Lift height limit respected. Canister meets specifications.
C	DOE SNF canisters	$C N p_1 p_3$	8.4E-06	Beyond Category 2	Numbers of DOE SNF casks Crane load-drop rate. Canister defect rate
D	DOE SNF canisters	$C N p_1 p_2$	4.0E-07	Beyond Category 2	Numbers of DOE SNF canister casks. Crane load-drop rate. Crane lift-height reliability.

6.3.1.14 Drop of an empty cask or MSC onto a loaded CSNF assembly cask or MSC or basket in the DTF remediation pool (GET-14)

The potential event under consideration will be prevented by an operational requirement to prohibit carrying empty casks or MSCs over loaded casks or baskets in the DTF remediation pool (Assumption 5.1.1.50).

6.3.1.15 Drops or collisions of empty or full canisters for damaged CSNF assemblies (empty or full) onto or against a cask or basket in the DTF remediation pool (GET-15)

After a damaged assembly is placed in a single-assembly canister in the DTF remediation pool, the canister will be transferred to an MSC or CSNF basket. To account for the case in which the canisterized assembly is transferred to a basket and then to an MSC, two transfers per canister are used. Figure 16 illustrates the logic for the categorization calculations. The probabilities of each branch are estimated in Table 37. The categorization calculations are presented in Table 38. To avoid a drop or collision involving an empty canister that could lead to a radiological release, an operational requirement will prohibit suspending an empty canister above an open cask, MSC, or CSNF basket that contains CSNF (Assumption 5.1.1.56).

Figure 16. GET-15: Logic for Drop or Collision of a Canisterized CSNF Assembly In the DTF Remediation Pool

Table 37. Inputs for Drop or Collision of a Canisterized CSNF Assembly In the DTF Remediation Pool

Item	Description and Calculation (if applicable)	Value	Cross Reference
C	Factor of conservatism.	1.1	Section 6.1.4
N	No more than 1 percent of spent fuel assemblies will arrive so severely damaged after arrival that they must be canisterized.	2,210	Assumptions 5.2.1.4 and 5.2.1.14
p_1	Probability of a drop of a CSNF assembly is given by the maximum number of transfers (2) times the assembly-drop rate of the fuel handling machine (10^{-5}).	2E-05	Assumption 5.1.1.7
p_2	Probability of a collision of a CSNF assembly is given by the maximum number of transfers (2) times assembly-collision rate of the fuel handling machine (10^{-5}).	2E-05	Assumption 5.1.1.8

Table 38. Categorization Calculations for Drop or Collision of a Canisterized CSNF Assembly In the DTF Remediation Pool

Event ID	Bounding Material at Risk	Categorization Formula	Expected Number of Events	Category	Features Credited in the Categorization Calculation or to Prevent Exposure
A	1 assembly (Assumption 5.2.1.3)	NA	NA	No collision	Fuel transfer machine reliability.
B	1 assembly (Assumption 5.2.1.3)	$C N p_2$	4.9E-02 collisions	Category 2	Numbers of assemblies. Collision rate.
C	2 assemblies	$C N p_1$	4.9E-02 drops	Category 2	Numbers of assemblies. Load-drop rate.

6.3.1.16 Drops or collisions involving CSNF assemblies in the pool (GET-16)

Each CSNF assembly that is transferred in the remediation pool in the DTF is staged prior to being loaded into another cask, so that there are two transfers per assembly. A dropped assembly could hit another assembly, with the result that two assemblies may be affected; for collisions, only one assembly is affected (Assumption 5.2.1.3). Figure 17 illustrates the logic for the categorization calculations. The probabilities of each branch are estimated in Table 39. The categorization calculations are presented in Table 40.

Number of CSNF assemblies	Assembly retained during transfer	Collision avoided	Categorization formula
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Figure 17. GET-16: Logic for Drop or Collision of a CSNF Assembly in the DTF Remediation Pool

Table 39. Inputs for Drop or Collision of a CSNF Assembly in the DTF Remediation Pool

Item	Description and Calculation (if applicable)	Value	Cross Reference
<i>C</i>	Factor of conservatism.	1.1	Section 6.1.4
<i>N</i>	The number of CSNF assemblies handled in the pool is 10 percent of the total.	22,100	Assumptions 5.2.1.4 and 5.2.3.2
<i>p</i> ₁	Probability of a drop of a CSNF assembly is given by the maximum number of transfers (2) times the assembly-drop rate of the fuel handling machine (10 ⁻⁵).	2E-05	Assumption 5.1.1.7
<i>p</i> ₂	Probability of a collision of a CSNF assembly is given by the maximum number of transfers (2) times assembly-collision rate of the fuel handling machine (10 ⁻⁵).	2E-05	Assumption 5.1.1.8

Table 40. Categorization Calculations for Drop or Collision of a CSNF Assembly in the DTF Remediation Pool

Event ID	Bounding Material at Risk	Categorization Formula	Expected Number of Events	Category	Features Credited in the Categorization Calculation or to Prevent Exposure
A	1 CSNF assembly	NA	NA	No collision	Fuel transfer machine reliability.
B	1 CSNF assembly	$C N p_2$	4.9E-01 collisions	Category 2	Numbers of assemblies. Collision rate.
C	2 CSNF assemblies	$C N p_1$	4.9E-01 drops	Category 2	Numbers of assemblies. Load-drop rate.

6.3.1.17 Drop of a filled CSNF basket from the fuel handling machine into the pool (GET-17)

Given that each fuel element handled in the remediation pool in the DTF may take a trip to and from the staging rack, there are at most two transfers per basket load. It is conservative for categorization to use the lowest number of assemblies per basket load; therefore the number used is nine assemblies per basket load (Assumption 5.2.3.3). Figure 18 illustrates the logic for the

categorization calculations. The probabilities of each branch are estimated in Table 41. The categorization calculations are presented in Table 42. The capacity of the basket, and therefore the material at risk (Assumption 5.1.5.7), is assumed to be sixteen PWR assemblies or nine BWR assemblies (Assumption 5.2.3.3).

Figure 18. GET-17: Logic for Drop of a CSNF Assembly Basket from the Fuel Handling Machine Into the Pool

Table 41. Inputs for Drop of a CSNF Assembly Basket in the Pool

Item	Description and Calculation (if applicable)	Value	Cross Reference
C	Factor of conservatism.	1.1	Section 6.1.4
N	Ten percent of CSNF assemblies are assumed to be handled in the pool. Each basket is assumed to hold 9 assemblies, which is conservative for categorization.	2456	Assumptions 5.2.1.4, 5.2.3.2, and 5.2.3.3
p_1	Probability of a drop of a CSNF assembly basket is given by the maximum number of transfers (2) times the load-drop rate of the spent fuel transfer machine (10^{-5}).	2E-05	Assumption 5.1.1.7

Table 42. Categorization Calculations for Drop of a CSNF Assembly Basket in the Pool

Event ID	Bounding Material at Risk	Categorization Formula	Expected Number of Events	Category	Features Credited in the Categorization Calculation or to Prevent Exposure
A	NA	NA	NA	No drop	Fuel transfer machine reliability
B	9 PWR assemblies or 16 BWR assemblies	CNp_1	5.4E-02	Category 2	Numbers of assemblies. Drop rate

6.3.1.18 Drop or collision of handling equipment into or against an opened container filled with CSNF during dry remediation (GET-18)

This section addresses drop or and collision of handling equipment during dry remediation activities in the DTF. Collisions with breach are considered Beyond Category 2 because the maximum speed of handling equipment movements will be below speeds that could initiate an event sequence upon collision with a CSNF assembly (Assumption 5.1.1.54). With the

possibility of staging, each assembly may be transferred up to two times. Figure 19 illustrates the logic for the categorization calculations. The probabilities of each branch are estimated in Table 43. The categorization calculations are presented in Table 44.

Figure 19. GET-18: Logic for Drop of Handling Equipment on CSNF Assemblies in Dry Remediation

Table 43. Inputs for Drop of Handling Equipment on CSNF Assemblies in Dry Remediation

Item	Description and Calculation (if applicable)	Value	Cross Reference
C	Factor of conservatism.	1.1	Section 6.1.4
N	Ten percent of 221,000 assemblies will be handled in dry remediation.	22,100	Assumptions 5.2.3.1 and 5.2.1.4
p_1	Probability of a load drop is given by the number of opportunities for a drop (2) times the equipment-drop rate for the spent fuel transfer machine (10^{-7}).	2E-07	See discussion above in this section. Assumption 5.1.1.9.

Table 44. Categorization Calculations for Drop of Handling Equipment on CSNF Assemblies in Dry Remediation

Event ID	Material at Risk	Categorization Formula	Expected Number of Events	Category	Features Credited in the Categorization Calculation or to Prevent Exposure
A	1 assembly (Assumption 5.2.1.11)	NA	NA	No drop	Spent fuel transfer machine equipment drop rate.
B	1 assembly (Assumption 5.2.1.11)	CNp_1	4.9E-03	Category 2	Spent fuel transfer machine equipment drop rate.

6.3.1.19 Drop of handling equipment into an open WP loaded with DOE canisters or a naval canister during dry remediation activities (GET-19)

Due to the possibility of staging, a canister may be transferred twice by crane: once to move it from the WP to the staging rack, and once to move it from the staging rack to a new WP or MSC. For MCOs and naval canisters, which will not be staged (Assumptions 5.2.1.2 and 5.2.1.20), allowing two transfers per canister is conservative. For each transfer during dry remediation activities in the DTF, there are two opportunities for equipment drop. Figure 20

illustrates the logic for the categorization calculations. The probabilities of each branch are estimated in Table 45. The categorization calculations are presented in Table 46.

Figure 20. GET-19: Logic for Handling-Equipment Drop onto a Canister During Dry Remediation

Table 45. Probabilities for Handling-Equipment Drop onto a Canister in Dry Remediation

Item	Description and Calculation (if applicable)	Value	Cross Reference
<i>C</i>	Factor of conservatism.	1.1	Section 6.1.4
<i>N</i>	Number of DOE and naval canisters handled in the Remediation Facility.	1,998	Table 8, Assumption 5.2.3.1
<i>p</i> ₁	Fraction of canisters that are DOE SNF canisters	1.8E-01	Table 8
<i>p</i> ₂	Probability of a handling-equipment drop is given by the maximum number of transfers (2) times the crane's handling-equipment drop rate per transfer (10 ⁻⁵).	2E-05	See discussion above in this section. Assumption 5.1.1.11.
<i>p</i> ₃	The conditional probability of exceeding the lift height given a drop of handling equipment.	1E-04	Assumption 5.1.1.12 and 5.1.1.31.
<i>p</i> ₄	The probability that a DOE SNF canister is defective and would breach if equipment is dropped from within the lift-height limit.	2.3E-04	Section 4.1.18. Assumption 5.1.1.31.

Table 46. Categorization of Handling-Equipment Drop onto a Canister in Dry Remediation

Event ID	Canister Affected (Material at Risk)	Categorization Formula	Expected Number of Events	Category	Features Credited in the Categorization Calculation or to Prevent Exposure
A	HLW or naval canister	NA	NA	No drop	Crane reliability.
B	HLW or naval canister	$CN(1-p_1)p_2$	3.6E-02	Category 2	Numbers of canisters. Crane load-drop rate.
C	DOE SNF canister	NA	NA	No drop	Crane reliability.
D	DOE SNF canister	NA	NA	No breach	Numbers of canisters. Crane load-drop rate.
E	DOE SNF canister	$CNp_1p_2p_4$	1.8E-06	Beyond Category 2	Numbers of canisters. Crane load-drop rate. Canister defect rate.
F	DOE SNF canister	$CNp_1p_2p_3$	7.9E-07	Beyond Category 2	Numbers of canisters. Crane load-drop rate. Crane lift-height reliability.

6.3.1.20 Drop or collision of the severed lid back onto or against the open DPC from the ceiling-mounted manipulator or overhead crane after the completion of the DPC lid-cutting (GET-20)

This section addresses the impact of the DPC lid against CSNF in the open DPC after the DPC lid cutting operation in the DTF. Because the lid must enter from the top, only collisions resulting from drops are considered. Figure 21 illustrates the logic for the categorization calculations. The probabilities of each branch are estimated in Table 47. The categorization calculations are presented in Table 48.

Figure 21. GET-20: Logic for Drop of Severed Lid Into an Opened DPC

Table 47. Inputs for Drop of Severed Lid Into an Opened DPC

Item	Description and Calculation (if applicable)	Value	Cross Reference
C	Factor of conservatism.	1.1	Section 6.1.4
N	The number of DPCs is conservatively assumed to be 9,508 (Assumption 5.2.1.7), which implies that all CSNF assemblies are received in DPCs.	9,508	Assumption 5.2.1.7
p_1	There is one lid transfer for each DPC. Probability of a load drop is given by the number of opportunities for a drop (1) times the crane load-drop rate per transfer (10^{-5}).	1E-05	Assumption 5.1.1.10

Table 48. Categorization Calculations for Drop of Severed Lid Into an Opened DPC

Event ID	Material at Risk	Categorization Formula	Expected Number of Events	Category	Features Credited in the Categorization Calculation or to Prevent Exposure
A	74 BWR assemblies or 36 PWR assemblies (Assumption 5.1.1.34).	NA	NA	No drop	Crane reliability.
B	74 BWR assemblies or 36 PWR assemblies (Assumption 5.1.1.34).	$C N p_1$	1.0E-01	Category 2	Crane load-drop rate.

6.3.1.21 Crane-load collision (GET-21)

This section considers collisions suffered by MSCs, transportation casks, transfer casks, canisters, and waste packages during transfer by crane. The collisions may take place in the CWPRB, the CHF, the DTF, or the FHF, as applicable. Collisions at speeds that could cause a breach of the cask, canister, or waste package involved in the lift will be prevented by design (Assumption 5.1.1.19). A special kind of collision is an attempt to move the load horizontally before it is lifted far enough to allow unimpeded horizontal movement; an example is an attempt to horizontally move a WP during a transfer from a WP from a loading pit in the CHF before the WP has been entirely removed from the pit. A design requirement will ensure that such collisions do not result in an event sequence (Assumption 5.1.1.20).

6.3.1.22 Trolley collision (GET-22)

This section considers collisions involving trolleys carrying transportation or transfer casks, MSCs, or waste packages. The collisions may take place in the CHF, the DTF, or the FHF. Collisions of trolleys at speeds that could cause the trolley to drop its load will be prevented by design (Assumption 5.1.1.61).

6.3.1.23 WP Emplacement Gantry collision (GET-23)

Collisions involving WPs carried in the emplacement drift by the WP Emplacement Gantry that could cause a waste-package breach will be prevented by design (Assumptions 5.1.8.7).

6.3.1.24 WP Emplacement Gantry drop (GET-24)

This section considers drops of waste packages during transfer by the WP Emplacement Gantry in the emplacement drift. Each waste package undergoes one trip into the emplacement drift, carried by the Emplacement Gantry. Figure 22 illustrates the logic for the categorization calculations. The probabilities of each branch of the event tree are estimated in Table 49. The categorization calculations are presented in Table 50.

Figure 22. GET-24: Logic for Emplacement Gantry Drops

Table 49. Inputs for Drops of a Sealed WP from an Emplacement Gantry

Item	Description and Calculation (if applicable)	Value	Cross Reference
C	Factor of conservatism.	1.1	Section 6.1.4
N	Number of WPs.	11,184	Section 4.1.1
p_1	The probability of a drop is given by the maximum number of times each WP is transferred by emplacement gantry (1) times the drop rate (1.E-05).	1.E-05	Assumption 5.1.8.1
p_2	A design requirement limits the conditional probability of having exceeded a specified height limit given that a drop has occurred.	1.E-04	Assumptions 5.1.3.8 and 5.1.8.10

Table 50. Categorization Calculations for Drop of a Sealed WP from an Emplacement Gantry

Event ID	Contents of WP	Categorization Formula	Expected Number of Events	Category	Features Credited in the Categorization Calculation or to Prevent Exposure
A	Any waste form	NA	NA	No collision	Load-drop rate
B	Any waste form	NA	NA	No breach	Number of WPs. Load-drop rate. Speed limit, structural capabilities of WPs.
C	Any waste form	$C N p_1 p_2$	1.2 E-05	Beyond Category 2	Number of WPs. Load-drop rate. Conditional probability of having exceeded the height limit given that a drop occurred.

6.3.1.25 Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radioactive contamination

Primary ventilation confinement is credited in two of the event sequences in Section 6.3.1.3 to mitigate doses after a drop or collision involving a CSNF assembly. Confinement is not credited in other event sequences. With appropriate operating procedures in place, a loss of confinement during otherwise normal operations in the CHF, DTF, FHF, or subsurface does not have the potential to expose individuals to significant amounts of radioactivity (Assumption 5.1.1.59).

6.3.1.26 Overheating of SNF or HLW due to a loss of HVAC

If ventilation is lost in areas of the CHF, DTF, or FHF where DOE or naval canisters are handled, no radiological release will occur from the canisters because containment within the canisters is maintained. Design and operational requirements are assumed to ensure that the thermal response of areas of the DTF or FHF where CSNF assemblies are handled or staged is such that a loss of HVAC would not cause radiological releases in excess of those considered in the consequence analysis for normal operations (Assumptions 5.1.2.4 and 5.1.1.45).

6.3.2 CWPRB: Transportation Cask Buffer Area

A description of the operations in this area and a listing of the hazards and potential events is provided in *Internal Hazards Analysis for License Application* (BSC 2005 [DIRS 171428], Section 6.6.1).

6.3.2.1 Collision/Crushing

6.3.2.1.1 Overturning or collision of a site prime mover moving an LWT or an OWT trailer holding a transportation cask (with impact limiters and personnel barrier installed)

Transportation casks with impact limiters are designed to withstand, without breaching, the drops specified in Section 4.2.1. The drops specified in Section 4.2.1 bound the impacts that could occur during cask handling at the repository. Consequently, an overturning or collision would not breach a transportation cask.

6.3.2.1.2 Derailment, overturning, or collision involving a site prime mover moving an offsite railcar holding a transportation cask (with impact limiters and personnel barrier installed) followed by a load tipover or fall

Transportation casks with impact limiters are designed to withstand, without breaching, the drops discussed in Section 4.2.1. The drops specified in Section 4.2.1 bound the impacts that could occur during cask handling at the repository. Consequently, a derailment, overturning or collision would not breach a transportation cask.

6.3.2.1.3 Collision involving a forklift and a cask on a railcar or an LWT or an OWT trailer (with or without impact limiters and personnel barrier installed)

Operational requirements are assumed to ensure that forklifts will not be operated in a manner that could breach a transportation cask (Assumption 5.1.1.41).

6.3.2.1.4 Collision involving a mobile elevated platform and a cask on a railcar or an LWT or an OWT trailer (with or without impact limiters and personnel barrier installed)

Operational requirements are assumed to ensure that the mobile elevated platform will not be operated in a manner that could breach a transportation cask (Assumption 5.1.1.41).

6.3.2.1.5 Drop of a transportation cask and its support skid (with impact limiters and personnel barrier installed) from the cask receipt and return area overhead crane during transfer to an SRTC

Transportation casks with impact limiters are designed and tested to withstand, without breaching, a 30-ft (9 m) drop onto an unyielding surface (Section 4.2.1). A design requirement will ensure that casks with impact limiters installed cannot be lifted higher than 30 ft above the floor (Assumption 5.1.9.1). Therefore, a drop of a transportation cask, with the impact limiters in place, will not lead to a breach or release of radiological materials.

6.3.2.1.6 Drop or collision of a transportation cask and a support skid (with impact limiters and personnel barrier installed) from cask receipt and return area overhead crane onto or against a sharp object during transfer to an SRTC

Design and operational requirements will ensure that load paths are kept free of puncture hazards (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.2.1.7 Drop of a transportation cask with impact limiters and personnel barrier removed (including the naval SNF cask or a transportation cask carrying a horizontal DPC not going to SNF Aging System) from the cask receipt and return area overhead crane during transfer to an SRTC

This event is included in Section 6.3.1.1.

6.3.2.1.8 Drop or collision of a transportation cask with impact limiters and personnel barrier removed (including the naval SNF cask or a transportation cask carrying a horizontal DPC not going to SNF Aging System) from the cask receipt and return area overhead crane onto or against a sharp object during transfer to an SRTC

Design and operational requirements will ensure that load paths are kept free of puncture hazards (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.2.1.9 Drop of a transportation cask containing a horizontal DPC (with impact limiters and personnel barrier removed) from the cask receipt and return area overhead crane during transfer to a horizontal cask transfer trailer (for subsequent emplacement in a HAM)

This event is included in Section 6.3.1.1.

6.3.2.1.10 Drop or collision of a transportation cask containing a horizontal DPC (with impact limiters and personnel barrier removed) from the cask receipt and return area overhead crane onto or against a sharp object during transfer to a horizontal cask transfer trailer (for subsequent emplacement in a HAM)

Design and operational requirements will ensure that load paths are kept free of puncture hazards (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

- 6.3.2.1.11 Slapdown of a naval transportation cask or a transportation cask carrying a horizontal DPC (or other cask requiring removal of impact limiters prior to transfer) from the cask receipt and return area overhead crane back onto the railcar (forward slapdown) or the ground or site prime mover (backward slapdown) during the upending of the cask to a vertical orientation from a horizontal orientation during cask removal from the offsite railcar or other transport**

This potential event is covered in Section 6.3.1.1.

- 6.3.2.1.12 Slapdown of a naval transportation cask (or other cask requiring removal of impact limiters prior to transfer) from the cask receipt and return area overhead crane onto the SRTC (forward slapdown) or the ground or SRTC tractor (backward slapdown) during the downending of the cask from a vertical to a horizontal orientation after cask removal from the offsite railcar or other transport**

This potential event is covered in Section 6.3.1.1.

- 6.3.2.1.13 Slapdown of a transportation cask holding a horizontal DPC (with impact limiters removed) from the cask receipt and return area overhead crane onto the horizontal cask transfer trailer or the site prime mover (forward slapdown) or the ground (backward slapdown) during the downending of the cask from a vertical to a horizontal orientation after cask removal from the offsite railcar or other transport**

This potential event is covered in Section 6.3.1.1.

- 6.3.2.1.14 Overturning or collision involving the site prime mover pulling a horizontal cask transfer trailer holding a transportation cask (without impact limiters) containing a horizontal DPC at the TCRRF or departing the TCRRF for the HAM.**

Nuclear safety design approaches S.23, S.24, S.25, and S.26 (Section 4.1.11) address this potential event sequence.

- 6.3.2.1.15 Runaway of a site prime mover pulling a horizontal cask transfer trailer holding a transportation cask (with no impact limiters) containing a horizontal DPC**

Nuclear safety design approach S.26 (Section 4.1.11) addresses this potential event sequence.

- 6.3.2.1.16 Drop or collision of handling equipment onto or against a transportation cask (with impact limiters and personnel barrier installed)**

Operational requirements will ensure that drops or collisions involving handling equipment associated with the transfer of the transportation cask will not breach the cask (Assumption 5.1.1.30).

6.3.2.1.17 Drop or collision of handling equipment onto or against a transportation cask (without impact limiters or personnel barriers installed)

Operational requirements will ensure that drops and collisions involving the handling equipment associated with the transfer of the transportation cask will not breach the cask (Assumption 5.1.1.30).

6.3.2.1.18 Drop or collision of heavy loads from the maintenance crane onto or against a transportation cask (with or without impact limiters or personnel barriers installed).

An operational requirement will ensure that heavy loads that could potentially initiate an event sequence if dropped or collided onto or against a cask will not be lifted over or near a transportation cask, except as needed for cask preparation and transfer operations (Assumption 5.1.1.33).

6.3.2.1.19 Derailment of the SRTC positioner moving an SRTC holding a transportation cask (with impact limiters and personnel barriers installed) resulting in an SRTC collision or derailment followed by a load tipover or fall

Transportation casks with impact limiters are designed to withstand, without breaching, the drops discussed in Section 4.2.1. The drops specified in Section 4.2.1 bound the impacts that could occur during cask handling at the repository. Consequently, a derailment, overturning or collision would not breach a transportation cask.

6.3.2.1.20 Derailment of the SRTC positioner moving an SRTC holding a transportation cask (with impact limiters and personnel barrier installed) due to a malfunction of the turntable in the TCBA, resulting in an SRTC collision or derailment followed by a load tipover or fall

Transportation casks with impact limiters are designed to withstand, without breaching, the drops discussed in Section 4.2.1. The drops specified in Section 4.2.1 bound the impacts that could occur during cask handling at the repository. Consequently, a derailment, overturning or collision would not breach a transportation cask.

6.3.2.1.21 Roll-off and/or derailment of an SRTC holding a transportation cask (with impact limiters and personnel barrier installed) from the SRTC positioner followed by a load tipover or fall

Transportation casks with impact limiters are designed to withstand, without breaching, the drops discussed in Section 4.2.1. The drops specified in Section 4.2.1 bound the impacts that could occur during cask handling at the repository. Consequently, this potential event would not breach a transportation cask.

6.3.2.1.22 Collision of an SRTC tractor and an SRTC holding a transportation cask (with impact limiters and personnel barrier installed)

Transportation casks with impact limiters are designed to withstand, without breaching, the drops discussed in Section 4.2.1. The drops specified in Section 4.2.1 bound the impacts that could occur during cask handling at the repository. Consequently, this potential event would not breach a transportation cask.

6.3.2.1.23 Derailment or collision involving an SRTC holding a transportation cask (with impact limiters and personnel barrier installed) being pushed or pulled by an SRTC tractor followed by a load tipover or fall

Transportation casks with impact limiters are designed to withstand, without breaching, the drops discussed in Section 4.2.1. The drops specified in Section 4.2.1 bound the impacts that could occur during cask handling at the repository. Consequently, this potential event would not breach a transportation cask.

6.3.2.1.24 An SRTC carrying a transportation cask (with impact limiters installed) from the CWPRB to the TCBA, the DTF, or the CHF is pushed by the SRTC tractor into the SRTC positioner trench

Transportation casks with impact limiters are designed to withstand, without breaching, the drops discussed in Section 4.2.1. The drops specified in Section 4.2.1 bound the impacts that could occur during cask handling at the repository. Consequently, this potential event would not breach a transportation cask.

6.3.2.1.25 Drop of a transfer cask containing a horizontal DPC (with impact limiters removed) from the cask receipt and return area overhead crane during transfer from a horizontal cask transfer trailer (after retrieval from a HAM) to an SRTC for processing in the DTF

This event is included in Section 6.3.1.1.

6.3.2.1.26 Drop or collision of a transfer cask containing a horizontal DPC (with impact limiters removed) from the cask receipt and return area overhead crane onto or against a sharp object during transfer from a horizontal cask transfer trailer (after retrieval from a HAM) to an SRTC for processing in the DTF

Design and operational requirements will ensure that load paths are kept free of puncture hazards (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

- 6.3.2.1.27 Slapdown of a transfer cask holding a horizontal DPC (without impact limiters) from the cask receipt and return area overhead crane back onto the horizontal cask transfer trailer or the site prime mover (forward slapdown) or the ground (backward slapdown) during the upending of the cask to a vertical orientation from a horizontal orientation during the transfer of the cask from the horizontal cask transfer trailer to an SRTC**

This potential event is covered in Section 6.3.1.1.

- 6.3.2.1.28 Slapdown of a transfer cask holding a horizontal DPC (without impact limiters) from the cask receipt and return area overhead crane onto an SRTC or SRTC Tractor (forward slapdown) or the ground (backward slapdown) during the downending of the cask to a vertical orientation from a horizontal orientation after removal from the horizontal cask transfer trailer**

This potential event is covered in Section 6.3.1.1.

- 6.3.2.1.29 Overturning or collision involving the site prime mover pulling a horizontal cask transfer trailer holding a transfer cask (without impact limiters) containing a horizontal DPC in transit to, or at, the TCRRF**

Nuclear safety design approaches S.23, S.24, S.25, and S.26 (Section 4.1.11) address this potential event sequence.

- 6.3.2.1.30 Runaway of a site prime mover pulling a horizontal cask transfer trailer holding a transfer cask (with no impact limiters) containing a horizontal DPC**

Nuclear safety design approach S.26 (Section 4.1.11) addresses this potential event sequence.

6.3.2.2 Chemical Contamination/Flooding

- 6.3.2.2.1 Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures**

Because the SNF in this area is contained in a sealed cask (BSC 2005 [DIRS 171428], Section 6.6.1), this potential event cannot occur unless an event sequence leads to exposure of SNF to air. The consequence analyses will account for the possibility of oxidation, if applicable.

6.3.2.3 Explosion/Implosion

- 6.3.2.3.1 Hydrogen explosion involving batteries on a forklift**

The waste is protected by casks or WPs while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to initiate an event sequence (Assumption 5.1.1.51).

6.3.2.3.2 Hydrogen explosion involving batteries on a mobile elevated platform

The waste is protected by casks or WPs while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to initiate an event sequence (Assumption 5.1.1.51).

6.3.2.3.3 Hydrogen explosion involving batteries on a site prime mover

The waste is protected by casks while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to initiate an event sequence (Assumption 5.1.1.51).

6.3.2.4 Fire, Thermal

6.3.2.4.1 Fire/explosion (battery/electrical fire) involving a site prime mover moving an LWT or an OWT trailer holding a transportation cask

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.2.4.2 Fire/explosion (battery/electrical fire) involving a site prime mover moving a railroad car holding a rail transportation cask

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.2.4.3 Fire/explosion (battery/electrical fire) involving a site prime mover pulling or pushing a horizontal cask transfer trailer holding a transportation cask containing a horizontal DPC (at the TCRRF or in transit to the HAM)

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.2.4.4 Fire/explosion (battery/electrical fire) involving a site prime mover pulling or pushing a horizontal cask transfer trailer holding a transfer cask containing a horizontal DPC (at the TCRRF or in transit from the HAM)

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.2.4.5 Diesel fuel fire/explosion involving an SRTC tractor pushing or pulling an SRTC holding a transportation cask

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.2.4.6 Electrical fire involving the cask receipt and return area overhead crane handling equipment or other electrical equipment

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.2.4.7 Electrical fire involving the SRTC positioner holding an SRTC loaded with a transportation cask

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.2.4.8 Electrical fire involving the turntable carrying the SRTC positioner holding an SRTC loaded with a transportation cask

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.2.4.9 Fire/Explosion (battery/electrical fire) associated with a forklift

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.2.4.10 Fire/Explosion (battery/electrical fire) associated with a mobile elevated platform

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.2.4.11 Transient combustible fire in CWPRB or the TCBA

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.2.4.12 Cask overheating due to solar insolation while on an offsite transport or an SRTC

Transportation casks must be evaluated under normal conditions of transport and hypothetical accident conditions, which include exposure to insolation under normal conditions and fires under hypothetical accident conditions as described in Section 4.2.1. The normal and hypothetical accident conditions bound insolation on site. Therefore, the incidence of solar radiation on transportation casks will not initiate an event sequence.

6.3.2.5 Radiation

6.3.2.5.1 Radiation exposure of a facility worker and/or the offsite public

Exposure of workers or the offsite public to radiation is a hazard for the potential event sequences considered in the present analysis. Consequence analyses will evaluate this hazard for event sequences and normal operations, as applicable.

6.3.2.5.2 Radiation-induced damage to a facility SSC

Radiation is one of the environmental conditions to which SSCs will be exposed, similar to vibration, humidity, load-imposed stresses, temperature fluctuations, etc. To the extent that radiation-induced failures of an SSC could lead to a radiological exposure, such failures are considered as part of the overall failure rate that is used to categorize event sequences. Where design requirements require prevention of radiological exposure, radiation is one of the environmental conditions that the design must account for. Therefore, radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization.

6.3.2.6 Fissile

6.3.2.6.1 Criticality associated with a transportation cask collision, drop, or slapdown (involving a crane) and a rearrangement of the cask internals

A criticality in the TCRRF or the TCBA is not credible because design requirements and waste acceptance criteria will ensure criticality safety in transportation casks (Assumption 5.1.1.4).

6.3.2.6.2 Criticality associated with an offsite railcar collision or derailment (holding a transportation cask) followed by a load tipover or fall and a rearrangement of the cask internals

This potential event is covered by the discussion in Section 6.3.2.6.1.

6.3.2.6.3 Criticality associated with a collision or overturning of an LWT or an OWT trailer (holding a transportation cask) and a rearrangement of the cask internals

This potential event is covered by the discussion in Section 6.3.2.6.1.

6.3.2.6.4 Criticality associated with an SRTC collision or derailment (holding a transportation cask) followed by a load tipover or fall and a rearrangement of the cask internals.

This potential event is covered by the discussion in Section 6.3.2.6.1.

6.3.2.6.5 Criticality associated with an SRTC positioner collision or derailment (carrying an SRTC holding a transportation cask) followed by a load tipover or fall and rearrangement of the cask internals

This potential event is covered by the discussion in Section 6.3.2.6.1.

6.3.2.6.6 Criticality associated with a transportation cask (holding a horizontal DPC) collision or derailment (involving a horizontal cask transfer trailer or railcar) followed by a load tipover or fall and a rearrangement of the cask internals.

A criticality is not credible because design requirements and waste acceptance criteria will ensure criticality safety in transportation casks (Assumption 5.1.1.4).

6.3.2.6.7 Criticality associated with a transportation cask (holding a horizontal DPC) drop or slapdown from the cask receipt and return area overhead crane and a rearrangement of the cask internals.

A criticality is not credible because design requirements and waste acceptance criteria will ensure criticality safety in transportation casks (Assumption 5.1.1.4).

6.3.2.6.8 Criticality associated with a transfer cask (holding a horizontal DPC) collision or derailment (involving a horizontal cask transfer trailer or an SRTC) followed by a load tipover or fall and a rearrangement of the cask internals.

A criticality in a transfer cask is not credible because a design requirement will ensure that transfer casks remain subcritical even with reconfiguration of the fissile material due to a drop and optimal moderation (Assumption 5.1.1.4).

6.3.2.6.9 Criticality associated with a transfer cask (holding a horizontal DPC) drop or slapdown from the cask receipt and return area overhead crane and a rearrangement of the cask internals.

A criticality in a transfer cask is not credible because a design requirement will ensure that transfer casks remain subcritical even with reconfiguration of the fissile material due to a drop and optimal moderation (Assumption 5.1.1.4).

6.3.3 CHF

A description of the operations in this facility and a listing of the hazards and potential events is provided in *Internal Hazards Analysis for License Application* (BSC 2005 [DIRS 171428], Section 6.6.2). SRTC's, LWT trailers, or OWT trailers carry transportation casks with impact limiters installed into the vestibule (BSC 2005 [DIRS 171428] Section 6.6.2.1).

6.3.3.1 Entrance Vestibule, Tools/Parts Storage Room

6.3.3.1.1 Collision/Crushing

6.3.3.1.1.1 SRTC derailment, overturning, or collision involving a loaded cask followed by a load tipover or fall

Transportation casks with impact limiters are designed to withstand, without breaching, the drops discussed in Section 4.2.1. The drops specified in Section 4.2.1 bound the drops that could occur during cask handling at the repository. Consequently, a derailment, overturning, or collision would not breach a transportation cask.

6.3.3.1.1.2 Overturning or collision involving an LWT trailer or OWT trailer holding a cask

Transportation casks with impact limiters are designed to withstand, without breaching, the drops discussed in Section 4.2.1. The drops specified in Section 4.2.1 bound the impacts that could occur during cask handling at the repository. Consequently, a derailment, overturning, or collision would not breach a transportation cask.

6.3.3.1.1.3 SRTC derailment, overturning, or collision involving a loaded MSC followed by a load tipover or fall

A design requirement is assumed to ensure that the SRTC will not derail and the MSC will not fall off the SRTC (Assumption 5.1.1.35). Because the SRTC remains upright there is no threat to the integrity of the cask.

6.3.3.1.1.4 Collision of an SRTC, an LWT trailer, or OWT trailer carrying a loaded cask with the entrance vestibule doors, the tool/parts storage room doors, or the canister transfer cell shield doors

Transportation casks with impact limiters are designed to withstand, without breaching, the drops discussed in Section 4.2.1. The drops specified in Section 4.2.1 bound the impacts that could occur during cask handling at the repository. Consequently, a derailment, overturning, or collision would not breach a transportation cask.

6.3.3.1.1.5 The entrance vestibule doors, tool/parts storage room doors, or the canister transfer cell shield doors close on an SRTC, an LWT trailer, or an OWT trailer carrying a loaded cask

Transportation casks with impact limiters are designed to withstand, without breaching, the drops discussed in Section 4.2.1. The drops specified in Section 4.2.1 bound the impacts that could occur during cask handling at the repository. Consequently, a derailment, overturning, or collision would not breach a transportation cask.

6.3.3.1.1.6 Collision of an SRTC carrying a loaded MSC with the entrance vestibule doors, tool/parts storage room doors, or the canister transfer cell shield doors

A design or operational requirement is assumed to ensure that a collision with the SRTC will not overturn the SRTC or cause it to drop its load (Assumption 5.1.1.38). Because the SRTC remains upright there is no threat to the integrity of the MSC.

6.3.3.1.1.7 The entrance vestibule doors, tool/parts storage room doors, or the canister transfer cell shield doors close on an SRTC carrying a loaded MSC

A design requirement is assumed to ensure that closure of the entrance vestibule doors, tool/parts storage room doors, or the canister transfer cell shield doors onto an SRTC would not overturn the SRTC or cause it to drop its load (Assumption 5.1.1.13). Because the SRTC remains upright there is no threat to the integrity of the cask.

6.3.3.1.1.8 Collision of a mobile elevated platform with a cask during removal of personnel barriers and impact limiters or during survey activities

Operational requirements are assumed to ensure that the mobile platform will not be operated in a manner that could breach a transportation cask (Assumption 5.1.1.41).

6.3.3.1.1.9 Drop or collision of personnel barriers or impact limiters from the entrance vestibule overhead crane onto or against a cask

Operational requirements will ensure that equipment associated with cask preparation and handling will not breach the cask (Assumption 5.1.1.30).

6.3.3.1.1.10 Collision between a forklift and a cask on an SRTC, an LWT trailer or an OWT trailer or the conveyance holding the cask

Operational requirements are assumed to ensure that the forklifts operating in the CHF will not be operated in a manner that could breach a loaded cask (Assumption 5.1.1.41).

6.3.3.1.1.11 Collision between a mobile elevated platform and a cask on an SRTC, an LWT trailer or an OWT trailer or the conveyance holding the cask

Operational requirements are assumed to ensure that the mobile platform will not be operated in a manner that could breach a transportation cask (Assumption 5.1.1.41).

6.3.3.1.1.12 Collision between a forklift and an MSC on an SRTC or the SRTC holding the cask

Operational requirements are assumed to ensure that the forklifts operating in the CHF will not be operated in a manner that could breach an MSC (Assumption 5.1.1.41).

6.3.3.1.1.13 Collision between a mobile elevated platform and an MSC on an SRTC or the SRTC holding the MSC

Operational requirements are assumed to ensure that the mobile platform will not be operated in a manner that could breach a transportation cask (Assumption 5.1.1.41).

6.3.3.1.1.14 Drop or collision of equipment from the entrance vestibule overhead bridge crane (including handling equipment for personnel barrier, impact limiters, etc.) onto or against a cask or MSC

Operational requirements are assumed to ensure that a drop or collision of handling equipment onto a transportation cask without impact limiters or onto an MSC would not breach the cask (Assumption 5.1.1.30).

6.3.3.1.2 Chemical Contamination/Flooding

6.3.3.1.2.1 Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures

Because the SNF in this area is contained in a sealed cask (BSC 2005 [DIRS 171428], Section 6.6.2), this potential event will not occur unless an event sequence leads to exposure of SNF to air. Oxidation of the fuel matrix is a possible outcome of an event that exposes SNF to air. The consequence analyses will account for the possibility of oxidation, if applicable.

6.3.3.1.3 Explosion/Implosion

6.3.3.1.3.1 Hydrogen explosion involving batteries on a forklift.

The waste is protected by casks or WPs while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to initiate an event sequence (Assumption 5.1.1.51).

6.3.3.1.3.2 Hydrogen explosion involving batteries on a mobile elevated platform

The waste is protected by casks or WPs while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to initiate an event sequence (Assumption 5.1.1.51).

6.3.3.1.3.3 Hydrogen explosion involving batteries on a site prime mover

The waste is protected by casks or WPs while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to initiate an event sequence (Assumption 5.1.1.51).

6.3.3.1.4 Fire/Thermal

6.3.3.1.4.1 Electrical fire associated with the entrance vestibule overhead crane

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.3.1.4.2 Electrical fire associated with handling equipment or other entrance vestibule electrical equipment

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.3.1.4.3 Diesel fuel fire/explosion involving a diesel-powered SRTC tractor pulling or pushing an SRTC holding a loaded cask or MSC.

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.3.1.4.4 Fire/explosion (battery/electrical fire) involving a site prime mover pulling or pushing an LWT or an OWT trailer holding a loaded cask.

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.3.1.4.5 Fire/explosion (battery/electrical fire) associated with a forklift

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.3.1.4.6 Fire/explosion (battery/electrical fire) associated with a mobile elevated platform

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.3.1.4.7 Transient combustible fire in the entrance vestibule or the tools/parts storage room

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.3.1.5 Radiation

6.3.3.1.5.1 Radiation exposure of a facility worker and/or the offsite public

Exposure of workers or the offsite public to radiation is a hazard for the potential event sequences considered in the present analysis. The consequence analysis will evaluate this hazard for event sequences and normal operations, as applicable.

6.3.3.1.5.2 Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation

This potential event is covered in Section 6.3.1.25.

6.3.3.1.5.3 Radiation-induced damage to a facility SSC

Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization as explained in Section 6.3.2.5.2.

6.3.3.1.6 Fissile

6.3.3.1.6.1 Criticality associated with an SRTC (holding a cask) derailment or collision followed by a load tipover or fall and rearrangement of the cask internals

A criticality in the cask-receipt area of the CHF is not credible because design requirements and waste acceptance criteria will ensure criticality safety in transportation casks (Assumption 5.1.1.4).

6.3.3.1.6.2 Criticality associated with overturning or collision involving an LWT or an OWT trailer holding a cask and rearrangement of cask internals.

A criticality in the cask-receipt area of the CHF is not credible because design requirements and waste acceptance criteria will ensure criticality safety in transportation casks (Assumption 5.1.1.4).

6.3.3.1.6.3 Criticality associated with an SRTC (holding a loaded MSC) derailment or collision followed by a load tipover or fall and rearrangement of the cask internals

A criticality in an MSC is not credible because a design requirement will ensure that MSCs remain subcritical even with the most reactive credible configuration of the fissile material and optimal moderation (Assumption 5.1.1.4).

6.3.3.2 Canister Transfer Cell (Canister Transfer)

6.3.3.2.1 Collision/Crushing

6.3.3.2.1.1 Slapdown of a cask onto an SRTC, a truck trailer, or the floor during upending of the cask to the vertical orientation

This potential event is covered by Section 6.3.1.1.

6.3.3.2.1.2 Drop of a cask from a canister transfer cell overhead crane onto the floor during the transfer from an SRTC or truck trailer to the cask preparation pit.

This potential event is covered by Section 6.3.1.1.

6.3.3.2.1.3 Drop or collision of a cask from a canister transfer cell overhead crane onto or against a sharp object during the transfer from an SRTC or truck trailer to the cask preparation pit

Design and operational requirements will ensure that the load paths are kept free of objects that could puncture a transportation cask in case of a drop (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.3.2.1.4 Drop of a loaded MSC from a canister transfer cell overhead crane onto the floor during the transfer from an SRTC to the cask preparation pit

This potential event is covered by Section 6.3.1.1.2.

6.3.3.2.1.5 Drop or collision of a loaded MSC from a canister transfer cell overhead crane onto or against a sharp object during the transfer from an SRTC to the cask preparation pit

Design and operational requirements will ensure that the load paths are kept free of objects that could puncture an MSC in case of a drop (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.3.2.1.6 Drop or collision of a cask from a canister transfer cell overhead crane into or against the cask preparation pit or an MSC/WP loading pit during the transfer from an SRTC or truck trailer to the cask preparation pit

Cask drops are covered in Section 6.3.1.1. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.3.2.1.7 Drop or collision of a loaded MSC from a canister transfer cell overhead crane into or against the cask preparation pit or an MSC/WP loading pit during the transfer from the SRTC to the cask preparation pit

MSC drop is covered in Section 6.3.1.1.2. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.3.2.1.8 Slapdown of a cask or MSC in the pit area due to off-center cask or MSC lowering into the cask preparation pit and followed by a cask or MSC corner drop onto the edge of the pit and slapdown

This potential event is covered by Sections 6.3.1.1 and 6.3.1.1.2.

6.3.3.2.1.9 Drop or collision involving the pit moveable platform onto or against a cask or MSC in the cask preparation pit

Operational requirements are assumed to ensure that the pit movable platform will not be operated in a manner that could breach a cask or MSC (Assumption 5.1.1.41).

6.3.3.2.1.10 Handling equipment drop onto or against a cask or MSC

Operational requirements are assumed to ensure that a drop of handling equipment onto a cask or MSC would not breach the cask or MSC (Assumption 5.1.1.30).

6.3.3.2.1.11 Drop of a cask or MSC outer lid from a canister transfer cell overhead crane onto a cask or MSC inner lid, as applicable

This potential event is bounded by the lid-drop event in Section 6.3.1.2. The expected number of occurrences is the lower because this event does not apply to WPs. The consequences are bounded because the inner lid is in place and will mitigate a release.

6.3.3.2.1.12 Drop of a cask or MSC inner lid from a canister transfer cell overhead crane onto a canister inside the cask or MSC, as applicable

Section 6.3.1.2 includes this potential event.

6.3.3.2.1.13 Drop or collision of tools or handling equipment (including the outer lid-lifting fixture, inner lid-lifting fixture, etc) onto or against a cask or MSC outer lid or a cask or MSC inner lid, as applicable

An operational requirement is assumed to ensure that drops or collisions of miscellaneous tools and equipment onto or against the inner lid would not initiate an event sequence (Assumption 5.1.1.32). If the outer lid is in place, it would provide additional protection against the initiation of an event sequence.

6.3.3.2.1.14 Drop or collision of tools or handling equipment, including a lift fixture with pintle or a shield ring, onto or against a canister inside an open cask or MSC

This potential event is included in Section 6.3.1.6. For DPC canisters, no credit is taken for the prevention or mitigation of a release that may be provided by the canister.

6.3.3.2.1.15 Drop of a canister from a canister transfer cell overhead crane back into the cask or MSC being unloaded (including a naval SNF canister, a DOE SNF MCO, a DPC, a DOE HLW canister, or a [standardized] DOE SNF canister)

This event is included in Section 6.3.1.5.

6.3.3.2.1.16 Drop or collision of a DOE HLW canister or a [standardized] DOE SNF canister from a canister transfer cell overhead crane onto or against another [standardized] DOE SNF canister, or DOE HLW canister in the cask being unloaded, as applicable

The drop event is included in Section 6.3.1.5. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.3.2.1.17 Horizontal movement of a canister before it is fully vertically lifted out of a cask or MSC

This collision event is included in Section 6.3.1.21.

6.3.3.2.1.18 Drop of a canister from a canister transfer cell overhead crane onto the cell floor or other flat object during transfer from the cask or MSC to a WP or an MSC, as applicable, or during transfer to a canister staging pit

This potential event is included in Section 6.3.1.5.

6.3.3.2.1.19 Drop or collision of a canister from a canister transfer cell overhead crane onto or against a sharp object during transfer from the cask or MSC to a WP or an MSC, as applicable, or during transfer to a canister staging pit

Design and operational requirements will ensure that the load paths are kept free of objects that could puncture a canister in case of a drop (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.3.2.1.20 Slapdown of a canister in an MSC/WP loading pit or the pit areas due to off-center canister lowering into the WP or MSC, followed by a canister corner drop onto the edge of the pit and slapdown

This potential event is included in Section 6.3.1.5.

6.3.3.2.1.21 Drop or collision of a DPC, DOE HLW canister, or [standardized] DOE SNF canister from a canister transfer cell overhead crane into or against the empty MSC being loaded

The drop event is included in Section 6.3.1.5. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.3.2.1.22 Drop or collision of a naval SNF canister, a DOE HLW canister, a DOE SNF MCO, or a [standardized] DOE SNF canister from a canister transfer cell overhead crane into or against the WP being loaded.

The drop event is included in Section 6.3.1.5. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.3.2.1.23 Drop or collision of a DOE HLW canister from a canister transfer cell overhead crane onto or against another DOE HLW canister, a DOE SNF MCO, or a [standardized] DOE SNF canister in a WP

The drop event is included in Section 6.3.1.5. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.3.2.1.24 Drop or collision of a DOE HLW canister from a canister transfer cell overhead crane onto or against another DOE HLW canister or a [standardized] DOE SNF canister in an MSC.

The drop event is included in Section 6.3.1.5. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.3.2.1.25 Drop or collision of a [standardized] DOE SNF canister from a canister transfer cell overhead crane onto or against a DOE HLW canister in a WP or MSC

The drop event is included in Section 6.3.1.5. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.3.2.1.26 Drop or collision of a DOE SNF MCO from a canister transfer cell overhead crane onto or against another DOE SNF MCO or onto a DOE HLW canister in a WP

The drop event is included in Section 6.3.1.5. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

- 6.3.3.2.1.27 Drop or collision of a DOE SNF MCO from a canister transfer cell overhead crane onto or against a [standardized] DOE SNF canister or a drop of a [standardized] DOE SNF canister onto or against another [standardized] DOE SNF canister in a WP due to a misload**

The drop event is included in Section 6.3.1.5. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

- 6.3.3.2.1.28 Drop or collision of a DOE SNF MCO from a canister transfer cell overhead crane onto or against a [standardized] DOE SNF canister or onto or against a DOE HLW canister or another misloaded DOE SNF MCO in an MSC due to a misload.**

The drop event is included in Section 6.3.1.5. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

- 6.3.3.2.1.29 Drop or collision of a DOE HLW canister or a [standardized] DOE SNF canister from a canister transfer cell overhead crane into or against a canister staging pit**

The drop event is included in Section 6.3.1.5. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

- 6.3.3.2.1.30 Slapdown of a DOE HLW canister or a [standardized] DOE SNF canister in the staging pit area due to off-center canister lowering into the pit and followed by a canister corner drop onto the edge of the staging pit and a slapdown**

This potential event is included in Section 6.3.1.5.

- 6.3.3.2.1.31 Drop or collision of a DOE HLW canister, or a [standardized] DOE SNF canister from a canister transfer cell overhead crane onto or against the top of another DOE HLW canister, or [standardized] DOE SNF canister in a canister staging pit**

The drop event is included in Section 6.3.1.5. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

- 6.3.3.2.1.32 Impact due to horizontal movement of a canister before it is fully vertically lifted out of a canister staging pit**

This collision event is included in Section 6.3.1.21.

- 6.3.3.2.1.33 Drop of or collision of handling equipment onto or against a DOE HLW canister or a [standardized] DOE SNF canister in a canister staging pit**

This potential event is included in Section 6.3.1.6. For DPC canisters, no credit is taken for the prevention or mitigation of a release that may be provided by the canister.

6.3.3.2.1.34 Drop of or collision of a canister staging pit shield plug onto or against a canister in the canister staging pit

A design requirement will ensure that the shield plug will not fit into the opening far enough to breach a canister inside (Assumption 5.1.6.1).

6.3.3.2.1.35 Drop or collision involving the pit moveable platform onto or against a loaded MSC in an MSC/WP loading pit

Operational requirements are assumed to ensure that the portable platform will not be operated in a manner that could breach an MSC (Assumption 5.1.1.41).

6.3.3.2.1.36 Drop of a WP inner lid into an open, loaded WP

The calculation in Section 6.3.1.2 includes this potential event.

6.3.3.2.1.37 Drop of the MSC lid into an open, loaded MSC

The calculation in Section 6.3.1.2 includes this potential event.

6.3.3.2.1.38 Drop or collision of tools or handling equipment into or against an open, loaded or partially loaded, WP.

This potential event is included in Section 6.3.1.6.

6.3.3.2.1.39 Drop or collision of tools or handling equipment into or against an open, loaded or partially loaded MSC

This potential event is included in Section 6.3.1.6.

6.3.3.2.1.40 Drop or collision of tools or equipment (including a lid-lifting fixture) onto or against a loaded WP inner lid

Operational requirements will prevent radiological releases due to this potential event (Assumption 5.1.3.3).

6.3.3.2.1.41 Drop or collision of tools or equipment (including a lid-lifting fixture) onto or against the lid of a loaded, unsealed or sealed MSC

Operational requirements will ensure that this potential event will not initiate an event sequence (Assumption 5.1.1.32).

6.3.3.2.2 Chemical Contamination/Flooding

6.3.3.2.2.1 Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures

Because the SNF in this area is contained in a sealed canister (BSC 2005 [DIRS 171428], Section 6.6.2), this potential event will not occur unless an event sequence leads to exposure of

SNF to air. Oxidation of the fuel matrix is a possible outcome of an event that exposes SNF to air. The consequence analyses will account for the possibility of oxidation, if applicable.

6.3.3.2.3 Explosion/Implosion

6.3.3.2.3.1 Cask sampling and purging system or decontamination (or other pneumatic or pressurized system) missile due to a fractured nozzle/valve stem/pneumatic device

An operational requirement is assumed to prevent initiation of an event sequence by this potential event (Assumption 5.1.1.5).

6.3.3.2.3.2 Explosion hazard associated with the cask sampling and purging system and the ignition of hydrogen that may have accumulated in the cask or MSC

Precautions taken during the cask sampling and purging process will provide reasonable assurance that such hydrogen explosions will not occur (Assumption 5.1.1.58).

6.3.3.2.3.3 Hydrogen explosion involving batteries on a forklift

The waste is protected by casks or WPs while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to cause a radiological release (Assumption 5.1.1.51).

6.3.3.2.3.4 Hydrogen explosion involving batteries on a site prime mover

The waste is protected by casks or WPs while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to cause a radiological release (Assumption 5.1.1.51).

6.3.3.2.4 Fire, Thermal

6.3.3.2.4.1 Electrical fire associated with the canister transfer cell overhead cranes

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.3.2.4.2 Electrical fire associated with handling equipment or other canister transfer cell electrical equipment

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.3.2.4.3 Diesel fuel fire/explosion on an SRTC tractor pushing an SRTC holding a loaded cask into the canister transfer cell

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.3.2.4.4 Fire/explosion (battery/electrical fire) involving a site prime mover pulling or pushing an LWT or an OWT trailer holding a loaded cask.

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.3.2.4.5 Diesel fuel fire/explosion associated with the SRTC tractor pushing an SRTC holding an MSC

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.3.2.4.6 Fire/explosion (battery/electrical fire) associated with a forklift

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.3.2.4.7 HEPA filter fire due to excessive radioactive decay within the filter bed

HEPA filters will be maintained well below their auto-ignition temperature to preclude a filter fire (Assumption 5.1.1.47).

6.3.3.2.4.8 Canister overheating in the canister staging pit due to a loss of cooling resulting in excessive temperature and possible damage to canister contents and/or confinement

This potential event is discussed in Section 6.3.1.26.

6.3.3.2.4.9 Transient combustible fire in the canister transfer cell

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.3.2.4.10 Overheating of a loaded cask, WP, or MSC while staged in a pit due to a loss of cooling resulting in excessive temperature and possible damage to canister contents

This potential event is discussed in Section 6.3.1.26.

6.3.3.2.5 Radiation

6.3.3.2.5.1 Radiation exposure of a facility worker and/or the offsite public

Exposure of workers or the offsite public to radiation is a hazard for the potential event sequences considered in the present analysis. Consequence analysis will evaluate this hazard for event sequences and normal operations, as applicable.

6.3.3.2.5.2 Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation

This potential event is covered in Section 6.3.1.25.

6.3.3.2.5.3 Damage or rupture of cask sampling and purging system, leading to a release of cask internal gases and radioactive material

The sampling operation will be conducted so that exposure of workers to radiation will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses (BSC 2004 [DIRS 172098], Section 3.2.2.1.1). Although a rupture leading to a radiological release would be an abnormal occurrence, radiation protection programs will ensure that such an occurrence would not contribute significantly to the normal operations dose. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.3.2.5.4 Thermal expansion of gases or other loss of confinement in an unsealed cask or MSC, leading to radiological release

Exposure of workers to radiation due to this potential event will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.3.2.5.5 Inadvertent opening of a canister transfer cell shield door or a cask preparation pit cover or an MSC/WP pit cover, leading to a worker exposure

This potential event could expose workers to radiation, but would not expose the public. The frequency of inadvertent actions that expose workers (but not the public) to radiation will be limited by design features and operating procedures that ensure that such events are not Category 1 (Assumption 5.1.1.57).

6.3.3.2.5.6 Radiation-induced damage to a facility SSC

Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization as explained in Section 6.3.2.5.2.

6.3.3.2.6 Fissile

6.3.3.2.6.1 Criticality associated with a drop or slapdown of a loaded cask from a canister transfer cell overhead crane and a rearrangement of cask internals

A criticality is not credible because design requirements and waste acceptance criteria will ensure criticality safety in transportation casks (Assumption 5.1.1.4).

6.3.3.2.6.2 Criticality associated with a drop or slapdown of a loaded MSC from a canister transfer cell overhead crane and a rearrangement of cask internals

A criticality in an MSC is not credible because a design requirement will ensure that MSCs remain subcritical even with the most reactive credible configuration of the fissile material and optimal moderation (Assumption 5.1.1.4).

6.3.3.2.6.3 Criticality associated with a drop or slapdown of a loaded WP (unsealed) from a canister transfer cell overhead crane and a rearrangement of WP internals

Because the WP does not spill its contents (Assumption 5.1.3.11) and moderator intrusion into the WP is controlled, the unsealed WP will remain subcritical (Assumptions 5.1.3.2 and 5.1.1.21).

6.3.3.2.6.4 Criticality associated with a drop or slapdown of a [standardized] DOE SNF canister, a naval SNF canister, a DOE SNF MCO, a DPC, or a DOE HLW canister and a rearrangement of canister internals

Design calculations will show that dropping a DOE SNF canister within its design basis will not lead to a criticality if moderator control is in effect (Assumption 5.1.1.3). A requirement will ensure that DPCs are designed such that drops, collisions, and other handling impacts (allowing for rearrangement of container internals and optimal moderator intrusion) cannot lead to a nuclear criticality (Assumption 5.1.1.4). The potential for criticality for naval canisters is addressed in Attachment I, where it is demonstrated that a criticality associated with the drop of a naval canister is Beyond Category 2. There is no potential for criticality of HLW canisters (Assumption 5.2.1.19).

6.3.3.2.6.5 Criticality associated with a misload of a WP or an MSC

A criticality due to misload of an MSC is not credible because a design requirement will ensure that MSCs remain subcritical even with the most reactive credible configuration of the fissile material and optimal moderation (Assumption 5.1.1.4). A criticality due to a canister misload of a WP is not credible because a design requirement will ensure that WPs and MSCs are designed such that they can be loaded with canisters that are acceptable for disposal without leading to a preclosure nuclear criticality provided that moderator control is in effect (Assumptions 5.1.3.2 and 5.1.1.21).

6.3.3.2.6.6 Criticality associated with a misload of a canister staging pit

A design requirement will ensure that misloading standardized DOE SNF canisters in the CHF staging pits cannot lead to a nuclear criticality (Assumption 5.1.1.2). Neither MCOs nor naval canisters will be staged (Assumption 5.2.1.20). There is no potential for criticality of HLW canisters (Assumption 5.2.1.19).

6.3.3.2.6.7 Criticality associated with a drop of heavy equipment onto an unsealed, loaded cask, WP, or MSC and a rearrangement of the container internals

For the WP, provided that moderators are controlled, the unsealed WP will remain subcritical (Assumptions 5.1.3.2 and 5.1.1.21). Design requirements and waste acceptance criteria will ensure criticality safety in transportation casks and MSCs (Assumption 5.1.1.4).

6.3.3.3 Canister Transfer Cell (WP Transfer to WP Closure, MSC Closure and Removal)

6.3.3.3.1 Collision/Crushing

6.3.3.3.1.1 Drop or collision of handling equipment or a lifting fixture onto or against a loaded WP inner lid

Operational requirements will prevent radiological releases due to this potential event (Assumption 5.1.3.3).

6.3.3.3.1.2 Drop or collision of handling equipment or a lifting fixture onto or against a loaded MSC lid

Operational requirements will ensure that this potential event will not initiate an event sequence (Assumption 5.1.1.32).

6.3.3.3.1.3 Impact due to horizontal movement of a loaded WP by a canister transfer cell overhead crane before it is fully lifted vertically out of the MSC/WP loading pit.

This collision event is included in Section 6.3.1.21.

6.3.3.3.1.4 Drop or collision of an unsealed, loaded WP from a canister transfer cell overhead crane back into or against the MSC/WP loading pit

This potential event is included in the calculation presented in Section 6.3.1.7.

6.3.3.3.1.5 Drop of an unsealed, loaded WP from a canister transfer cell overhead crane onto the cell floor or a pit cover during the lift and transfer to the WP positioning cell pedestal and trolley

This potential event is included in the calculation presented in Section 6.3.1.7. A design requirement will ensure that the WP will not penetrate the pit cover (Assumption 5.1.6.6).

6.3.3.3.1.6 Drop or collision of an unsealed, loaded WP from a canister transfer cell overhead crane onto or against a sharp object during the lift and transfer to the WP positioning cell pedestal and trolley

Design and operational requirements will ensure that load paths are kept free of puncture hazards (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.3.3.1.7 Slapdown of a loaded, unsealed WP onto the cell floor, into a wall, or onto a pit cover following a drop from a canister transfer cell overhead crane onto the edge of the trolley, a pit edge, or pit cover during the lift and transfer to the WP positioning cell pedestal and trolley

This potential event is included in the calculation presented in Section 6.3.1.7. A design requirement will ensure that the WP will not penetrate the pit cover (Assumption 5.1.6.6).

6.3.3.3.1.8 Drop or collision of an unsealed, loaded WP from a canister transfer cell overhead crane onto or against a loaded or partially loaded MSC or WP (with no lid in place) in an MSC/WP loading pit (with no pit cover in place) during the lift and transfer to the WP positioning cell pedestal and trolley

This potential event sequence will be precluded by operational and design requirements. Operational requirements will ensure that a loaded WP is not carried over or near a loaded MSC/WP loading pit (Assumption 5.1.6.2) and that pit covers are replaced whenever individual waste-form handling operations are suspended unless the loading operation is complete and the next operation involving the overhead crane is to remove the associated WP or MSC from the pit (Assumption 5.1.6.3).

6.3.3.3.1.9 Drop or collision of a unsealed, loaded WP from a canister transfer cell overhead crane onto or against a loaded MSC or WP (with lid in place) in an MSC/WP loading pit (with no pit cover in place) during the lift and transfer to the WP positioning cell pedestal and trolley

This potential event is rendered Beyond Category 2 by the same operational requirements invoked in Section 6.3.3.3.1.8.

6.3.3.3.1.10 Drop or collision of an unsealed, loaded WP from a canister transfer cell overhead crane onto or against, a loaded, unsealed WP on the opposite WP positioning cell pedestal and trolley during the lift and transfer to a WP positioning cell pedestal and trolley

An operational requirement will ensure that, whenever a waste-package trolley is being loaded, the opposite trolley is located in its positioning cell or is otherwise out of the way (Assumption 5.1.6.4). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

- 6.3.3.3.1.11 Drop or collision of an unsealed, loaded WP from a canister transfer cell overhead crane onto or against, a loaded, sealed WP on the opposite WP positioning cell pedestal and trolley during the lift and transfer to a WP positioning cell pedestal and trolley**

The operational requirements cited in Section 6.3.3.3.1.10 preclude this potential event.

- 6.3.3.3.1.12 Slapdown of a loaded, unsealed WP onto the floor and then across or into an empty MSC/WP loading pit (with no pit cover in place) following a drop from a canister transfer cell overhead crane onto the edge of the trolley or pit edge during the lift and transfer to the WP positioning cell pedestal and trolley**

The calculation presented in Section 6.3.1.7 includes this potential event.

- 6.3.3.3.1.13 Slapdown of a loaded, unsealed WP onto the floor and then across or into an MSC/WP loading pit (with no pit cover in place and a loaded or partially loaded, sealed or unsealed MSC or WP in place) following a drop from a canister transfer cell overhead crane onto the edge of the trolley or pit edge during the lift and transfer to the WP positioning cell pedestal and trolley**

The calculation presented in Section 6.3.1.7 includes this potential event. The operational requirements cited in Section 6.3.3.3.1.8 preclude a drop into an occupied loading pit.

- 6.3.3.3.1.14 Slapdown of a loaded, unsealed WP that subsequently impacts a loaded, unsealed WP on the opposite WP positioning cell trolley following a drop from a canister transfer cell overhead crane onto the edge of the opposite WP positioning cell trolley, a pit edge, or other object during the lift and transfer to the WP positioning cell pedestal and trolley**

The operational requirements cited in Section 6.3.3.3.1.10 preclude this potential event.

- 6.3.3.3.1.15 Slapdown of a loaded, unsealed WP that subsequently impacts a loaded, sealed WP on the opposite WP positioning cell trolley following a drop from a canister transfer cell overhead crane onto the edge of the WP positioning cell trolley, a pit edge, or other object during the lift and transfer to the WP positioning cell pedestal and trolley**

The operational requirements cited in Section 6.3.3.3.1.10 preclude this potential event.

- 6.3.3.3.1.16 Impact due to horizontal movement of a loaded, sealed MSC by a canister transfer cell overhead crane before it is fully vertically lifted out of the MSC/WP loading pit**

This collision event is included in Section 6.3.1.21.

6.3.3.3.1.17 Drop or collision of a loaded, sealed MSC from a canister transfer cell overhead crane back into or against the MSC/WP loading pit during MSC removal and transfer to the SRTC

MSC drop is covered in Section 6.3.1.1.2. Note that the transfers are different, but there are still two transfers: (1) from the loading pit to the SRTC before aging and (2) after aging, from the SRTC to the trolley in the DTF. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.3.3.1.18 Slapdown of a loaded, sealed MSC onto the cell floor, into a wall, or onto a pit cover following a drop from a canister transfer cell overhead crane onto the edge of the MSC/WP loading pit or the SRTC during MSC removal from the pit and transfer to the SRTC

This potential event is covered by Section 6.3.1.1.2. Note that the transfers are different, but there are still two transfers: (1) from the loading pit to the SRTC before aging and (2) after aging, from the SRTC to the trolley in the DTF. A design requirement will ensure that a dropped MSC will not penetrate the pit cover (Assumption 5.1.6.6).

6.3.3.3.1.19 Drop or collision of a loaded, sealed MSC from a canister transfer cell overhead crane onto or against the SRTC following removal of the MSC from the MSC/WP loading pit during transfer to the SRTC for removal from the building.

MSC drop is covered in Section 6.3.1.1.2. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.3.3.1.20 Drop of a loaded, sealed MSC from a canister transfer cell overhead crane onto the canister transfer cell floor or a pit cover following removal of the MSC from the MSC/WP loading pit

MSC drop is covered in Section 6.3.1.1.2. A design requirement will ensure that a dropped MSC will not penetrate the pit cover (Assumption 5.1.6.6).

6.3.3.3.1.21 Drop or collision of a loaded, sealed MSC from a canister transfer cell overhead crane onto or against a sharp object following removal of the MSC from the MSC/WP loading pit

Design and operational requirements will ensure that load paths are kept free of puncture hazards (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.3.3.1.22 Collision of the SRTC (holding a loaded, sealed MSC) with the entrance vestibule doors, the tool/parts storage room doors, or the canister transfer cell shield doors

A design or operational requirement is assumed to ensure that a collision between the entrance vestibule doors, the tool/parts storage room doors, or the canister transfer cell shield doors and the SRTC will not overturn the SRTC or cause it to drop its load (Assumption 5.1.1.38).

6.3.3.3.1.23 The entrance vestibule doors, the tool/parts storage room doors, or the canister transfer cell shield doors close on the SRTC (holding a loaded, sealed MSC)

A design requirement is assumed to ensure that closure of the various doors onto the SRTC will not overturn the SRTC or cause it to drop its load (Assumption 5.1.1.13). Because the SRTC remains upright there is no threat to the integrity of the MSC.

6.3.3.3.2 Chemical Contamination/Flooding

6.3.3.3.2.1 Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures

Because the SNF in this area is contained in a sealed canister (BSC 2005 [DIRS 171428], Section 6.6.2), this potential event will not occur unless an event sequence leads to exposure of SNF to air. Oxidation of the fuel matrix is a possible outcome of an event that exposes SNF to air. The consequence analyses will account for the possibility of oxidation, if applicable.

6.3.3.3.3 Explosion/Implosion

6.3.3.3.3.1 MSC inerting system (or other pneumatic or pressurized system) missile due to a fractured nozzle/valve stem/pneumatic device

An operational requirement is assumed to prevent initiation of an event sequence by this potential event (Assumption 5.1.1.5).

6.3.3.3.4 Fire, Thermal

6.3.3.3.4.1 Electrical fire associated with the canister transfer cell overhead cranes

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.3.3.4.2 Electrical fire associated with handling equipment or other canister transfer cell electrical equipment

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.3.3.4.3 Diesel fuel fire/explosion associated with the SRTC tractor pulling an SRTC holding an MSC

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.3.3.4.4 HEPA filter fire due to excessive radioactive decay within the filter bed

HEPA filters will be maintained well below their auto-ignition temperature to preclude a filter fire (Assumption 5.1.1.47).

6.3.3.3.4.5 Transient combustible fire in the canister transfer cell

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.3.3.4.6 Thermal hazard (from decay heat) associated with a vertical orientation of a non-inerted, loaded, unsealed WP with normal cooling

This potential event is covered in Section 6.3.3.3.2.1.

6.3.3.3.4.7 Overheating of a loaded, unsealed (and uninerted) WP or MSC due to a loss of cooling resulting in excessive temperature and possible damage to canister contents

This potential event is discussed in Section 6.3.1.26.

6.3.3.3.5 Radiation

6.3.3.3.5.1 Radiation exposure of a facility worker and/or the offsite public

Exposure of workers or the public to radiation is a hazard for the potential event sequences considered in the present analysis. The consequence analysis will evaluate this hazard for event sequences and normal operations, as applicable.

6.3.3.3.5.2 Loss of confinement zones due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation

This potential event is covered in Section 6.3.1.25.

6.3.3.3.5.3 Inadvertent opening of a canister transfer cell shield door or a WP positioning cell shield door, leading to a worker exposure

This potential event could expose workers to radiation, but would not expose the public. The frequency of inadvertent actions that expose workers to radiation will be limited by design features and operating procedures that ensure that such events are not Category 1 (Assumption 5.1.1.57).

6.3.3.3.5.4 Radiation-induced damage to a facility SSC

Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization as explained in Section 6.3.2.5.2.

6.3.3.3.6 Fissile

6.3.3.3.6.1 Criticality associated with a drop or slapdown of a loaded MSC from a canister transfer cell overhead crane and a rearrangement of cask internals

A criticality in an MSC is not credible because a design requirement will ensure that MSCs remain subcritical even with the most reactive credible configuration of the fissile material and optimal moderation (Assumption 5.1.1.4).

6.3.3.3.6.2 Criticality associated with an SRTC (holding a loaded MSC) derailment or collision followed by a load tipover or fall and rearrangement of the cask internals

A criticality in an MSC is not credible because a design requirement will ensure that MSCs remain subcritical even with the most reactive credible configuration of the fissile material and optimal moderation (Assumption 5.1.1.4).

6.3.3.3.6.3 Criticality associated with a drop or slapdown of a loaded, unsealed WP from a canister transfer cell overhead crane and a rearrangement of WP internals

Because the WP does not spill its contents (Assumption 5.1.3.11) and moderator intrusion into the WP is controlled, the unsealed WP will remain subcritical (Assumptions 5.1.3.2 and 5.1.1.21).

6.3.3.3.6.4 Criticality associated with a drop of heavy equipment onto an unsealed, loaded WP or MSC and a rearrangement of the container internals

For the WP, provided that moderators are controlled, the unsealed WP will remain subcritical (Assumptions 5.1.3.2 and 5.1.1.21). A criticality in an MSC is not credible because a design requirement will ensure that MSCs remain subcritical even with the most reactive credible configuration of the fissile material and optimal moderation (Assumption 5.1.1.4).

6.3.3.4 WP Closure

6.3.3.4.1 Collision/Crushing

6.3.3.4.1.1 Derailment of a trolley holding a loaded, unsealed WP followed by a load tipover or fall

A design requirement is assumed to ensure that the trolley will not derail or allow the unsealed WP to fall off the trolley (Assumption 5.1.1.36). Because the WP remains upright there is no event sequence.

6.3.3.4.1.2 Drop or collision of equipment from a canister transfer cell overhead crane onto or against a loaded, unsealed WP positioned on a pedestal on a trolley

Operational requirements will prevent radiological releases due to this potential event (Assumption 5.1.3.3).

6.3.3.4.1.3 Collision involving the trolley holding the loaded, unsealed WP and the shield doors between the canister transfer cell and the WP positioning cell

This potential event is included in Section 6.3.1.22.

6.3.3.4.1.4 Shield doors between the canister transfer cell and the WP positioning cell close on the trolley holding the loaded, unsealed WP

A design requirement is assumed to ensure that closure of the shield doors onto a trolley would not overturn the trolley or cause it to drop its load (Assumption 5.1.1.13).

6.3.3.4.1.5 Lid drop onto a WP from the lid placement fixture equipment during the welding process

The event is included with the generalized lid-drop event sequence discussed in Section 6.3.1.2.

6.3.3.4.1.6 Equipment drop onto a WP during the welding process

Operational requirements will prevent radiological releases due to this potential event (Assumption 5.1.3.3).

6.3.3.4.1.7 Drop or collision of equipment from a canister transfer cell overhead crane onto or against a loaded, sealed WP positioned on a pedestal on a trolley

Operational requirements will prevent radiological releases due to this potential event (Assumption 5.1.3.3).

6.3.3.4.1.8 Collision involving the trolley holding the loaded, sealed WP and the shield doors between the WP positioning cell and the canister transfer cell

This potential event is included in Section 6.3.1.22.

6.3.3.4.1.9 Shield doors between the WP positioning cell and the canister transfer cell close on the trolley holding the loaded, sealed WP

A design requirement is assumed to ensure that closure of the shield doors onto a trolley would not overturn the trolley or cause it to drop its load (Assumption 5.1.1.13). Because the trolley remains upright, the WP will not breach.

6.3.3.4.2 Chemical Contamination/Flooding

6.3.3.4.2.1 Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures

Because the CHF does not handle uncanistered waste, the SNF is contained in a sealed canister (BSC 2005 [DIRS 171428], Section 6.6.2). This potential event cannot occur unless an event sequence leads to exposure of SNF to air. Oxidation of the fuel matrix is a possible outcome of an event that exposes SNF to air. The consequence analyses will account for the possibility of oxidation, where applicable.

6.3.3.4.3 Explosion/Implosion

6.3.3.4.3.1 WP inerting system (or other pneumatic or pressurized system) missile due to a fractured nozzle/valve stem/pneumatic device

An operational requirement is assumed to prevent initiation of an event sequence by this potential event (Assumption 5.1.1.5).

6.3.3.4.3.2 Explosion hazard associated with the WP purging and inerting system and the ignition of hydrogen that may have accumulated in the WP

Precautions taken during the cask sampling and purging process will provide reasonable assurance that such hydrogen explosions will not occur (Assumption 5.1.1.58).

6.3.3.4.4 Fire, Thermal

6.3.3.4.4.1 Electrical fire associated with handling equipment and other electrically-powered equipment in the WP closure cell or the WP positioning cell, including the overhead cranes and the welding subsystem in the WP closure cells

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.3.4.4.2 Electrical fire associated with a motor on a WP trolley

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.3.4.4.3 Canister/SNF damage by burn-through during welding process/heat damage

Burn-through of the inner lid is not possible with the gas tungsten arc welding process, which is used for the closure welds (BSC 2005 [DIRS 171428], Section 6.6.3.10; BSC 2004 [DIRS 172428], Section 3).

6.3.3.4.4.4 Thermal hazard/canister/SNF overheating in a WP during the welding process resulting in excessive cladding temperature and possible zircaloy cladding (or other cladding) unzipping

Overheating of the WP contents due to welding is not possible using the gas tungsten arc welding process, which is used for the closure welds (BSC 2005 [DIRS 171428], Section 6.6.3.10; BSC 2004 [DIRS 172428], Section 3).

6.3.3.4.4.5 Overheating of a loaded WP due to a loss of cooling resulting in excessive temperature and possible damage to the canister contents

This potential event is discussed in Section 6.3.1.26.

6.3.3.4.4.6 Transient combustible fire in the WP closure cell or the WP positioning cell

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.3.4.5 Radiation

6.3.3.4.5.1 Radiation exposure of a facility worker and/or the offsite public

Exposure of workers or the public to radiation is a hazard for the potential event sequences considered in the present analysis. The consequence analysis will evaluate this hazard for event sequences and normal operations, as applicable.

6.3.3.4.5.2 Glovebox leak leads to a radiological release

Gloveboxes will be inspected for proper functioning and monitored for release of radioactive contamination. Therefore, exposure of workers to radiation due to a glovebox leak will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.3.4.5.3 Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation

This potential event is covered in Section 6.3.1.25.

6.3.3.4.5.4 Inadvertent opening of a canister transfer cell shield door or a WP positioning cell shield door, leading to a worker exposure

This potential event could expose workers to radiation, but would not expose the public. The frequency of inadvertent actions that expose workers to radiation will be limited by design features and operating procedures that ensure that such events are not Category 1 (Assumption 5.1.1.57).

6.3.3.4.5.5 Radiation-induced damage to a facility SSC

Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization as explained in Section 6.3.2.5.2.

6.3.3.4.6 Fissile

6.3.3.4.6.1 Criticality associated with a trolley holding a sealed or unsealed WP derailment followed by a load tipover or fall and rearrangement of the container internals

A design requirement is assumed to ensure that the trolley will not derail or allow the unsealed WP to fall off the trolley (Assumption 5.1.1.36). Because the WP remains upright, there is no mechanism for reconfiguration of internals and, therefore, no criticality.

6.3.3.4.6.2 Criticality associated with a drop of heavy equipment onto an unsealed, loaded WP and a rearrangement of the container internals

A design requirement will ensure criticality safety for unsealed WPs with moderator control in effect (Assumptions 5.1.3.2 and 5.1.1.21).

6.3.3.5 WP Loadout: Canister Transfer Cell, WP Tool Storage Room, Exit Vestibule

6.3.3.5.1 Collision/Crushing

6.3.3.5.1.1 Derailment of a trolley holding a loaded, sealed WP followed by a load tipover or fall.

A design requirement is assumed to ensure that a derailment of a trolley will not cause the trolley to overturn and allow the WP to fall to the floor (Assumption 5.1.1.36). Because the trolley remains upright there is no threat to the integrity of the WP.

6.3.3.5.1.2 Drop of a loaded, sealed WP from a canister transfer cell overhead crane onto the floor during transfer from the trolley to the survey area

Section 6.3.1.8 includes this potential event.

6.3.3.5.1.3 Drop or collision of a loaded, sealed WP from a canister transfer cell overhead crane onto or against a sharp object during transfer from the trolley to the survey area

Design and operational requirements will ensure that load paths are kept free of puncture hazards (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

- 6.3.3.5.1.4 Slapdown of a loaded, sealed WP that subsequently impacts a loaded, unsealed WP on the opposite WP positioning cell trolley following a drop from a canister transfer cell overhead crane onto the edge of the opposite WP positioning cell trolley, a pit edge, or other object during the lift and transfer to the survey area**

The operational requirements cited in Section 6.3.3.3.1.10 preclude this potential event.

- 6.3.3.5.1.5 Slapdown of a loaded, sealed WP that subsequently impacts a loaded, sealed WP on the opposite WP positioning cell trolley following a drop from a canister transfer cell overhead crane onto the edge of the WP positioning cell trolley, a pit edge, or other object during the lift and transfer to the survey area**

The operational requirements cited in Section 6.3.3.3.1.10 preclude this potential event.

- 6.3.3.5.1.6 Drop or collision of a sealed, loaded WP from a canister transfer cell overhead crane onto or against a loaded, unsealed WP on the opposite WP positioning cell pedestal and trolley during the lift and transfer to the survey area**

The operational requirements cited in Section 6.3.3.3.1.10 preclude the potential drop event. The potential collision event is included in Section 6.3.1.21.

- 6.3.3.5.1.7 Drop or collision of a sealed, loaded WP from a canister transfer cell overhead crane onto or against, a loaded, sealed WP on the opposite WP positioning cell pedestal and trolley during the lift and transfer to the survey area**

The operational requirements cited in Section 6.3.3.3.1.10 preclude this potential event. The potential collision event is included in Section 6.3.1.21.

- 6.3.3.5.1.8 Drop of a loaded, sealed WP from a canister transfer cell overhead crane onto the floor during transfer from the survey area to the tilting machine**

This potential event is included in Section 6.3.1.8.

- 6.3.3.5.1.9 Drop of a loaded, sealed WP from a canister transfer cell overhead crane back onto the pedestal on the trolley during the transfer from the survey area to the tilting machine.**

Section 6.3.1.8 includes this potential event.

6.3.3.5.1.10 Drop or collision of a loaded, sealed WP from a canister transfer cell overhead crane onto or against a sharp object (including the tilting machine) during transfer from the survey area to the tilting machine

Section 6.3.1.8 includes the potential drop event. The potential collision event is included in Section 6.3.1.21.

6.3.3.5.1.11 Slapdown (either forward into the WP turntable or backward onto the floor) of a loaded, sealed WP in the tilting machine from a canister transfer cell overhead crane during the lowering of the WP to the horizontal position on the pallet previously placed on the WP turntable

The WP is assumed to survive a forward slapdown without breach (Assumption 5.1.3.12). A design requirement is assumed to prevent backward slapdowns (Assumption 5.1.1.53).

6.3.3.5.1.12 Collision of the tilting machine against a loaded, sealed WP on a pallet on the WP turntable.

A design or operational requirement is assumed to ensure that a collision between the tilting machine and a WP would not initiate an event sequence (Assumption 5.1.3.10).

6.3.3.5.1.13 Drop or collision of a lifting collar from a canister transfer cell overhead crane onto or against a WP after removal of the collar from the WP collar removal machine.

Operational requirements will prevent radiological releases due to this potential event (Assumption 5.1.3.3).

6.3.3.5.1.14 Collision or impact of the trunnion collar removal machine and a loaded, sealed WP positioned on a pallet positioned on the WP turntable

A design or operational requirement is assumed to ensure that a collision between the trunnion collar removal machine and a WP would not breach the WP (Assumption 5.1.3.10).

6.3.3.5.1.15 Drop of a loaded, sealed WP positioned on a pallet (from a horizontal position) from a canister transfer cell overhead crane onto the floor or the bedplate during transfer of the WP and pallet from the WP turntable to the WP transporter bedplate

Section 6.3.1.8 includes this potential event.

6.3.3.5.1.16 Drop or collision of a loaded, sealed WP positioned on a pallet (from a horizontal position) from a canister transfer cell overhead crane onto or against a sharp object during transfer of the WP and pallet from the WP turntable to the WP transporter bedplate

Design and operational requirements will ensure that load paths are kept free of puncture hazards (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.3.5.1.17 Equipment drop or collision (including lifting yokes) onto or against a loaded, sealed WP when the WP is on the pallet on the WP turntable or when the WP is on the pallet on the WP transporter bedplate

Operational requirements will prevent radiological releases due to this potential event (Assumption 5.1.3.3).

6.3.3.5.1.18 Collision involving a WP transporter (holding the sealed WP on a pallet) and the shield doors between the canister transfer cell and the WP tool storage room

A design requirement is assumed to ensure that a collision of the WP transporter would not cause a WP breach (Assumptions 5.1.7.3 and 5.1.7.7).

6.3.3.5.1.19 The shield doors between the canister transfer cell and the WP tool storage room close on the WP transporter (holding the sealed WP on a pallet)

A design requirement is assumed to ensure that closure of the shield doors onto a transporter would not overturn the transporter or cause it to drop its load (Assumption 5.1.1.13). Because the transporter remains upright there is no threat to the integrity of the WP.

6.3.3.5.1.20 Collision involving WP transporter (holding the sealed WP on a pallet) and the shield doors between the WP tool storage room and the exit vestibule

A design requirement is assumed to ensure that a collision of the WP transporter would not cause a WP breach (Assumptions 5.1.7.3 and 5.1.7.7).

6.3.3.5.1.21 The doors between the WP tool storage room and the exit vestibule close on the WP transporter (holding the sealed WP on a pallet)

A design requirement is assumed to ensure that closure of the shield doors onto a trolley would not overturn the trolley or cause it to drop its load (Assumption 5.1.1.13). Because the trolley remains upright the WP will not breach.

6.3.3.5.1.22 Collision involving WP transporter (holding the sealed WP on a pallet) and the doors between the exit vestibule and the ambient air (outside)

A design requirement is assumed to ensure that a collision of the WP transporter would not cause a WP breach (Assumptions 5.1.7.3 and 5.1.7.7).

6.3.3.5.1.23 Doors between the exit vestibule and the ambient air (outside) close on the WP transporter (holding the sealed WP on a pallet)

A design requirement is assumed to ensure that closure of the shield doors onto a WP transporter would not overturn the WP transporter or cause it to drop its load (Assumption 5.1.1.13).

6.3.3.5.1.24 Derailment of a WP transporter in the exit vestibule, WP tool storage room, or WP loadout area of the canister transfer cell followed by a load tipover or fall

A design requirement is assumed to ensure that a derailment of the WP transporter would not cause a WP breach (Assumptions 5.1.7.3 and 5.1.7.7).

6.3.3.5.2 Chemical Contamination/Flooding

6.3.3.5.2.1 Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures

Because the SNF in this area is contained in a sealed canister and WP, this potential event will not occur unless an event sequence leads to exposure of SNF to air (BSC 2005 [DIRS 171428], Section 6.6.2). Oxidation of the fuel matrix is a possible outcome of an event that exposes SNF to air. The consequence analyses will account for the possibility of oxidation, if applicable.

6.3.3.5.3 Explosion/Implosion

6.3.3.5.3.1 Hydraulic system or other pneumatic or pressurized system missile due to a fractured nozzle/valve stem/pneumatic device

An operational requirement is assumed to prevent initiation of an event sequence by this potential event (Assumption 5.1.1.5).

6.3.3.5.4 Fire, Thermal

6.3.3.5.4.1 Electrical fire associated with the WP transporter loadout area housing the equipment for WP tilt and WP transporter loading, as well as the WP tool storage room and the exit vestibule (including the WP trunnion collar removal machine, the tilting machine, and the WP turntable)

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.3.5.4.2 Electrical fire associated with the overhead bridge cranes

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.3.5.4.3 Electrical fire associated with equipment on the WP transporter, including motors to extend the WP transporter bedplate

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.3.5.4.4 Electrical fire associated with the WP transporter locomotive

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.3.5.4.5 Electrical fire associated with a motor on a WP trolley

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.3.5.4.6 Overheating of a loaded, sealed WP due to a loss of cooling resulting in excessive temperature and possible damage to the canister contents

This potential event is discussed in Section 6.3.1.26.

6.3.3.5.4.7 Transient combustible fire in the canister transfer area, the WP tool storage room, or the exit vestibule

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.3.5.5 Radiation

6.3.3.5.5.1 Radiation exposure of a facility worker and/or the offsite public

Exposure of workers or the public to radiation is a hazard for the potential event sequences considered in the present analysis. The consequence analysis will evaluate this hazard for event sequences and normal operations, as applicable.

6.3.3.5.5.2 Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation

This potential event is covered in Section 6.3.1.25.

6.3.3.5.5.3 Inadvertent opening of a canister transfer cell shield door, leading to a worker exposure

This potential event could expose workers to radiation, but would not expose the public. The frequency of inadvertent actions that expose workers to radiation will be limited by design features and operating procedures that ensure that such events are not Category 1 (Assumption 5.1.1.57).

6.3.3.5.5.4 Inadvertent opening of the WP transporter shielded enclosure doors, leading to a worker exposure

This potential event could expose workers to radiation, but would not expose the public. The frequency of inadvertent actions that expose workers to radiation will be limited by design features and operating procedures that ensure that such events are not Category 1 (Assumption 5.1.1.57).

6.3.3.5.6 Fissile

6.3.3.5.6.1 Criticality associated with a trolley holding a WP derailment followed by a load tipover or fall and rearrangement of the WP internals

A design requirement is assumed to ensure that the trolley will not derail or allow the unsealed WP to fall off the trolley (Assumption 5.1.1.36). Because the WP remains upright, there is no mechanism for reconfiguration of internals and, therefore, no criticality.

6.3.3.5.6.2 Criticality associated with a WP transporter derailment followed by a load tipover or fall and rearrangement of the WP internals

A design requirement is assumed to ensure that a derailment of the WP transporter would not cause a WP breach (Assumptions 5.1.7.3 and 5.1.7.7). Another design requirement is assumed to preclude criticality in sealed WPs (Assumption 5.1.3.1).

6.3.3.5.6.3 Criticality associated with a drop, slapdown, or collision of a WP and a rearrangement of the container internals

A design requirement will ensure that WPs are designed such that drops, collisions, and other handling impacts within their design bases (allowing for rearrangement of container internals and without credit for burnup) cannot lead to a nuclear criticality (Assumption 5.1.3.1).

6.3.3.6 CHF (Empty Transportation Cask and MSC Removal): Canister Transfer Cell, WP Tool Storage Room, Exit Vestibule

No events identified.

6.3.4 DTF

A description of the operations in this facility and a listing of the hazards and potential events is provided in *Internal Hazards Analysis for License Application* (BSC 2005 [DIRS 171428], Section 6.6.3).

6.3.4.1 Cask and MSC Entrance Vestibule, Cask and MSC SRTC Receipt Area, Cask and MSC to Trolley Transfer Room

6.3.4.1.1 Collision/Crushing

6.3.4.1.1.1 SRTC derailment involving a loaded cask (with impact limiters installed) followed by a load tipover or fall

Transportation casks with impact limiters are designed to withstand, without breaching, the drops discussed in Section 4.2.1. The drops specified in Section 4.2.1 bound the impacts that could occur during cask handling at the repository. Consequently, a derailment would not breach a transportation cask.

6.3.4.1.1.2 Collision of an SRTC carrying a loaded cask (with impact limiters installed) with the cask and MSC entrance vestibule doors or the cask and MSC SRTC receipt area doors

Transportation casks with impact limiters are designed to withstand, without breaching, the drops discussed in Section 4.2.1. The drops specified in Section 4.2.1 bound the impacts that could occur during cask handling at the repository. Consequently, a collision within the facility would not breach a transportation cask.

6.3.4.1.1.3 The cask and MSC entrance vestibule doors or the cask and MSC SRTC receipt area doors close on an SRTC carrying a loaded cask (with impact limiters installed)

A design requirement is assumed to ensure that closure of the entrance vestibule doors or shield doors onto an SRTC would not overturn the SRTC or cause it to drop its load (Assumption 5.1.1.13). Because the SRTC remains upright there is no threat to the integrity of the cask.

6.3.4.1.1.4 MSC transporter collision or overturning involving a loaded MSC followed by a load tipover or fall

Design and operational requirement are assumed to ensure that an MSC transporter will not collide or overturn (Assumption 5.1.1.38). Because the transporter remains upright there is no threat to the integrity of the cask.

6.3.4.1.1.5 Collision of an MSC transporter carrying a loaded MSC with the cask and MSC entrance vestibule doors or the cask and MSC SRTC receipt area shield doors

Design and operational requirements are assumed to ensure that a collision involving the MSC transporter with the MSC entrance vestibule doors or the cask and MSC SRTC receipt area shield doors would not overturn it or cause it to drop its load (Assumption 5.1.1.38). Because the MSC does not fall off the transporter as a result of the collision, there is no threat to its integrity.

6.3.4.1.1.6 The cask and MSC entrance vestibule doors or the cask and MSC SRTC receipt area shield doors close on an MSC transporter carrying a loaded MSC

A design requirement is assumed to ensure that closure of the shield doors onto an MSC transporter would not overturn it or cause it to drop its load (Assumption 5.1.1.13). Because the MSC does not fall off the transporter as a result of the collision, there is no threat to its integrity.

6.3.4.1.1.7 Collision of a mobile elevated platform with a loaded cask during removal of the personnel barriers and impact limiters or during survey activities

Operational requirements are assumed to ensure that the mobile elevated platform will not be operated in a manner that could breach or overturn a transportation cask (Assumption 5.1.1.41).

6.3.4.1.1.8 Forklift collision with a cask on an SRTC (with or without impact limiters installed on the cask) or the SRTC holding the cask

Operational requirements are assumed to ensure that forklifts will not be operated in a manner that could breach a transportation cask (Assumption 5.1.1.41).

6.3.4.1.1.9 Collision between a forklift and an MSC positioned on the floor, an MSC on a pedestal on a trolley, or the MSC transporter holding the MSC

Operational requirements are assumed to ensure that forklifts will not be operated in a manner that could breach an MSC (Assumption 5.1.1.41).

6.3.4.1.1.10 Collision between a mobile elevated platform and an MSC positioned on the floor, an MSC on a pedestal on a trolley, or the MSC transporter holding the MSC

Operational requirements are assumed to ensure that the mobile elevated platform will not be operated in a manner that could breach an MSC (Assumption 5.1.1.41).

6.3.4.1.1.11 Drop or collision of personnel barriers or impact limiters from the receipt area crane onto or against a loaded cask

Operational requirements will ensure that equipment associated with cask preparation and handling will not breach the cask (Assumption 5.1.1.30).

6.3.4.1.1.12 Slapdown of a loaded cask onto an SRTC during the upending of the loaded cask to the vertical orientation by the overhead crane

This potential event is covered by Section 6.3.1.1.

6.3.4.1.1.13 Drop of a loaded cask from an overhead crane onto the floor during the transfer from an SRTC to a pedestal previously staged on a trolley

This potential event is covered by Section 6.3.1.1.

6.3.4.1.1.14 Drop of a loaded cask from an overhead crane onto the pedestal on a trolley during the transfer from an SRTC to a pedestal previously staged on a trolley

This potential event is covered by Section 6.3.1.1.

6.3.4.1.1.15 Drop or collision of a loaded cask from an overhead crane onto or against a sharp object during the transfer from an SRTC to a pedestal previously positioned on a trolley

Design and operational requirements will ensure that load paths are kept free of puncture hazards (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.1.1.16 Slapdown of a loaded cask following a drop from an overhead crane onto the edge of the trolley or pedestal during transfer of the cask from the SRTC to the pedestal on a trolley

This potential event is covered by Section 6.3.1.1.

6.3.4.1.1.17 Collision of a loaded cask suspended from an overhead crane with the shield doors separating the cask and MSC SRTC receipt area and the cask and MSC to trolley transfer room during the transfer of the cask from the SRTC to the trolley

Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.1.1.18 Closing of the shield doors separating the cask and MSC SRTC receipt area and the cask and MSC to trolley transfer room (striking a loaded cask while it is suspended from the overhead crane) during the transfer of the cask from the SRTC to the pedestal on a trolley

A design requirement is assumed to ensure that closure of the shield doors onto a cask suspended from the overhead crane will not breach the cask or cause the crane to drop the load (Assumption 5.1.1.13).

6.3.4.1.1.19 Drop of a loaded MSC from an overhead crane onto the floor during the transfer from an SRTC to a pedestal previously positioned on a trolley

This potential event is covered by Section 6.3.1.1.2.

6.3.4.1.1.20 Drop of a loaded MSC from an overhead crane onto the pedestal on a trolley during the transfer from an SRTC to a pedestal previously positioned on a trolley.

This potential event is covered by Section 6.3.1.1.2.

6.3.4.1.1.21 Drop or collision of a loaded MSC from an overhead crane onto or against a sharp object during the transfer from the floor (after delivery by the MSC transporter) to a pedestal previously staged on a trolley

Design and operational requirements will ensure that load paths are kept free of puncture hazards (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.1.1.22 Collision of a loaded MSC suspended from an overhead crane with the shield doors separating the cask and MSC SRTC receipt area and the cask and MSC to trolley transfer room during transfer of the MSC from the floor (after delivery by the MSC transporter) to the pedestal on a trolley

Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.1.1.23 Closing of the shield doors separating the cask and MSC SRTC receipt area and the cask and MSC to trolley transfer room (striking a loaded MSC while it is suspended from the overhead crane) during the transfer of the MSC from the floor (after delivery by the MSC transporter) to the pedestal on a trolley

A design requirement is assumed to ensure that closure of the shield doors onto a cask suspended from the overhead crane will not breach the cask or cause the crane to drop the load (Assumption 5.1.1.13).

6.3.4.1.1.24 Slapdown of a loaded MSC following a drop from an overhead crane onto the edge of the trolley or pedestal during transfer of the MSC from the floor (after delivery by the MSC transporter) to the pedestal on a trolley

This potential event is covered by Section 6.3.1.1.2.

6.3.4.1.1.25 Drop or collision of handling equipment from an overhead bridge crane onto or against a loaded cask or MSC

Operational requirements are assumed to ensure that a drop or collision of handling equipment onto or against a transportation cask without impact limiters or an MSC would not breach the cask (Assumption 5.1.1.30).

6.3.4.1.1.26 Drop or collision of equipment from the maintenance crane onto or against a loaded cask or MSC

Operational requirements are assumed to ensure that a drop or collision of handling equipment onto or against a transportation cask without impact limiters or an MSC would not breach the cask (Assumption 5.1.1.30).

6.3.4.1.1.27 Collision of a trolley holding a cask or MSC on a pedestal with the shield doors separating the cask and MSC to trolley transfer room and the cask and MSC turntable room

This potential event is included in Section 6.3.1.22.

6.3.4.1.1.28 The shield doors separating the cask and MSC to trolley transfer room and the cask and MSC turntable room close on a trolley holding a loaded cask or MSC on a pedestal

A design requirement is assumed to ensure that closure of the shield doors onto a trolley holding a loaded cask or MSC would not overturn the trolley or cause it to drop its load (Assumption 5.1.1.13). Because the trolley remains upright there is no threat to the integrity of the cask.

6.3.4.1.1.29 Derailment of a trolley holding a cask or MSC on a pedestal followed by a load tipover or fall

A design requirement is assumed to ensure that the trolley will not derail or allow the cask to fall off the trolley (Assumption 5.1.1.36).

6.3.4.1.2 Chemical Contamination/Flooding

6.3.4.1.2.1 Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures

Because the SNF in this area is contained in a sealed cask, this potential event will not occur unless an event sequence leads to exposure of SNF to air (BSC 2005 [DIRS 171428], Section 6.6.3.1). Oxidation of the fuel matrix is a possible outcome of an event that exposes SNF to air. The consequence analyses will account for the possibility of oxidation, if applicable.

6.3.4.1.3 Explosion/Implosion

6.3.4.1.3.1 Hydrogen explosion involving batteries on a cask trolley

The waste is protected by casks or WPs while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to cause a breach in casks or WPs (Assumption 5.1.1.51).

6.3.4.1.3.2 Hydrogen explosion involving batteries on a forklift

The waste is protected by casks or WPs while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to cause a radiological release (Assumption 5.1.1.51).

6.3.4.1.3.3 Hydrogen explosion involving batteries on a mobile elevated platform

The waste is protected by casks or WPs while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to cause a radiological release (Assumption 5.1.1.51).

6.3.4.1.4 Fire, Thermal

6.3.4.1.4.1 Electrical fire associated with the cask and MSC SRTC receipt area overhead cranes.

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.1.4.2 Electrical fire associated with handling equipment or other electrical equipment in the cask and MSC entrance vestibule, cask and MSC SRTC receipt area, or the cask and MSC to trolley transfer room

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.1.4.3 Diesel fuel fire/explosion involving an SRTC tractor pulling or pushing an SRTC holding a loaded cask

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.1.4.4 Diesel fuel fire/explosion involving an MSC transporter holding a loaded MSC

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.1.4.5 Fire/explosion (battery/electrical fire) associated with the cask trolley

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.1.4.6 Fire/explosion (battery/electrical fire) associated with a forklift

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.1.4.7 Fire/explosion (battery/electrical fire) associated with a mobile elevated platform.

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.1.4.8 Transient combustible fire in the cask and MSC SRTC receipt area, the cask and MSC entrance vestibule, or the cask and MSC to trolley transfer room.

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.1.4.9 Thermal hazard (from decay heat) associated with a vertical orientation of a loaded cask.

Transportation casks are designed to withstand normal conditions of transport (including high ambient temperatures and insolation) and hypothetical accident conditions (including fire) (Section 4.2.1). These conditions bound the thermal effect of orienting the cask vertically rather than horizontally. Therefore, this potential event will not lead to exposure of individuals to radiation because the waste is contained in a sealed cask (BSC 2005 [DIRS 171428], Section 6.6.3.1).

6.3.4.1.5 Radiation

6.3.4.1.5.1 Radiation exposure of a facility worker and/or the offsite public

Exposure of workers or the offsite public to radiation is a hazard for the potential event sequences considered in the present analysis. Consequence analysis will evaluate this hazard for event sequences and normal operations, as applicable.

6.3.4.1.5.2 Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation

This potential event is covered in Section 6.3.1.25.

6.3.4.1.5.3 Radiation-induced damage to a facility SSC

Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization as explained in Section 6.3.2.5.2.

6.3.4.1.6 Fissile

6.3.4.1.6.1 Criticality associated with an SRTC derailment or collision followed by a load tipover or fall and a rearrangement of cask internals

A criticality in a transportation cask is not credible because design requirements and waste acceptance criteria will ensure criticality safety in transportation casks (Assumption 5.1.1.4).

6.3.4.1.6.2 Criticality associated with a cask drop, slapdown, or collision and rearrangement of cask internals.

A criticality in a transportation cask is not credible because design requirements and waste acceptance criteria will ensure criticality safety in transportation casks (Assumption 5.1.1.4).

6.3.4.1.6.3 Criticality associated with an MSC drop, slapdown, or collision and rearrangement of cask internals

A criticality in an MSC is not credible because a design requirement will ensure that MSCs remain subcritical even with the most reactive credible configuration of the fissile material and optimal moderation (Assumption 5.1.1.4).

6.3.4.1.6.4 Criticality associated with an MSC transporter (holding a loaded MSC) collision followed by a load tipover or fall and rearrangement of the MSC internals

A criticality in an MSC is not credible because a design requirement will ensure that MSCs remain subcritical even with the most reactive credible configuration of the fissile material and optimal moderation (Assumption 5.1.1.4).

6.3.4.2 Cask/MSC Turntable Room, Cask Preparation Room

6.3.4.2.1 Collision/Crushing

6.3.4.2.1.1 Derailment of a trolley holding a cask or MSC on a pedestal (with outer and/or inner lid bolted in place, if applicable) followed by a load tipover or fall

A design requirement is assumed to ensure that the cask-transfer trolley carrying transportation casks or MSCs in the DTF would not derail or allow the cask to fall off the trolley (Assumption 5.1.1.36).

6.3.4.2.1.2 Derailment of a trolley holding a cask or MSC on a pedestal (with outer and/or inner lid bolted in place, if applicable) due to a turntable malfunction followed by a load tipover or fall

A design requirement is assumed to ensure that the cask-transfer trolley carrying transportation casks or MSCs in the DTF would not cause the trolley to derail or drop its load (Assumption

5.1.1.36). Because the transfer trolley remains upright there is no threat to the integrity of the cask.

6.3.4.2.1.3 Collision of a trolley holding a cask or MSC on a pedestal (with outer and/or inner lid bolted in place, if applicable) with shield doors separating the cask/MSC turntable room and the cask preparation room

This potential event is included in Section 6.3.1.22.

6.3.4.2.1.4 Closure of the shield doors separating the cask/MSC turntable room and the cask preparation room onto the trolley holding a cask or MSC on a pedestal (with outer and/or inner lid bolted in place, if applicable)

A design requirement is assumed to ensure that the airlock and shield doors cannot overturn the trolley or cause it to drop its load (Assumption 5.1.1.13). Because the trolley remains upright there is no threat to the integrity of the cask.

6.3.4.2.1.5 Collision involving two trolleys with at least one holding a cask or MSC on a pedestal (with outer and/or inner lid bolted in place, if applicable)

This potential event is included in Section 6.3.1.22.

6.3.4.2.1.6 Drop or collision of tools or equipment (including a lid-lifting fixture, lid bolts, etc.) onto or against a cask or MSC outer lid (if applicable) or a cask or MSC inner lid in the cask preparation room

Operational requirements will ensure that this potential event will not initiate an event sequence (Assumption 5.1.1.32).

6.3.4.2.1.7 Drop of a cask or MSC outer lid from the overhead crane onto the cask or MSC (if applicable) in the cask preparation room

The frequency and consequences of this event are bounded by those of the Category 2 inner lid-drop event sequence discussed in Section 6.3.1.2. The frequency is bounded because this event only applies to transportation casks and MSCs, while the bounding event also applies to WPs. The consequences are bounded because the contents of the cask are protected by the inner lid for this event, whereas no lids are in place for the bounding event.

6.3.4.2.1.8 Drop or collision of a docking ring onto or against a cask or MSC in the cask preparation room

Operational requirements will ensure that this potential event will not initiate an event sequence (Assumption 5.1.1.32).

6.3.4.2.2 Chemical Contamination/Flooding

6.3.4.2.2.1 Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures

Oxidation of failed CSNF assemblies is expected as a part of normal operations wherever CSNF assemblies are exposed to air. Resulting exposure of workers to radiation will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.4.2.3 Explosion/Implosion

6.3.4.2.3.1 Cask purging or sampling system (or other pneumatic or pressurized system) missile due to a fractured nozzle/valve stem/pneumatic device

An operational requirement is assumed to prevent initiation of an event sequence by this potential event (Assumption 5.1.1.5).

6.3.4.2.3.2 Explosion hazard associated with the cask sampling and purging system and the ignition of hydrogen that may have accumulated in the cask

Precautions taken during the cask sampling and purging process will provide reasonable assurance that such hydrogen explosions will not occur (Assumption 5.1.1.58).

6.3.4.2.3.3 Hydrogen explosion involving batteries on a trolley

The waste is protected by casks or WPs while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to cause a breach in casks or WPs (Assumption 5.1.1.51).

6.3.4.2.4 Fire, Thermal

6.3.4.2.4.1 Electrical fire associated with the cask preparation area 20-ton overhead crane (in room 2051)

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.2.4.2 Electrical fire associated with handling equipment or other cask preparation area equipment, including the turntable

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.2.4.3 Fire/explosion (battery/electrical fire) associated with the trolley.

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.2.4.4 Transient combustible fire in the cask preparation room or the cask/MSC turntable room.

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.2.4.5 Thermal hazard (from decay heat) associated with vertical orientation of the loaded cask.

This potential hazard is addressed in Section 6.3.4.2.2.1

6.3.4.2.4.6 Intact or non-intact SNF overheating or damage to cask or MSC contents due to a loss of cooling resulting in excessive temperature and possible zircaloy cladding (or other cladding) unzipping or cladding failure due to excessive hoop stresses.

This potential event is discussed in Section 6.3.1.26.

6.3.4.2.5 Radiation

6.3.4.2.5.1 Radiation exposure of a facility worker and/or the offsite public

Exposure of workers or the offsite public to radiation is a hazard for the potential event sequences considered in the present analysis. Consequence analysis will evaluate this hazard for event sequences and normal operations, as applicable.

6.3.4.2.5.2 Damage or rupture of cask sampling and purging system, leading to a release of cask or MSC internal gases and radioactive material

The sampling operation will be conducted so that exposure of workers to radiation will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses (BSC 2004 [DIRS 172098], Section 3.2.2.1.1). Although a rupture leading to a radiological release would be an abnormal occurrence, radiation protection programs will ensure that such an occurrence would not contribute significantly to the normal operations dose. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.4.2.5.3 Thermal expansion of gases or other loss of confinement in an unsealed cask or MSC, leading to radiological release

Exposure of workers to radiation due to this potential event will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.4.2.5.4 Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation

This potential event is covered in Section 6.3.1.25.

6.3.4.2.5.5 Radiation-induced damage to a facility SSC

Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization as explained in Section 6.3.2.5.2.

6.3.4.2.6 Fissile

6.3.4.2.6.1 Criticality associated with a cask or MSC collision followed by a load tipover or fall and a rearrangement of the cask or MSC internals

This potential event will be rendered Beyond Category 2 because design requirements and waste acceptance criteria will ensure criticality safety in transportation casks and MSCs (Assumption 5.1.1.4)

6.3.4.2.6.2 Criticality associated with a cask or MSC trolley derailment followed by a load tipover or fall and a rearrangement of the cask or MSC internals

A criticality in an MSC is not credible because design requirements and waste acceptance criteria will ensure criticality safety in MSCs (Assumption 5.1.1.4).

6.3.4.3 Cask and MSC Docking Room

6.3.4.3.1 Collision/Crushing

6.3.4.3.1.1 Derailment of a trolley holding a cask or MSC on a pedestal (with outer lid removed [if applicable] and inner lid unbolted but in place) followed by a load tipover or fall

A design requirement is assumed to ensure that the cask-transfer trolley holding a loaded cask on a pedestal would not derail or allow the cask to fall off the trolley (Assumption 5.1.1.36). Because the trolley remains upright there will be no event sequence.

6.3.4.3.1.2 Derailment of a trolley holding a cask or MSC on a pedestal (with outer lid removed [if applicable] and inner lid unbolted but in place) due to a turntable malfunction followed by a load tipover or fall

This event is similar to the event discussed in Section 6.3.4.3.1.1 and the argument presented in that section applies here.

- 6.3.4.3.1.3 Collision of a trolley holding a cask or MSC on a pedestal (with outer lid removed [if applicable] and inner lid unbolted but in place) with shield doors separating the cask preparation room and the cask/MSC turntable room or the shield doors separating the cask/MSC turntable room and the cask and MSC docking room**

This potential event is included in Section 6.3.1.22.

- 6.3.4.3.1.4 Closure of the shield doors separating the cask preparation room and the cask/MSC turntable room or the shield doors separating the cask/MSC turntable room and the cask and MSC docking room onto the trolley holding a cask or MSC on a pedestal (with outer lid removed [if applicable] and inner lid unbolted but in place)**

A design requirement is assumed to ensure that closure of the shield doors onto a trolley holding a loaded cask or MSC cannot overturn the trolley or cause it to drop its load (Assumption 5.1.1.13). Because the trolley remains upright there is no threat to the integrity of the cask.

- 6.3.4.3.1.5 Collision involving two trolleys with at least one holding a cask or MSC on a pedestal (with outer lid removed [if applicable] and inner lid unbolted but in place)**

This potential event is included in Section 6.3.1.22.

- 6.3.4.3.1.6 Drop or collision of a docking port (mobile slab) onto or against a cask or MSC**

A design requirement is assumed to ensure that this potential event will not initiate an event sequence (Assumption 5.1.1.17).

- 6.3.4.3.1.7 Drop or collision of a docking port plug onto or against a cask lid or MSC lid (with outer lid removed [if applicable] and inner lid unbolted but in place)**

A design requirement to consider 2-over-1 event sequences will prevent initiation of an event sequence as a result of this potential event (Assumption 5.1.1.37).

- 6.3.4.3.1.8 Drop of an inner lid into a cask or MSC (with outer lid removed [if applicable])**

This potential event is included in Section 6.3.1.2.

6.3.4.3.2 Chemical Contamination/Flooding

- 6.3.4.3.2.1 Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures**

Oxidation of failed CSNF assemblies is expected as a part of normal operations wherever CSNF assemblies are exposed to air. Resulting exposure of workers to radiation will be managed as a

normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.4.3.3 Explosion/Implosion

6.3.4.3.3.1 Hydrogen explosion involving batteries on a cask trolley

The waste is protected by casks or WPs while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to cause a breach in casks or WPs (Assumption 5.1.1.51).

6.3.4.3.4 Fire, Thermal

6.3.4.3.4.1 Electrical fire associated with handling equipment or other cask and MSC docking room equipment (including the turntables).

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.3.4.2 Fire/explosion (battery/electrical fire) associated with the cask trolley.

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.3.4.3 Transient combustible fire in the cask and MSC docking room

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.3.4.4 Thermal hazard (from decay heat) associated with vertical orientation of the loaded cask

This potential hazard is addressed in Section 6.3.4.3.2.1.

6.3.4.3.4.5 Intact or non-intact SNF overheating or damage to cask contents due to a loss of cooling resulting in excessive temperature and possible zircaloy cladding (or other cladding) unzipping or cladding failure due to excessive hoop stresses

This potential event is discussed in Section 6.3.1.26.

6.3.4.3.5 Radiation

6.3.4.3.5.1 Radiation exposure of a facility worker and/or the offsite public

Exposure of workers or the offsite public to radiation is a hazard for the potential event sequences considered in the present analysis. The consequence analysis will evaluate this hazard for event sequences and normal operations, as applicable.

6.3.4.3.5.2 Docking ring failure leads to radiological release

This potential event is covered in Section 6.3.1.25.

6.3.4.3.5.3 Radiological release due to installation of incorrect docking ring

Docking ring failure has the same consequences as installation of an incorrect docking ring. Therefore, the analysis in Section 6.3.1.25 applies to this potential event.

6.3.4.3.5.4 Thermal expansion of gases or other loss of confinement in an unsealed cask or MSC, leading to radiological release

Thermal expansion of gases is to be expected as a part of normal operations. Resulting exposure of workers to radiation will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.4.3.5.5 Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation

This potential event is covered in Section 6.3.1.25.

6.3.4.3.5.6 Radiation-induced damage to a facility SSC

Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization as explained in Section 6.3.2.5.2.

6.3.4.3.6 Fissile

6.3.4.3.6.1 Criticality associated with cask or MSC collisions or a trolley derailment followed by a load tipover or fall and a rearrangement of cask or MSC internals

A criticality in a transportation cask or MSC is not credible because design requirements and waste acceptance criteria will ensure criticality safety (Assumption 5.1.1.4).

6.3.4.4 Empty WP and MSC processing prior to loading

No potential event sequences have been identified that affect a waste form.

6.3.4.5 Naval SNF Receipt: WP and Navy Cask Entrance Vestibule, WP/Navy Cask SRTC Receipt Area, WP/Navy to Trolley Transfer Room, WP/Navy Cask Preparation Room

6.3.4.5.1 Collision/Crushing

6.3.4.5.1.1 SRTC derailment involving a loaded naval SNF cask followed by a load tipover or fall

A derailment is only a realistic possibility while the SRTC is in motion. The SRTC is not in motion after the impact limiters are removed (BSC 2005 [DIRS 171428], Section 6.6.3.5). Transportation casks with impact limiters are designed to withstand, without breaching, the drops discussed in Section 4.2.1. The drops specified in Section 4.2.1 bound the impacts that could occur during cask handling at the repository. Consequently, a derailment, overturning, or collision would not breach a transportation cask with impact limiters. To cover the case in which impact limiters have been removed, a design requirement will ensure that the SRTC will not derail and the cask will not fall off the SRTC (Assumption 5.1.1.35). Because the SRTC remains upright there is no threat to the integrity of the cask.

6.3.4.5.1.2 Collision of an SRTC carrying a loaded naval SNF cask with the WP and navy cask entrance vestibule doors or the WP/navy cask SRTC receipt area shield doors

A collision of the SRTC with doors is only a possibility while the SRTC is in motion. The SRTC is not in motion after the impact limiters are removed (BSC 2005 [DIRS 171428], Section 6.6.3.5). Transportation casks with impact limiters are designed to withstand, without breaching, the drops discussed in Section 4.2.1. The drops specified in Section 4.2.1 bound the impacts that could occur during cask handling at the repository. Consequently, collision would not breach a transportation cask with impact limiters.

6.3.4.5.1.3 The WP and navy cask entrance vestibule doors or the WP/navy cask SRTC receipt area shield doors close on an SRTC carrying a loaded cask

A design requirement is assumed to ensure that closure of the entrance vestibule doors or shield doors onto an SRTC would not overturn the SRTC or cause it to drop its load (Assumption 5.1.1.13). Because the SRTC remains upright there is no threat to the integrity of the cask.

6.3.4.5.1.4 Collision of mobile elevated platforms with a loaded naval SNF cask during removal of personnel barriers and impact limiters or during survey activities

Operational requirements are assumed to ensure that the mobile elevated platform will not be operated in a manner that could breach a transportation cask (Assumption 5.1.1.41).

6.3.4.5.1.5 Forklift collision with a naval SNF cask on an SRTC (with or without impact limiters installed on the cask) or the SRTC holding the cask

Operational requirements are assumed to ensure that forklifts will not be operated in a manner that could breach a transportation cask (Assumption 5.1.1.41).

6.3.4.5.1.6 Drop or collision of personnel barriers or impact limiters from the receipt area crane onto or against a loaded naval SNF cask

Operational requirements will ensure that equipment associated with cask preparation and handling will not breach the cask (Assumption 5.1.1.30).

6.3.4.5.1.7 Slapdown of a loaded naval SNF cask onto an SRTC during upending of the loaded cask to the vertical orientation

This potential event is covered by Section 6.3.1.1.

6.3.4.5.1.8 Drop of a loaded naval SNF cask from the overhead crane onto the floor during the transfer from an SRTC to a pedestal previously positioned on a trolley

This potential event is covered by Section 6.3.1.1.

6.3.4.5.1.9 Drop of a loaded naval SNF cask from the overhead crane onto a pedestal on a trolley during the transfer from an SRTC to a pedestal previously positioned on a trolley

This potential event is covered by Section 6.3.1.1.

6.3.4.5.1.10 Drop or collision of a loaded cask from the overhead crane onto or against a sharp object during the transfer from an SRTC to a pedestal previously positioned on trolley

Design and operational requirements will ensure that load paths are kept free of puncture hazards (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.5.1.11 Collision of a loaded naval SNF cask suspended from the overhead crane with the shield doors separating the WP/navy cask SRTC receipt area and the WP/navy to trolley transfer room during transfer of the naval SNF cask from the SRTC to the trolley

Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.5.1.12 Closing of the shield doors separating the WP/navy cask SRTC receipt area and the WP/navy to trolley transfer room (striking the cask while the loaded cask is suspended from the overhead crane) during the transfer of the cask from the SRTC to the trolley

A design requirement is assumed to ensure that closure of the shield doors onto a cask suspended from the overhead crane cannot breach the cask or cause the crane to drop the load (Assumption 5.1.1.13).

6.3.4.5.1.13 Slapdown of a loaded naval SNF cask following a drop from the overhead crane onto the edge of the trolley or pedestal during transfer of the cask from the SRTC to the trolley

This potential event is covered by Section 6.3.1.1.

6.3.4.5.1.14 Drop or collision of handling equipment from the overhead bridge crane onto or against a loaded naval SNF cask

Operational requirements will ensure that a drop of handling equipment onto a transportation cask without impact limiters will not breach the cask (Assumption 5.1.1.30).

6.3.4.5.1.15 Drop or collision of other miscellaneous (non-handling) equipment (gas-sampling, lid bolt removal, etc.) from the overhead bridge crane onto or against a loaded naval SNF cask

Operational requirements will prevent cask breach for this potential event (Assumption 5.1.1.30).

6.3.4.5.1.16 Collision of a trolley holding a naval SNF cask on a pedestal with shield doors separating the WP/navy to trolley transfer room and the WP/navy cask preparation room

This potential event is included in Section 6.3.1.22.

6.3.4.5.1.17 Closing of the shield doors separating the WP/navy to trolley transfer room and the WP/navy cask preparation room on a trolley holding a naval SNF cask on a pedestal

A design requirement is assumed to ensure that closure of the shield doors onto a trolley holding a loaded cask or MSC would not overturn the trolley or cause it to drop its load (Assumption 5.1.1.13). Because the trolley remains upright there is no threat to the integrity of the cask.

6.3.4.5.1.18 Derailment of a trolley holding a naval SNF cask on a pedestal followed by a load tipover or fall

A design requirement is assumed to ensure that the cask-transfer trolley holding a loaded cask on a pedestal would not derail or allow the cask to fall off the trolley (Assumption 5.1.1.36). Because the transfer trolley remains upright there is no threat to the integrity of the cask.

6.3.4.5.2 Explosion/Implosion

6.3.4.5.2.1 Hydrogen explosion involving batteries on a forklift

The waste is protected by casks or WPs while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to cause a breach in casks or WPs (Assumption 5.1.1.51).

6.3.4.5.2.2 Hydrogen explosion involving batteries on a mobile elevated platform

The waste is protected by casks or WPs while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to cause a breach in casks or WPs (Assumption 5.1.1.51).

6.3.4.5.3 Fire, Thermal

6.3.4.5.3.1 Electrical fire associated with the WP/navy cask SRTC receipt area overhead cranes

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.5.3.2 Electrical fire associated with handling equipment or other electrical equipment in the WP/navy cask SRTC receipt area, WP and navy cask entrance vestibule, the WP/navy to trolley transfer room, or the WP/navy cask preparation room

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.5.3.3 Diesel fuel fire/explosion involving an SRTC tractor pulling or pushing an SRTC holding a naval SNF cask containing a naval SNF canister

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.5.3.4 Electrical fire associated with a trolley holding a naval SNF cask containing a naval SNF canister.

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.5.3.5 Fire/explosion (battery/electrical fire) associated with a forklift.

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.5.3.6 Fire/explosion (battery/electrical fire) associated with a mobile elevated platform.

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.5.3.7 Transient combustible fire in the WP and navy cask entrance vestibule, the WP/navy cask SRTC receipt area, the WP/navy to trolley transfer room, or the WP/navy cask preparation room

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.5.3.8 Thermal hazard (from decay heat) associated with a vertical orientation of a loaded naval SNF cask

This potential event will not cause oxidation of SNF leading to exposure of individuals to radiation because the naval SNF is contained in sealed canisters (BSC 2005 [DIRS 171428], Section 6.6.3.5).

6.3.4.5.4 Radiation

6.3.4.5.4.1 Radiation exposure of a facility worker and/or the offsite public

Exposure of workers or the public to radiation is a hazard for the potential event sequences considered in the present analysis. The consequence analysis will evaluate this hazard for event sequences and normal operations, as applicable.

6.3.4.5.4.2 Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation

This potential event is covered in Section 6.3.1.25.

6.3.4.5.4.3 Radiation-induced damage to a facility SSC

Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization as explained in Section 6.3.2.5.2.

6.3.4.5.5 Fissile

6.3.4.5.5.1 Criticality associated with an SRTC derailment or collision followed by a load tipover or fall and a rearrangement of the naval SNF cask internals

Naval casks are moved on the SRTC with impact limiters in place. Transportation casks with impact limiters are designed to withstand, without breaching, the drops discussed in Section 4.2.1. A criticality in the naval SNF receipt area is not credible because design requirements and waste acceptance criteria will ensure criticality safety in transportation casks (Assumption 5.1.1.4).

6.3.4.5.5.2 Criticality associated with a naval SNF cask drop, slapdown, or collision and rearrangement of cask internals

A criticality in the naval SNF receipt area is not credible because design requirements and waste acceptance criteria will ensure criticality safety in transportation casks (Assumption 5.1.1.4).

6.3.4.5.5.3 Criticality associated with naval SNF cask trolley derailment followed by a load tipover or fall and a rearrangement of the cask internals

A design requirement is assumed to ensure that the cask-transfer trolley carrying transportation casks or MSCs in the DTF would not derail or allow the cask to fall off the trolley (Assumption 5.1.1.36).

6.3.4.6 Naval SNF Processing: WP Docking Cell, WP Loading (Navy Canister)/Docking Ring Removal Cell, WP Loading/Docking Ring Removal Cell

6.3.4.6.1 Collision/Crushing

6.3.4.6.1.1 Derailment of a trolley holding a loaded naval SNF cask on a pedestal followed by a load tipover or fall

A design requirement is assumed to ensure that the cask-transfer trolley holding a loaded cask on a pedestal would not derail or allow the cask to fall off the trolley (Assumption 5.1.1.36). Because the transfer trolley remains upright there is no threat to the integrity of the cask.

6.3.4.6.1.2 Drop or collision of handling equipment (such as the lid grapple) onto or against a naval SNF cask outer lid (if applicable) or inner lid

Operational requirements will ensure that this potential event will not initiate an event sequence (Assumption 5.1.1.32).

6.3.4.6.1.3 Drop of a naval SNF cask inner lid (if applicable) from the 70-ton navy canister handling crane onto a naval SNF canister

After the inner lid of a transportation cask is removed, the lid could be dropped back into the opening of the cask. If the lid rotates before impact, its edge could strike the naval canister. This potential event is included in Section 6.3.1.2.

6.3.4.6.1.4 Drop or collision of handling equipment (such as a canister grapple) into or against an open naval SNF cask loaded with a naval SNF canister

This potential event is included in the generalized handling-equipment drop in Section 6.3.1.6.

6.3.4.6.1.5 Drop or collision of a naval SNF canister from the WP docking cell crane back into or against the naval SNF cask being unloaded

The potential drop event is included in Section 6.3.1.5. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.6.1.6 Fall of a naval SNF canister from the WP docking crane onto the edge of the cask, the edge of the WP, or the edge of the transfer floor, followed by a slapdown of the canister

This potential event is included in Section 6.3.1.5.

6.3.4.6.1.7 Drop or collision of a naval SNF canister from the 70-ton navy canister handling crane onto or against a sharp object

Design and operational requirements will ensure that load paths are kept free of puncture hazards (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.6.1.8 Collision involving a naval SNF canister suspended from the 70-ton navy canister handling crane with equipment located in the WP docking cell or the WP loading (navy canister)/docking ring removal cell, such as lid lifting equipment

Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.6.1.9 Drop of a naval SNF canister from the 70-ton navy canister handling crane onto the navy transfer/docking ring removal cell floor

This potential event is included in Section 6.3.1.5.

6.3.4.6.1.10 Impact due to horizontal movement of the naval SNF canister before it is completely removed from the naval transportation cask

Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.6.1.11 Drop or collision of a naval SNF canister from the 70-ton navy canister handling crane into or against the WP

This potential event is included in Section 6.3.1.5. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.6.1.12 Drop or collision of handling equipment into or against an open WP loaded with a naval SNF canister

This potential event is included in Section 6.3.1.6.

6.3.4.6.1.13 Drop of a WP inner lid from the WP docking cell crane into a loaded naval WP

The calculation in Section 6.3.1.2 includes this potential event.

6.3.4.6.2 Explosion/Implosion

No explosion/implosion events in this area.

6.3.4.6.3 Fire, Thermal

6.3.4.6.3.1 Electrical fire associated with SNF handling equipment in the WP docking cell, and the WP loading (naval SNF canister)/docking ring removal cell (including the overhead cranes, etc.).

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.6.3.2 Electrical fire associated with the trolley holding either a loaded, unsealed WP or a loaded naval SNF cask holding a naval SNF canister.

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.6.3.3 Thermal hazard (from decay heat) associated with a vertical orientation of the naval SNF cask.

This potential event will not cause oxidation of SNF leading to exposure of individuals to radiation because naval SNF is handled in sealed canisters (BSC 2005 [DIRS 171428], Section 6.6.3.6).

6.3.4.6.3.4 Overheating of a loaded, unsealed (and uninerted) cask or WP due to a loss of cooling resulting in excessive temperature and possible damage to canister contents

This potential event is discussed in Section 6.3.1.26.

6.3.4.6.3.5 Transient combustible fire in the WP docking cell, or the WP loading (naval SNF canister)/docking ring removal cell

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.6.4 Radiation

6.3.4.6.4.1 Radiation exposure of a facility worker and/or the offsite public

Exposure of workers or the public to radiation is a hazard for the potential event sequences considered in the present analysis. The consequence analysis will evaluate this hazard for event sequences and normal operations, as applicable.

6.3.4.6.4.2 Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation

This potential event is covered in Section 6.3.1.25.

6.3.4.6.4.3 Inadvertent opening of a shield door, leading to a worker exposure

This potential event could expose workers to radiation, but would not expose the public. The frequency of inadvertent actions that expose workers to radiation will be limited by design features and operating procedures that ensure that such events are not Category 1 (Assumption 5.1.1.57).

6.3.4.6.4.4 Radiation-induced damage to a facility SSC

Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization as explained in Section 6.3.2.5.2.

6.3.4.6.5 Fissile

6.3.4.6.5.1 Criticality associated with a naval SNF cask drop, slapdown, or collision and rearrangement of cask internals

A criticality in a transportation cask is not credible because design requirements and waste acceptance criteria will ensure criticality safety in transportation casks (Assumption 5.1.1.4).

6.3.4.7 Cask and MSC Docking Room, Waste Transfer Cell, WP Docking Cell, WP Loading/Docking Ring Removal Cell

6.3.4.7.1 Collision/Crushing

6.3.4.7.1.1 Drop or collision of handling equipment into or against an open cask or open MSC loaded with commercial SNF assemblies, a DOE HLW canister, a DOE SNF MCO, or a [standardized] DOE SNF canister

Drops of handling equipment onto non-SNF assembly canisters are treated in Section 6.3.1.6. Drops of handling equipment onto CSNF assemblies are treated in Section 6.3.1.4.

6.3.4.7.1.2 Drop or collision of an SNF assembly from the spent fuel transfer machine back into or against a cask or MSC being unloaded

This event is included in Section 6.3.1.3.

6.3.4.7.1.3 Drop or collision of an SNF assembly from the spent fuel transfer machine back onto or against one or more SNF assembly(ies) in a cask or MSC

The calculation in Section 6.3.1.3 includes this potential event as part of a generalized Category 1 event sequence. The generalized drop and collision events discussed in Section 6.3.1.3 include assembly drops and collisions in the DTF.

6.3.4.7.1.4 Impact due to horizontal movement of an SNF assembly by the spent fuel transfer machine before the assembly is completely removed from the cask or MSC

This potential event is a collision between the assembly and the wall of the basket structure in the cask. Assembly collisions are included in Section 6.3.1.3.

6.3.4.7.1.5 Drop of an SNF assembly from the spent fuel transfer machine onto the waste transfer cell floor

The calculation in Section 6.3.1.3 includes this potential event as part of a generalized Category 1 event sequence.

6.3.4.7.1.6 Collision involving an SNF assembly suspended from the spent fuel transfer machine with equipment located in the waste transfer cell or on the cell floor (such as lid lifting equipment)

The calculation in Section 6.3.1.3 includes this potential event as part of a generalized Category 1 event sequence.

6.3.4.7.1.7 Drop or collision of an SNF assembly from the spent fuel transfer machine onto or against a sharp object

Assemblies are assumed to breach when they are dropped or involved in a collision. The calculation in Section 6.3.1.3 includes the potential event.

6.3.4.7.1.8 Drop or collision of an SNF assembly from the spent fuel transfer machine into or against an empty WP or MSC being loaded

The calculation in Section 6.3.1.3 includes this potential event.

6.3.4.7.1.9 Drop and slapdown of an SNF assembly from the spent fuel transfer machine (due to impact with an edge of the cask, MSC, WP, floor edge, WP internal baffle, staging rack, etc.) during the transfer from the cask or MSC to a WP, or staging rack

The calculation in Section 6.3.1.3 includes this potential event.

6.3.4.7.1.10 Drop or collision of an SNF assembly from the spent fuel transfer machine onto or against another SNF assembly in a WP or MSC

The calculation in Section 6.3.1.3 includes this potential event.

6.3.4.7.1.11 Drop or collision of an SNF assembly from the spent fuel transfer machine into or against an empty staging rack in the waste transfer cell

The calculation in Section 6.3.1.3 includes this potential event.

6.3.4.7.1.12 Drop or collision of an SNF assembly from the spent fuel transfer machine onto or against one or more SNF assemblies in a staging rack

The calculation in Section 6.3.1.3 includes this potential event.

6.3.4.7.1.13 Drop or collision of an SNF assembly from the spent fuel transfer machine onto or against a DOE HLW canister or [standardized] DOE SNF canister in a staging rack

An operational requirement is assumed to preclude contact between a CSNF assembly and a staged canister (Assumption 5.1.4.1).

6.3.4.7.1.14 Drop or collision of a DOE HLW canister, a [standardized] DOE SNF canister, from the waste transfer cell overhead crane back into or against the cask or MSC being unloaded

This potential drop event is included in Section 6.3.1.5. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.7.1.15 Drop or collision of a DOE SNF MCO from the waste transfer cell overhead crane back into or against the cask being unloaded

This potential drop event is included in Section 6.3.1.5. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.7.1.16 Impact due to horizontal movement of a DOE HLW canister, or a [standardized] DOE SNF canister with the waste transfer cell overhead crane before the canister is completely removed from the cask or MSC

Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.7.1.17 Impact due to horizontal movement of a DOE SNF MCO with the waste transfer cell overhead crane before the canister is completely removed from the cask

Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.7.1.18 Drop and slapdown of a DOE HLW canister or a [standardized] DOE SNF canister from the waste transfer cell overhead crane (due to impact with an edge of the cask, MSC, WP, floor edge, WP internal baffle, staging rack, etc.) during the transfer from the cask or MSC to a WP, or staging rack

Section 6.3.1.5 includes this potential event.

- 6.3.4.7.1.19 Drop and slapdown of a DOE SNF MCO from the waste transfer cell overhead crane (due to impact with an edge of the cask, WP, floor edge, WP internal baffle, etc.) during the transfer from the cask to a WP**

Section 6.3.1.5 includes this potential event.

- 6.3.4.7.1.20 Drop or collision of a DOE HLW canister, a [standardized] DOE SNF canister, or a DOE SNF MCO from the waste transfer cell overhead crane onto or against a sharp object.**

Design and operational requirements will ensure that load paths are kept free of puncture hazards (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

- 6.3.4.7.1.21 Collision involving a DOE HLW canister, a [standardized] DOE SNF canister, or a DOE SNF MCO suspended from the waste transfer cell overhead crane with equipment located in the waste transfer cell or on the cell floor, such as lid lifting equipment.**

Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

- 6.3.4.7.1.22 Drop of a DOE HLW canister, a [standardized] DOE SNF canister, or a DOE SNF MCO from the waste transfer cell overhead crane onto the waste transfer cell floor.**

Section 6.3.1.5 includes this potential event.

- 6.3.4.7.1.23 Drop or collision of a DOE HLW canister or a [standardized] DOE SNF canister from the waste transfer cell crane into or against an empty canister staging rack**

Section 6.3.1.5 includes this potential drop event. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

- 6.3.4.7.1.24 Drop or collision of a DOE HLW canister or a [standardized] DOE SNF canister from the waste transfer cell crane into or against an SNF assembly staging rack loaded with SNF assemblies**

An operational requirement will prohibit carrying canisters over or near staging racks for CSNF (Assumption 5.1.4.4). Therefore, this potential event is not considered further.

- 6.3.4.7.1.25 Drop or collision of a DOE HLW canister or a [standardized] DOE SNF canister from the waste transfer cell crane onto or against another DOE HLW canister or [standardized] DOE SNF canister in a staging rack**

Section 6.3.1.5 includes this potential drop event. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.7.1.26 Drop or collision of a DOE HLW canister, or a [standardized] DOE SNF canister from the waste transfer cell crane into or against an empty WP or into or against an empty MSC being loaded

Section 6.3.1.5 includes this potential drop event. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.7.1.27 Drop or collision of a DOE SNF MCO from the waste transfer cell crane into or against an empty WP being loaded

Section 6.3.1.5 includes this potential drop event. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.7.1.28 Drop or collision of a DOE HLW canister from the waste transfer cell crane onto or against another DOE HLW canister, a [standardized] DOE SNF canister, or a DOE SNF MCO in a WP being loaded

Section 6.3.1.5 includes this potential drop event. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.7.1.29 Drop or collision of a DOE HLW canister from the waste transfer cell crane onto or against another DOE HLW canister or a [standardized] DOE SNF canister in a WP or in an MSC being loaded

Section 6.3.1.5 includes this potential event. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.7.1.30 Drop or collision of a [standardized] DOE SNF canister from the waste transfer cell crane onto or against a DOE HLW canister in a WP or in an MSC

Dropping a DOE SNF canister onto a DOE HLW canister is rendered Beyond Category 2 by an operational requirement not to transfer the DOE SNF canister into the WP if there are one or more DOE HLW canisters present in the WP or MSC (Assumption 5.1.1.23). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.7.1.31 Drop or collision of a DOE SNF MCO from the waste transfer cell crane onto or against another DOE SNF MCO or a DOE HLW canister in a WP being loaded

Drop of a DOE SNF MCO from above its lift-height limit is Beyond Category 2, as shown in Table 18, Event F. If a DOE SNF MCO is dropped onto another MCO within the lift-height limit, neither MCO will breach (Assumption 5.1.1.28). Dropping a DOE SNF MCO onto a DOE HLW canister is rendered Beyond Category 2 by an operational requirement not to transfer the DOE SNF canister into the WP if there are one or more DOE HLW canisters present in the WP or MSC (Assumption 5.1.1.23). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.7.1.32 Drop or collision of a [standardized] DOE SNF canister from the waste transfer cell crane onto or against another [standardized] DOE SNF canister in a WP or in an MSC in a misload situation

Section 6.3.1.5 includes this potential drop event. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.7.1.33 Drop or collision of a DOE SNF MCO from the waste transfer cell crane onto or against a [standardized] DOE SNF canister in a WP in a misload situation

Section 6.3.1.5 includes this potential drop event. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.7.1.34 Drop or collision of a DOE HLW canister, a [standardized] DOE SNF canister, or a DOE SNF MCO from the waste transfer cell crane onto or against SNF assemblies in a WP or in an MSC in a misload situation

This potential event requires, in addition to a drop or collision, an attempt to load a canister into a WP or MSC designed for bare CSNF assemblies. An operational requirement will prevent this misload situation (Assumption 5.1.1.27).

6.3.4.7.1.35 Drop or collision of an SNF assembly from the spent fuel transfer machine onto or against a DOE HLW canister or a [standardized] DOE SNF canister, in a WP or in an MSC in a misload situation

This potential event is unlikely because it requires, in addition to a drop or collision, an attempt to load a CSNF assembly into a WP or MSC designed for canisters. An operational requirement will prevent this misload situation (Assumption 5.1.1.26).

6.3.4.7.1.36 Drop or collision of an SNF assembly from the spent fuel transfer machine onto or against a DOE HLW canister, or a DOE SNF MCO in a WP in a misload situation

This potential event is unlikely because it requires, in addition to a dropped assembly, an attempt to load a CSNF assembly into a WP or MSC designed for canisters. An operational requirement will prevent this misload situation (Assumption 5.1.1.26).

6.3.4.7.1.37 Drop or collision of handling equipment onto or against SNF assemblies in the SNF staging rack

Drops of handling equipment onto CSNF assemblies are treated in Section 6.3.1.4.

6.3.4.7.1.38 Drop or collision of handling equipment onto or against a DOE HLW canister or a [standardized] DOE SNF canister in a canister staging rack

This event is included in Section 6.3.1.6.

6.3.4.7.1.39 Drop or collision of handling equipment into or against an open MSC or an open WP filled with SNF assemblies

Drops of handling equipment onto CSNF assemblies are treated in Section 6.3.1.4.

6.3.4.7.1.40 Drop or collision of handling equipment into or against an open WP loaded with SNF assemblies, DOE HLW canisters, and/or a [standardized] DOE SNF canister, and/or DOE SNF MCOs

This event is included in Section 6.3.1.6.

6.3.4.7.1.41 Drop or collision of a WP inner lid or MSC cask inner lid from the docking station crane onto or against a loaded WP or loaded MSC

This event is included in Section 6.3.1.2.

6.3.4.7.1.42 Drop or collision of a WP docking port plug from the waste transfer cell crane onto or against the inner lid of a loaded WP or loaded MSC (with lid in place but not sealed)

A design requirement to consider 2-over-1 event sequences will prevent initiation of an event sequence as a result of this potential event (Assumption 5.1.1.37).

6.3.4.7.1.43 Drop or collision of a WP docking ring onto or against a loaded WP (with lid in place but not sealed) during docking ring removal in the WP loading/docking ring removal cell

The inner lid is in place for this potential event. Operational requirements will prevent radiological releases due to this potential event (Assumption 5.1.3.3).

6.3.4.7.1.44 Drop or collision of a handling or other miscellaneous equipment onto or against a loaded WP (with lid in place but not sealed) during docking ring removal in the WP loading/docking ring removal cell

The inner lid is in place for this potential event. Operational requirements will prevent radiological releases due to this potential event (Assumption 5.1.3.3).

6.3.4.7.1.45 Derailment of a trolley holding a loaded, unsealed WP (with lid in place but not sealed) followed by a load tipover or fall

A design requirement is assumed to ensure that the trolley carrying a WP would not derail or allow the WP to fall off the trolley (Assumption 5.1.1.36).

6.3.4.7.2 Chemical Contamination/Flooding

6.3.4.7.2.1 Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures

Oxidation of failed CSNF assemblies is expected as a part of normal operations wherever CSNF assemblies are exposed to air. Resulting exposure of workers to radiation will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.4.7.3 Explosion/Implosion

6.3.4.7.3.1 Hydrogen explosion involving batteries on a cask trolley

The waste is protected by casks or WPs while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to cause a breach in casks or WPs (Assumption 5.1.1.51).

6.3.4.7.4 Fire, Thermal

6.3.4.7.4.1 HEPA filter fire due to excessive radioactive decay within the filter bed.

HEPA filters will be maintained well below their auto-ignition temperature to preclude a filter fire (Assumption 5.1.1.47).

6.3.4.7.4.2 Electrical fire associated with SNF and HLW handling equipment or other electrically-powered equipment in the waste transfer cell, the WP docking cell, or the WP loading/docking ring removal cell (including the overhead cranes and the spent fuel transfer machine)

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.7.4.3 Fire/explosion (battery/electrical fire) associated with a cask trolley holding an unsealed, partially filled or filled cask or MSC

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.7.4.4 Electrical fire associated with a WP trolley holding an unsealed, partially-filled or filled WP

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.7.4.5 Intact or non-intact SNF overheating or damage to canister contents due to a loss of cooling resulting in excessive temperature and possible zircaloy cladding (or other cladding) unzipping or cladding failure due to excessive hoop stresses.

This potential event is discussed in Section 6.3.1.26.

6.3.4.7.4.6 Transient combustible fire in the cask and MSC docking room, waste transfer cell, the WP docking cell, or the WP loading/docking ring removal cell.

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.7.5 Radiation

6.3.4.7.5.1 Radiation exposure of a facility worker and/or the offsite public

Exposure of workers or the public to radiation is a hazard for the potential event sequences considered in the present analysis. The consequence analysis will evaluate this hazard for event sequences and normal operations, as applicable.

6.3.4.7.5.2 Docking ring failure leads to a radiological release

This potential event is covered in Section 6.3.1.25.

6.3.4.7.5.3 Radiological release due to installation of incorrect docking ring

Docking ring failure has the same consequences as installation of an incorrect docking ring. Therefore, the analysis in Section 6.3.1.25 applies to this potential event.

6.3.4.7.5.4 Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne contamination

This potential event is covered in Section 6.3.1.25.

6.3.4.7.5.5 Thermal expansion of gases or other loss of confinement in an unsealed cask or MSC, leading to radiological release

Thermal expansion of gases is to be expected as a part of normal operations. Resulting exposure of workers to radiation will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.4.7.5.6 Inadvertent opening of a shield door, leading to a worker exposure

This potential event could expose workers to radiation, but would not expose the public. The frequency of inadvertent actions that expose workers to radiation will be limited by design features and operating procedures that ensure that such events are not Category 1 (Assumption 5.1.1.57).

6.3.4.7.5.7 Radiation-induced damage to a facility SSC

Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization as explained in Section 6.3.2.5.2.

6.3.4.7.6 Fissile

6.3.4.7.6.1 Criticality associated with a drop of an SNF assembly from the spent fuel transfer machine into a cask, MSC, or WP and a rearrangement of the cask, MSC, or WP internals

Design calculations and the resulting design requirements will ensure criticality safety for this event (Assumptions 5.1.1.4, 5.1.3.1, and 5.1.3.2).

6.3.4.7.6.2 Criticality associated with a drop of an SNF assembly from the spent fuel transfer machine and a rearrangement of the fuel rods that comprise the assembly due to impact

The analysis *Surface Facility Criticality Safety Calculations* (BSC 2004 [DIRS 168132], Section 5.2.3.1) determined that a drop of two CSNF assemblies does not pose a criticality safety concern. This result ensures that drops, collisions, and other handling impacts of a CSNF assembly (allowing for rearrangement of fuel rods and without credit for burnup or moderator control) does not pose a criticality safety concern (see Section 4.1.10).

6.3.4.7.6.3 Criticality associated with a drop of an SNF assembly from the spent fuel transfer machine onto the storage racks and a rearrangement of the orientation of the SNF assemblies in the storage racks

Design calculations and the resulting design requirements will ensure criticality safety for this event (Assumptions 5.1.4.3).

6.3.4.7.6.4 Criticality associated with a drop or slapdown of a [standardized] DOE SNF canister, a DOE SNF MCO, or a DOE HLW canister

Design calculations and the resulting design requirements will ensure criticality safety for this event (Assumptions 5.1.1.4, 5.1.3.2, and 5.1.1.3). There is no potential for criticality of HLW canisters (Assumption 5.2.1.19).

6.3.4.7.6.5 Criticality associated with the drop of heavy equipment onto a loaded, unsealed cask, MSC, or WP and a rearrangement of the container internals

Equipment drop onto a transportation cask or MSC will not lead to a criticality because design requirements and waste acceptance criteria will ensure criticality safety (Assumption 5.1.1.4). Equipment drop onto a WP will not lead to criticality because (1) a design requirement will ensure that WPs are subcritical provided that moderator control is in effect (Assumptions 5.1.3.2 and 5.1.1.21) and (2) design features of the WP will ensure that an unsealed WP suffering an impact from heavy equipment drop will not become critical (Assumptions 5.1.3.2).

6.3.4.7.6.6 Criticality associated with a misload of a WP or an MSC

WPs are designed such that no combination of CSNF assemblies that may be accepted for disposal could lead to a nuclear criticality inside the WP during preclosure provided that moderator control is in effect (Assumptions 5.1.3.2 and 5.1.1.21). MSCs will be designed to remain subcritical with the most reactive commercial CSNF assemblies and optimal moderation (Assumption 5.1.1.4). Therefore, a preclosure criticality due to misload is not credible and administrative controls on container loading are not relied upon to prevent preclosure criticality.

6.3.4.7.6.7 Criticality associated with a misload of a commercial SNF staging rack

Criticality due to misload will be rendered Beyond Category 2 because a design requirement will ensure that the staging racks with moderator control can be loaded to capacity with the most reactive CSNF assemblies without causing a nuclear criticality (Assumption 5.1.4.2).

6.3.4.7.6.8 Criticality associated with a misload of a canister staging rack

Criticality due to misload will be rendered Beyond Category 2 because a design requirement will ensure that the most reactive configuration of standardized DOE SNF canisters can be loaded into DOE SNF staging racks (with moderator control) without causing a nuclear criticality (Assumption 5.1.1.2). An operational requirement is assumed to ensure that CSNF assemblies are not loaded into the canister staging rack in the DTF (Assumption 5.1.4.1). Neither MCOs nor naval canisters will be staged (Assumption 5.2.1.20). There is no potential for criticality of HLW canisters (Assumption 5.2.1.19).

6.3.4.8 Empty Transportation Cask/MSC/DPC Removal: Cask and MSC Docking Room, Cask/MSC Turntable Room, Cask Restoration Room, Cask and MSC to Trolley Transfer Room, Cask and MSC SRTC Receipt Area, Cask and MSC Entrance Vestibule

6.3.4.8.1 Radiation

6.3.4.8.1.1 Radiation exposure of a facility worker

Exposure of workers or the public to radiation is a hazard for the potential event sequences considered in the present analysis. The consequence analysis will evaluate this hazard for event sequences and normal operations, as applicable.

6.3.4.8.1.2 Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation

This potential event is covered in Section 6.3.1.25.

6.3.4.8.2 Fissile

6.3.4.8.2.1 Criticality associated with the collection and concentration of fissile material collected from casks during cask restoration activities

An operational requirement will ensure that radioactive contamination that is collected during cleanup activities in transfer cells is handled in a manner that precludes nuclear criticality (Assumption 5.1.1.64).

6.3.4.9 Loaded MSC Removal: Cask and MSC Docking Room, Cask/MSC Turntable Room, Cask Preparation Room, Cask and MSC to Trolley Transfer Room, Cask and MSC SRTC Receipt Area, Cask and MSC Entrance Vestibule

6.3.4.9.1 Collision/Crushing

6.3.4.9.1.1 Derailment of a trolley holding a loaded MSC on a pedestal followed by a load tipover or fall (before or after the outer lid [as applicable] is fastened)

A design requirement is assumed to ensure that the trolley carrying an MSC would not derail or allow the MSC to fall off the trolley (Assumption 5.1.1.36). Because the trolley remains upright there is no threat to the integrity of the cask.

6.3.4.9.1.2 Derailment of a trolley holding a loaded MSC on a pedestal due to a turntable malfunction followed by a load tipover or fall (before or after the outer lid [as applicable] is fastened)

A design requirement is assumed to ensure that the cask-transfer trolley carrying a transportation cask or MSC in the DTF would not derail or allow the cask to fall off the trolley (Assumption 5.1.1.36). Because the transfer trolley remains upright there is no threat to the integrity of the cask.

- 6.3.4.9.1.3 Collision of a trolley holding a loaded MSC on a pedestal with shield doors separating the cask and MSC docking room and the cask/MSC turntable room or the cask/MSC turntable room and the cask preparation room (before or after the outer lid [as applicable] is fastened)**

Trolley collision is addressed in Section 6.3.1.22.

- 6.3.4.9.1.4 Closure of the shield doors separating the cask and MSC docking room and the cask/MSC turntable room or the cask/MSC turntable room and the cask preparation room onto the trolley holding a loaded MSC on a pedestal (before or after the outer lid [as applicable] is fastened)**

A design requirement is assumed to ensure that closure of the airlock and shield doors onto a trolley would not overturn the trolley or cause it to drop its load (Assumption 5.1.1.13). Because the trolley remains upright there is no threat to the integrity of the cask.

- 6.3.4.9.1.5 Collision involving two trolleys holding casks on pedestals (including a loaded MSC) (before or after the outer lid [as applicable] is fastened)**

Trolley collision is addressed in Section 6.3.1.22.

- 6.3.4.9.1.6 Drop or collision of tools or equipment (including the outer lid-lifting fixture, inner lid-lifting fixture, lid bolts, etc.) onto or against an MSC inner lid or outer lid, as applicable, during the MSC lid fastening process**

Operational requirements will ensure that this potential event will not initiate an event sequence (Assumption 5.1.1.32).

- 6.3.4.9.1.7 Drop of an MSC outer lid from the overhead crane onto the loaded MSC inner lid, as applicable**

The frequency and consequences of this event are bounded by those of the Category 2 lid-drop event sequence discussed in Section 6.3.1.2. The frequency is bounded because the bounding event applies to WPs, MSCs, and transportation casks, but this event applies only to MSCs. The consequences are bounded because the contents of the MSC are protected by the inner lid, whereas no lids are in place for the bounding event. An operational requirement is assumed to ensure that the outer-lid drop will not breach a DOE SNF canister inside (Assumption 5.1.1.44).

- 6.3.4.9.1.8 Drop or collision of a docking ring onto or against a loaded MSC**

Operational requirements will ensure that this potential event will not initiate an event sequence (Assumption 5.1.1.32).

- 6.3.4.9.1.9 Collision of a trolley holding a loaded, sealed MSC on a pedestal with shield doors separating cask/MSC turntable room and the cask and MSC to trolley transfer room**

Trolley collision is addressed in Section 6.3.1.22.

6.3.4.9.1.10 Closure of the shield doors separating cask/MSC turntable room and the cask and MSC to trolley transfer room onto the trolley holding a loaded, sealed MSC on a pedestal

A design requirement is assumed to ensure that closure of the airlock and shield doors onto a trolley would not overturn the trolley or cause it to drop its load (Assumption 5.1.1.13). Because the trolley remains upright there is no threat to the integrity of the cask.

6.3.4.9.1.11 Drop of a loaded, sealed MSC from the overhead crane onto the floor during the transfer of the MSC from a pedestal staged on a trolley to the floor in the lay-down area in the cask and MSC SRTC receipt area

This potential event is covered by Section 6.3.1.1.2.

6.3.4.9.1.12 Drop or collision of a loaded MSC from the overhead crane onto or against a sharp object during the transfer of the MSC from a pedestal staged on a trolley to the floor in the lay-down area in the cask and MSC SRTC receipt area

Design and operational requirements will ensure that load paths are kept free of puncture hazards (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.9.1.13 Slapdown of a loaded, sealed MSC following a drop onto the edge of the pedestal, trolley, railcar or other object during the transfer of the MSC from a pedestal staged on a trolley to the floor in the lay-down area in the cask and MSC SRTC receipt area

This potential event is covered by Section 6.3.1.1.2.

6.3.4.9.1.14 Drop or collision of handling equipment from the overhead bridge crane onto or against a loaded MSC

Operational requirements will prevent initiation of an event sequence for this potential event (Assumption 5.1.1.30).

6.3.4.9.1.15 Drop or collision of equipment from the 25-ton material handling crane onto or against a loaded, sealed MSC

Operational requirements will prevent initiation of an event sequence for this potential event (Assumption 5.1.1.30).

6.3.4.9.1.16 Forklift collision with a loaded, sealed MSC on a pedestal on a trolley, an MSC positioned on the floor in the lay-down area in the cask and MSC SRTC receipt area, or with the MSC transporter holding the MSC

Operational requirements are assumed to ensure that forklifts will not be operated in a manner that could breach an MSC (Assumption 5.1.1.41).

6.3.4.9.1.17 Mobile elevated platform collision with a loaded, sealed MSC on a pedestal on a trolley, an MSC positioned on the floor in the lay-down area in the cask and MSC SRTC receipt area, or with the MSC transporter holding the MSC

Operational requirements are assumed to ensure that the platform will not be operated in a manner that could breach an MSC (Assumption 5.1.1.41).

6.3.4.9.1.18 Drop of a loaded MSC from the MSC transporter onto the floor inside the DTF while in-transit to the SNF Aging System

Item S.12, (Section 4.1.11) addresses this potential event sequence.

6.3.4.9.1.19 Drop or collision of a loaded MSC from the MSC transporter onto or against a sharp object inside the DTF while in-transit to the SNF Aging System

Item S.12, S.23, and S.26 (Section 4.1.11) addresses this potential event sequence.

6.3.4.9.1.20 MSC transporter collision while carrying a loaded, sealed MSC followed by an MSC tipover or fall.

Nuclear safety design approaches S.23, S.24, S.25, and S.26 (Section 4.1.11) address this potential event sequence.

6.3.4.9.1.21 MSC transporter collision into a loaded, sealed MSC followed by an MSC tipover or fall

Nuclear safety design approaches S.23, S.24, S.25, and S.26 (Section 4.1.11) address this potential event sequence.

6.3.4.9.1.22 Collision of the MSC transporter (holding a loaded, sealed MSC) with the cask and MSC SRTC receipt area shield doors or the cask and MSC entrance vestibule doors

A design or operational requirement is assumed to ensure that a collision of the MSC transporter with the MSC SRTC receipt area shield doors or the cask and MSC entrance vestibule doors would not overturn the MSC transporter or cause it to drop its load (Assumption 5.1.1.38). Because the MSC transporter remains upright there is no threat to the integrity of the cask.

6.3.4.9.1.23 The cask and MSC SRTC receipt area shield doors or the cask and MSC entrance vestibule doors close on the MSC transporter holding a loaded, sealed MSC

A design requirement is assumed to ensure that closure of the entrance vestibule doors or receipt area shield doors onto the MSC transporter holding a loaded, sealed MSC would not overturn the MSC transporter or cause it to drop its load (Assumption 5.1.1.13). Because the MSC transporter remains upright there is no threat to the integrity of the cask.

6.3.4.9.2 Chemical Contamination/Flooding

6.3.4.9.2.1 Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures

Oxidation of failed CSNF assemblies is expected as a part of normal operations wherever CSNF assemblies are exposed to air. Resulting exposure of workers to radiation will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.4.9.3 Explosion/Implosion

6.3.4.9.3.1 MSC inerting system (or other pneumatic or pressurized system) missile due to a fractured nozzle/valve stem/pneumatic device

An operational requirement is assumed to prevent initiation of an event sequence by this potential event (Assumption 5.1.1.5).

6.3.4.9.3.2 Hydrogen explosion involving batteries on a cask trolley

The waste is protected by casks or WPs while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to cause a breach in casks or WPs (Assumption 5.1.1.51).

6.3.4.9.3.3 Hydrogen explosion involving batteries on a mobile elevated platform

The waste is protected by casks or WPs while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to cause a breach in casks or WPs (Assumption 5.1.1.51).

6.3.4.9.3.4 Hydrogen explosion involving batteries on a forklift

The waste is protected by casks or WPs while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to cause a breach in casks or WPs (Assumption 5.1.1.51).

6.3.4.9.3.5 Explosion hazard associated with the cask purging system and the ignition of hydrogen that may have accumulated in the cask prior to MSC purging and inerting

Precautions taken during the cask sampling and purging process will provide reasonable assurance that such hydrogen explosions will not occur (Assumption 5.1.1.58).

6.3.4.9.4 Fire, Thermal

6.3.4.9.4.1 Electrical fire associated with the overhead cranes, including those located in the cask and MSC docking room, and the cask and MSC SRTC receipt area

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.9.4.2 Electrical fire associated with handling equipment or other equipment located in the cask and MSC docking room, cask/MSC turntable room, cask and MSC to trolley transfer room, cask preparation room, cask and MSC SRTC receipt area, or the cask and MSC entrance vestibule (including the turntables)

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.9.4.3 Transient combustible fire in the cask and MSC docking room, cask/MSC turntable room, cask preparation room, cask and MSC to trolley transfer room, cask and MSC SRTC receipt area, or the cask and MSC entrance vestibule

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.9.4.4 Fire/explosion (battery/electrical fire) associated with the cask trolley

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.9.4.5 Fire/explosion (battery/electrical fire) associated with a forklift

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.9.4.6 Fire/explosion (battery/electrical fire) associated with a mobile elevated platform

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.9.4.7 Diesel fuel fire/explosion involving an MSC transporter holding a loaded MSC

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.9.5 Radiation

6.3.4.9.5.1 Radiation exposure of a facility worker and/or the offsite public

Exposure of workers or the offsite public to radiation is a hazard for the potential event sequences considered in the present analysis. The consequence analysis will evaluate this hazard for event sequences and normal operations, as applicable.

6.3.4.9.5.2 Damage or rupture of cask inerting system leading to a release of MSC internal gases

Exposure of workers to radiation as a result of this potential event will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. Although a rupture leading to a radiological release would be an abnormal occurrence, radiation protection programs will ensure that such an occurrence would not contribute significantly to the normal operations dose. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.4.9.5.3 Expansion of gases in the loaded, unsealed MSC, leading to radiological release

Thermal expansion of gases is to be expected as a part of normal operations. Resulting exposure of workers to radiation will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.4.9.5.4 Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation

This potential event is covered in Section 6.3.1.25.

6.3.4.9.5.5 Radiation-induced damage to a facility SSC

Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization as explained in Section 6.3.2.5.2.

6.3.4.9.6 Fissile

6.3.4.9.6.1 Criticality associated with an MSC collision or trolley derailment followed by a load tipover or fall and a rearrangement of the MSC internals (before or after the outer lid [as applicable] is fastened)

A criticality in an MSC is not credible because a design requirement will ensure that MSCs remain subcritical even with the most reactive credible configuration of the fissile material and optimal moderation (Assumption 5.1.1.4).

6.3.4.9.6.2 Criticality associated with a drop or slapdown of a loaded, sealed MSC from an overhead crane and a rearrangement of cask internals

A criticality in an MSC is not credible because a design requirement will ensure that MSCs remain subcritical even with the most reactive credible configuration of the fissile material and optimal moderation (Assumption 5.1.1.4).

6.3.4.9.6.3 Criticality associated with an MSC transporter collision while holding a loaded, sealed MSC followed by a load tipover or fall and rearrangement of the cask internals

A design requirement is assumed to ensure that the MSC transporter will not derail or allow the MSC to fall off the trolley (Assumption 5.1.1.36). Because the transporter remains upright, there is no mechanism for reconfiguration of internals and, therefore, no criticality.

6.3.4.10 WP Handling and Staging Cell, WP Positioning Cells, WP Closure Cells, and the WP/trolley decontamination room

6.3.4.10.1 Collision/Crushing

6.3.4.10.1.1 Collision involving the trolley holding the loaded, unsealed WP and the shield doors between the WP loading/docking ring removal cell and the WP handling and staging cell

Trolley collision is addressed in Section 6.3.1.22.

6.3.4.10.1.2 Shield doors between the WP loading/docking ring removal cell and the WP handling and staging cell close on the trolley holding the loaded, unsealed WP

A design requirement is assumed to ensure that closure of the shield doors onto a trolley would not overturn the trolley or cause it to drop its load (Assumption 5.1.1.13). Because the trolley remains upright there is no threat to the integrity of the loaded, unsealed WP.

6.3.4.10.1.3 Derailment of a trolley holding a loaded, unsealed WP followed by a load tipover or fall

A design requirement is assumed to ensure that a loaded transfer trolley would not derail or allow a WP to fall off the trolley (Assumption 5.1.1.36).

6.3.4.10.1.4 Drop of a loaded, unsealed WP from the WP handling and staging cell overhead crane onto the floor during the transfer from the waste transfer area pedestal and trolley to a WP positioning cell pedestal and trolley

This event is included in Section 6.3.1.7.

- 6.3.4.10.1.5 Drop of a loaded, unsealed WP from the WP handling and staging cell overhead crane onto a pedestal on a trolley during the transfer from the waste transfer area pedestal and trolley to a WP positioning cell pedestal and trolley.**

This event is included in Section 6.3.1.7.

- 6.3.4.10.1.6 Drop or collision of a loaded, unsealed WP from the WP handling and staging cell overhead crane onto or against a sharp object during the transfer from the waste transfer area pedestal and trolley to a WP positioning cell pedestal and trolley**

Design and operational requirements will ensure that load paths are kept free of puncture hazards (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

- 6.3.4.10.1.7 Slapdown of a loaded, unsealed WP from the WP handling and staging cell overhead crane (due to impact with a curb/berm/impact limiter used to maintain drop height limits) or pedestal edge during the transfer from the waste transfer area pedestal and trolley to a WP positioning cell pedestal and trolley**

This event is included in Section 6.3.1.7.

- 6.3.4.10.1.8 Drop or collision of equipment (handling equipment, etc.) from the WP handling and staging cell overhead crane onto or against a loaded, unsealed WP positioned on a pedestal on a trolley**

Operational requirements will prevent radiological releases due to this potential event (Assumption 5.1.3.3).

- 6.3.4.10.1.9 Collision involving the trolley holding the loaded, unsealed WP and the shield doors between WP handling and staging cell and the WP positioning cell**

Trolley collision is addressed in Section 6.3.1.22.

- 6.3.4.10.1.10 Shield doors between the WP handling and staging cell and the WP positioning cell close on the trolley holding the loaded, unsealed WP**

A design requirement is assumed to ensure that closure of the shield doors onto a trolley would not overturn the trolley or cause it to drop its load (Assumption 5.1.1.13). Because the trolley remains upright the unsealed WP will not spill its contents and no event sequence will result.

- 6.3.4.10.1.11 Lid drop onto a WP from the lid placement fixture equipment during the welding process**

The event is included with the generalized lid-drop event sequence discussed in Section 6.3.1.2.

6.3.4.10.1.12 Equipment drop onto a WP during the welding process

Operational requirements will prevent radiological releases due to this potential event (Assumption 5.1.3.3).

6.3.4.10.1.13 Drop or collision of equipment (handling equipment, etc.) from the WP handling and staging cell overhead crane onto or against a loaded, sealed WP positioned on a pedestal on a trolley

Operational requirements will prevent radiological releases due to this potential event (Assumption 5.1.3.3).

6.3.4.10.1.14 Collision involving the trolley holding the loaded, sealed WP and the shield doors between the WP positioning cell and the WP handling and staging cell

Trolley collision is addressed in Section 6.3.1.22.

6.3.4.10.1.15 Shield doors between the WP positioning cell and the WP handling and staging cell close on the trolley holding the loaded, sealed WP

A design requirement is assumed to ensure that closure of the shield doors onto a trolley would not overturn the trolley or cause it to drop its load (Assumption 5.1.1.13). Because the trolley remains upright the WP will not breach no event sequence will result.

6.3.4.10.1.16 Derailment of a trolley holding a loaded, sealed WP on the rails leading from the WP positioning cell, followed by a load tipover or fall

A design requirement is assumed to ensure that loaded transfer trolleys will not derail or allow the WP to fall off the trolley (Assumption 5.1.1.36). Because the trolley remains upright, there is no threat to the integrity of the WP. Therefore, no event sequence will occur as a result of this potential event.

6.3.4.10.1.17 Drop of a loaded, sealed WP from the WP handling and staging cell overhead crane onto the floor during transfer from the WP positioning cell pedestal and trolley to the WP survey station

This event is included in Section 6.3.1.8.

6.3.4.10.1.18 Drop or collision of a loaded, sealed WP from the WP handling and staging cell overhead crane onto or against a sharp object during transfer from the WP positioning cell pedestal and trolley to the WP survey station

Design and operational requirements will ensure that load paths are kept free of puncture hazards (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.10.1.19 Drop of a loaded, sealed WP from the WP handling and staging cell overhead crane onto the floor during transfer from the WP survey station to a trolley for transfer to the WP loadout cell or during transfer to a position in a vertical orientation in a staging area location in the WP handling and staging cell

Section 6.3.1.8 includes this potential event.

6.3.4.10.1.20 Drop of a loaded, sealed WP from the WP handling and staging cell overhead crane onto a trolley during the transfer from the WP survey station to a trolley for transfer to the WP loadout cell.

Section 6.3.1.8 includes this potential event.

6.3.4.10.1.21 Drop or collision of a loaded, sealed WP from the WP handling and staging cell overhead crane onto or against a sharp object during transfer from the WP survey station to a trolley for transfer to the WP loadout cell or during transfer to a position in a vertical orientation in a staging area location in the WP handling and staging cell

Design and operational requirements will ensure that load paths are kept free of puncture hazards (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.10.1.22 Slapdown of a loaded, sealed WP from the WP handling and staging cell overhead crane (due to impact with a curb/berm/impact limiter used to maintain drop height limits) or trolley edge during transfer from the WP survey station to a trolley for transfer to the WP loadout cell or during transfer to a position in a vertical orientation in a staging area location in the WP handling and staging cell

Section 6.3.1.8 includes this potential event. The WP is assumed to survive a slapdown without breach (Assumption 5.1.3.12). A design requirement is assumed to prevent backward slapdowns (Assumption 5.1.1.53).

6.3.4.10.1.23 Drop or collision of equipment (handling equipment, etc.) from the WP handling and staging cell overhead crane onto or against a loaded, sealed WP positioned in a vertical position in a staging area location in the WP handling and staging cell

Operational requirements will prevent radiological releases due to this potential event (Assumption 5.1.3.3).

- 6.3.4.10.1.24 Drop of a loaded, partially sealed WP (WP with a known weld defect) from the WP handling and staging cell overhead crane onto the floor during transfer from the WP positioning cell pedestal and trolley to a trolley for transfer to the DPC cutting/WP dry remediation cell**

Section 6.3.1.9 includes this potential event.

- 6.3.4.10.1.25 Drop of a loaded, partially sealed WP (WP with a known weld defect) from the WP handling and staging cell overhead crane onto a trolley during the transfer from the WP positioning cell pedestal and trolley to a trolley for transfer to the DPC cutting/WP dry remediation cell.**

Section 6.3.1.9 includes this potential event.

- 6.3.4.10.1.26 Drop or collision of a loaded, partially sealed WP (WP with a known weld defect) from the WP handling and staging cell overhead crane onto or against a sharp object during transfer from the WP positioning cell pedestal and trolley to a trolley for transfer to the DPC cutting/WP dry remediation cell**

Design and operational requirements will ensure that load paths are kept free of puncture hazards (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

- 6.3.4.10.1.27 Slapdown of a loaded, partially sealed WP (WP with a known weld defect) from the WP handling and staging cell overhead crane (due to impact with a curb/berm/impact limiter used to maintain drop height limits) or trolley edge during the transfer from the WP positioning cell pedestal and trolley to a trolley for transfer to the DPC cutting/WP dry remediation cell**

Section 6.3.1.9 includes this potential event.

- 6.3.4.10.1.28 Drop of a loaded, sealed WP (WP needing decontamination) from the WP handling and staging cell overhead crane onto the floor during transfer from the WP survey station to a trolley for transfer to the WP/trolley decontamination room**

Section 6.3.1.8 includes this potential event.

- 6.3.4.10.1.29 Drop of a loaded, sealed WP (WP needing decontamination) from the WP handling and staging cell overhead crane onto a trolley during transfer from the WP survey station to a trolley for transfer to the WP/trolley decontamination room.**

Section 6.3.1.8 includes this potential event.

6.3.4.10.1.30 Drop or collision of a loaded, sealed WP (WP needing decontamination) from the WP handling and staging cell overhead crane onto or against a sharp object during transfer from the WP survey station to a trolley for transfer to the WP/trolley decontamination room

Design and operational requirements will ensure that load paths are kept free of puncture hazards (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.10.1.31 Slapdown of a loaded, sealed WP (WP needing decontamination) from the WP handling and staging cell overhead crane (due to impact with a curb/berm/impact limiter used to maintain drop height limits) or trolley edge during the transfer from the WP survey station to a trolley for transfer to the WP/trolley decontamination room

Section 6.3.1.8 includes this potential event. The WP is assumed to survive a slapdown without breach (Assumption 5.1.3.12).

6.3.4.10.1.32 Collision involving the trolley holding the loaded, sealed, contaminated or decontaminated WP and the shield doors between the WP handling and staging cell and the WP/trolley decontamination room

Trolley collision is addressed in Section 6.3.1.22.

6.3.4.10.1.33 Shield doors between the WP handling and staging cell and the WP/trolley decontamination room close on the trolley holding the loaded, sealed, contaminated or decontaminated WP

A design requirement is assumed to ensure that closure of the shield doors onto a trolley would not overturn the trolley or cause it to drop its load (Assumption 5.1.1.13).

6.3.4.10.1.34 Derailment of a trolley holding the loaded, sealed, contaminated or decontaminated WP in the WP/trolley decontamination room (or on the rails leading to/from this room) followed by a load tipover or fall

A design requirement is assumed to ensure that the trolley will not derail or allow the unsealed WP to fall off the trolley (Assumption 5.1.1.36). Because the WP remains upright there is no threat to the integrity of the unsealed WP.

6.3.4.10.1.35 Drop or collision of equipment (handling equipment, decontamination equipment etc.) onto or against a loaded, sealed contaminated or decontaminated WP positioned on a trolley in the WP/trolley decontamination room

Operational requirements will prevent radiological releases due to this potential event (Assumption 5.1.3.3).

6.3.4.10.1.36 Drop of a loaded, sealed, decontaminated WP from the WP handling and staging cell overhead crane onto the floor during transfer from the trolley serving the WP/trolley decontamination room to the trolley to the WP loadout cell

Section 6.3.1.8 includes the potential drop event. Trolley collision is addressed in Section 6.3.1.22.

6.3.4.10.1.37 Drop of a loaded, sealed, decontaminated WP from the WP handling and staging cell overhead crane onto a trolley during transfer from the trolley serving the WP/trolley decontamination room to the trolley to the WP loadout cell.

Section 6.3.1.8 includes this potential event.

6.3.4.10.1.38 Drop or collision of a loaded, sealed, decontaminated WP from the WP handling and staging cell overhead crane onto or against a sharp object during transfer from the trolley serving the WP/trolley decontamination room to the trolley to the WP loadout cell

Design and operational requirements will ensure that load paths are kept free of puncture hazards (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.10.1.39 Slapdown (tipover from an elevated surface) of a loaded, sealed, decontaminated WP from the WP handling and staging cell overhead crane (due to impact with a curb/berm/impact limiter used to maintain drop height limits) or trolley edge during the transfer from the trolley serving the WP/trolley decontamination room to the trolley to the WP loadout cell

Section 6.3.1.8 includes this potential event. The WP is assumed to survive a slapdown without breach (Assumption 5.1.3.12).

6.3.4.10.1.40 Drop or collision of equipment (handling equipment, etc.) from the WP handling and staging cell overhead crane onto or against a loaded, sealed or partially sealed (with a known weld defect), contaminated or decontaminated WP positioned on a pedestal on a trolley, on a trolley without a pedestal, or the WP survey station

Operational requirements will prevent radiological releases due to this potential event (Assumption 5.1.3.3).

6.3.4.10.1.41 Derailment of a trolley holding a loaded, sealed WP on the rails leading from the WP handling and staging cell to the WP loadout cell, followed by a load tipover or fall

A design requirement is assumed to ensure that the trolley will not derail or allow the unsealed WP to fall off the trolley (Assumption 5.1.1.36). Because the WP remains upright there is no threat to the integrity of the unsealed WP.

6.3.4.10.2 Chemical Contamination/Flooding

6.3.4.10.2.1 Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures

Oxidation of failed CSNF assemblies is expected as a part of normal operations wherever CSNF assemblies are exposed to air. Resulting exposure of workers to radiation will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.4.10.2.2 Flooding due to rupture of water line or clogging of drain associated with the high pressure water system used for decontamination activities in the WP/Trolley decontamination room

Minor increases in worker doses that may be caused by the spread of contamination due to flooding would be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.4.10.3 Explosion/Implosion

6.3.4.10.3.1 Explosion hazard associated with the WP purging and inerting system and the ignition of hydrogen that may have accumulated in the WP

Precautions taken during the cask sampling and purging process will provide reasonable assurance that such hydrogen explosions will not occur (Assumption 5.1.1.58).

6.3.4.10.3.2 WP decontamination system missile due to a fractured nozzle/valve stem/pneumatic device

An operational requirement is assumed to prevent initiation of an event sequence by this potential event (Assumption 5.1.1.5).

6.3.4.10.3.3 WP inerting system (or other pneumatic or pressurized system) missile due to a fractured nozzle/valve stem/pneumatic device

An operational requirement is assumed to prevent initiation of an event sequence by this potential event (Assumption 5.1.1.5).

6.3.4.10.4 Fire, Thermal

6.3.4.10.4.1 Electrical fire associated with handling and other electrically-powered equipment in the WP handling and staging cell, the WP positioning cells, and the WP closure cells, including the cranes and the welding subsystem in the WP closure cells.

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.10.4.2 Electrical fire associated with a trolley holding a loaded WP (unsealed or sealed)

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.10.4.3 Fuel damage by burn-through during welding process/heat damage

Burn-through of the inner lid is not possible with the gas tungsten arc welding process, which is used for the closure welds (BSC 2005 [DIRS 171428], Section 6.6.3.10; BSC 2004 [DIRS 172428], Section 3).

6.3.4.10.4.4 Thermal hazard/SNF overheating in a WP during the welding process resulting in excessive cladding temperature and possible zircaloy cladding (or other cladding) unzipping

Overheating of the WP contents due to welding is not possible using the gas tungsten arc welding process, which is used for the closure welds (BSC 2005 [DIRS 171428], Section 6.6.3.10; BSC 2004 [DIRS 172428], Section 3).

6.3.4.10.4.5 Thermal hazard/SNF overheating in a partially sealed WP (WP with weld defects) in the WP handling and staging cell, prior to entering WP remediation

This potential event is discussed in Section 6.3.1.26.

6.3.4.10.4.6 Intact or non-intact SNF overheating or damage to canister contents due to a loss of cooling resulting in excessive temperature and possible zircaloy cladding (or other cladding) unzipping or cladding failure due to excessive hoop stresses

This potential event is discussed in Section 6.3.1.26.

6.3.4.10.4.7 Transient combustible fire in the WP handling and staging cells, WP positioning cells, WP closure cells, and the WP/trolley decontamination room

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.10.5 Radiation

6.3.4.10.5.1 Radiation exposure of a facility worker and/or the offsite public

Exposure of workers or the public to radiation is a hazard for the potential event sequences considered in the present analysis. The consequence analysis will evaluate this hazard for event sequences and normal operations, as applicable.

6.3.4.10.5.2 Glovebox leak leads to radiological release of airborne contamination

Gloveboxes will be inspected for proper functioning and monitored for release of radioactive contamination. Therefore, exposure of workers to radiation due to a glovebox leak will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.4.10.5.3 Thermal expansion of gases within WP (prior to seal of inner lid) leads to radiological release

Thermal expansion of gases is to be expected as a part of normal operations. Resulting exposure of workers to radiation will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.4.10.5.4 Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation

This potential event is covered in Section 6.3.1.25.

6.3.4.10.5.5 Inadvertent opening of a shield door, leading to a worker exposure

This potential event could expose workers to radiation, but would not expose the public. The frequency of inadvertent actions that expose workers to radiation will be limited by design features and operating procedures that ensure that such events are not Category 1 (Assumption 5.1.1.57).

6.3.4.10.5.6 Radiation-induced damage to a facility SSC

Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization as explained in Section 6.3.2.5.2.

6.3.4.10.6 Fissile

6.3.4.10.6.1 Criticality associated with a trolley holding a loaded, sealed or unsealed WP derailment followed by a load tipover or fall and a rearrangement of the container internals

A design requirement is assumed to ensure that the trolley will not derail or allow the WP to fall off the trolley (Assumption 5.1.1.36).

6.3.4.10.6.2 Criticality associated with a drop or slapdown of a loaded, unsealed WP and a rearrangement of the container contents (including SNF assemblies that may move out of the WP)

Because the WP does not spill its contents (Assumption 5.1.3.11) and moderators are excluded from the WP (Assumptions 5.1.3.2 and 5.1.1.21), the unsealed WP will remain subcritical.

6.3.4.10.6.3 Criticality associated with the drop of heavy equipment onto a loaded, unsealed WP and a rearrangement of the container internals

A design requirement will ensure that WPs are designed such that drops, collisions, and other handling impacts within their design bases (allowing for rearrangement of container internals and without credit for burnup) cannot lead to a nuclear criticality (Assumption 5.1.3.2). A design requirement will also ensure that unsealed WPs cannot sustain a nuclear criticality with moderator control in effect (Assumption 5.1.1.21).

6.3.4.10.6.4 Criticality associated with a drop or slapdown of a loaded, sealed WP and a rearrangement of the container internals

A design requirement will ensure that WPs are designed such that drops, collisions, and other handling impacts within their design bases (allowing for rearrangement of container internals and without credit for burnup) cannot lead to a nuclear criticality (Assumption 5.1.3.1).

6.3.4.11 WP Loadout Cell, WP Transporter Vestibule, Exit Vestibule

6.3.4.11.1 Collision/Crushing

6.3.4.11.1.1 Collision involving the trolley holding the loaded, sealed WP and the shield doors between the WP handling and staging cell and the WP loadout cell

Trolley collision is addressed in Section 6.3.1.22.

6.3.4.11.1.2 Shield doors between the WP handling and staging cell and the WP loadout cell close on the trolley holding the loaded, sealed WP

A design requirement is assumed to ensure that closure of the shield doors onto a trolley would not overturn the trolley or cause it to drop its load (Assumption 5.1.1.13). Because the trolley remains upright there is no threat to the integrity of the WP.

6.3.4.11.1.3 Derailment of a trolley in the WP loadout cell holding a loaded, sealed WP followed by a load tipover or fall

A design requirement is assumed to ensure that the trolley will not derail or allow the WP to fall off the trolley (Assumption 5.1.1.36). Because the WP remains upright there is no threat to the integrity of the WP.

6.3.4.11.1.4 Drop of a loaded, sealed WP from the WP loadout cell overhead crane onto the floor during the transfer from the trolley to the tilting machine

This potential event is covered by Section 6.3.1.8.

6.3.4.11.1.5 Drop of a loaded, sealed WP from the WP loadout cell overhead crane back onto the trolley during the transfer from the trolley to the tilting machine.

Section 6.3.1.8 includes this potential event.

6.3.4.11.1.6 Drop or collision of a loaded, sealed WP from the WP loadout cell overhead crane onto or against a sharp object (including the tilting machine) during transfer from the trolley to the tilting machine

Design and operational requirements will ensure that load paths are kept free of puncture hazards (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.11.1.7 Slapdown (either forward into the WP turntable or backward onto the floor) of a loaded, sealed WP engaged in the tilting machine from the WP loadout cell overhead crane during the lowering of the WP to the horizontal position on the WP pallet previously placed on the WP turntable

Section 6.3.1.8 includes this potential event. The WP is assumed to survive a slapdown without breach (Assumption 5.1.3.12). A design requirement is assumed to prevent backward slapdowns (Assumption 5.1.1.53).

6.3.4.11.1.8 Collision of the tilting machine against a loaded, sealed WP on a pallet on the WP turntable

A design or operational requirement is assumed to ensure that a collision between the tilting machine and a WP would not breach the WP (Assumption 5.1.3.10).

6.3.4.11.1.9 Equipment drop or collision (including lifting yokes) onto or against a loaded, sealed WP during the process to move the WP from the trolley to the tilting machine

Operational requirements will prevent radiological releases due to this potential event (Assumption 5.1.3.3).

6.3.4.11.1.10 Collision of the WP trunnion collar removal machine and the WP during trunnion collar removal

A design or operational requirement is assumed to ensure that a collision between the trunnion collar removal machine and a WP would not breach the WP (Assumption 5.1.3.10).

6.3.4.11.1.11 Drop of trunnion collar from the 100-ton overhead bridge crane in the WP loadout cell onto a WP during trunnion collar removal

Operational requirements will prevent radiological releases due to this potential event (Assumption 5.1.3.3).

6.3.4.11.1.12 Movement of the WP turntable holding the loaded, sealed WP (positioned on the WP pallet) prior to disengagement/removal of the WP trunnion collar removal machine

A design requirement is assumed to ensure that premature actuation of the turntable will not cause the WP to breach (Assumption 5.1.1.16).

6.3.4.11.1.13 Collision of the WP transporter or transporter bedplate with the loaded, sealed WP positioned on a pallet on the WP turntable during movement of the bedplate under the WP turntable

Design and operational requirements are assumed to ensure that collision of the WP transporter or transporter bedplate with the loaded, sealed WP will not breach the WP or knock it off of the turntable (Assumption 5.1.1.39).

6.3.4.11.1.14 Drop of the loaded, sealed WP (positioned on a pallet) onto the transporter bedplate during the lowering of the WP and emplacement pallet from the WP turntable to the transporter bedplate positioned under the WP turntable

Section 6.3.1.8 includes this potential event.

6.3.4.11.1.15 Collision involving a WP transporter (holding the sealed WP on a pallet) and the shield doors between the WP loadout cell and the WP transporter vestibule

A design requirement is assumed to ensure that a collision of the WP transporter could not cause a WP breach (Assumptions 5.1.7.3 and 5.1.7.7).

6.3.4.11.1.16 Shield doors between the WP loadout cell and the WP transporter vestibule close on the WP transporter (holding the loaded, sealed WP on a pallet)

A design requirement is assumed to ensure that closure of the shield doors onto a transporter would not overturn the transporter or cause it to drop its load (Assumption 5.1.1.13). Because the transporter remains upright there is no threat to the integrity of the WP.

6.3.4.11.1.17 Collision involving WP transporter (holding the loaded, sealed WP on a pallet) and the shield doors between the WP transporter vestibule and the exit vestibule

This potential event is covered by the argument presented in Section 6.3.4.11.1.15.

6.3.4.11.1.18 Shield doors between the WP transporter vestibule and the exit vestibule close on the WP transporter (holding the loaded, sealed WP on a pallet).

This potential event is covered by the argument presented in Section 6.3.4.11.1.16.

6.3.4.11.1.19 Collision involving the WP transporter (holding the loaded, sealed WP on a pallet) and the doors between the exit vestibule and the ambient air (outside)

This potential event is covered by the argument presented in Section 6.3.4.11.1.15.

6.3.4.11.1.20 Doors between the exit vestibule and the ambient air (outside) close on the WP transporter (holding the loaded, sealed WP on a pallet)

This potential event is covered by the analysis in Section 6.3.4.11.1.16.

6.3.4.11.1.21 Derailment of a WP transporter in the exit vestibule, WP transporter vestibule, or WP loadout cell followed by a load tipover or fall

A design requirement is assumed to ensure that a derailment of the WP transporter could not cause a WP breach (Assumptions 5.1.7.3 and 5.1.7.7).

6.3.4.11.1.22 Drop of a heavy load from the WP loadout crane auxiliary trolley hoist in the WP loadout crane park cell onto a loaded, sealed WP

An operational requirement will ensure that heavy loads that could potentially initiate an event sequence if dropped onto a WP will not be lifted over or near a WP, except as needed for transfer and closure operations (Assumption 5.1.1.33).

6.3.4.11.2 Chemical Contamination/Flooding

6.3.4.11.2.1 Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures

Because the SNF in this area is contained in a sealed WP (BSC 2005 [DIRS 171428], Section 6.6.3.11), this potential event will not occur unless an event sequence leads to exposure of SNF

to air. Oxidation of the fuel matrix is a possible outcome of an event that exposes SNF to air. The consequence analyses will account for the possibility of oxidation, if applicable.

6.3.4.11.3 Explosion/Implosion

6.3.4.11.3.1 Hydraulic system or other pneumatic or pressurized system missile due to a fractured nozzle/valve stem/pneumatic device

An operational requirement is assumed to prevent initiation of an event sequence by this potential event (Assumption 5.1.1.5).

6.3.4.11.4 Fire, Thermal

6.3.4.11.4.1 Electrical fire associated with the WP loadout cell, the WP transporter vestibule, or the exit vestibule (including the WP trunnion collar removal machine, the tilting machine, and the WP turntable).

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.11.4.2 Electrical fire associated with a trolley holding a sealed WP.

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.11.4.3 Electrical fire associated with the WP loadout cell overhead bridge crane.

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.11.4.4 Electrical fire associated with equipment on the WP transporter, including motors to extend the WP transporter bedplate.

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.11.4.5 Electrical fire associated with the WP transport locomotive.

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.11.4.6 Intact or non-intact SNF overheating or damage to canister contents due to a loss of cooling resulting in excessive temperature and possible zircaloy cladding (or other cladding) unzipping or cladding failure due to excessive hoop stresses

This potential event is discussed in Section 6.3.1.26.

6.3.4.11.4.7 Transient combustible fire in the WP loadout cell, the WP transporter vestibule, or the exit vestibule

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.11.5 Radiation

6.3.4.11.5.1 Radiation exposure of a facility worker and/or the offsite public

Exposure of workers or the public to radiation is a hazard for the potential event sequences considered in the present analysis. The consequence analysis will evaluate this hazard for event sequences and normal operations, as applicable.

6.3.4.11.5.2 Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation

This potential event is covered in Section 6.3.1.25.

6.3.4.11.5.3 Inadvertent opening of a shield door, leading to a worker exposure

This potential event could expose workers to radiation, but would not expose the public. The frequency of inadvertent actions that expose workers to radiation will be limited by design features and operating procedures that ensure that such events are not Category 1 (Assumption 5.1.1.57).

6.3.4.11.5.4 Inadvertent opening of the WP transporter shielded enclosure doors, leading to a worker exposure

This potential event could expose workers to radiation, but would not expose the public. The frequency of inadvertent actions that expose workers to radiation will be limited by design features and operating procedures that ensure that such events are not Category 1 (Assumption 5.1.1.57).

6.3.4.11.5.5 Radiation-induced damage to a facility SSC

Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization as explained in Section 6.3.2.5.2.

6.3.4.11.6 Fissile

6.3.4.11.6.1 Criticality associated with a trolley holding a loaded, sealed WP derailment followed by a load tipover or fall and a rearrangement of the container internals

A design requirement is assumed to ensure that a the trolley will not derail or allow the WP to fall off the trolley (Assumptions 5.1.3.1 and 5.1.1.36).

6.3.4.11.6.2 Criticality associated with a drop, slapdown, or collision of a loaded, sealed WP and a rearrangement of the container internals

A design requirement will ensure that WPs are designed such that drops, collisions, and other handling impacts within their design bases (allowing for rearrangement of container internals and without credit for burnup) cannot lead to a nuclear criticality (Assumption 5.1.3.1).

6.3.4.11.6.3 Criticality associated with a WP transporter derailment followed by a load tipover or fall and rearrangement of the WP internals

A design requirement is assumed to ensure that a derailment of the WP transporter would not cause a WP breach (Assumptions 5.1.7.3 and 5.1.7.7). Another design requirement is assumed to preclude criticality in sealed WPs (Assumption 5.1.3.1).

6.3.4.12 WP Remediation: DPC Cutting/WP Dry Remediation Cell

6.3.4.12.1 Collision/Crushing

6.3.4.12.1.1 Collision involving the trolley holding a loaded, partially sealed WP (with a known weld defect) and the shield doors between the WP handling and staging cell and the WP/trolley decontamination room or the doors between the WP/trolley decontamination room and the DPC cutting/WP dry remediation cell

Trolley collision is addressed in Section 6.3.1.22.

6.3.4.12.1.2 Shield doors between the WP handling and staging cell and the WP/trolley decontamination room or the doors between the WP/trolley decontamination room and the DPC cutting/WP dry remediation cell close on the trolley holding a loaded, partially sealed WP (WP with a known weld defect)

A design requirement is assumed to ensure that closure of the shield doors in the DTF onto a transfer trolley would not overturn the trolley or cause it to drop its load (Assumption 5.1.1.13). Because the trolley remains upright there is no threat to the integrity of the WP, transportation cask, MSC, or shuttle cask. Therefore, this potential event will not initiate an event sequence.

6.3.4.12.1.3 Derailment of a trolley holding a loaded, partially sealed WP (WP with a known weld defect) followed by a load tipover or fall, in the DPC cutting/WP dry remediation cell

A design requirement is assumed to ensure that the trolley carrying a WP would not derail or allow the WP to fall off the trolley (Assumption 5.1.1.36). Because the transfer trolley remains upright there is no threat to the integrity of the cask.

6.3.4.12.1.4 Drop of a loaded, partially sealed WP (WP with a known weld defect) from the DPC cutting/WP dry remediation cell overhead crane onto the floor during transfer from the trolley to the cutting machine base

This event is covered in Section 6.3.1.9.

6.3.4.12.1.5 Drop of a loaded, partially sealed WP (WP with a known weld defect) from the DPC cutting/WP dry remediation cell overhead crane onto the cutting machine base during transfer from the trolley to the cutting machine base

The calculation in Section 6.3.1.9 includes this potential event.

6.3.4.12.1.6 Drop or collision of a loaded, partially sealed WP (WP with a known weld defect) from the DPC cutting/WP dry remediation cell overhead crane onto or against a sharp object during transfer from the trolley to the cutting machine base.

Design and operational requirements will ensure that load paths are kept free of puncture hazards (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.12.1.7 Drop or collision of equipment (including a lifting yoke) from the DPC cutting/WP dry remediation cell overhead crane onto or against a loaded, partially sealed WP (WP with a known weld defect)

Operational requirements will prevent radiological releases due to this potential event (Assumption 5.1.3.3).

6.3.4.12.1.8 Drop or collision of the WP/canister cutting machine onto or against the defective WP during the lowering of the machine for the lid-cutting operation

A design requirement is assumed to ensure that the mass, lift height, and other characteristics of the cutting machine are such that the waste-package lid (without credit for the weld) will be able to prevent a radiological release should the cutting machine fall onto the WP on approach, during cutting, or on withdrawal (Assumption 5.1.5.2).

6.3.4.12.1.9 Damage to the WP contents (fuel assembly(ies), canisters, etc.) during lid-cutting operations

Design requirements for the lid-cutting machine will preclude damage to the contents of the WP during the cutting process that results in a radiological release (Assumption 5.1.5.2).

6.3.4.12.1.10 Drop or collision of the WP/canister cutting machine onto or against the defective WP during the removal of the machine after the lid-cutting operation

A design requirement is assumed to ensure that the mass, lift height, and other characteristics of the cutting machine are such that the waste-package lid (without credit for the weld) will be able to prevent a radiological release should the cutting machine fall onto the WP on approach, during cutting, or on withdrawal (Assumption 5.1.5.2).

6.3.4.12.1.11 Drop of a severed lid (outer, middle, or inner) back onto the WP from an overhead crane during, or after, the completion, of the WP cutting

The frequency and consequences of this event are bounded by the Category 2 lid-drop event discussed in Section 6.3.1.2. The frequency is bounded because this event only applies to WPs in the Remediation Facility, while the bounding event applies to WPs, MSCs, and transportation casks in the DTF. The consequences are bounded because WPs have smaller CSNF assembly capacities than assumed in the analysis for transportation casks.

6.3.4.12.1.12 Drop or collision of handling equipment (lid grapple) onto or against the unsealed (open), loaded WP

The lid grapple will not be suspended above the open WP unless the lid is in place or is being lifted (Assumption 5.1.1.55). If the lid is in place, operational requirements will prevent radiological releases due to this potential event (Assumption 5.1.3.3). If the lid is being lifted, the potential event is analyzed as a lid-drop event in Section 6.3.4.12.1.11.

6.3.4.12.1.13 Drop of an unsealed (open), loaded WP from the overhead crane in the DPC cutting/WP dry remediation cell onto the floor during transfer of the WP from the cutting machine base to the trolley that travels to the unloading port to the waste transfer cell

The calculation in Section 6.3.1.7 includes this potential event as a component of a generalized waste-package drop.

6.3.4.12.1.14 Drop of an unsealed (open), loaded WP from the overhead crane in the DPC cutting/WP dry remediation cell onto the trolley during the transfer of the WP from the cutting machine base to the trolley that travels to the unloading port to the waste transfer cell

The calculation in Section 6.3.1.7 includes this potential event.

6.3.4.12.1.15 Drop or collision of an unsealed (open), loaded WP from the overhead crane in the DPC cutting/WP dry remediation cell onto or against a sharp object during transfer of the WP from the cutting machine base to the trolley that travels to the unloading port to the waste transfer cell

Design and operational requirements will ensure that load paths are kept free of puncture hazards (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.12.1.16 Slapdown of an unsealed (open), loaded WP following a drop from the overhead crane in the DPC cutting/WP dry remediation cell onto the edge of a pedestal or impact limiter on/near the trolley that travels to the unloading port to the waste transfer cell during the lift and transfer to the trolley

The calculation in Section 6.3.1.7 includes this potential event as a component of a generalized waste-package drop. The possibility that the contents of the WP could slide out and be sandwiched between the floor of the transfer cell and the lip of the falling WP will be prevented by design features (Assumption 5.1.3.11).

6.3.4.12.1.17 Derailment of a trolley (that travels to the unloading port to the waste transfer cell) holding a loaded WP (in an opened state) in the DPC cutting/WP dry remediation cell followed by a load tipover or fall

A design requirement is assumed to ensure that the loaded transfer trolleys will not derail or allow the WP to fall off the trolley (Assumption 5.1.1.36). Therefore, this potential event will not initiate an event sequence.

6.3.4.12.1.18 Drop or collision of an SNF assembly from the spent fuel transfer machine into or against the WP

This event is included in Section 6.3.1.10.

6.3.4.12.1.19 Drop or collision of an SNF assembly from the spent fuel transfer machine onto or against another SNF assembly or assemblies in the WP

The calculation in Section 6.3.1.10 includes this potential event as a component of a generalized assembly drop, which is found to be Category 2.

6.3.4.12.1.20 Impact due to horizontal movement of an SNF assembly by the spent fuel transfer machine before the assembly is fully lifted out of the WP

The calculation in Section 6.3.1.10 includes this potential event as a component of a generalized assembly drop or collision.

6.3.4.12.1.21 Drop and slapdown of an SNF assembly from the spent fuel transfer machine (due to impact with an edge of the WP, floor edge, WP internal baffle, etc.) during the transfer of the SNF assemblies to a WP or staging rack

The calculation in Section 6.3.1.10 includes this potential event as a component of a generalized assembly drop.

6.3.4.12.1.22 Drop or collision of a naval SNF canister, a DOE HLW canister, a [standardized] DOE SNF canister, or a DOE SNF MCO from the waste transfer cell overhead crane back into or against the WP being unloaded

The drop event is included in Section 6.3.1.11. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.12.1.23 Impact due to horizontal movement of a naval SNF canister, a DOE HLW canister, a [standardized] DOE SNF canister, or a DOE SNF MCO with the waste transfer cell overhead crane before the canister is completely removed from the WP

Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.12.1.24 Drop or collision of a DOE HLW canister from the waste transfer cell crane back onto or against another DOE HLW canister, a [standardized] DOE SNF canister, or a DOE SNF MCO in a WP

The drop event is included in Section 6.3.1.5. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.12.1.25 Drop or collision of a [standardized] DOE SNF canister from the waste transfer cell crane onto or against a DOE HLW canister in the WP

Dropping a DOE SNF canister onto a DOE HLW canister is rendered Beyond Category 2 by an operational requirement not to transfer a DOE SNF canister into the WP if a DOE HLW canister is present in the same WP (Assumption 5.1.1.23). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.12.1.26 Drop or collision of a DOE SNF MCO from the waste transfer cell crane onto or against another DOE SNF MCO or a DOE HLW canister in the WP

Drop of a DOE SNF MCO from above its lift-height limit is Beyond Category 2, as shown in Table 31, Event F. If a DOE SNF MCO is dropped onto another MCO within the lift-height limit, neither MCO will breach (Assumption 5.1.1.28). Dropping a DOE SNF MCO onto a DOE HLW canister is rendered Beyond Category 2 by an operational requirement not to transfer a DOE SNF canister into a WP if a DOE HLW canister is present in the same WP (Assumption 5.1.1.23). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.12.1.27 Drop and slapdown of a DOE HLW canister, a DOE SNF MCO, a [standardized] DOE SNF canister, or a naval SNF canister from the waste transfer cell overhead crane (due to impact with an edge of the WP, floor edge, WP internal baffle, etc.) during the transfer from the WP to a new WP, MSC, or staging rack (if applicable)

For HLW and naval canisters, this event is covered by Table 31, Event B, where it is shown to be Category 2. Drop of a standardized DOE SNF canister or MCO from above its lift-height limit is Beyond Category 2, as shown in Table 31, Event F. If a DOE SNF canister is dropped on an edge as required for this event, the canister breach is Beyond Category 2 (Assumption 5.1.1.29).

6.3.4.12.1.28 Drop or collision of handling equipment into or against an opened WP filled with SNF assemblies

Section 6.3.1.18 covers this potential event.

6.3.4.12.1.29 Drop or collision of handling equipment into or against an opened WP loaded with a naval SNF canister, DOE HLW canisters, and/or [standardized] DOE SNF canisters, and/or DOE SNF MCOs

Section 6.3.1.19 covers this potential event.

6.3.4.12.2 Chemical Contamination/Flooding

6.3.4.12.2.1 Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures

Oxidation of failed CSNF assemblies is expected as a part of normal operations wherever CSNF assemblies are exposed to air. Resulting exposure of workers to radiation will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.4.12.3 Explosion/Implosion

6.3.4.12.3.1 Explosion hazard associated with the cutting and removal of the WP lid system and the ignition of hydrogen that may have accumulated inside the WP, including hydrogen removed during the purging process

Precautions taken during the cask sampling and purging process will provide reasonable assurance that such hydrogen explosions will not occur (Assumption 5.1.1.58).

6.3.4.12.3.2 Cask/WP purging or sampling system (or other pneumatic or pressurized system) missile due to a fractured nozzle/valve stem/pneumatic device

An operational requirement is assumed to prevent initiation of an event sequence by this potential event (Assumption 5.1.1.5).

6.3.4.12.4 Fire, Thermal

6.3.4.12.4.1 Electrical fire associated with SNF and HLW handling equipment in the DPC cutting/WP dry remediation cell (including the overhead cranes, manipulators, the chipless cutting equipment, etc.)

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.12.4.2 Electrical fire associated with the trolley

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.12.4.3 Intact or non-intact SNF overheating or damage to canister contents due to a loss of cooling resulting in excessive temperature and possible zircaloy cladding (or other cladding) unzipping or cladding failure due to excessive hoop stresses

This potential event is discussed in Section 6.3.1.26.

6.3.4.12.4.4 Thermal hazard (from decay heat) associated with vertical orientation of the non-inerted opened, loaded WP

This potential hazard is addressed in Section 6.3.4.12.2.1.

6.3.4.12.4.5 Transient combustible fire in the DPC cutting/WP dry remediation cell

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.12.5 Radiation

6.3.4.12.5.1 Radiation exposure of a facility worker and/or the offsite public

Exposure of workers or the offsite public to radiation is a hazard for the potential event sequences considered in the present analysis. The consequence analysis will evaluate this hazard for event sequences and normal operations, as applicable.

6.3.4.12.5.2 Damage or rupture of the WP sampling and purging system, leading to a release of WP internal gases and radioactive material

Like the cask-sampling operation, the WP sampling operation will be conducted so that exposure of workers to radiation will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses (BSC 2004 [DIRS 172098], Section 3.2.2.1.1). Although a rupture leading to a radiological release would be an abnormal occurrence, radiation protection programs will ensure that such an occurrence would not contribute significantly to the normal operations

dose. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.4.12.5.3 Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation

This potential event is covered in Section 6.3.1.25.

6.3.4.12.5.4 Thermal expansion of gases or other loss of confinement in an unsealed cask, leading to radiological release

Exposure of workers to radiation due to this potential event will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.4.12.5.5 Radiation-induced damage to a facility SSC

Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization as explained in Section 6.3.2.5.2.

6.3.4.12.6 Fissile

6.3.4.12.6.1 Criticality associated with a trolley (holding a partially sealed WP requiring remediation) derailment followed by a load tipover or fall and a rearrangement of the container internals

A design requirement is assumed to ensure that the trolley will not derail or allow the unsealed WP to fall off the trolley (Assumption 5.1.1.36), thereby making this event Beyond Category 2.

6.3.4.12.6.2 Criticality associated with a drop of an SNF assembly from the waste transfer cell spent fuel transfer machine back into the WP being unloaded and a rearrangement of the WP internals

Design calculations and the resulting design requirements will ensure criticality safety for this event (Assumption 5.1.3.2).

6.3.4.12.6.3 Criticality associated with a drop of an SNF assembly from the spent fuel transfer machine back into a WP being unloaded and a rearrangement of the fuel rods that comprise the assembly due to impact

Design calculations and the resulting design requirements will ensure criticality safety for this event (Assumption 5.1.3.2).

6.3.4.12.6.4 Criticality associated with a drop or slapdown of a WP from the DPC cutting/WP dry remediation cell overhead crane and a rearrangement of the container internals

A design requirement will ensure that WPs are designed such that drops, collisions, and other handling impacts within their design bases (allowing for rearrangement of container internals and without credit for burnup) cannot lead to a nuclear criticality (Assumption 5.1.3.1).

6.3.4.12.6.5 Criticality associated with a drop or slapdown of a naval SNF canister, a [standardized] DOE SNF canister, a DOE SNF MCO, or a DOE HLW canister from the waste transfer cell overhead crane during WP unloading

Design calculations and the resulting design requirements will ensure criticality safety for DOE SNF canisters involved in this event (Assumption 5.1.1.3). The potential for criticality for naval canisters is addressed in Attachment I, where it is demonstrated that a criticality associated with the drop of a naval canister is Beyond Category 2. There is no potential for criticality of HLW canisters (Assumption 5.2.1.19).

6.3.4.12.6.6 Criticality associated with a trolley (holding an unsealed, open WP) derailment followed by a load tipover or fall and a rearrangement of the container internals

A design requirement is assumed to ensure that the trolley will not derail or allow the unsealed WP to tip over or fall (Assumption 5.1.1.36).

6.3.4.12.6.7 Criticality associated with the drop of heavy equipment onto an unsealed, open WP and a rearrangement of the container internals

A design requirement will ensure that WPs are designed such that drops, collisions, and other handling impacts within their design bases (allowing for rearrangement of container internals and without credit for burnup) cannot lead to a nuclear criticality (Assumption 5.1.3.1). A design requirement will also ensure that unsealed WPs cannot sustain a nuclear criticality with moderator control in effect (Assumption 5.1.1.21).

6.3.4.13 Dry Remediation: Cask Docking/Dry Remediation Room, Tool Spare Transfer Room, DPC Cutting/WP Dry Remediation Cell

6.3.4.13.1 Collision/Crushing

6.3.4.13.1.1 Collision involving the trolley holding the cask or MSC requiring remediation and the shield doors between the cask and MSC docking room and the cask/MSC turntable room, the cask/MSC turntable room and the cask preparation room, the cask preparation room and the DPC preparation/cask dry remediation room, the DPC preparation/cask dry remediation room and the DPC docking room, the DPC docking room and the cask docking/dry remediation room, or the cask docking/dry remediation room and the tool spare transfer room

Trolley collision is addressed in Section 6.3.1.22.

6.3.4.13.1.2 Shield doors between the cask and MSC docking room and the cask/MSC turntable room, the cask/MSC turntable room and the cask preparation room, the cask preparation room and the DPC preparation/cask dry remediation room, the DPC preparation/cask dry remediation room and the DPC docking room, the DPC docking room and the cask docking/dry remediation room, or the cask docking/dry remediation room and the tool spare transfer room close on the trolley holding the cask or MSC requiring remediation

A design requirement is assumed to ensure that closure of the shield doors onto a transfer trolley would not overturn the trolley or cause it to drop its load (Assumption 5.1.1.13). Because the trolley remains upright there is no threat to the integrity of the WP. Therefore, this potential event will not initiate an event sequence.

6.3.4.13.1.3 Derailment of a trolley in the cask and MSC docking room, the cask/MSC turntable room, the cask preparation room, the DPC preparation/cask dry remediation room, the DPC docking room, the cask docking/dry remediation room, or the tool spare transfer room while holding a cask or MSC, followed by a load tipover or fall

A design requirement is assumed to ensure that the trolley will not derail or allow the unsealed WP to fall off the trolley (Assumption 5.1.1.36), thereby making this event Beyond Category 2. Because the WP remains upright there is no threat to the integrity of the unsealed WP.

6.3.4.13.1.4 Drop or collision of tools or equipment onto or against a cask or MSC requiring remediation

Operational requirements will prevent initiation of an event sequence for this potential event (Assumption 5.1.1.30).

6.3.4.13.1.5 Collision involving an access platform or a mobile elevated platform (if required) and a cask or MSC requiring remediation

Operational requirements are assumed to ensure that the access platform will not be operated in a manner that could breach a transportation cask or MSC (Assumption 5.1.1.41).

6.3.4.13.1.6 Collision of a trolley holding the cask or MSC requiring remediation with another trolley holding a cask or MSC on the turntable in the DPC docking room or on the tracks leading to the cask docking/dry remediation room or tool spare transfer room

Trolley collision is addressed in Section 6.3.1.22.

6.3.4.13.1.7 Drop or collision of a docking port (mobile slab) onto or against a cask or MSC

A design requirement is assumed to ensure that this potential event will not initiate an event sequence (Assumption 5.1.1.17).

6.3.4.13.1.8 Drop or collision of a docking port plug onto or against a cask lid or MSC lid (with outer lid removed [if applicable] and inner lid unbolted but in place)

A design requirement to consider 2-over-1 event sequences will prevent initiation of an event sequence as a result of this potential event (Assumption 5.1.1.37).

6.3.4.13.1.9 Drop of an inner lid on a cask or MSC (with outer lid removed [if applicable])

This potential event is included in Section 6.3.1.2.

6.3.4.13.1.10 Drop or collision of a grapple or other handling equipment into or against an open cask or MSC loaded with commercial SNF assemblies, a DPC, a DOE HLW canister, a DOE SNF MCO, or a [standardized] DOE SNF canister

This potential event is treated as two different events, depending on the contents of the cask. In each case, it is assumed that no more than 10 percent of the SNF and HLW to be emplaced is handled in the dry remediation areas (Assumption 5.2.3.1). For CSNF assemblies, the analysis of Section 6.3.1.18 applies, and the event sequence is Category 2. The amount of material at risk is one CSNF assembly.

For the cases in which the cask contains a DOE HLW canister, a DOE SNF MCO, a DOE SNF canister, or a naval canister, the analysis in Section 6.3.1.19 applies. One Category 2 event sequence emerges and it results in the breach of one HLW canister.

6.3.4.13.1.11 Drop or collision of an SNF assembly from the DPC cutting/WP dry remediation cell crane back into or against a cask or MSC being unloaded

The calculation in Section 6.3.1.10 includes this potential event as a component of a generalized assembly drop.

6.3.4.13.1.12 Drop or collision of an SNF assembly from the DPC cutting/WP dry remediation cell crane onto or against another SNF assembly in a cask or MSC

The calculation in Section 6.3.1.10 includes this potential event as a component of a generalized assembly drop.

6.3.4.13.1.13 Impact due to horizontal movement of an SNF assembly by the DPC cutting/WP dry remediation cell crane before the assembly is completely removed from the cask or MSC

The calculation in Section 6.3.1.10 includes this potential event as a component of the generalized assembly collision in the dry remediation areas.

6.3.4.13.1.14 Drop of an SNF assembly from the DPC cutting/WP dry remediation cell crane onto the DPC cutting/WP dry remediation cell floor

The calculation in Section 6.3.1.10 includes this potential event as a component of a generalized assembly drop.

6.3.4.13.1.15 Collision involving an SNF assembly suspended from the DPC cutting/WP dry remediation cell crane with equipment located in the DPC cutting/WP dry remediation cell or on the cell floor (such as lid lifting equipment)

The calculation in Section 6.3.1.10 includes this potential event as a component of the generalized assembly collision in the dry remediation areas.

6.3.4.13.1.16 Drop or collision of an SNF assembly from the DPC cutting/WP dry remediation cell crane onto or against a sharp object

The calculation in Section 6.3.1.10 includes this potential event because the assembly is assumed to breach.

6.3.4.13.1.17 Drop or collision of an SNF assembly from the DPC cutting/WP dry remediation cell crane into or against an empty basket located on a trolley in the DPC cutting/WP dry remediation cell

The calculation in Section 6.3.1.10 includes this potential event.

- 6.3.4.13.1.18 Drop and slapdown of an SNF assembly from the DPC cutting/WP dry remediation cell crane (due to impact with an edge of the cask, MSC, basket, floor edge, basket internal baffle, etc.) during the transfer from the cask or MSC to a basket on a trolley in the DPC cutting/WP dry remediation cell**

The calculation in Section 6.3.1.10 includes this potential event.

- 6.3.4.13.1.19 Drop or collision of an SNF assembly from the DPC cutting/WP dry remediation cell crane onto or against one or more SNF assemblies in a basket on a trolley in the DPC cutting/WP dry remediation cell**

The calculation in Section 6.3.1.10 includes this potential event.

- 6.3.4.13.1.20 Drop or collision of a DPC, a DOE HLW canister, a [standardized] DOE SNF canister, or a DOE SNF MCO from the DPC cutting/WP dry remediation cell crane back into or against the cask or MSC being unloaded, as applicable**

The calculation in Section 6.3.1.11 includes the potential drop event. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

- 6.3.4.13.1.21 Drop or collision of a DPC, a DOE HLW canister, a [standardized] DOE SNF canister, or a DOE SNF MCO from the DPC cutting/WP dry remediation cell crane back into or against a DPC, a DOE HLW canister, a [standardized] DOE SNF canister, or a DOE SNF MCO in the cask or MSC, as applicable**

The calculation in Section 6.3.1.11 includes the potential drop event. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

- 6.3.4.13.1.22 Impact due to horizontal movement of a DPC, a DOE HLW canister, a [standardized] DOE SNF canister, or a DOE SNF MCO with the DPC cutting/WP dry remediation cell crane before the canister is completely removed from the cask or MSC, as applicable**

Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

- 6.3.4.13.1.23 Drop and slapdown of a DPC, a DOE HLW canister, a DOE SNF MCO, or a [standardized] DOE SNF canister from the DPC cutting/WP dry remediation cell crane (due to impact with an edge of the cask, MSC, floor edge, basket internal baffle, etc.) during the transfer from the cask or MSC (as applicable) to a basket on a trolley in the DPC cutting/WP dry remediation cell**

This potential event is included in Section 6.3.1.11.

6.3.4.13.1.24 Drop or collision of a DPC, a DOE HLW canister, a [standardized] DOE SNF canister, or a DOE SNF MCO from the DPC cutting/WP dry remediation cell crane onto or against a sharp object.

Design and operational requirements will ensure that load paths are kept free of puncture hazards (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.13.1.25 Collision involving a DPC, a DOE HLW canister, a [standardized] DOE SNF canister, or a DOE SNF MCO suspended from the DPC cutting/WP dry remediation cell crane with equipment located in the DPC cutting/WP dry remediation cell or on the cell floor

The calculation in Section 6.3.1.11 includes the potential drop event. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.13.1.26 Drop of a DPC, a DOE HLW canister, a [standardized] DOE SNF canister, or a DOE SNF MCO from the DPC cutting/WP dry remediation cell crane onto the DPC cutting/WP dry remediation cell floor

This potential event is included in Section 6.3.1.11.

6.3.4.13.1.27 Drop or collision of a DPC, a DOE HLW canister, a [standardized] DOE SNF canister, or a DOE SNF MCO from the DPC cutting/WP dry remediation cell crane into or against an empty basket on a trolley in the DPC cutting/WP dry remediation cell

The calculation in Section 6.3.1.11 includes the potential drop event. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.13.1.28 Drop or collision of a DOE HLW canister from the DPC cutting/WP dry remediation cell crane onto or against another DOE HLW canister or [standardized] DOE SNF canister or a DOE SNF MCO in a basket, as applicable, on a trolley in the DPC cutting/WP dry remediation cell

The calculation in Section 6.3.1.11 includes the potential drop event. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.13.1.29 Drop or collision of a [standardized] DOE SNF canister from the DPC cutting/WP dry remediation cell crane onto or against a DOE HLW canister, as applicable, in a basket on a trolley in the DPC cutting/WP dry remediation cell

The calculation in Section 6.3.1.11 includes the potential drop event. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.13.130 Drop or collision of a DOE SNF MCO from the DPC cutting/WP dry remediation cell crane onto or against another DOE SNF MCO or a DOE HLW canister, as applicable, in a basket on a trolley in the DPC cutting/WP dry remediation cell

The calculation in Section 6.3.1.11 includes the potential drop event. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.13.131 Drop or collision of handling equipment from the DPC cutting/WP dry remediation cell crane into or against a basket on a trolley in the DPC cutting/WP dry remediation cell filled with SNF assemblies

This event is included in Section 6.3.1.18.

6.3.4.13.132 Drop or collision of handling equipment from the DPC cutting/WP dry remediation cell crane into or against a basket on a trolley in the DPC cutting/WP dry remediation cell loaded with DOE HLW canisters, and/or a [standardized] DOE SNF canister, and/or DOE SNF MCOs, as applicable

This event sequence is bounded in frequency by the analysis in Section 6.3.1.6 because only a fraction of canisters are handled in the dry remediation areas. Therefore, the event is Category 2. The amount of material at risk is one HLW canister.

6.3.4.13.133 Drop or collision of handling equipment from the DPC cutting/WP dry remediation cell crane into or against a basket on a trolley in the DPC cutting/WP dry remediation cell loaded with a DPC (if not emptied)

This event is included in Section 6.3.1.18.

6.3.4.13.134 Derailment of a trolley (that travels to the unloading port to the waste transfer cell) holding a loaded basket containing SNF assemblies in the DPC cutting/WP dry remediation cell, followed by a load tipover or fall

A design requirement is assumed to ensure that the trolley will not derail or allow the loaded basket to fall off the trolley (Assumption 5.1.1.36), thereby rendering this event Beyond Category 2. Because the WP remains upright there is no threat to the integrity of the loaded basket.

6.3.4.13.135 Derailment of a trolley (that travels to the unloading port to the waste transfer cell) holding a loaded basket containing a DPC (if not emptied), or a combination of DOE HLW canisters, [standardized] DOE SNF canisters, or DOE SNF MCOs, as applicable, in the DPC cutting/WP dry remediation cell, followed by a load tipover or fall

A design requirement is assumed to ensure that the trolley will not derail or allow the loaded basket to fall off the trolley (Assumption 5.1.1.36), thereby rendering this event Beyond Category 2. Because the WP remains upright there is no threat to the integrity of the loaded basket.

6.3.4.13.136 Drop or collision of an SNF assembly from the spent fuel transfer machine back into or against the basket on a trolley that is being unloaded

The calculation in Section 6.3.1.10 includes this potential event as a component of a generalized assembly drop, which is found to be Category 2.

6.3.4.13.137 Drop or collision of an SNF assembly from the spent fuel transfer machine back onto or against another SNF assembly or assemblies in the basket on a trolley

The calculation in Section 6.3.1.10 includes this potential event as a component of a generalized assembly drop, which is found to be Category 2.

6.3.4.13.138 Impact due to horizontal movement of an SNF assembly by the spent fuel transfer machine before the assembly is fully lifted out of the basket on a trolley

The calculation in Section 6.3.1.10 includes this potential event as a component of a generalized assembly drop, which is found to be Category 2.

6.3.4.13.139 Drop and slapdown of an SNF assembly from the spent fuel transfer machine (due to impact with an edge of the basket, the floor edge, a basket internal baffle, etc.) during the SNF transfer from the basket on the trolley to a WP or staging rack

The calculation in Section 6.3.1.10 includes this potential event as a component of a generalized assembly drop.

6.3.4.13.140 Drop or collision of a DPC (if not emptied), a DOE HLW canister, a [standardized] DOE SNF canister, or a DOE SNF MCO, as applicable, from the waste transfer cell overhead crane back into or against the basket on a trolley being unloaded

The calculation in Section 6.3.1.11 includes the potential drop event. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.13.141 Impact due to horizontal movement of a DPC (if not emptied), a DOE HLW canister, a [standardized] DOE SNF canister, or DOE SNF MCO, as applicable, with the waste transfer cell overhead crane before the canister is completely removed from the basket on a trolley

Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.13.1.42 Drop or collision of a DOE HLW canister from the waste transfer cell crane back onto or against another DOE HLW canister, a [standardized] DOE SNF canister, or a DOE SNF MCO, as applicable, in the basket on a trolley

This potential event is included in Section 6.3.1.5. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.13.1.43 Drop or collision of a [standardized] DOE SNF canister from the waste transfer cell crane onto or against a DOE HLW canister in the basket on a trolley

The potential drop event is included in Section 6.3.1.5. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.13.1.44 Drop or collision of a DOE SNF MCO from the waste transfer cell crane onto or against another DOE SNF MCO or a DOE HLW canister, as applicable, in the basket on a trolley

The potential drop event is included in Section 6.3.1.5. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.13.1.45 Drop and slapdown of a DOE HLW canister, a DOE SNF MCO, or a [standardized] DOE SNF canister, as applicable, from the waste transfer cell overhead crane (due to impact with an edge of the basket, floor edge, basket internal baffle, etc.) during the transfer from the basket on a trolley to a new WP or staging rack (if applicable)

This potential event is included in Section 6.3.1.11.

6.3.4.13.1.46 Drop or collision of handling equipment from the spent fuel transfer machine into or against a basket on a trolley filled with SNF assemblies

This event is included in Section 6.3.1.18.

6.3.4.13.1.47 Drop or collision of handling equipment from the waste transfer cell overhead crane into or against a basket on a trolley loaded with DOE HLW canisters, and/or [standardized] DOE SNF canisters, and/or DOE SNF MCOs, as applicable

This event is bounded by Section 6.3.1.6. The expected number of events is bounded because only a fraction of the DOE canisters will be handled in the Remediation Facility. The potential consequences are the same.

6.3.4.13.2 Chemical Contamination/Flooding

6.3.4.13.2.1 Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures

High temperatures could lead to oxidation of the CSNF matrix whenever CSNF assemblies with failed cladding are exposed to air. Oxidation of failed CSNF assemblies is expected as a part of normal operations wherever CSNF assemblies are exposed to air. Resulting exposure of workers to radiation will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.4.13.3 Explosion/Implosion

6.3.4.13.3.1 Hydrogen explosion involving batteries on a mobile elevated platform

The waste is protected by casks or WPs while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to cause a radiological release (Assumption 5.1.1.51).

6.3.4.13.3.2 Explosion hazard associated with the cask and MSC sampling and purging system and the ignition of hydrogen that may have accumulated in the cask or MSC

Precautions taken during the cask sampling and purging process will provide reasonable assurance that such hydrogen explosions will not occur (Assumption 5.1.1.58).

6.3.4.13.4 Fire, Thermal

6.3.4.13.4.1 Electrical fire associated with tools or SNF and HLW handling equipment in the cask docking/ dry remediation room, the tool spare transfer room, or the DPC cutting/WP dry remediation cell (including the overhead cranes, manipulators, turntable, etc.)

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.13.4.2 Intact or non-intact SNF overheating or damage to canister contents due to a loss of cooling resulting in excessive temperature and possible zircaloy cladding (or other cladding) unzipping or cladding failure due to excessive hoop stresses

This potential event is discussed in Section 6.3.1.26.

6.3.4.13.4.3 Thermal hazard (from decay heat) associated with vertical orientation of the cask, MSC, or basket

This hazard is addressed in Section 6.3.4.13.2.1.

6.3.4.13.4.4 Transient combustible fire in the cask docking/dry remediation room, the tool spare transfer room, or the DPC cutting/WP dry remediation cell

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.13.4.5 Electrical fire associated with the trolley

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.13.4.6 Fire/explosion (battery/electrical fire) associated with a mobile elevated platform

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.13.5 Radiation

6.3.4.13.5.1 Radiation exposure of a facility worker and/or the offsite public

Exposure of workers or the offsite public to radiation is a hazard for the potential event sequences considered in the present analysis. The consequence analysis will evaluate this hazard for event sequences and normal operations, as applicable.

6.3.4.13.5.2 Damage or rupture of the cask and MSC sampling and purging system, leading to a release of canister internal gases and radioactive material

The sampling operation will be conducted so that exposure of workers to radiation will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. (BSC 2004 [DIRS 172098], Section 3.2.2.1.1). Although a rupture leading to a radiological release would be an abnormal occurrence, radiation protection programs will ensure that such an occurrence would not contribute significantly to the normal operations dose. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.4.13.5.3 Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation

This potential event is covered in Section 6.3.1.25.

6.3.4.13.5.4 Thermal expansion of gases or other loss of confinement in an unsealed cask or MSC, leading to radiological release

Exposure of workers to radiation will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.4.13.5.5 Radiation-induced damage to a facility SSC

Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization as explained in Section 6.3.2.5.2.

6.3.4.13.6 Fissile

6.3.4.13.6.1 Criticality associated with a trolley derailment (holding a cask or MSC requiring remediation) followed by a load tipover or fall and a rearrangement of the container internals

A design requirement is assumed to ensure that the trolley will not derail or allow a cask to fall off the trolley (Assumption 5.1.1.36), thereby making this event Beyond Category 2. Because the trolley remains upright, there is no mechanism for reconfiguration of internals and, therefore, no criticality.

6.3.4.13.6.2 Criticality associated with a drop of an SNF assembly from the DPC cutting/WP dry remediation cell crane back into the cask or MSC being unloaded or drop into a basket on a trolley being unloaded and a rearrangement of the cask, MSC, or basket internals

A design requirement will ensure that a drop of a CSNF assembly back into the cask or MSC or a drop into a basket (allowing for rearrangement of container internals and optimal moderator intrusion) cannot lead to a nuclear criticality (Assumption 5.1.1.4).

6.3.4.13.6.3 Criticality associated with a drop or slapdown of a [standardized] DOE SNF canister, a DOE SNF MCO, or a DOE HLW canister from DPC cutting/WP dry remediation cell crane during cask or MSC unloading or basket on a trolley loading (as applicable)

Design calculations and the resulting design requirements will ensure criticality safety for DOE SNF canisters involved in this event (Assumption 5.1.1.3). There is no potential for criticality of HLW canisters (Assumption 5.2.1.19).

6.3.4.13.6.4 Criticality associated with a trolley (holding a basket containing SNF assemblies, a naval SNF canister, or various combinations of [standardized] DOE SNF canisters, DOE SNF MCOs, or DOE HLW canisters) derailment followed by a load tipover or fall and a rearrangement of the basket contents

A design requirement is assumed to ensure that the trolley will not derail or allow a basket to fall off the trolley (Assumption 5.1.1.36). Because the basket remains upright, there is no mechanism for reconfiguration of internals and, therefore, no criticality.

6.3.4.13.6.5 Criticality associated with a drop of an SNF assembly from the spent fuel transfer machine back into the basket on a trolley being unloaded and a rearrangement of the basket contents

Design requirements will ensure that dropping a CSNF assembly back into the basket (allowing for rearrangement of container internals) cannot lead to a nuclear criticality (Assumption 5.1.1.4).

6.3.4.13.6.6 Criticality associated with a drop of an SNF assembly from the DPC cutting/WP dry remediation cell crane back into the cask or MSC being unloaded or onto the DPC cutting/WP dry remediation cell floor and a rearrangement of the fuel rods that comprise the assembly due to impact

A design requirement will ensure that drops and collisions involving a CSNF assembly (allowing for rearrangement of fuel rods and without credit for burnup) cannot lead to a nuclear criticality (Section 4.1.10 and Assumption 5.1.1.4).

6.3.4.13.6.7 Criticality associated with a drop or slapdown of a [standardized] DOE SNF canister, a DOE SNF MCO, or a DOE HLW canister from waste transfer cell crane during the unloading of the basket on a trolley (as applicable)

Design calculations and the resulting design requirements will ensure criticality safety for DOE SNF canisters involved in this event (Assumption 5.1.1.3). There is no potential for criticality of HLW canisters (Assumption 5.2.1.19).

6.3.4.13.6.8 Criticality associated with the drop of heavy equipment (lifting fixture, etc.) onto a basket on a trolley and a rearrangement of the basket contents

An operational requirement will prohibit lifting heavy equipment high enough above a basket on a trolley to pose a criticality concern (Assumption 5.1.5.8).

6.3.4.14 Wet Remediation: Cask Wet Remediation/Laydown Area, Cask Wet Remediation Entrance Vestibule

6.3.4.14.1 Collision/Crushing

6.3.4.14.1.1 Collision involving the trolley (holding the cask or MSC to be remediated) and the door to the cask wet remediation entrance vestibule, the shield doors between the cask wet remediation entrance vestibule and the cask wet remediation/laydown area, or the shield doors between the DPC docking room and the cask wet remediation/laydown area

Trolley collision is addressed in Section 6.3.1.22.

6.3.4.14.1.2 Doors to the cask wet remediation entrance vestibule, the shield doors between the cask wet remediation entrance vestibule and the cask wet remediation/laydown area, or the shield doors between the DPC docking room and the cask wet remediation/laydown area close on the trolley (holding the cask or MSC to be remediated)

A design requirement is assumed to ensure that closure of the shield doors in the Remediation Facility onto a transfer trolley would not overturn the trolley or cause it to drop its load (Assumption 5.1.1.13). Because the trolley remains upright there is no threat to the integrity of the cask.

6.3.4.14.1.3 Derailment of a trolley in the cask wet remediation/laydown area while holding a cask or MSC to be remediated, followed by a load tipover or fall.

A design requirement is assumed to ensure that the cask-transfer trolley would not derail or allow the cask to fall off the trolley (Assumption 5.1.1.36). Because the transfer trolley remains upright there is no threat to the integrity of the cask.

6.3.4.14.1.4 SRTC derailment involving a loaded cask (with or without impact limiters installed) or MSC

A design requirement is assumed to ensure that the SRTC will not derail and the cask or MSC will not fall off the SRTC (Assumption 5.1.1.35). Because the SRTC remains upright there is no threat to the integrity of the cask.

6.3.4.14.1.5 Collision of an SRTC carrying a loaded cask (with or without impact limiters installed) or MSC with the cask wet remediation entrance vestibule doors or the cask wet remediation/laydown area shield doors

A design or operational requirement is assumed to ensure that a collision of the SRTC with the doors will not overturn the SRTC or cause it to drop its load (Assumption 5.1.1.38). Because the SRTC remains upright there is no threat to the integrity of the MSC.

6.3.4.14.1.6 Cask wet remediation entrance vestibule doors or the cask wet remediation/laydown area shield doors close on an SRTC carrying a loaded cask (with or without impact limiters installed) or MSC

A design requirement is assumed to ensure that closure of the shield doors onto an SRTC would not overturn the SRTC or cause it to drop its load (Assumption 5.1.1.13).

6.3.4.14.1.7 Collision of a mobile elevated platform with a loaded cask or MSC during removal of a personnel barriers and impact limiters (if applicable) or during survey activities

Operational requirements are assumed to ensure that the mobile elevated platform will not be operated in a manner that could breach a loaded cask or MSC (Assumption 5.1.1.41).

6.3.4.14.1.8 Drop or collision of personnel barriers or impact limiters from the cask wet remediation/laydown area crane onto or against a loaded cask (if applicable)

Operational requirements will prevent initiation of an event sequence for this potential event (Assumption 5.1.1.30).

6.3.4.14.1.9 Slapdown of a loaded cask onto an SRTC during upending of the loaded cask to the vertical orientation

This potential event is covered by Section 6.3.1.1.

6.3.4.14.1.10 Drop and slapdown of a loaded MSC onto an SRTC or the floor during the lift of the loaded MSC off of the SRTC

This potential event is covered by Section 6.3.1.1.

6.3.4.14.1.11 Drop of a loaded cask or MSC from the overhead bridge crane onto the floor during transfer from the trolley or SRTC to the cask decontamination pit/cask prep pit

This event is included as part of Section 6.3.1.13.

6.3.4.14.1.12 Drop or collision of a loaded cask or MSC from the overhead bridge crane onto or against a sharp object during transfer from the trolley or SRTC to the cask decontamination pit/cask prep pit

Design and operational requirements will ensure that load paths are kept free of puncture hazards (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.14.1.13 Drop or collision of a loaded cask or MSC from the overhead bridge crane into or against the cask decontamination pit/cask prep pit during transfer from the trolley or SRTC to the cask decontamination pit/cask prep pit

The potential drop event is included as part of Section 6.3.1.13. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.14.1.14 Tipover or slapdown of a loaded cask or MSC from the overhead bridge crane into the cask decontamination pit/cask prep pit or onto the floor due to contact with the pit ledge or access platform during transfer from the trolley or SRTC to the cask decontamination pit/cask prep pit.

This event is included as part of Section 6.3.1.13.

6.3.4.14.1.15 Drop or collision of handling equipment (including the cask lifting yoke, cask skirt, cask skirt lifting beam, and cask immersion rod) onto or against the cask or MSC before or after transfer of the cask to the cask decontamination pit/cask prep pit.

Operational requirements will prevent initiation of an event sequence for this potential event (Assumption 5.1.1.30).

6.3.4.14.1.16 Collision involving an access platform and a cask or MSC in the cask decontamination pit/cask prep pit.

Operational requirements are assumed to ensure that the access platform will not be operated in a manner that could breach a transportation cask (Assumption 5.1.1.41).

6.3.4.14.1.17 Drop or collision of the cask lid bolt detorque machine or other cask prep equipment onto or against a loaded cask or MSC or cask or MSC inner lid (including a lid-lifting fixture, cask gas sample/purge system equipment, cask cool-down equipment, etc.).

An operational requirement is assumed to ensure that the detorque machine or other equipment will not be handled in a manner that could breach the transportation cask or MSC or the associated inner lid (without credit for the bolts) if the machine or other equipment is dropped (Assumptions 5.1.5.6 and 5.1.1.30).

6.3.4.14.1.18 Drop of a cask or MSC outer lid from the overhead crane onto the cask or MSC

The frequency and consequences of this event are bounded by those of the Category 2 lid-drop event for CSNF assembly casks that was discussed in Section 6.3.1.2. The frequency is bounded because this event only applies to transportation casks and MSCs in the remediation pool, while the bounding event applies to WPs, MSCs, and transportation casks in the other areas. The consequences are bounded because the amount of material at risk (74 BWR or 36 PWR assemblies) is the same in each instance but the pool would mitigate the release for this event.

6.3.4.14.1.19 Drop or collision of a loaded cask or MSC from the overhead bridge crane back into or against a pit during transfer from the cask decontamination pit/cask prep pit into the pool

The potential drop event is covered in Section 6.3.1.13. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.14.1.20 Drop of a loaded cask or MSC from the overhead bridge crane onto the cell floor during transfer from the cask decontamination pit/cask prep pit into the pool

This event is included as part of Section 6.3.1.13.

6.3.4.14.1.21 Drop or collision of a loaded cask or MSC from the overhead bridge crane onto or against a sharp object during transfer from the cask decontamination pit/cask prep pit into the pool

Design and operational requirements will ensure that load paths are kept free of puncture hazards (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.14.1.22 Drop of a loaded cask or MSC from the overhead bridge crane onto the pool floor during transfer from the cask decontamination pit/cask prep pit into the pool.

This event is included as part of Section 6.3.1.13.

6.3.4.14.1.23 Drop or collision of a loaded cask or MSC from the overhead bridge crane onto or against an empty cask or MSC already in the pool during transfer from the cask decontamination pit/cask prep pit into the pool

The potential drop event is covered in Section 6.3.1.13. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.14.1.24 Tipover or slapdown of a loaded cask or MSC from the overhead bridge crane (due to impact with the pool edge or ledge/wall in the pool) into the pool during transfer from the cask decontamination pit/cask prep pit into the pool

This event is included as part of Section 6.3.1.13.

6.3.4.14.1.25 Drop or collision of handling equipment (or other equipment, including an immersion rod) onto or against the lid of a loaded cask or MSC positioned in the pool prior to, or after, the cask or MSC lid removal or installation process, respectively.

This potential event involves a drop of equipment, either before lid removal or after lid installation. Thus, the lid is always in place at the time of this potential event. Operational requirements will prevent initiation of an event sequence for this potential event (Assumption 5.1.1.30).

6.3.4.14.1.26 Collision involving a lid suspended in the pool from the fuel handling machine removing (or installing) the cask or MSC lid during the lid removal (or installation) process in the pool

The frequency and consequences of this event are bounded by those of the Category 2 lid-drop event discussed in Section 6.3.1.2. The frequency is bounded because this event only applies to transportation casks and MSCs in the remediation pool, while the bounding event applies to WPs, MSCs, and transportation casks in the DTF. The consequences are bounded because the amount of material at risk is the same in each instance but the pool would mitigate the release for this event.

6.3.4.14.1.27 Drop of a cask or MSC inner lid onto or into a loaded cask or MSC from the fuel handling machine during the lid removal (or installation) process in the pool

The frequency and consequences of this event are bounded by those of the Category 2 lid-drop event discussed in Section 6.3.1.2. The frequency is bounded because this event only applies to transportation casks and MSCs in the remediation pool, while the bounding event applies to WPs, MSCs, and transportation casks in the DTF. The consequences are bounded because the amount of material at risk is the same in each instance but the pool would mitigate the release for this event.

6.3.4.14.1.28 Drop or collision of an empty cask or MSC from overhead bridge crane onto or against the cask or MSC already in the pool (to be unloaded) during the lowering of the empty cask or MSC into the pool

The potential drop event is addressed in Section 6.3.1.14. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.14.1.29 Drop or collision of the cask or MSC lid from the empty cask or MSC onto or against the unsealed (open) cask to be unloaded

This event is included in Section 6.3.4.14.1.18.

6.3.4.14.1.30 Drop or collision of an empty SNF basket onto or against the cask to be unloaded

It is assumed that an empty basket dropped or collided against a cask will not cause a radiological release (Assumption 5.1.5.7).

6.3.4.14.1.31 Drop or collision of an empty or full canister for damaged SNF onto or against the cask being unloaded

This event is included as part of Section 6.3.1.15.

6.3.4.14.1.32 Drop or collision of an empty or full canister for damaged SNF onto or against the empty or full SNF basket being loaded

This event is included as part of Section 6.3.1.15.

6.3.4.14.1.33 Drop of an SNF assembly onto the pool floor while suspended from the fuel handling machine during transfer from the cask to the SNF basket or to the empty cask or MSC in the pool

This event is included as part of Section 6.3.1.16.

6.3.4.14.1.34 Drop or collision of an SNF assembly onto or against a sharp object while suspended from the fuel handling machine during transfer from the cask to the SNF basket or to the empty cask or MSC in the pool

This event is included as part of Section 6.3.1.16. The assembly is assumed to breach.

6.3.4.14.1.35 Drop or collision of an SNF assembly back into or against the cask or MSC being unloaded while suspended from the fuel handling machine during transfer from the cask to the SNF basket or to the empty cask or MSC in the pool

This event is included as part of Section 6.3.1.16.

6.3.4.14.1.36 Drop or collision of an SNF assembly onto or against another assembly or assemblies in the cask or MSC while suspended from the fuel handling machine during transfer from the cask to the SNF basket or to the empty cask or MSC in the pool.

This event is included as part of Section 6.3.1.16.

6.3.4.14.1.37 Impact due to horizontal movement of an SNF assembly by the fuel handling machine before the assembly is fully lifted out of the cask or MSC

This event is a collision of the assembly with the basket structure within the cask. Drops and collisions occur at approximately the same rate per transfer (Assumptions 5.1.1.7 and 5.1.1.8). Therefore, the finding of Category 2 in Section 6.3.1.16 applies to this collision event as well. In this event, only one assembly is affected.

6.3.4.14.1.38 Drop or collision of an SNF assembly into or against the empty SNF basket in the pool while suspended from the fuel handling machine during transfer from the cask or MSC to an empty location in the SNF basket

This event is included as part of Section 6.3.1.16.

6.3.4.14.1.39 Drop or collision of an SNF assembly onto or against another fuel assembly or assemblies in the SNF basket in the pool while suspended from the fuel handling machine during transfer from the cask or MSC to an empty location in the SNF basket

This event is included as part of Section 6.3.1.16.

6.3.4.14.1.40 Collision of the fuel handling machine basket grapple with a filled SNF basket during the closing (or opening) of the SNF basket

It is assumed that a basket grapple collided against a cask will not damage fuel in the cask and will not cause a radiological release (Assumption 5.1.5.7).

6.3.4.14.1.41 Drop of a filled SNF basket from the fuel handling machine onto the pool floor during transfer of the filled SNF basket to (or from) the pool area basket storage rack

This event is included as part of Section 6.3.1.17.

6.3.4.14.1.42 Drop or collision of a filled SNF basket from the fuel handling machine onto or against a sharp object during transfer of the filled SNF basket to (or from) the pool area basket storage rack

This event is included as part of Section 6.3.1.17. The assembly is assumed to breach.

6.3.4.14.1.43 Drop or collision of a filled SNF basket from the fuel handling machine onto, into, or against the cask or MSC being unloaded or loaded (containing SNF) during transfer of the filled SNF basket to or from the pool area basket storage rack.

This event is included as part of Section 6.3.1.17.

6.3.4.14.1.44 Drop or collision of a filled SNF basket from the fuel handling machine onto or against an empty basket storage rack location during transfer of the filled SNF basket to (or from) the pool area basket storage rack

This event is included as part of Section 6.3.1.17.

6.3.4.14.1.45 Drop or collision of a filled SNF basket from the fuel handling machine onto or against a filled basket storage rack location (onto another filled SNF basket) during transfer of the filled SNF basket to (or from) the pool area basket storage rack

This event is included as part of Section 6.3.1.17.

6.3.4.14.1.46 Drop or collision of handling equipment from the fuel handling machine onto or against an SNF assembly or assemblies in the SNF basket (before or after transfer to pool area basket storage rack)

This event is included in Section 6.3.1.12.

6.3.4.14.1.47 Drop of an SNF assembly onto the pool floor while suspended from the fuel handling machine during transfer to an empty cask or MSC from the SNF basket

This event is included as part of Section 6.3.1.16.

6.3.4.14.1.48 Drop or collision of an SNF assembly onto or against a sharp object while suspended from the fuel handling machine during transfer to an empty cask or MSC from the SNF basket

This event is included as part of Section 6.3.1.16. The assembly is assumed to breach.

6.3.4.14.1.49 Impact due to horizontal movement of an SNF assembly by the fuel handling machine before the assembly is fully lifted out of the SNF basket

This event is a collision of the assembly with the basket structure within the cask. Drops and collisions occur at approximately the same rate per transfer (Assumptions 5.1.1.7 and 5.1.1.8). Therefore, the finding of Category 2 in Section 6.3.1.16 applies to this collision event as well. In this event, only one assembly is affected.

6.3.4.14.1.50 Drop or collision of an SNF assembly back into or against the SNF basket being unloaded in the pool while suspended from the fuel handling machine during transfer to an empty cask or MSC

This event is included as part of Section 6.3.1.16.

6.3.4.14.1.51 Drop or collision of an SNF assembly onto or against another assembly or assemblies in the SNF basket in the pool while suspended from the fuel handling machine during transfer to an empty cask or MSC

This event is included as part of Section 6.3.1.16.

6.3.4.14.1.52 Drop or collision of an SNF assembly into or against an empty MSC in the pool while suspended from the fuel handling machine during transfer to an empty location in a cask or MSC from the SNF basket

This event is included as part of Section 6.3.1.16.

6.3.4.14.1.53 Drop or collision of an SNF assembly onto or against another fuel assembly or assemblies inside the MSC in the pool while suspended from the fuel handling machine during transfer to an empty location in a cask or MSC from the SNF basket

This event is included as part of Section 6.3.1.16.

6.3.4.14.1.54 Drop or collision of an empty SNF basket onto or against a filled cask or MSC during movement of the empty SNF basket (after closure of the basket) back to the pool area basket storage rack

It is assumed that an empty basket dropped or collided against a cask will not cause a radiological release (Assumption 5.1.5.7).

6.3.4.14.1.55 Drop or collision of handling equipment or a lid (or other equipment), either from the overhead bridge crane, maintenance crane, or from the fuel handling machine, onto or against an SNF assembly or assemblies in an open unsealed cask or MSC positioned at the bottom of the pool

Drops or collisions of handling equipment are covered in Section 6.3.1.12. Lid drops are discussed in Section 6.3.4.14.1.18.

6.3.4.14.1.56 Drop or collision of handling equipment (or other equipment) from the overhead bridge crane onto or against a loaded cask or MSC positioned at the bottom of the pool after the lid has been installed, prior to removal from the pool

Operational requirements will prevent initiation of an event sequence for this potential event (Assumption 5.1.1.30).

6.3.4.14.1.57 Drop of a loaded cask or MSC from the overhead bridge crane onto the pool floor during transfer from the pool to the cask decontamination pit/cask prep pit

This event is included as part of Section 6.3.1.13.

6.3.4.14.1.58 Drop or collision of a loaded cask or MSC from the overhead bridge crane onto or against a sharp object in the pool during transfer out of the pool to the cask decontamination pit/cask prep pit

Design and operational requirements will ensure that load paths are kept free of puncture hazards (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.14.1.59 Tipover or slapdown of a loaded cask or MSC into the cask decontamination pit/cask prep pit from overhead bridge crane due to impact with the pit edge or access platform in the pit during transfer from the pool to the cask decontamination pit/cask prep pit

This event is included as part of Section 6.3.1.13.

6.3.4.14.1.60 Tipover or slapdown of a loaded cask or MSC into the pool from the overhead bridge crane due to impact with the pool edge or ledge/wall in the pool during transfer from the pool to the cask decontamination pit/cask prep pit.

This event is included as part of Section 6.3.1.13.

6.3.4.14.1.61 Drop or collision of a loaded cask or MSC from the overhead bridge crane into or against the cask decontamination pit/cask prep pit during transfer from the pool to the cask decontamination pit/cask prep pit

The potential drop event is covered in Section 6.3.1.13. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.14.1.62 Drop of a loaded cask or MSC from the overhead bridge crane onto the wet remediation area floor during transfer from the pool to the cask decontamination pit/cask prep pit or from the cask decontamination pit/cask prep pit to a trolley

This event is included as part of Section 6.3.1.13.

6.3.4.14.1.63 Drop of a loaded cask or MSC from the overhead bridge crane onto the trolley during the transfer from the cask decontamination pit/cask prep pit to a trolley.

This event is included as part of Section 6.3.1.13.

6.3.4.14.1.64 Drop or collision of a loaded cask or MSC from the overhead bridge crane onto or against a sharp object in the cask wet remediation/laydown area during transfer from the pool to the cask decontamination pit/cask prep pit or from the cask decontamination pit/cask prep pit to a trolley

Design and operational requirements will ensure that load paths are kept free of puncture hazards (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.14.1.65 Slapdown of a loaded cask or MSC following a drop from the overhead bridge crane (due to contact with the edge of a trolley or trolley pedestal) during the lift from the cask decontamination pit/cask prep pit to the trolley

This event is included as part of Section 6.3.1.13.

6.3.4.14.1.66 Drop or collision of an unloaded cask from the overhead bridge crane onto or against a loaded cask or MSC in the pool during transfer of the empty cask from the pool

The potential drop event is addressed in Section 6.3.1.14. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.14.1.67 Collision involving an access platform and a loaded cask or MSC in the cask decontamination pit/cask prep pit

Operational requirements are assumed to ensure that the access platform will not be operated in a manner that could breach a transportation cask or MSC (Assumption 5.1.1.41).

6.3.4.14.1.68 Drop of a cask or MSC outer lid from the overhead crane onto the loaded cask or MSC

The frequency and consequences of this event are bounded by those of the Category 2 lid-drop event discussed in Section 6.3.1.2. The frequency is bounded because this event only applies to transportation casks in the remediation pool, while the bounding event applies to WPs, MSCs, and transportation casks in the DTF. The consequences are bounded because the amount of material at risk is the same in each instance but the pool would mitigate the release for this event.

6.3.4.14.1.69 Drop or collision of equipment (including the lifting yoke, cask skirt, cask skirt lifting beam, etc.), the lid bolt torque machine, dry vacuum equipment, leak test equipment, flushing equipment, etc., or other cask preparation or decontamination equipment, onto or against a loaded cask or MSC or cask or MSC inner lid

Operational requirements will prevent initiation of an event sequence for this potential event (Assumption 5.1.1.30).

6.3.4.14.1.70 Drop or collision of handling equipment (including the cask lifting yoke) onto or against a cask or MSC before or after transfer of the loaded, sealed cask or MSC to the trolley.

Operational requirements are assumed to ensure that a drop of handling equipment onto a transportation cask without impact limiters or an MSC would not breach the cask (Assumption 5.1.1.30).

6.3.4.14.1.71 Derailment of a trolley holding a loaded, sealed cask or MSC followed by a load tipover or fall

A design requirement is assumed to ensure that the trolley will not derail or allow the cask or MSC to fall off the trolley (Assumption 5.1.1.36). Because the cask or MSC remains upright there is no threat to the integrity of the cask or MSC.

6.3.4.14.1.72 Collision of a trolley holding a loaded, sealed remediated cask or MSC with shield doors separating the cask wet remediation/laydown area and DPC docking room

Collisions involving trolleys are covered in Section 6.3.1.22.

6.3.4.14.1.73 Shield doors separating the cask wet remediation/laydown area and the DPC docking room close on a trolley holding a loaded, sealed, remediated cask or MSC

A design requirement is assumed to ensure that closure of the shield doors onto a trolley would not overturn the trolley or cause it to drop its load (Assumption 5.1.1.13).

6.3.4.14.2 Chemical Contamination/Flooding

6.3.4.14.2.1 Uncontrolled pool water draindown resulting in flooding (including a draindown resulting from a puncture of the pool liner due to a cask drop)

Design and operational requirements are assumed to ensure that loss of pool water will not initiate an event sequence in the pool (Assumptions 5.1.2.5 and 5.1.2.6). Initiation of an event sequence due to flooding initiated in the pool and spreading to moderator control areas of the facility is rendered Beyond Category 2 by a design requirement that mandates flood controls (Assumption 5.1.1.21).

6.3.4.14.2.2 Uncontrolled pool water overflow resulting in flooding (including an overflow resulting from cask or MSC placement into an overfilled pool, malfunction of make-up water equipment, etc.)

A design requirement is assumed to ensure that flooding of areas of the facility where moderators are excluded due to the presence of fissile material is precluded by passive design features such as drains, flood control channels, curbs, elevated processing areas, and walls (Assumption 5.1.1.21). Therefore, flooding due to uncontrolled filling or draining of the pool will not initiate an event sequence as a result of a flood initiated in the pool spreading to other areas of the facility.

6.3.4.14.2.3 Cask decontamination pit/cask prep pit flooding due to pool overflow, flooding, pool equipment malfunction, cask preparation system (cask cooling) equipment malfunction, etc

The only hazard due to flooding involves the possibility of criticality due to moderator intrusion. Flooding the pit will not lead to a nuclear criticality because transportation casks (Section 4.2.1) and MSCs (Assumption 5.1.1.4) must be subcritical even with the most reactive credible configuration of the fissile material and moderation to the most reactive credible extent.

6.3.4.14.2.4 Uncontrolled water spill from the cask decontamination system or the cask preparation system (cask cooling) in the cask wet remediation/laydown area

The only hazard due to flooding involves the possibility of criticality due to moderator intrusion. Flooding the wet remediation/laydown area will not lead to a nuclear criticality because transportation casks (Section 4.2.1) and MSCs (Assumption 5.1.1.4) must be subcritical even with the most reactive credible configuration of the fissile material and moderation to the most reactive credible extent.

6.3.4.14.2.5 Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures

High temperatures could lead to oxidation of the CSNF matrix whenever CSNF with failed cladding is exposed to air. Oxidation of failed CSNF assemblies is expected as a part of normal operations wherever CSNF assemblies are exposed to air. Resulting exposure of workers to radiation will be managed as a normal-operations dose by procedures for monitoring radiation

doses and assigning work, which ensure that workers do not receive excessive radiation doses. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.4.14.3 Explosion/Implosion

6.3.4.14.3.1 Hydrogen explosion involving batteries on a trolley

The waste is protected by casks or WPs while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to cause a breach in casks or WPs (Assumption 5.1.1.51).

6.3.4.14.3.2 Explosion hazard associated with the cask sampling and purging system and the ignition of hydrogen that may have accumulated in the cask or MSC

Precautions taken during the cask sampling and purging process will provide reasonable assurance that such hydrogen explosions will not occur (Assumption 5.1.1.58).

6.3.4.14.3.3 Cask cooling system (nitrogen, air, etc.) or MSC drying system (or other pneumatic or pressurized system) missile due to fractured nozzle/valve stem/pneumatic device

An operational requirement is assumed to prevent initiation of an event sequence by this potential event (Assumption 5.1.1.5).

6.3.4.14.3.4 Hydrogen explosion involving batteries on a mobile elevated platform

The waste is protected by transportation casks or MSCs while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to cause a radiological release (Assumption 5.1.1.51).

6.3.4.14.3.5 Steam explosion or cask overpressurization due to insufficient cooling of a cask or MSC contents prior to insertion of the cask or MSC into the pool

The quenching operation will take into account the need to sufficiently cool the cask before insertion into the pool (Assumption 5.1.5.10).

6.3.4.14.4 Fire, Thermal

6.3.4.14.4.1 Electrical fires associated with the vacuum drier, pool water makeup equipment, or other pool-related equipment

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.14.4.2 Electrical fire associated with SNF and HLW handling equipment or other associated equipment in the cask wet remediation/laydown area and cask wet remediation entrance vestibule (including the cask lid bolt detorque device, the turntable, manipulators, overhead bridge cranes, the fuel handling machine, etc.)

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.14.4.3 Fire/explosion (battery/electrical fire) associated with the trolley

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.14.4.4 Fire/explosion (battery/electrical fire) associated with the mobile elevated platform

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.14.4.5 Diesel fuel fire/explosion involving an SRTC tractor pushing an SRTC holding a transportation cask or MSC into the cask wet remediation entrance vestibule

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.14.4.6 Overheating of SNF due to loss of pool water, including events that could lead to such a loss, including the breakdown of the pool water cooling system, resulting in excessive cladding temperature and possible zircaloy cladding (or other cladding) unzipping

Design and operational requirements are assumed to ensure that loss of pool water will not initiate an event sequence in the pool (Assumptions 5.1.2.5 and 5.1.2.6).

6.3.4.14.4.7 Rapid cooling of SNF assemblies, leading to excessive thermal stresses in the SNF cladding

Quenching of CSNF assemblies is a part of normal operations. The normal operation will take into account the thermal stresses induced to prevent initiation of an event sequence (Assumption 5.1.5.10).

6.3.4.14.4.8 Damage to SNF due to insufficient cooling of a cask prior to lowering it into the pool, resulting in a thermal shock that damages the SNF cladding

Quenching of casks is a part of normal operations. The normal operation will take into account the thermal stresses induced to prevent initiation of an event sequence (Assumption 5.1.5.10).

6.3.4.14.4.9 Intact or non-intact SNF overheating due to a loss of cooling resulting in excessive temperature and possible zircaloy cladding (or other cladding) unzipping or cladding failure due to excessive hoop stresses

This potential event is discussed in Section 6.3.1.26.

6.3.4.14.4.10 Thermal hazard (from decay heat) associated with vertical orientation of a cask or MSC

This hazard is addressed in Section 6.3.4.14.2.5.

6.3.4.14.4.11 Transient combustible fire in the cask wet remediation/laydown area or the cask wet remediation entrance vestibule

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.14.5 Radiation

6.3.4.14.5.1 Damage or rupture of the cask sampling and purging system, leading to a release of internal gases and radioactive material

The sampling operation will be conducted so that exposure of workers to radiation will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. (BSC 2004 [DIRS 172098], Section 3.2.2.1.1). Although a rupture leading to a radiological release would be an abnormal occurrence, radiation protection programs will ensure that such an occurrence would not contribute significantly to the normal operations dose. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.4.14.5.2 Uncontrolled pool water draindown/fill or leak of pool cooling or water treatment system resulting in flooding and radioactive contamination of adjoining areas

Design and operational requirements will ensure that a loss of pool water will not initiate an event sequence in the pool (Assumptions 5.1.2.5 and 5.1.2.6). Water quality will be kept within prescribed limits to ensure radiological doses as low as reasonably achievable in the areas around the pools; and the disposition of leaking water will be controlled (BSC 2004 [DIRS 167860], Section 7). Pool operations will be conducted so that exposure of workers to radiation will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.4.14.5.3 Increased radiation levels in the pool cell due to low pool water level uncovering of SNF assemblies (either in an opened cask or MSC or in the SNF basket staging rack)

Design and operational requirements are assumed to ensure that pool water level is maintained (Assumptions 5.1.2.5 and 5.1.2.6).

6.3.4.14.5.4 Radiation exposure of a facility worker and/or the offsite public

Exposure of workers or the offsite public to radiation is a hazard for the potential event sequences considered in the present analysis. The consequence analysis will evaluate this hazard for event sequences and normal operations, as applicable.

6.3.4.14.5.5 Loss of confinement zones due to a ventilation system malfunction or other breach of a confinement barrier leading to a release of radiation

This potential event is covered in Section 6.3.1.25.

6.3.4.14.5.6 Insufficient cooling of a cask or loss of the cask cooling system prior to lowering of a cask into the pool, leading to a release of radiologically contaminated steam or gases

Pool operations will be conducted so that exposure of workers to radiation will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.4.14.5.7 Thermal expansion of gases or other loss of confinement in an unsealed cask or MSC, leading to radiological release

Thermal expansion of gases is to be expected as a part of normal operations. Resulting exposure of workers to radiation will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.4.14.5.8 Radiation-induced damage to a facility SSC

Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization as explained in Section 6.3.2.5.2.

6.3.4.14.6 Fissile

6.3.4.14.6.1 Criticality associated with a derailment of a trolley moving a loaded cask or MSC followed by a load tipover or fall and a rearrangement of the container internals.

A design requirement is assumed to ensure that the trolley will not derail or allow a loaded cask or MSC to fall off the trolley (Assumption 5.1.1.36).

6.3.4.14.6.2 Criticality associated with a derailment of a SRTC holding a loaded cask or MSC followed by a load tipover or fall and a rearrangement of the container internals

A design requirement is assumed to ensure that a SRTC will not derail or allow a cask or an MSC to fall off the SRTC (Assumption 5.1.1.35).

6.3.4.14.6.3 Criticality associated with a drop, slapdown, or collision of a cask or an MSC (when handled with an overhead crane) and a rearrangement of the container internals.

This event, which involves a single transportation cask or MSC, will not lead to a criticality because design requirements and waste acceptance criteria will ensure criticality safety in transportation casks and MSCs (Assumption 5.1.1.4).

6.3.4.14.6.4 Criticality associated with a drop of an SNF assembly while unloading a transportation cask, loading cask or MSC, or filling or emptying an SNF basket in the pool, and a rearrangement of SNF in the cask, MSC, or basket.

A design requirement is assumed to ensure criticality safety in the baskets and baskets in the storage rack (Assumption 5.1.5.9). Transportation casks and MSCs will remain subcritical even with configuration of the fissile material and optimal moderation (Assumption 5.1.1.4).

6.3.4.14.6.5 Criticality associated with a drop of an SNF assembly from the fuel handling machine (in the pool) and a rearrangement of the fuel rods that comprise the assembly due to impact

Drops and collisions involving the drop of a single CSNF assembly cannot lead to a nuclear criticality (Section 4.1.10).

6.3.4.14.6.6 Criticality associated with a misload of a cask or MSC in the pool

A design requirement is assumed to ensure that MSCs remain subcritical with optimum moderation and most reactive waste forms (Assumption 5.1.1.4). Therefore, misload of an MSC cannot cause a nuclear criticality.

6.3.4.14.6.7 Criticality associated with a misload of an SNF baskets or SNF baskets in the basket storage rack

A design requirement is assumed to preclude this potential event (Assumption 5.1.5.9).

6.3.4.14.6.8 Criticality associated with the drop of a spent fuel assembly basket holding several SNF assemblies in the pool (including a drop onto another basket) and a rearrangement of the contents of the basket or baskets

A design requirement is assumed to ensure that the baskets are designed to have sufficient nuclear criticality controls to remain subcritical under the expected range of conditions resulting from handling incidents, in and out of staging racks (Assumption 5.1.5.9).

6.3.4.14.6.9 Criticality associated with the drop of heavy equipment onto a loaded fuel basket (either a single basket or several baskets in a basket storage rack) and a rearrangement of the contents of the basket or baskets

A design requirement is assumed to ensure that the baskets are designed to have sufficient nuclear criticality controls to remain subcritical under the expected range of conditions resulting from handling incidents, in and out of staging racks (Assumption 5.1.5.9). Therefore, equipment drop with consequent deformation of the fuel assemblies in the storage rack cannot lead to a criticality.

6.3.4.14.6.10 Criticality associated with the drop of heavy equipment onto a loaded cask or MSC and a rearrangement of the container internals (either in or out of the pool)

This event will not lead to a criticality because transportation casks and MSCs must be subcritical (Section 5.1.1.4) even with the most reactive credible configuration of the fissile material and moderation to the most reactive credible extent.

6.3.4.15 DPC Cutting: DPC Preparation/Cask Dry Remediation Room, DPC Docking Room, DPC Cutting/WP Dry Remediation Cell

6.3.4.15.1 Collision/Crushing

6.3.4.15.1.1 Collision involving the trolley holding the cask containing the loaded DPC and the shield doors between the cask preparation room and the DPC preparation/cask dry remediation room

Collisions involving trolleys are covered in Section 6.3.1.22.

6.3.4.15.1.2 Shield doors between the cask preparation room and the DPC preparation/cask dry remediation room close on the trolley holding the cask containing the loaded DPC

A design requirement is assumed to ensure that closure of the shield doors onto a trolley would not overturn the trolley or cause it to drop its load (Assumption 5.1.1.13).

6.3.4.15.1.3 Derailment of a trolley in the DPC preparation/cask dry remediation room or DPC docking room (including derailment due to turntable malfunction or operational error) while holding a cask containing a loaded DPC followed by a load tipover or fall

A design requirement is assumed to ensure that the transfer trolley carrying a loaded SNF DPC will not derail or allow the DPC to fall off the trolley (Assumption 5.1.1.36), thereby making this event Beyond Category 2. Because the trolley remains upright there is no threat to the integrity of the DPC.

6.3.4.15.1.4 Drop or collision of a docking ring (or tools, or equipment) onto or against the cask containing the DPC.

Operational requirements will ensure that this potential event will not initiate an event sequence (Assumption 5.1.1.32).

6.3.4.15.1.5 Collision involving the docking ring station or other access platforms and a cask containing a loaded DPC in the DPC preparation/cask dry remediation room

Operational requirements are assumed to ensure that the docking ring station or other access platforms will be not be operated in a manner that could breach or overturn a cask (Assumption 5.1.1.41).

6.3.4.15.1.6 Collision involving a trolley holding the cask containing the loaded DPC and the shield doors between DPC preparation/cask dry remediation room and the DPC docking room

Collisions involving trolleys are covered in Section 6.3.1.22.

6.3.4.15.1.7 Shield doors between the DPC preparation/cask dry remediation room and the DPC docking room close on a trolley holding the cask containing the loaded DPC

A design requirement is assumed to ensure that closure of the shield doors onto a transportation cask transfer trolley would not overturn the trolley or cause it to drop its load (Assumption 5.1.1.13). Because the trolley remains upright there is no threat to the integrity of the cask.

6.3.4.15.1.8 Derailment of a trolley holding the cask containing the loaded DPC on the turntable in the DPC docking room followed by a load tipover or fall

A design requirement is assumed to ensure that the cask-transfer trolley carrying a DPC in the DTF will not derail or allow the DPC to fall off the trolley (Assumption 5.1.1.36). Because the transfer trolley remains upright there is no threat to the integrity of the cask.

6.3.4.15.1.9 Collision of a trolley holding the cask containing the loaded DPC with another trolley holding a cask on the turntable in the DPC docking room

Collisions involving trolleys are covered in Section 6.3.1.22.

6.3.4.15.1.10 Drop or collision of a docking port (mobile slab) onto or against a cask containing the loaded DPC

A design requirement is assumed to ensure that this potential event will not initiate an event sequence (Assumption 5.1.1.17).

6.3.4.15.1.11 Drop or collision of a docking port plug onto or against the lid of a cask containing the loaded DPC (with outer lid removed [if applicable] and inner lid unbolted but in place)

A design requirement to consider 2-over-1 event sequences will prevent initiation of an event sequence as a result of this potential event (Assumption 5.1.1.37).

6.3.4.15.1.12 Drop of an inner lid on a cask containing the loaded DPC (with outer lid removed [if applicable])

This potential event is included in Section 6.3.1.2.

6.3.4.15.1.13 Drop or collision of DPC handling device or tools or equipment onto or against the DPC during the drilling/installation of the DPC handling device.

Operational requirements will ensure that this potential event will not initiate an event sequence (Assumption 5.1.1.32).

6.3.4.15.1.14 Drop or collision of a loaded DPC from the DPC Cutting/WP Dry Remediation Cell overhead crane through the unload port back into or against the cask being unloaded during the DPC transfer from the cask to the DPC cutting/WP dry remediation cell cutting machine base

The potential drop event is included in Section 6.3.1.5. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.15.1.15 Drop of a loaded DPC from the DPC Cutting/WP Dry Remediation Cell overhead crane onto the DPC cutting/WP dry remediation cell floor during DPC transfer from the cask to the DPC cutting/WP dry remediation cell cutting machine base

This potential event is included in Section 6.3.1.5.

6.3.4.15.1.16 Drop of a loaded DPC from the DPC Cutting/WP Dry Remediation Cell overhead crane onto the cutting machine base during DPC transfer from the cask to the DPC cutting/WP dry remediation cell cutting machine base

This potential event is included in Section 6.3.1.5.

6.3.4.15.1.17 Drop or collision of a loaded DPC from the DPC Cutting/WP Dry Remediation Cell overhead crane onto or against a sharp object during DPC transfer from the cask to the DPC cutting/WP dry remediation cell cutting machine base

DPCs and the assemblies within are assumed to breach when dropped. The potential drop event is included in Section 6.3.1.5. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.15.1.18 Drop or collision of the lid-cutting machine onto or against the DPC during the lowering of the machine for the lid-cutting operation.

A design requirement is assumed to ensure that the mass, lift height, and other characteristics of the lid-cutting machine are such that the DPC will be able to prevent a radiological release should the lid-cutting machine fall onto the DPC on approach or during lid-cutting operations (Assumption 5.1.5.3).

6.3.4.15.1.19 Damage to one or more fuel assemblies during lid-cutting operations or the DPC drainpipe cutting operation.

The design of the canister-cutting machine will preclude a radiological release as a result of damage to CSNF assemblies during the cutting process (Assumption 5.1.5.4).

6.3.4.15.1.20 Drop or collision of the DPC cutting machine onto or against the open (lidless) DPC during the removal of the machine after the lid-cutting operation

An operational requirement is assumed to ensure that this potential event does not initiate an event sequence (Assumption 5.1.5.5).

6.3.4.15.1.21 Drop or collision of the severed lid back onto or against the open DPC from the ceiling-mounted manipulator or overhead crane after the completion of the DPC lid-cutting

Section 6.3.1.20 covers this potential event.

6.3.4.15.1.22 Drop or collision of handling equipment (lid grapple, etc.) onto or against the unsealed (open), loaded DPC

The lid grapple will not be suspended above the open DPC unless the lid is in place or is being lifted (Assumption 5.1.1.55). If the lid is in place, a design requirement ensures that drop of handling equipment onto a DPC with its severed lid in place would not initiate an event sequence (Assumption 5.1.1.32). If the lid is being lifted, the potential event is analyzed as a lid-drop event in Section 6.3.4.15.1.21.

6.3.4.15.1.23 Drop of an unsealed (open), loaded DPC from the overhead crane in the DPC cutting/WP dry remediation cell onto the floor during transfer of the DPC from the DPC cutting machine base to the trolley that travels to the unloading port to the waste transfer cell

This event is included in the analysis of Section 6.3.1.5.

6.3.4.15.1.24 Drop of an unsealed (open), loaded DPC from the overhead crane in the DPC cutting/WP dry remediation cell onto the trolley during the transfer of the DPC from the DPC cutting machine base to the trolley that travels to the unloading port to the waste transfer cell

This event is included in the analysis of Section 6.3.1.5.

6.3.4.15.1.25 Drop or collision of an unsealed (open), loaded DPC from the overhead crane in the DPC cutting/WP dry remediation cell onto or against a sharp object during transfer of the DPC from the DPC cutting machine base to the trolley that travels to the unloading port to the waste transfer cell

Design and operational requirements will ensure that load paths are kept free of puncture hazards (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.4.15.1.26 Slapdown of an unsealed (open), loaded DPC following a drop from the overhead crane in the DPC cutting/WP dry remediation cell onto the edge of a trolley that travels to the unloading port to the waste transfer cell during the lift and transfer to the trolley

This event is included in the analysis of Section 6.3.1.5.

6.3.4.15.1.27 Derailment of a trolley (that travels to the unloading port to the waste transfer cell) holding a loaded DPC (in an unsealed, opened state) in the DPC cutting/WP dry remediation cell, followed by a load tipover or fall

A design requirement is assumed to ensure that a derailment of a WP/DPC trolley carrying a WP/DPC in the DTF would not cause the trolley to overturn or the DPC to fall off the trolley (Assumption 5.1.1.36).

6.3.4.15.1.28 Drop or collision of an SNF assembly from the spent fuel transfer machine back into or against the DPC being unloaded

The calculation in Section 6.3.1.3 includes this potential event.

6.3.4.15.1.29 Drop or collision of an SNF assembly from the spent fuel transfer machine onto or against another SNF assembly or assemblies in the DPC being unloaded

The calculation in Section 6.3.1.3 includes this potential event.

6.3.4.15.1.30 Impact due to horizontal movement of an SNF assembly by the spent fuel transfer machine before the assembly is fully lifted out of the DPC.

The calculation in Section 6.3.1.3 includes this potential event.

6.3.4.15.1.31 Drop or collision of an SNF assembly from the spent fuel transfer machine onto or against a sharp object (other than another SNF assembly).

Design and operational requirements will ensure that load paths are kept free of puncture hazards (Assumption 5.1.1.40).

6.3.4.15.1.32 Drop and slapdown of an SNF assembly from the spent fuel transfer machine (due to impact with an edge of the DPC, the floor edge, a DPC internal baffle, etc.) during the SNF transfer from the DPC to a WP or staging rack

The calculation in Section 6.3.1.3 includes this potential event.

6.3.4.15.2 Chemical Contamination/Flooding

6.3.4.15.2.1 Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures

High temperatures could lead to oxidation of the CSNF matrix whenever CSNF with failed cladding is exposed to air. Oxidation of failed CSNF assemblies is expected as a part of normal operations wherever CSNF assemblies are exposed to air. Resulting exposure of workers to radiation will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.4.15.3 Explosion/Implosion

6.3.4.15.3.1 Hydrogen explosion involving batteries on a cask-handling trolley

The waste is protected by transportation casks or MSCs while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to cause a radiological release (Assumption 5.1.1.51).

6.3.4.15.3.2 Explosion hazard associated with the sampling and purging system or the cutting and removal of the DPC enclosure lid system and the ignition of hydrogen that may have accumulated in the canister

Precautions taken during the cask sampling and purging process will provide reasonable assurance that such hydrogen explosions will not occur (Assumption 5.1.1.58).

6.3.4.15.3.3 DPC sampling and purging system (or other pneumatic or pressurized system) missile due to a fractured nozzle/valve stem/pneumatic device

An operational requirement is assumed to prevent initiation of an event sequence by this potential event (Assumption 5.1.1.5).

6.3.4.15.4 Fire, Thermal

6.3.4.15.4.1 Electrical fire associated with SNF handling equipment in the DPC preparation/dry remediation room, DPC docking room, the waste transfer cell, or the DPC cutting/WP dry remediation cell (including the overhead cranes, manipulators, the chipless cutting equipment, etc.)

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.15.4.2 Fire/explosion (battery/electrical fire) associated with the cask-handling trolley

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.15.4.3 Electrical fire associated with the trolley in the DPC cutting/WP dry remediation cell

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.15.4.4 Intact or non-intact SNF overheating due to a loss of cooling resulting in excessive temperature and possible zircaloy cladding (or other cladding) unzipping or cladding failure due to excessive hoop stress

This potential event is discussed in Section 6.3.1.26.

6.3.4.15.4.5 Thermal hazard (from decay heat) associated with vertical orientation of the cask holding the DPC

This hazard is addressed in Section 6.3.4.15.2.1.

6.3.4.15.4.6 Transient combustible fire in the DPC preparation/dry remediation room, DPC docking room, the waste transfer cell, or the DPC cutting/WP dry remediation cell

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.4.15.5 Radiation

6.3.4.15.5.1 Radiation exposure of a facility worker and/or the offsite public

Exposure of workers or the offsite public to radiation is a hazard for the potential event sequences considered in the present analysis. The consequence analysis will evaluate this hazard for event sequences and normal operations, as applicable.

6.3.4.15.5.2 Damage or rupture of the DPC sampling and purging system, leading to a release of canister internal gases and radioactive material

The sampling operation will be conducted so that exposure of workers to radiation will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. (BSC 2004 [DIRS 172098], Section 3.2.2.1.1). Although a rupture leading to a radiological release would be an off-normal occurrence, any release and related dose would be managed as part of routine radiation protection operations. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.4.15.5.3 Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation

This potential event is covered in Section 6.3.1.25.

6.3.4.15.5.4 Thermal expansion of gases or other loss of confinement in an unsealed cask, leading to radiological release

Thermal expansion of gases is to be expected as a part of normal operations. Resulting exposure of workers to radiation will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.4.15.5.5 Radiation-induced damage to a facility SSC

Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization as explained in Section 6.3.2.5.2.

6.3.4.15.6 Fissile

6.3.4.15.6.1 Criticality associated with a derailment of a trolley moving a cask holding a sealed, loaded DPC and a rearrangement of the DPC contents followed by a load tipover or fall

A criticality in the DTF is not credible because design requirements and waste acceptance criteria will ensure criticality safety in DPCs (Assumption 5.1.1.4)

6.3.4.15.6.2 Criticality associated with a drop or slapdown of a sealed, loaded DPC from the DPC Cutting/WP Dry Remediation Cell overhead crane and a rearrangement of the DPC contents

The event discussed in Section 6.3.5.5.6.2 covers this event.

6.3.4.15.6.3 Criticality associated with a drop or slapdown of an unsealed (open) loaded, or sealed (unopened) loaded DPC from DPC cutting area overhead crane and a rearrangement of the DPC contents

A design requirement will ensure that DPCs are designed such that handling impacts (allowing for rearrangement of container internals) cannot lead to a nuclear criticality with moderator control in effect (Assumption 5.1.1.4).

6.3.4.15.6.4 Criticality associated with a derailment of a trolley moving an unsealed (open) loaded DPC followed by a load tipover or fall and a rearrangement of the DPC contents

A design requirement is assumed to ensure that the trolley will not derail or allow the unsealed DPC to fall off the trolley (Assumption 5.1.1.36), thereby making this event Beyond Category 2. Because the WP remains upright, there is no mechanism for reconfiguration of internals and, therefore, no criticality.

6.3.4.15.6.5 Criticality associated with a drop of an SNF assembly from the spent fuel transfer machine back into the DPC being unloaded and a rearrangement of the canister internals

Design calculations and the resulting design requirements will ensure criticality safety for this event (Assumption 5.1.1.4).

6.3.4.15.6.6 Criticality associated with a drop of an SNF assembly from the spent fuel transfer machine and a rearrangement of the fuel rods that comprise the assembly due to impact

Drops and collisions involving the drop of a single CSNF assembly cannot lead to a nuclear criticality (Section 4.1.10).

6.3.4.15.6.7 Criticality associated with the drop of heavy equipment onto an unsealed (open) loaded, or sealed (unopened) loaded DPC and a rearrangement of the container internals

A design requirement will ensure that DPCs are designed such that handling impacts (allowing for rearrangement of container internals) cannot lead to a nuclear criticality with moderator control in effect (Assumption 5.1.1.4).

6.3.5 FHF

A description of the operations in this area and a listing of the hazards and potential events are provided in *Internal Hazards Analysis for License Application* (BSC 2005 [DIRS 171428], Section 6.6.4).

6.3.5.1 FHF Entrance Vestibule (Cask and MSC Receipt)

6.3.5.1.1 Collision/Crushing

6.3.5.1.1.1 Railcar derailment, overturning, or collision involving a loaded cask followed by a load tipover or fall

Transportation casks with impact limiters are designed to withstand, without breaching, the drops discussed in Section 4.2.1. The drops specified in Section 4.2.1 bound the impacts that could occur during cask handling at the repository. Consequently, a derailment, overturning, or collision would not breach a transportation cask.

6.3.5.1.1.2 Overturning or collision involving an LWT or an OWT holding a loaded cask (with impact limiters and personnel barrier installed)

Transportation casks with impact limiters are designed to withstand, without breaching, the drops discussed in Section 4.2.1. The drops specified in Section 4.2.1 bound the impacts that could occur during cask handling at the repository. Consequently, a derailment, overturning, or collision would not breach a transportation cask.

6.3.5.1.1.3 Collision of a railcar, an LWT, or OWT carrying a loaded cask (with impact limiters and personnel barrier installed) with the entrance vestibule doors

Transportation casks with impact limiters are designed to withstand, without breaching, the drops discussed in Section 4.2.1. The drops specified in Section 4.2.1 bound the impacts that could occur during cask handling at the repository. Consequently, a derailment, overturning, or collision would not breach a transportation cask.

6.3.5.1.1.4 The entrance vestibule doors close on a railcar, an LWT, or an OWT carrying a loaded cask (with impact limiters and personnel barrier installed)

Transportation casks with impact limiters are designed to withstand, without breaching, the drops discussed in Section 4.2.1. The drops specified in Section 4.2.1 bound the impacts that could occur during cask handling at the repository. Consequently, a derailment, overturning, or collision would not breach a transportation cask.

6.3.5.1.1.5 Collision of the gantry crane carrying a loaded MSC with the entrance vestibule doors

Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.5.1.1.6 The entrance vestibule doors close on the entrance vestibule gantry crane carrying a loaded MSC

A design requirement is assumed to ensure that closure of the doors onto an MSC would not cause the crane to drop its load (Assumption 5.1.1.13).

6.3.5.1.1.7 Collision of a mobile elevated platform with a loaded cask or the conveyance holding the cask during removal of personnel barriers and impact limiters or during survey activities

Operational requirements are assumed to ensure that the mobile elevated platform will not be operated in a manner that could breach a transportation cask (Assumption 5.1.1.41).

6.3.5.1.1.8 Drop or collision of personnel barriers or impact limiters from the entrance vestibule gantry crane onto or against the loaded cask

Operational requirements will prevent initiation of an event sequence for this potential event (Assumption 5.1.1.30).

6.3.5.1.1.9 Collision between a forklift and a loaded cask on a railcar, an LWT, an OWT, or the conveyance holding the cask, prior to or after the removal of impact limiters and personnel barrier

Operational requirements are assumed to ensure that forklifts will not be operated in a manner that could breach a transportation cask (Assumption 5.1.1.41).

6.3.5.1.1.10 Collision between a mobile elevated platform and a loaded cask on a railcar, an LWT, an OWT, or the conveyance holding the cask

Transportation casks with impact limiters are designed to withstand, without breaching, the impacts discussed in Section 4.2.1. The impacts specified in Section 4.2.1 bound the impacts that could occur during cask handling at the repository. Consequently, a derailment, overturning, or collision would not breach a transportation cask.

6.3.5.1.1.11 Collision between the entrance vestibule gantry crane carrying a loaded MSC and a forklift

Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21). Operational requirements are assumed to ensure that forklifts will not be operated in a manner that could breach an MSC (Assumption 5.1.1.41).

6.3.5.1.1.12 Collision between the entrance vestibule gantry crane carrying the loaded MSC and a mobile elevated platform

Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21). Operational requirements are assumed to ensure that mobile elevated platforms will not be operated in a manner that could breach an MSC (Assumption 5.1.1.41).

6.3.5.1.1.13 Drop or collision of equipment from the entrance vestibule gantry crane (including handling equipment for personnel barriers, impact limiters, etc.) onto or against a loaded cask or loaded MSC

Operational requirements will ensure that a drop or collision of handling equipment onto or against a transportation cask without impact limiters or an MSC would not breach the cask (Assumption 5.1.1.30).

6.3.5.1.1.14 Slapdown of a loaded cask onto a railcar, a truck trailer, or the floor during upending of the cask to the vertical orientation (after removal of the impact limiters and personnel barrier)

This potential event is covered by Section 6.3.1.1.

6.3.5.1.1.15 Drop of a loaded cask in a horizontal position (such as the HI-STAR) from the entrance vestibule gantry crane onto the floor or back onto the railcar or truck trailer during the transfer from a railcar or truck trailer to the tilting frame.

This potential event is covered by Section 6.3.1.1.

6.3.5.1.1.16 Drop or collision of a loaded cask in a horizontal position (such as the HI-STAR) from the entrance vestibule gantry crane onto or against a sharp object or the tilting frame during the transfer from a railcar or truck trailer to the tilting frame.

Design and operational requirements will ensure that load paths are kept free of puncture hazards (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.5.1.1.17 Drop of a loaded cask from the entrance vestibule gantry crane onto the floor during the transfer from a railcar, truck trailer, or tilting frame to the pedestal on an import-export trolley

This potential event is covered by Section 6.3.1.1.

6.3.5.1.1.18 Drop of a loaded cask from the entrance vestibule gantry crane onto the pedestal on an import-export trolley during the transfer from a railcar, truck trailer, or tilting frame to the pedestal on an import-export trolley

This potential event is covered by Section 6.3.1.1.

6.3.5.1.1.19 Drop or collision of a loaded cask from the entrance vestibule gantry crane onto or against a sharp object during the transfer from a railcar, truck trailer, or tilting frame to the pedestal on an import-export trolley

Design and operational requirements will ensure that load paths are kept free of puncture hazards (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.5.1.1.20 Drop of a loaded MSC from the entrance vestibule gantry crane onto the floor during the transfer from the FHF pad to the pedestal on an import-export trolley

The analysis of transportation cask drops (Section 6.3.1.1) bounds this potential event, with the number of MSCs being less than the number of casks. There are two transfers: (1) from the trolley to the FHF pad before aging and (2) after aging, from the FHF pad to the trolley. The event sequence involving breach and release involving SNF or HLW is Category 2. Naval canisters are omitted because they will not be sent to the aging pads (Assumption 5.2.1.20). It is assumed that MSCs may be loaded with up to five DOE SNF canisters when staging at the aging pads is required (Assumption 5.2.4.1).

6.3.5.1.1.21 Drop of a loaded MSC from the entrance vestibule gantry crane onto the pedestal on an import-export trolley during the transfer from the FHF pad to the pedestal on an import-export trolley

Section 6.3.5.1.1.20 includes this potential event.

6.3.5.1.1.22 Drop or collision of a loaded MSC from the entrance vestibule gantry crane onto or against a sharp object during the transfer from the FHF pad to the pedestal on an import-export trolley

Design and operational requirements will ensure that load paths are kept free of puncture hazards (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.5.1.1.23 Slapdown of a loaded cask in the entrance vestibule due to off-center cask lowering or drop onto the pedestal on an import-export trolley

This potential event is covered by Section 6.3.1.1.

6.3.5.1.1.24 Slapdown of a loaded MSC in the entrance vestibule due to off-center MSC lowering or drop onto the pedestal or edge of the pedestal on an import-export trolley

The analysis presented in Section 6.3.5.1.1.20 includes this potential event.

6.3.5.1.1.25 Handling equipment drop onto a loaded cask or loaded MSC

Operational requirements will ensure that a drop of handling equipment onto a transportation cask without impact limiters or an MSC would not breach the cask (Assumption 5.1.1.30).

6.3.5.1.2 Chemical Contamination/Flooding

6.3.5.1.2.1 Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures or during off-normal temperatures (e.g. during a failure of the cooling system)

Because the SNF in this area is contained in a sealed transportation cask or MSC (BSC 2005 [DIRS 171428], Section 6.6.4.1), this potential event will not occur unless an event sequence leads to exposure of SNF to air. Oxidation of the fuel matrix is a possible outcome of an event that exposes SNF to air. The consequence analyses will account for the possibility of oxidation, if applicable.

6.3.5.1.3 Explosion/Implosion

6.3.5.1.3.1 Hydrogen explosion involving batteries on a forklift

The waste is protected by casks or WPs while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to cause a radiological release (Assumption 5.1.1.51).

6.3.5.1.3.2 Hydrogen explosion involving batteries on a mobile elevated platform.

The waste is protected by transportation casks or MSCs while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to cause a radiological release (Assumption 5.1.1.51).

6.3.5.1.3.3 Hydrogen explosion involving batteries on the import-export trolley.

The waste is protected by transportation casks or MSCs while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to cause a radiological release (Assumption 5.1.1.51).

6.3.5.1.3.4 Hydrogen explosion involving batteries on a site prime mover

The waste is protected by transportation casks or MSCs while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to cause a radiological release (Assumption 5.1.1.51).

6.3.5.1.4 Fire, Thermal

6.3.5.1.4.1 Electrical fire associated with the entrance vestibule gantry crane

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.5.1.4.2 Electrical fire associated with handling equipment or other entrance vestibule electrical equipment

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.5.1.4.3 Fire/explosion (battery/electrical fire) involving a site prime mover pulling or pushing a conveyance holding a loaded cask

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.5.1.4.4 Fire/explosion (battery/electrical fire) associated with the import-export trolley

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.5.1.4.5 Fire/explosion (battery/electrical fire) associated with a forklift.

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.5.1.4.6 Fire/explosion (battery/electrical fire) associated with the mobile elevated platform

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.5.1.4.7 Thermal hazard (from decay heat) associated with vertical orientation of a loaded cask

Transportation casks are designed to withstand normal conditions of transport (including high ambient temperatures and insolation) and hypothetical accident conditions (including fire) (Section 4.2.1). These conditions bound the thermal effect of orienting the cask vertically rather than horizontally. This potential event will not cause oxidation of SNF leading to exposure of individuals to radiation because the waste is contained in a sealed cask (BSC 2005 [DIRS 171428], Section 6.6.4.1).

6.3.5.1.4.8 Transient combustible fire in the entrance vestibule

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.5.1.5 Radiation

6.3.5.1.5.1 Radiation exposure of a facility worker and/or the offsite public

Exposure of workers or the offsite public to radiation is a hazard for the potential event sequences considered in the present analysis. The consequence analysis will evaluate this hazard for event sequences and normal operations, as applicable.

6.3.5.1.5.2 Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation

This potential event is covered in Section 6.3.1.25.

6.3.5.1.5.3 Radiation-induced damage to a facility SSC

Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization as explained in Section 6.3.2.5.2.

6.3.5.1.6 Fissile

6.3.5.1.6.1 Criticality associated with a railcar (holding a loaded cask) derailment or collision followed by a load tipover or fall and rearrangement of the cask internals

A criticality is not credible because the design requirements and waste acceptance criteria will ensure criticality safety in transportation casks (Assumption 5.1.1.4).

6.3.5.1.6.2 Criticality associated with an overturning or collision involving an LWT or an OWT holding a loaded cask and rearrangement of cask internals

A criticality in the cask-receipt area of the FHF is not credible because design requirements and waste acceptance criteria will ensure criticality safety in transportation casks (Assumption 5.1.1.4).

6.3.5.1.6.3 Criticality associated with a drop or slapdown of a cask and a rearrangement of the container internals

A criticality in the cask-receipt area of the FHF is not credible because design requirements and waste acceptance criteria will ensure criticality safety in transportation casks (Assumption 5.1.1.4).

6.3.5.1.6.4 Criticality associated with a drop or slapdown of an MSC and a rearrangement of the container internals

A criticality in an MSC is not credible because a design requirement will ensure that MSCs remain subcritical even with the most reactive credible configuration of the fissile material and optimal moderation (Assumption 5.1.1.4).

6.3.5.1.6.5 Criticality associated with collision of the entrance vestibule gantry crane holding an MSC followed by a load drop or tipover and a rearrangement of the MSC internals

A criticality in an MSC is not credible because a design requirement will ensure that MSCs remain subcritical even with the most reactive credible configuration of the fissile material and optimal moderation (Assumption 5.1.1.4).

6.3.5.2 FHF Preparation Room

6.3.5.2.1 Collision/Crushing

6.3.5.2.1.1 Collision of a loaded cask or loaded MSC on a pedestal on an import-export trolley with the preparation room shield doors separating the FHF entrance vestibule from the preparation room

Collisions involving trolleys are covered in Section 6.3.1.22.

6.3.5.2.1.2 The preparation room shield doors separating the FHF entrance vestibule from the preparation room close on a loaded cask or loaded MSC on a pedestal on an import-export trolley

A design requirement is assumed to ensure that closure of the shield doors onto a trolley holding a loaded cask or MSC would not overturn the trolley or cause it to drop its load (Assumption 5.1.1.13). Because the trolley remains upright there is no threat to the integrity of the cask.

6.3.5.2.1.3 Derailment of an import-export trolley holding a loaded cask or loaded MSC on a pedestal (with outer and/or inner lid bolted in place, if applicable) followed by a load tipover or fall

A design requirement is assumed to ensure that the trolley will not derail or allow the cask to fall off the trolley (Assumption 5.1.1.36), thereby making this event Beyond Category 2. Because the cask remains upright there is no threat to the integrity of the unsealed WP.

6.3.5.2.1.4 Drop or collision of tools or equipment (including a lid-lifting fixture, lid bolts, etc.) onto or against a loaded cask or loaded MSC outer lid (if applicable) or a cask or MSC inner lid in the preparation room

Operational requirements will ensure that this potential event will not initiate an event sequence when the inner lid is exposed (Assumption 5.1.1.32). If inner lid is protected by the outer lid, the conclusion that an event sequence will not be initiated still holds.

6.3.5.2.1.5 Collision of a mobile elevated platform with a loaded cask or loaded MSC during preparation activities on top of the cask or MSC

Operational requirements are assumed to ensure that the mobile elevated platform will not be operated in a manner that could breach an MSC (Assumption 5.1.1.41).

6.3.5.2.1.6 Drop of a cask or MSC outer lid onto the loaded cask or loaded MSC (if applicable) in the preparation room

The frequency and consequences of this event are bounded by those of the Category 2 lid-drop event sequence discussed in Section 6.3.1.2. The frequency is bounded because this event only applies to transportation casks and MSCs, while the bounding event also applies to WPs. The consequences are bounded because the contents of the cask are protected by the inner lid for this event, whereas no lids are in place for the bounding event.

6.3.5.2.1.7 Derailment of an import-export trolley holding a loaded cask or loaded MSC on a pedestal (with outer lid removed [if applicable] and inner lid unbolted but in place) followed by a load tipover or fall

A design requirement is assumed to ensure that the import-export trolley holding a loaded cask on a pedestal will not derail or allow the cask to fall off the trolley (Assumption 5.1.1.36). Because the trolley remains upright there is no threat to the integrity of the cask.

6.3.5.2.1.8 Collision of an import-export trolley holding a loaded cask or loaded MSC on a pedestal (with outer lid removed [if applicable] and inner lid unbolted but in place) with shield doors separating the preparation room and the main transfer room

Collisions involving trolleys are covered in Section 6.3.1.22.

6.3.5.2.1.9 Closure of the shield doors separating the preparation room and the main transfer room onto the import-export trolley holding a loaded cask or loaded MSC on a pedestal (with outer lid removed [if applicable] and inner lid unbolted but in place)

A design requirement is assumed to ensure that closure of the airlock and shield doors onto a trolley would not overturn the trolley or cause it to drop its load (Assumption 5.1.1.13). Because the trolley remains upright there is no threat to the integrity of the cask.

6.3.5.2.2 Chemical Contamination/Flooding

6.3.5.2.2.1 Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures

High temperatures could lead to oxidation of the CSNF matrix whenever CSNF assemblies with failed cladding is exposed to air. Oxidation of failed CSNF assemblies is expected as a part of normal operations wherever CSNF assemblies are exposed to air. Resulting exposure of workers to radiation will be managed as a normal-operations dose by procedures for monitoring radiation

doses and assigning work, which ensure that workers do not receive excessive radiation doses. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.5.2.3 Explosion/Implosion

6.3.5.2.3.1 Cask sampling and inerting system (or other pneumatic or pressurized system) missile due to a fractured nozzle/valve stem/pneumatic device

An operational requirement is assumed to prevent initiation of an event sequence by this potential event (Assumption 5.1.1.5).

6.3.5.2.3.2 Explosion hazard associated with the cask sampling and inerting system and the ignition of hydrogen that may have accumulated in the cask

Precautions taken during the cask sampling and purging process will provide reasonable assurance that such hydrogen explosions will not occur (Assumption 5.1.1.58).

6.3.5.2.3.3 Hydrogen explosion involving batteries on the import-export trolley

The waste is protected by casks or WPs while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to cause a radiological release (Assumption 5.1.1.51).

6.3.5.2.3.4 Hydrogen explosion involving batteries on a mobile elevated platform

The waste is protected by casks or WPs while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to cause a radiological release (Assumption 5.1.1.51).

6.3.5.2.4 Fire, Thermal

6.3.5.2.4.1 Electrical fire associated with handling equipment or other preparation room equipment, including the main transfer room overhead crane (which can access the preparation room via an overhead hatch)

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.5.2.4.2 Fire/explosion (battery/electrical fire) associated with the import-export trolley

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.5.2.4.3 Fire/explosion (battery/electrical fire) associated with the mobile elevated platform

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.5.2.4.4 Transient combustible fire in the preparation area

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.5.2.4.5 Thermal hazard (from decay heat) associated with vertical orientation of the loaded cask

This hazard is addressed in Section 6.3.5.2.2.1.

6.3.5.2.4.6 Intact or non-intact SNF overheating or damage to canister contents due to a loss of cooling resulting in excessive temperature and possible zircaloy cladding (or other cladding) unzipping or cladding failure due to excessive hoop stresses

This potential event is discussed in Section 6.3.1.26.

6.3.5.2.5 Radiation

6.3.5.2.5.1 Radiation exposure of a facility worker and/or the offsite public

Exposure of workers or the public to radiation is a hazard for the potential event sequences considered in the present analysis. The consequence analysis will evaluate this hazard for event sequences and normal operations, as applicable.

6.3.5.2.5.2 Damage or rupture of cask sampling and purging system, leading to a release of cask internal gases and radioactive material

The sampling operation will be conducted so that exposure of workers to radiation will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. (BSC 2004 [DIRS 172098], Section 3.2.2.1.1). Although a rupture leading to a radiological release would be an abnormal occurrence, radiation protection programs will ensure that such an occurrence would not contribute significantly to the normal operations dose. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.5.2.5.3 Thermal expansion of gases or other loss of confinement in an unsealed cask or MSC, leading to radiological release

Exposure of workers to radiation due to this potential event will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.5.2.5.4 Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation

This potential event is covered in Section 6.3.1.25.

6.3.5.2.5.5 Radiation-induced damage to a facility SSC

Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization as explained in Section 6.3.2.5.2.

6.3.5.2.6 Fissile

6.3.5.2.6.1 Criticality associated with a loaded cask or loaded MSC collision or trolley derailment followed by a load tipover or fall and a rearrangement of the cask internals

A criticality will not occur because design requirements and waste acceptance criteria will ensure criticality safety in transportation casks (Assumption 5.1.1.4).

6.3.5.3 FHF Entrance Vestibule, Preparation Room, Main Transfer Room, and Fuel Transfer Bay (Empty WP/Empty MSC Processing)

No potential event sequences have been identified that affect a waste form.

6.3.5.4 FHF Main Transfer Room, Fuel Transfer Bay, Fuel Transfer Room (SNF Assembly Transfer)

6.3.5.4.1 Collision/Crushing

6.3.5.4.1.1 Derailment of the import-export trolley holding a loaded cask or loaded MSC on a pedestal (with inner lid in place, unbolted) followed by a load tipover or fall

A design requirement is assumed to ensure that the trolley holding a loaded cask on a pedestal will not derail or allow the cask to fall off the trolley (Assumption 5.1.1.36). Because the trolley remains upright there will be no event sequence.

6.3.5.4.1.2 Drop of a loaded cask or MSC (with inner lid in place, unbolted) onto the floor during the lift using the overhead bridge crane from the import-export trolley to the cask transfer trolley or MSC trolley, respectively

Transportation cask drops are covered in Section 6.3.1.1.1. MSC drops are covered in 6.3.1.1.2.

6.3.5.4.1.3 Drop of a loaded cask or MSC (with inner lid in place, unbolted) onto the trolley during the lift using the overhead bridge crane from the import-export trolley to the cask transfer trolley or MSC trolley, respectively

Transportation cask drops are covered in Section 6.3.1.1.1. MSC drops are covered in 6.3.1.1.2.

- 6.3.5.4.1.4 Drop or collision of a loaded cask or MSC (with inner lid in place, unbolted) onto or against a sharp object during the lift using the overhead bridge crane from the import-export trolley to the cask transfer trolley or MSC trolley, respectively**

Design and operational requirements will ensure that load paths are kept free of puncture hazards (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

- 6.3.5.4.1.5 Slapdown of a loaded cask or MSC (with inner lid in place, unbolted) following a drop from the overhead bridge crane onto the edge of the pedestal, trolley, or other object during the transfer from the import-export trolley to the cask transfer trolley or MSC trolley, respectively**

Transportation cask drops are covered in Section 6.3.1.1.1. MSC drops are covered in 6.3.1.1.2.

- 6.3.5.4.1.6 Drop or collision of a docking ring onto or against a loaded cask or loaded MSC prior to entering the fuel transfer bay for unloading**

Operational requirements will ensure that this potential event will not initiate an event sequence (Assumption 5.1.1.32).

- 6.3.5.4.1.7 Collision of a mobile elevated platform with a loaded cask or loaded MSC during docking ring installation activities associated with the cask or MSC prior to entering the fuel transfer bay for unloading**

Operational requirements are assumed to ensure that the mobile elevated platform will not be operated in a manner that could breach or overturn a transportation cask (Assumption 5.1.1.41).

- 6.3.5.4.1.8 Drop or collision of a manipulator, handling equipment, or other miscellaneous equipment onto or against a loaded cask or loaded MSC prior to entering the fuel transfer bay for unloading**

Operational requirements will ensure that this potential event will not initiate an event sequence (Assumption 5.1.1.32).

- 6.3.5.4.1.9 Derailment of the cask transfer trolley or MSC trolley holding a loaded cask or loaded MSC, respectively, on a pedestal (with inner lid in place, unbolted) followed by a load tipover or fall**

A design requirement is assumed to ensure that the trolley will not derail or allow the cask or MSC to fall off the trolley (Assumption 5.1.1.36).

6.3.5.4.1.10 Collision of a trolley holding a loaded cask or loaded MSC on a pedestal (with outer lid removed [if applicable] and inner lid unbolted but in place) with shield doors separating the main transfer room and the fuel transfer bay

Trolley collisions are covered in Section 6.3.1.22.

6.3.5.4.1.11 Closure of the shield doors separating the main transfer room and the fuel transfer bay onto the trolley holding a loaded cask or loaded MSC on a pedestal (with outer lid removed [if applicable] and inner lid unbolted but in place)

A design requirement is assumed to ensure that closure of shield doors onto a trolley would not overturn the trolley or cause it to drop its load (Assumption 5.1.1.13). Because the trolley remains upright there will be no event sequence as a result of this potential event.

6.3.5.4.1.12 Drop or collision of [components associated with] a docking port onto or against a cask or MSC

A design requirement is assumed to ensure that this potential event will not initiate an event sequence (Assumption 5.1.1.17).

6.3.5.4.1.13 Drop or collision of a docking port plug onto or against a cask lid or MSC lid (with outer lid removed [if applicable] and inner lid unbolted but in place)

A design requirement to consider 2-over-1 event sequences will prevent initiation of an event sequence as a result of this potential event (Assumption 5.1.1.37).

6.3.5.4.1.14 Drop of an inner lid on a cask or MSC (with outer lid removed [if applicable])

This potential event is included in Section 6.3.1.2.

6.3.5.4.1.15 Drop or collision of an SNF assembly from the spent fuel transfer machine back into or against a cask or MSC being unloaded

This potential event is included in Section 6.3.1.3.

6.3.5.4.1.16 Drop or collision of an SNF assembly from the spent fuel transfer machine onto or against one or more SNF assembly(ies) in the cask or MSC being unloaded or onto one or more SNF assembly(ies) in the WP or MSC being loaded

This potential event is included in Section 6.3.1.3.

6.3.5.4.1.17 Impact due to horizontal movement of an SNF assembly by the spent fuel transfer machine before the assembly is completely removed from the cask or MSC

This potential event is included in Section 6.3.1.3.

6.3.5.4.1.18 Drop of an SNF assembly from the spent fuel transfer machine onto the fuel transfer room floor

This potential event is included in Section 6.3.1.3.

6.3.5.4.1.19 Collision involving an SNF assembly suspended from the spent fuel transfer machine with wall-mounted equipment located in the fuel transfer room.

This potential event is included in Section 6.3.1.3.

6.3.5.4.1.20 Drop or collision of an SNF assembly from the spent fuel transfer machine onto or against a sharp object

Assemblies are assumed to breach when they are dropped or involved in a collision. The calculation in Section 6.3.1.3 includes the potential event.

6.3.5.4.1.21 Drop or collision of an SNF assembly from the spent fuel transfer machine into or against an empty WP or MSC being loaded

This potential event is included in Section 6.3.1.3.

6.3.5.4.1.22 Drop and slapdown of an SNF assembly from the spent fuel transfer machine (due to impact with an edge of the cask, MSC, WP, floor edge, WP internal baffle, etc.) during the transfer from the cask or MSC to a WP or MSC

This potential event is included in Section 6.3.1.3.

6.3.5.4.1.23 Drop or collision of handling equipment into or against an open MSC or an open WP filled with commercial SNF assemblies

Drops of handling equipment onto CSNF assemblies are treated in Section 6.3.1.4.

6.3.5.4.1.24 Drop of a WP inner lid or MSC cask inner lid (as appropriate) from the fuel transfer room crane onto a loaded WP or loaded MSC

The calculation in Section 6.3.1.2 includes this potential event.

6.3.5.4.1.25 Drop or collision of a transfer port seal plug from the fuel transfer room crane onto or against the inner lid of a loaded WP or a loaded MSC

A design requirement to consider 2-over-1 event sequences will prevent initiation of an event sequence as a result of this potential event (Assumption 5.1.1.37).

6.3.5.4.2 Chemical Contamination/Flooding

6.3.5.4.2.1 Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures

High temperatures could lead to oxidation of the CSNF matrix whenever CSNF assemblies with failed cladding is exposed to air. Oxidation of failed CSNF assemblies is expected as a part of normal operations wherever CSNF assemblies are exposed to air. Resulting exposure of workers to radiation will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.5.4.3 Explosion/Implosion

6.3.5.4.3.1 Hydrogen explosion involving batteries on a cask transfer trolley or an MSC trolley

The waste is protected by casks or WPs while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to cause a radiological release (Assumption 5.1.1.51).

6.3.5.4.3.2 Hydrogen explosion involving batteries on a mobile elevated platform

The waste is protected by casks or WPs while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to cause a radiological release (Assumption 5.1.1.51).

6.3.5.4.4 Fire, Thermal

6.3.5.4.4.1 Electrical fire associated with SNF handling equipment or other electrically-powered equipment in the main transfer room, the fuel transfer bays, or the fuel transfer room (including the overhead cranes and the spent fuel transfer machine)

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.5.4.4.2 Fire/explosion (battery/electrical fire) associated with an import-export trolley, a cask transfer trolley, or an MSC trolley holding a filled or partially filled cask or MSC, respectively, with or without inner lid in place (but not sealed)

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.5.4.4.3 Electrical fire associated with a WP trolley holding a partially filled or filled WP, with or without inner lid in place (but not sealed).

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.5.4.4.4 Fire/explosion (battery/electrical fire) associated with the mobile elevated platform

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.5.4.4.5 HEPA filter fire due to excessive radioactive decay within the filter bed

HEPA filters will be maintained well below their auto-ignition temperature to preclude a filter fire (Assumption 5.1.1.47).

6.3.5.4.4.6 Intact or non-intact SNF overheating due to a loss of cooling resulting in excessive temperature and possible zircaloy cladding (or other cladding) unzipping or cladding failure due to excessive hoop stresses

This potential event is discussed in Section 6.3.1.26.

6.3.5.4.4.7 Thermal hazard (from decay heat) associated with a vertical orientation of a loaded cask (sealed/inerted or unsealed/non-inerted) or loaded, unsealed/non-inerted WP

This potential event is discussed in Section 6.3.5.4.2.1.

6.3.5.4.4.8 Transient combustible fire in the main transfer room, the fuel transfer bays, or the fuel transfer room

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.5.4.5 Radiation

6.3.5.4.5.1 Radiation exposure of a facility worker and/or the offsite public

Exposure of workers or the public to radiation is a hazard for the potential event sequences considered in the present analysis. The consequence analysis will evaluate this hazard for event sequences and normal operations, as applicable.

6.3.5.4.5.2 Docking ring failure leads to a radiological release

This potential event is covered in Section 6.3.1.25.

6.3.5.4.5.3 Radiological release due to installation of incorrect docking ring

Docking ring failure has the same consequences as installation of an incorrect docking ring. Therefore, the analysis in Section 6.3.1.25 applies to this potential event.

6.3.5.4.5.4 Thermal expansion of gases or other loss of confinement in an unsealed cask or MSC, leading to radiological release

Thermal expansion of gases is to be expected as a part of normal operations. Resulting exposure of workers to radiation will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.5.4.5.5 Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne contamination

This potential event is covered in Section 6.3.1.25.

6.3.5.4.5.6 Inadvertent opening of a fuel transfer bay door, leading to a worker exposure

This potential event could expose workers to radiation, but would not expose the public. The frequency of inadvertent actions that expose workers to radiation will be limited by design features and operating procedures that ensure that such events are not Category 1 (Assumption 5.1.1.57).

6.3.5.4.5.7 Radiation-induced damage to a facility SSC

Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization as explained in Section 6.3.2.5.2.

6.3.5.4.6 Fissile

6.3.5.4.6.1 Criticality associated with a drop or slapdown of a loaded, unsealed cask or MSC from the main transfer room overhead crane and a rearrangement of the container internals

A criticality will not occur because design requirements and waste acceptance criteria will ensure criticality safety in transportation casks and MSCs (Assumption 5.1.1.4).

6.3.5.4.6.2 Criticality associated with an import-export trolley, a cask transfer trolley, or an MSC trolley holding a loaded, unsealed cask or MSC (as applicable) derailment followed by a load tipover or fall and a rearrangement of the container internals

A criticality in a cask or MSC is not credible because a design requirement will ensure that casks and MSCs remain subcritical even with the most reactive credible configuration of the fissile material and optimal moderation (Assumption 5.1.1.4).

6.3.5.4.6.3 Criticality associated with a drop of an SNF assembly from the spent fuel transfer machine into a cask, MSC, or WP and a rearrangement of the cask, MSC, or WP internals

Design calculations and the resulting design requirements will ensure criticality safety for this event (Assumptions 5.1.1.4, 5.1.3.1, and 5.1.3.2).

6.3.5.4.6.4 Criticality associated with a drop of an SNF assembly from the spent fuel transfer machine and a rearrangement of the fuel rods that comprise the assembly due to impact

Design calculations and the resulting design requirements will ensure criticality safety for this event (Assumptions 5.1.1.4, 5.1.3.1, and 5.1.3.2).

6.3.5.4.6.5 Criticality associated with the drop of heavy equipment onto a loaded, open cask, MSC, or WP and a rearrangement of the container internals

Equipment drop onto a transportation cask, or MSC will not lead to a criticality because design requirements and waste acceptance criteria will ensure criticality safety in transportation casks (Assumption 5.1.1.4). Equipment drop onto a WP will not lead to criticality because:

- A design requirement will ensure that WPs are subcritical provided that moderator control is in effect (Assumptions 5.1.3.2 and 5.1.1.21).
- Design features of the WP will ensure that an open WP suffering an impact from heavy equipment drop will not become critical (Assumption 5.1.3.2).

6.3.5.4.6.6 Criticality associated with a misload of a WP or an MSC

WPs are designed such that no combination of CSNF assemblies that may be accepted for disposal could lead to a nuclear criticality inside the WP provided that moderator control is in effect (Assumptions 5.1.3.2 and 5.1.1.21). MSCs are designed to remain subcritical with optimum moderation and most reactive waste forms (Assumption 5.1.1.4). Therefore, a preclosure criticality due to misload is not credible and administrative controls on container loading are not relied upon to prevent preclosure criticality.

6.3.5.5 FHF Main Transfer Room (Canister Transfer)

6.3.5.5.1 Collision/Crushing

6.3.5.5.1.1 Drop of a loaded cask (with inner lid in place, unbolted) from the main transfer room overhead crane onto the floor during the transfer from a pedestal on the import-export trolley to the cask transfer station

Cask drops are covered in Section 6.3.1.1.

6.3.5.5.1.2 Drop or collision of a loaded cask (with inner lid in place, unbolted) from the main transfer room overhead crane onto or against a sharp object during the transfer from a pedestal on the import-export trolley to the cask transfer station

An operational requirement will ensure that the load paths are kept free of puncture hazards (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.5.5.1.3 Drop or collision of a loaded cask (with inner lid in place, unbolted) from the main transfer room overhead crane into or against the canister transfer station

Cask drops are covered in Section 6.3.1.1. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.5.5.1.4 Slapdown of a loaded cask (with inner lid in place, unbolted) in the main transfer room due to a cask corner drop from the main transfer room overhead crane onto the edge of the pedestal or import-export trolley

This potential event is covered by Section 6.3.1.1.

6.3.5.5.1.5 Drop or collision of a loaded cask (with inner lid in place, unbolted) from the main transfer room overhead crane into or against the canister transfer station

Cask drops are covered in Section 6.3.1.1. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.5.5.1.6 Slapdown of a loaded cask (with inner lid in place, unbolted) onto the floor, cask slapdown into the canister transfer station, or cask slapdown into a wall; all due to off-center cask lowering into the canister transfer station

This potential event is covered by Section 6.3.1.1.

6.3.5.5.1.7 Drop or collision of a manipulator, handling equipment, or other miscellaneous equipment onto or against a loaded cask (with inner lid in place, unbolted) prior to entering the canister transfer station for unloading

Operational requirements will ensure that a drop of handling equipment onto a transportation cask without impact limiters or an MSC would not breach the cask (Assumption 5.1.1.30).

6.3.5.5.1.8 Drop of a cask inner lid, as appropriate, from the main transfer room overhead crane into a loaded cask to be unloaded

The calculation in Section 6.3.1.2 includes this potential event.

6.3.5.5.1.9 Drop or collision of handling equipment into or against an open cask loaded with a DPC, a DOE HLW canister, a naval SNF canister, or a [standardized] DOE SNF canister

This potential event is included in Section 6.3.1.6. For DPC canisters, no credit is taken for the prevention or mitigation of a release that may be provided by the canister.

6.3.5.5.1.10 Drop or collision of a DPC, a DOE HLW canister, a [standardized] DOE SNF canister, or a naval SNF canister from the main transfer room overhead crane back into or against the cask being unloaded

Section 6.3.1.5 includes the potential drop event. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.5.5.1.11 Impact due to horizontal movement of a naval SNF canister, a DPC, a DOE HLW canister, or a [standardized] DOE SNF canister with the main transfer room overhead crane before the canister is completely removed from the cask

Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.5.5.1.12 Drop and slapdown of a naval SNF canister, a DOE HLW canister or a [standardized] DOE SNF canister from the main transfer room overhead crane into the side of the canister transfer station (due to impact with an edge of the cask, MSC, WP, floor edge, WP or MSC internal baffle, etc.) during the transfer from the cask to a WP or MSC (as appropriate)

Section 6.3.1.5 includes this potential event.

6.3.5.5.1.13 Drop and slapdown of a DPC from the main transfer room overhead crane into the side of the canister transfer station (due to impact with an edge of the cask, MSC, floor edge, MSC internal baffle, etc.) during the transfer from the cask to an MSC

This potential event is included in Section 6.3.1.5.

6.3.5.5.1.14 Drop or collision of a DPC, a DOE HLW canister, a [standardized] DOE SNF canister, or a naval SNF canister from the main transfer room overhead crane onto or against a sharp object or edge in the canister transfer station

Design and operational requirements will ensure that load paths are kept free of puncture hazards (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.5.5.1.15 Drop of a DPC, a DOE HLW canister, a [standardized] DOE SNF canister, or a naval SNF canister from the main transfer room overhead crane onto the canister transfer station floor

This potential event is included in Section 6.3.1.5.

6.3.5.5.1.16 Drop or collision of a DOE HLW canister, a [standardized] DOE SNF canister, or a naval SNF canister from the main transfer room crane into or against an empty WP or empty MSC

The potential drop event is included in Section 6.3.1.5. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.5.5.1.17 Drop or collision of a naval SNF canister from the main transfer room crane into or against an empty WP

The potential drop event is included in Section 6.3.1.5. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.5.5.1.18 Drop or collision of a DPC from the main transfer room crane into or against an empty MSC

The potential drop event is included in Section 6.3.1.5. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.5.5.1.19 Collision involving a DPC, a DOE HLW canister, a [standardized] DOE SNF canister, or a naval SNF canister and the canister transfer station

Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.5.5.1.20 Drop or collision of a DOE HLW canister from the main transfer room overhead crane onto or against another DOE HLW canister or a [standardized] DOE SNF canister in a WP or in an MSC

The potential drop event is included in Section 6.3.1.5. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.5.5.1.21 Drop or collision of a [standardized] DOE SNF canister from the main transfer room overhead crane onto or against a DOE HLW canister in a WP or in an MSC

The drop event is covered in Section 6.3.1.5. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.5.5.1.22 Drop or collision of handling equipment into or against an open WP or MSC loaded with a DPC, DOE HLW canisters, and/or [standardized] DOE SNF canisters, and/or a naval SNF canister, as appropriate

This potential event is included in Section 6.3.1.6. For DPC canisters, no credit is taken for the prevention or mitigation of a release that may be provided by the canister.

6.3.5.5.1.23 Drop of a WP inner lid or MSC cask inner lid, as appropriate, from the main transfer room overhead crane onto a filled (loaded) WP or loaded MSC

The calculation in Section 6.3.1.2 includes this potential event.

6.3.5.5.2 Chemical Contamination/Flooding

6.3.5.5.2.1 Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures

Because this section considers SNF in sealed canisters only (BSC 2005 [DIRS 171428], Section 6.6.4.5), this potential event will not occur unless an event sequence leads to exposure of SNF to air. Oxidation of the fuel matrix is a possible outcome of an event that exposes SNF to air. The consequence analyses will account for the possibility of oxidation, if applicable.

6.3.5.5.3 Explosion/Implosion

6.3.5.5.3.1 Hydrogen explosion involving batteries on the import-export trolley

The waste is protected by casks or WPs while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to cause a radiological release (Assumption 5.1.1.51).

6.3.5.5.3.2 Hydrogen explosion involving batteries on a mobile elevated platform

The waste is protected by casks or WPs while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to cause a radiological release (Assumption 5.1.1.51).

6.3.5.5.4 Fire, Thermal

6.3.5.5.4.1 Electrical fire associated with SNF and HLW handling equipment in the main transfer room (including the overhead crane, manipulators, the movable platform/sleeve assembly, etc.)

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.5.5.4.2 Fire/explosion (battery/electrical fire) associated with the import-export trolley

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.5.5.4.3 Fire/explosion (battery/electrical fire) associated with the mobile elevated platform

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.5.5.4.4 Thermal hazard (from decay heat) associated with a vertical orientation of a loaded cask (with inner lid in place, unbolted)

This hazard is addressed in Section 6.3.5.5.2.1.

6.3.5.5.4.5 Overheating of a loaded cask, WP, or MSC due to a loss of cooling resulting in excessive temperature and possible damage to canister contents

This potential event is discussed in Section 6.3.1.26.

6.3.5.5.4.6 Transient combustible fire in the main transfer room

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.5.5.5 Radiation

6.3.5.5.5.1 Radiation exposure of a facility worker and/or the offsite public

Exposure of workers or the public to radiation is a hazard for the potential event sequences considered in the present analysis. The consequence analysis will evaluate this hazard for event sequences and normal operations, as applicable.

6.3.5.5.5.2 Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne contamination

This potential event is covered in Section 6.3.1.25.

6.3.5.5.3 Thermal expansion of gases or other loss of confinement in an unsealed cask, leading to radiological release

Thermal expansion of gases is to be expected as a part of normal operations. Resulting exposure of workers to radiation will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.5.5.4 Inadvertent opening of the main transfer room shield door, leading to a worker exposure

This potential event could expose workers to radiation, but would not expose the public. The frequency of inadvertent actions that expose workers to radiation will be limited by design features and operating procedures that ensure that such events are not Category 1 (Assumption 5.1.1.57).

6.3.5.5.5 Radiation-induced damage to a facility SSC

Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization as explained in Section 6.3.2.5.2.

6.3.5.5.6 Fissile

6.3.5.5.6.1 Criticality associated with a drop or slapdown of a loaded cask or MSC from the main transfer room overhead crane and a rearrangement of the cask or MSC internals

A criticality in an MSC is not credible because a design requirement will ensure that MSCs remain subcritical even with the most reactive credible configuration of the fissile material and optimal moderation (Assumption 5.1.1.4).

6.3.5.5.6.2 Criticality associated with a drop or slapdown of a DPC, a [standardized] DOE SNF canister, a naval SNF canister, or a DOE HLW canister and a rearrangement of canister internals

Design calculations will show that dropping a DOE SNF canister within its design basis will not lead to a criticality if moderator control is in effect (Assumption 5.1.1.3). A waste acceptance criterion will ensure that DPCs are designed such that drops, collisions, and other handling impacts (allowing for rearrangement of container internals and optimal moderator intrusion) cannot lead to a nuclear criticality (Assumption 5.1.1.4). The potential for criticality for naval canisters is addressed in Attachment I, where it is demonstrated that a criticality associated with the drop of a naval canister is Beyond Category 2. There is no potential for criticality of HLW canisters (Assumption 5.2.1.19).

6.3.5.5.6.3 Criticality associated with the drop of heavy equipment onto a loaded, open cask, MSC, or WP and a rearrangement of the container internals

Equipment drop onto a transportation cask or MSC will not lead to a criticality because design requirements and waste acceptance criteria will ensure criticality safety in transportation casks and MSCs (Assumption 5.1.1.4). Equipment drop onto a WP will not lead to criticality because (1) a design requirement will ensure that WPs are subcritical provided that moderator control is in effect (Assumptions 5.1.3.2 and 5.1.1.21) and (2) design features of the WP will ensure that a WP suffering an impact from heavy equipment drop will not become critical (Assumptions 5.1.3.1).

6.3.5.5.6.4 Criticality associated with a misload of a WP or an MSC

WPs are designed such that no combination of CSNF assemblies that may be accepted for disposal could lead to a nuclear criticality inside the WP provided that moderator control is in effect (Assumptions 5.1.3.2 and 5.1.1.21). MSCs are designed to remain with optimum moderation and most reactive waste forms (Assumption 5.1.1.4). Therefore, a preclosure criticality due to misload is not credible and administrative controls on container loading are not relied upon to prevent preclosure criticality.

6.3.5.6 FHF Main Transfer Room, WP Positioning Cell, WP Closure Cell (WP Closure)

6.3.5.6.1 Collision/Crushing

6.3.5.6.1.1 Collision involving the trolley holding the loaded, unsealed WP and the shield doors between the main transfer room and the WP positioning cell

Trolley collisions are covered in Section 6.3.1.22.

6.3.5.6.1.2 Shield doors between the main transfer room and the WP positioning cell close on the trolley holding the loaded, unsealed WP

A design requirement is assumed to ensure that closure of the shield doors onto a trolley would not overturn the trolley or cause it to drop its load (Assumption 5.1.1.13). Only the stainless steel inner lid will have been installed before this event occurs. Because the trolley remains upright there is no threat to the integrity of the loaded, unsealed WP. Therefore, unplanned radiological exposure will not occur as a result of this potential event.

6.3.5.6.1.3 Derailment of a trolley holding a loaded, unsealed WP followed by a load tipover or fall

A design requirement is assumed to ensure that loaded transfer trolleys will not derail or allow the WP to fall off the trolley (Assumption 5.1.1.36). Because the trolley remains upright, the WP will not spill its contents and no event sequence will occur.

- 6.3.5.6.1.4 Drop or collision of equipment from a main transfer room overhead crane, including a docking ring, lifting equipment, or a lifting fixture, onto or against a loaded, unsealed WP or WP inner lid**

Operational requirements will prevent radiological releases due to this potential event (Assumption 5.1.3.3).

- 6.3.5.6.1.5 Drop or collision of an unsealed, loaded WP from the main transfer room overhead crane back into or against the canister transfer station**

Section 6.3.1.7 includes the potential drop event. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

- 6.3.5.6.1.6 Drop of an unsealed, loaded WP from the main transfer room overhead crane onto the main transfer room floor during the lift and transfer to the WP positioning cell pedestal and trolley**

Section 6.3.1.7 includes this potential event.

- 6.3.5.6.1.7 Drop of an unsealed, loaded WP from the main transfer room overhead crane onto the pedestal on the WP positioning cell trolley during the lift and transfer to the WP positioning cell pedestal and trolley**

Section 6.3.1.7 includes this potential event.

- 6.3.5.6.1.8 Drop or collision of an unsealed, loaded WP from the main transfer room overhead crane onto or against a sharp object during the lift and transfer to the WP positioning cell pedestal and trolley**

Design and operational requirements will ensure that load paths are kept free of puncture hazards (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

- 6.3.5.6.1.9 Slapdown of a loaded, unsealed WP onto the floor, into a wall, or into nearby equipment following a drop from the main transfer room overhead crane onto the edge of the trolley, pedestal, or other equipment during the lift and transfer to the WP positioning cell pedestal and trolley**

Section 6.3.1.7 includes this potential event.

- 6.3.5.6.1.10 Lid drop onto a WP from the lid placement fixture equipment during the welding process**

The frequency and consequences of this event are bounded by those of the Category 2 lid-drop event sequence discussed in Section 6.3.1.2. The frequency is bounded because the bounding event applies to WPs, MSCs, and transportation casks, whereas the present event applies only to WPs. The consequences are bounded because the contents of the cask are protected by the inner lid for this event, whereas no lids are in place for the bounding event.

6.3.5.6.1.11 Equipment drop onto a WP during the welding process

Operational requirements will prevent radiological releases due to this potential event (Assumption 5.1.3.3).

6.3.5.6.1.12 Drop or collision of equipment from a main transfer room overhead crane onto or against a loaded, sealed WP positioned on a pedestal on a trolley

Operational requirements will prevent radiological releases due to this potential event (Assumption 5.1.3.3).

6.3.5.6.1.13 Collision involving the trolley holding the loaded, sealed WP and the shield doors between the WP positioning cell and the main transfer room

Trolley collisions are covered in Section 6.3.1.22.

6.3.5.6.1.14 Shield doors between the WP positioning cell and the main transfer room close on the trolley holding the loaded, sealed WP

A design requirement is assumed to ensure that closure of the shield doors onto a trolley would not overturn the trolley or cause it to drop its load (Assumption 5.1.1.13). Because the trolley remains upright the WP will not breach no event sequence will result.

6.3.5.6.2 Chemical Contamination/Flooding

6.3.5.6.2.1 Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures

Oxidation of failed CSNF assemblies is expected as a part of normal operations wherever CSNF assemblies are exposed to air. Resulting exposure of workers to radiation will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.5.6.3 Explosion/Implosion

6.3.5.6.3.1 Explosion hazard associated with the WP purging and inerting system and the ignition of hydrogen that may have accumulated in the WP

Precautions taken during the cask sampling and purging process will provide reasonable assurance that such hydrogen explosions will not occur (Assumption 5.1.1.58).

6.3.5.6.3.2 WP inerting system (or other pneumatic or pressurized system) missile due to a fractured nozzle/valve stem/pneumatic device

An operational requirement is assumed to prevent initiation of an event sequence by this potential event (Assumption 5.1.1.5).

6.3.5.6.3.3 Hydrogen explosion involving batteries on the WP closure transfer trolley

The waste is protected by the WP while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to cause a WP breach (Assumption 5.1.1.51).

6.3.5.6.4 Fire, Thermal

6.3.5.6.4.1 Electrical fire associated with handling equipment or other electrically-powered equipment in the WP closure cell and the WP positioning cell, including the overhead cranes and the welding subsystem in the WP closure cell

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.5.6.4.2 Fire/explosion (battery/electrical fire) associated with the WP transfer trolley holding a loaded, unsealed WP or a WP closure transfer trolley holding a loaded, unsealed or sealed WP

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.5.6.4.3 Intact or non-intact SNF overheating or damage to canister contents due to a loss of cooling resulting in excessive temperature and possible zircaloy cladding (or other cladding) unzipping or cladding failure due to excessive hoop stresses

This potential event is discussed in Section 6.3.1.26.

6.3.5.6.4.4 Canister/fuel damage by burn-through during welding process/heat damage

Burn-through of the inner lid is not possible with the gas tungsten arc welding process, which is used for the closure welds (BSC 2005 [DIRS 171428], Section 6.6.3.10; BSC 2004 [DIRS 172428], Section 3).

6.3.5.6.4.5 Thermal hazard/canister contents overheating/SNF assemblies overheating in a WP during the welding process resulting in excessive cladding temperature and possible zircaloy cladding (or other cladding) unzipping

Overheating of the WP contents due to welding is not possible using the gas tungsten arc welding process, which is used for the closure welds (BSC 2005 [DIRS 171428], Section 6.6.3.10; BSC 2004 [DIRS 172428], Section 3).

6.3.5.6.4.6 Transient combustible fire in the WP closure cell and the WP positioning cell

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.5.6.5 Radiation

6.3.5.6.5.1 Radiation exposure of a facility worker and/or the offsite public

Exposure of workers or the public to radiation is a hazard for the potential event sequences considered in the present analysis. The consequence analysis will evaluate this hazard for event sequences and normal operations, as applicable.

6.3.5.6.5.2 Glovebox leak leads to a radiological release

Exposure of workers to radiation due to a glovebox leak will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.5.6.5.3 Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation

This potential event is covered in Section 6.3.1.25.

6.3.5.6.5.4 Inadvertent opening of a transfer bay shield door or the WP positioning cell shield door, leading to a worker exposure

This potential event could expose workers to radiation, but would not expose the public. The frequency of inadvertent actions that expose workers to radiation will be limited by design features and operating procedures that ensure that such events are not Category 1 (Assumption 5.1.1.57).

6.3.5.6.5.5 Radiation-induced damage to a facility SSC

Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization as explained in Section 6.3.2.5.2.

6.3.5.6.6 Fissile

6.3.5.6.6.1 Criticality associated with a trolley holding a sealed or unsealed WP derailment followed by a load tipover or fall and rearrangement of the container internals

A design requirement is assumed to ensure that the trolley will not derail or allow the unsealed WP to fall off the trolley (Assumption 5.1.1.36).

6.3.5.6.6.2 Criticality associated with a drop or slapdown of a loaded, unsealed WP from the main transfer room overhead crane and a rearrangement of the container internals

Because the WP does not spill its contents (Assumption 5.1.3.11) and moderators are excluded from the WP (Assumptions 5.1.3.2 and 5.1.1.21), the unsealed WP will remain subcritical.

6.3.5.6.6.3 Criticality associated with the drop of heavy equipment onto a loaded, unsealed WP and a rearrangement of the container internals

A design requirement will ensure that WPs are designed such that drops, collisions, and other handling impacts within their design bases (allowing for rearrangement of container internals and without credit for burnup) cannot lead to a nuclear criticality (Assumption 5.1.3.1). A design requirement will also ensure that unsealed WPs cannot become critical with moderator control in effect (Assumption 5.1.3.2).

6.3.5.7 FHF Main Transfer Room, Preparation Room, Entrance Vestibule (WP Loadout)

6.3.5.7.1 Collision/Crushing

6.3.5.7.1.1 Derailment of a trolley holding a loaded, sealed WP followed by a load tipover or fall

A design requirement is assumed to ensure that the trolley will not derail or allow the unsealed WP to fall off the trolley (Assumption 5.1.1.36). Because the WP remains upright there is no threat to the integrity of the unsealed WP.

6.3.5.7.1.2 Drop of a loaded, sealed WP from a main transfer room overhead crane onto the floor during transfer from the trolley to the survey area or from the survey area to the tilting machine

This potential event is covered by Section 6.3.1.8.

6.3.5.7.1.3 Drop or collision of a loaded, sealed WP from a main transfer room overhead crane onto or against a sharp object (including the tilting machine) during transfer from the trolley to the survey area or from the survey area to the tilting machine

A design requirement will ensure that operating areas are free of design features that could cause a puncture in case of a drop (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.5.7.1.4 Slapdown of a loaded, sealed WP from a main transfer room overhead crane to the cell floor during transfer from the trolley to the survey area due to drop from the overhead crane onto the edge of the pedestal on the trolley, the edge of the trolley, or another object on the floor

Section 6.3.1.8 includes this potential event. The WP is assumed to survive a slapdown without breach (Assumption 5.1.3.12).

6.3.5.7.1.5 Slapdown (either forward into the WP turntable or backward onto the floor) of a loaded, sealed WP in the tilting machine from a main transfer room overhead crane during the lowering of the WP to the horizontal position on the pallet previously placed on the WP turntable

Section 6.3.1.8 includes this potential event. The WP is assumed to survive a slapdown without breach (Assumption 5.1.3.12). A design requirement is assumed to prevent backward slapdowns (Assumption 5.1.1.53).

6.3.5.7.1.6 Collision of the tilting machine against a loaded, sealed WP on a pallet on the WP turntable

A design or operational requirement is assumed to ensure that a collision between the tilting machine and a WP would not breach the WP (Assumption 5.1.3.10).

6.3.5.7.1.7 Drop or collision of a lifting collar from a main transfer room overhead crane onto or against a loaded, sealed WP after removal of the collar from the WP collar removal machine

Operational requirements will prevent radiological releases due to this potential event (Assumption 5.1.3.3).

6.3.5.7.1.8 Collision or impact of the lifting collar removal machine and a loaded, sealed WP placed on a pallet positioned on the WP turntable

A design or operational requirement is assumed to ensure that an impact or collision between the trunnion collar removal machine and a WP would not breach the WP (Assumption 5.1.3.10).

6.3.5.7.1.9 Drop of a loaded, sealed WP and pallet from a main transfer room overhead crane onto the floor during transfer of the WP and pallet from the WP turntable to the WP transporter bedplate

Section 6.3.1.8 includes this potential event.

6.3.5.7.1.10 Drop of a loaded, sealed WP and pallet from a main transfer room overhead crane onto the WP transporter bedplate during transfer of the WP and pallet from the WP turntable to the WP transporter bedplate

Section 6.3.1.8 includes the potential drop event. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.5.7.1.11 Drop or collision of a loaded, sealed WP on a pallet from a main transfer room overhead crane onto or against a sharp object during transfer of the WP and pallet from the WP turntable to the WP transporter bedplate

Section 6.3.1.8 includes the potential drop event. Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.5.7.1.12 Equipment drop or collision (including lifting yokes) onto or against a loaded, sealed WP in the WP transporter load area (including the process to move the WP from the trolley to the WP transporter)

Operational requirements will prevent radiological releases due to this potential event (Assumption 5.1.3.3).

6.3.5.7.1.13 Collision involving a WP transporter (holding the sealed WP on a pallet) and the doors between the main transfer room and the preparation room

A design requirement will prevent radiological releases due to this potential event (Assumptions 5.1.7.3 and 5.1.7.7).

6.3.5.7.1.14 The doors between the main transfer room and the preparation room close on the WP transporter (holding the sealed WP on a pallet)

A design requirement is assumed to ensure that closure of the shield doors onto a transporter would not overturn the transporter or cause it to drop its load (Assumption 5.1.1.13). Because the transporter remains upright there is no threat to the integrity of the WP.

6.3.5.7.1.15 Collision involving WP transporter (holding the sealed WP on a pallet) and the shield doors between the preparation room and the entrance vestibule

A design requirement will prevent radiological releases due to this potential event (Assumptions 5.1.7.3 and 5.1.7.7).

6.3.5.7.1.16 Shield doors between the preparation room and the entrance vestibule close on the WP transporter (holding the sealed WP on a pallet)

A design requirement is assumed to ensure that closure of the shield doors onto a transporter would not overturn the transporter or cause it to drop its load (Assumption 5.1.1.13). Because the transporter remains upright there is no threat to the integrity of the WP.

6.3.5.7.1.17 Collision involving WP transporter (holding the sealed WP on a pallet) and the doors between the entrance vestibule and the ambient air (outside)

A design requirement will prevent radiological releases due to this potential event (Assumptions 5.1.7.3 and 5.1.7.7).

6.3.5.7.1.18 Doors between the entrance vestibule and the ambient air (outside) close on the WP transporter (holding the sealed WP on a pallet)

A design requirement is assumed to ensure that closure of the shield doors onto a transporter would not overturn the transporter or cause it to drop its load (Assumption 5.1.1.13). Because the transporter remains upright there is no threat to the integrity of the WP.

6.3.5.7.1.19 Derailment or collision of a WP transporter (holding the sealed WP on a pallet) in the main transfer room, preparation room, or entrance vestibule followed by a load tipover or fall

A design requirement is assumed to ensure that a collision or derailment of the WP transporter would not cause a WP breach (Assumptions 5.1.7.3 and 5.1.7.7).

6.3.5.7.2 Chemical Contamination/Flooding

6.3.5.7.2.1 Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures

Because this section considers SNF contained in a sealed WP only (BSC 2005 [DIRS 171428], Section 6.6.4.7), this potential event will not occur unless an event sequence leads to exposure of SNF to air. Oxidation of the fuel matrix is a possible outcome of an event that exposes SNF to air. The consequence analyses will account for the possibility of oxidation, if applicable.

6.3.5.7.3 Explosion/Implosion

6.3.5.7.3.1 Hydraulic system (or other pneumatic or pressurized system) missile due to a fractured nozzle/valve stem/pneumatic device

An operational requirement is assumed to prevent initiation of an event sequence by this potential event (Assumption 5.1.1.5).

6.3.5.7.3.2 Hydrogen explosion involving batteries on a trolley.

The waste is protected by casks or WPs while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to cause a radiological release (Assumption 5.1.1.51).

6.3.5.7.4 Fire, Thermal

6.3.5.7.4.1 Electrical fire associated with the equipment in the WP transporter load area of the main transfer room, including the WP collar removal machine, the tilting machine, and the WP turntable

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.5.7.4.2 Electrical fire associated with the main transfer room overhead cranes

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.5.7.4.3 Electrical fire associated with equipment on the WP transporter, including motors to extend the WP transporter bedplate

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.5.7.4.4 Electrical fire associated with the WP transporter locomotive

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.5.7.4.5 Fire/explosion (battery/electrical fire) associated with the WP closure transfer trolley

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.5.7.4.6 Transient combustible fire in the main transfer room, preparation room, or the entrance vestibule

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.5.7.5 Radiation

6.3.5.7.5.1 Radiation exposure of a facility worker and/or the offsite public

Exposure of workers or the public to radiation is a hazard for the potential event sequences considered in the present analysis. The consequence analysis will evaluate this hazard for event sequences and normal operations, as applicable.

6.3.5.7.5.2 Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation

This potential event is covered in Section 6.3.1.25.

6.3.5.7.5.3 Inadvertent opening of the main transfer room shield door, leading to a worker exposure

This potential event could expose workers to radiation, but would not expose the public. The frequency of inadvertent actions that expose workers to radiation will be limited by design features and operating procedures that ensure that such events are not Category 1 (Assumption 5.1.1.57).

6.3.5.7.5.4 Inadvertent opening of the WP transporter shielded enclosure doors, leading to a worker exposure

This potential event could expose workers to radiation, but would not expose the public. The frequency of inadvertent actions that expose workers to radiation will be limited by design

features and operating procedures that ensure that such events are not Category 1 (Assumption 5.1.1.57).

6.3.5.7.5.5 Radiation-induced damage to a facility SSC

Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization as explained in Section 6.3.2.5.2.

6.3.5.7.6 Fissile

6.3.5.7.6.1 Criticality associated with a trolley holding a sealed WP derailment followed by a load tipover or fall and rearrangement of the WP internals

A design requirement is assumed to ensure that the trolley will not derail or allow the unsealed WP to fall off the trolley (Assumption 5.1.1.36). Because the WP remains upright, there is no mechanism for reconfiguration of internals and, therefore, no criticality.

6.3.5.7.6.2 Criticality associated with a drop, slapdown, or collision of a sealed WP and a rearrangement of the container internals

A design requirement will ensure that WPs are designed such that drops, collisions, and other handling impacts within their design bases (allowing for rearrangement of container internals and without credit for burnup) cannot lead to a nuclear criticality (Assumption 5.1.3.1).

6.3.5.7.6.3 Criticality associated with a WP transporter derailment followed by a load tipover or fall and rearrangement of the WP internals

A design requirement is assumed to ensure that a derailment of the WP transporter would not cause a WP breach (Assumptions 5.1.7.3 and 5.1.7.7). Another design requirement is assumed to preclude criticality in sealed WPs (Assumption 5.1.3.1).

6.3.5.8 FHF Main Transfer Room, Preparation Room, Entrance Vestibule (Loaded MSC Removal)

6.3.5.8.1 Collision/Crushing

6.3.5.8.1.1 Impact due to horizontal movement of a loaded MSC by the main transfer room overhead crane before it is fully removed from the canister transfer station

Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.5.8.1.2 Collision of a loaded MSC from the main transfer room overhead crane with the canister transfer station

Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.5.8.1.3 Drop of an MSC inner or outer lid (as applicable) from the fuel transfer room overhead crane onto the loaded MSC in the fuel transfer bay or main transfer room (as applicable)

The frequency and consequences of the drop of an outer lid are bounded by those of the Category 2 lid-drop event sequence discussed in Section 6.3.1.2. The frequency is bounded because the bounding event applies to WPs, MSCs, and transportation casks, but this event applies only to MSCs. The consequences are bounded because the contents of the MSC are protected by the inner lid, whereas no lids are in place for the bounding event. The material at risk is 5 HLW canisters. An operational requirement is assumed to ensure that the lid drop will not breach a DOE SNF canister inside (Assumption 5.1.1.44).

The drop of an inner lid is included in Section 6.3.1.2.

6.3.5.8.1.4 Drop or collision of the transfer port plug from the fuel transfer room overhead crane onto or against the inner lid or outer lid of a loaded MSC (as applicable) in the fuel transfer bay

A design requirement to consider 2-over-1 event sequences will prevent initiation of an event sequence as a result of this potential event (Assumption 5.1.1.37).

6.3.5.8.1.5 Drop of an MSC inner or outer lid (as applicable) from the main transfer room overhead crane onto the loaded MSC in the canister transfer station

This potential event is covered by the analysis in Section 6.3.1.2.

6.3.5.8.1.6 Collision of a mobile elevated platform with a loaded MSC during docking ring removal activities associated with the MSC

Operational requirements are assumed to ensure that the mobile elevated platform will not be operated in a manner that could breach an MSC (Assumption 5.1.1.41).

6.3.5.8.1.7 Collision of a trolley holding a loaded MSC on a pedestal with the shield doors separating the fuel transfer bay and the main transfer room

Trolley collisions are covered in Section 6.3.1.22.

6.3.5.8.1.8 Closure of the shield doors separating the fuel transfer bay and the main transfer room onto the trolley holding a loaded MSC on a pedestal

A design requirement is assumed to ensure that closure of shield doors onto a trolley would not overturn the trolley or cause it to drop its load (Assumption 5.1.1.13). Because the trolley remains upright there is no threat to the integrity of the cask.

6.3.5.8.1.9 Drop or collision of tools or equipment (including the outer lid-lifting fixture, inner lid-lifting fixture [as applicable], lid bolts, etc.) onto or against an MSC inner lid or outer lid (as applicable) during the MSC sealing process

Operational requirements will ensure that this potential event will not initiate an event sequence (Assumption 5.1.1.32).

6.3.5.8.1.10 Derailment of a trolley serving a fuel transfer bay or the import-export trolley holding a loaded MSC on a pedestal followed by a load tipover or fall

A design requirement is assumed to ensure that the import-export trolley carrying an MSC will not derail or allow the MSC to fall off the trolley (Assumption 5.1.1.36). Because the trolley remains upright there is no threat to the integrity of the cask.

6.3.5.8.1.11 Drop of a loaded MSC from the main transfer room overhead crane onto the floor during the MSC transfer from a pedestal staged on a trolley serving the fuel transfer bay or from the canister transfer station to the import-export trolley and pedestal

The analysis presented in Section 6.3.1.1.2 includes this potential event.

6.3.5.8.1.12 Drop of a loaded MSC from the main transfer room overhead crane onto the pedestal on a trolley during the MSC transfer from a pedestal staged on a transfer trolley serving the fuel transfer bay or from the canister transfer station to the import-export trolley and pedestal

The analysis presented in Section 6.3.1.1.2 includes this potential event.

6.3.5.8.1.13 Drop or collision of a loaded MSC from the main transfer room overhead crane onto or against a sharp object during the transfer from a pedestal staged on a transfer trolley serving the fuel transfer bay or from the canister transfer station to the import-export trolley and pedestal

Design and operational requirements will ensure that load paths are kept free of puncture hazards (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.5.8.1.14 Slapdown of a loaded MSC following a drop onto the edge of the pedestal or trolley or other object during the transfer from a pedestal staged on a transfer trolley serving the fuel transfer bay or from the canister transfer station to the import-export trolley and pedestal

This potential event is covered by Section 6.3.1.1.2.

- 6.3.5.8.1.15 Slapdown of a loaded MSC onto the floor, into a wall, or into nearby equipment following a drop from the main transfer room overhead crane onto the edge of the import-export trolley, pedestal, or other equipment during the lift and transfer of the MSC from the canister transfer station to the import-export trolley**

This potential event is covered by Section 6.3.1.1.2.

- 6.3.5.8.1.16 Collision of the import-export trolley holding a loaded MSC on a pedestal with the shield doors separating the main transfer room and the preparation room or the preparation room and the entrance vestibule**

Trolley collisions are covered in Section 6.3.1.22.

- 6.3.5.8.1.17 Closure of the shield doors separating main transfer room and the preparation room or the preparation room and the entrance vestibule onto the import-export trolley holding a loaded MSC on a pedestal**

A design requirement is assumed to ensure that closure of shield doors onto a trolley would not overturn the trolley or cause it to drop its load (Assumption 5.1.1.13). Because the trolley remains upright there is no threat to the integrity of the cask.

- 6.3.5.8.1.18 Drop or collision of equipment in the preparation room onto or against a loaded MSC on a pedestal on an import-export trolley**

Operational requirements will ensure that this potential event will not initiate an event sequence (Assumption 5.1.1.32).

- 6.3.5.8.1.19 Drop of a loaded MSC from the entrance vestibule gantry crane onto the floor during the lifting of the loaded MSC off of the pedestal on the import-export trolley**

This potential event is covered by Section 6.3.1.1.2.

- 6.3.5.8.1.20 Drop or collision of a loaded MSC from the entrance vestibule gantry crane onto or against a sharp object during the lifting of the loaded MSC off of the pedestal on the import-export trolley**

Design and operational requirements will ensure that load paths are kept free of puncture hazards (Assumption 5.1.1.40). Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

- 6.3.5.8.1.21 Slapdown of a loaded, sealed MSC following a drop from the entrance vestibule gantry crane onto the edge of the pedestal, edge of the import-export trolley, or other equipment during the lifting of the loaded MSC off of the pedestal on the import-export trolley**

This potential event is covered by Section 6.3.1.1.2.

6.3.5.8.1.22 Collision of the entrance vestibule gantry crane holding a loaded MSC with a forklift, mobile elevated platform, or other object in the entrance vestibule

Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21). Operational requirements are assumed to ensure that forklifts and mobile elevated platforms will not be operated in a manner that could breach or overturn a transportation cask (Assumption 5.1.1.41).

6.3.5.8.1.23 Collision of the entrance vestibule gantry crane holding a loaded MSC with the entrance vestibule doors

Crane-load collisions do not initiate Category 1 or Category 2 event sequences (Section 6.3.1.21).

6.3.5.8.1.24 The entrance vestibule doors close on the entrance vestibule gantry crane holding a loaded MSC

A design requirement is assumed to ensure that closure of a door onto a trolley would not overturn the trolley or cause it to drop its load (Assumption 5.1.1.13). Because the trolley remains upright there is no threat to the integrity of the cask.

6.3.5.8.2 Chemical Contamination/Flooding

6.3.5.8.2.1 Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures.

Because this section considers SNF in sealed MSCs only (BSC 2005 [DIRS 171428], Section 6.6.4.8), this potential event will not occur unless an event sequence leads to exposure of SNF to air. Oxidation of the fuel matrix is a possible outcome of an event that exposes SNF to air. The consequence analyses will account for the possibility of oxidation, if applicable.

6.3.5.8.3 Explosion/Implosion

6.3.5.8.3.1 MSC inerting system (or other pneumatic or pressurized system) missile due to a fractured nozzle/valve stem/pneumatic device

An operational requirement is assumed to prevent initiation of an event sequence by this potential event (Assumption 5.1.1.5).

6.3.5.8.3.2 Hydrogen explosion involving batteries on the import-export trolley

The waste is protected by casks or WPs while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to cause a radiological release (Assumption 5.1.1.51).

6.3.5.8.3.3 Hydrogen explosion involving batteries on a mobile elevated platform

The waste is protected by casks or WPs while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to cause a radiological release (Assumption 5.1.1.51).

6.3.5.8.3.4 Explosion hazard associated with the cask purging system and the ignition of hydrogen that may have accumulated in the cask prior to MSC purging and inerting

Precautions taken during the cask sampling and purging process will provide reasonable assurance that such hydrogen explosions will not occur (Assumption 5.1.1.58).

6.3.5.8.4 Fire, Thermal

6.3.5.8.4.1 Electrical fire associated with the main transfer room overhead crane, or the entrance vestibule gantry crane

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.5.8.4.2 Electrical fire associated with handling equipment or other equipment located in the main transfer room, the preparation room, or the entrance vestibule

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.5.8.4.3 Transient combustible fire in the main transfer room, preparation room, or the entrance vestibule

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.5.8.4.4 Intact or non-intact SNF overheating due to a loss of cooling resulting in excessive temperature and possible zircaloy cladding (or other cladding) unzipping or cladding failure due to excessive hoop stresses

This potential event is discussed in Section 6.3.1.26.

6.3.5.8.4.5 Fire/explosion (battery/electrical fire) associated with the import-export trolley or the MSC trolley

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.5.8.4.6 Fire/explosion (battery/electrical fire) associated with a mobile elevated platform

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.5.8.5 Radiation

6.3.5.8.5.1 Radiation exposure of a facility worker and/or the offsite public

Exposure of workers or the offsite public to radiation is a hazard for the potential event sequences considered in the present analysis. The consequence analysis will evaluate this hazard for event sequences and normal operations, as applicable.

6.3.5.8.5.2 Damage or rupture of cask inerting system leading to a release of cask internal gases

Exposure of workers to radiation as a result of this potential event will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. Although a rupture leading to a radiological release would be an abnormal occurrence, radiation protection programs will ensure that such an occurrence would not contribute significantly to the normal operations dose. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.5.8.5.3 Expansion of gases in the MSC, leading to radiological release

Thermal expansion of gases is to be expected as a part of normal operations. Resulting exposure of workers to radiation will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.5.8.5.4 Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation

This potential event is covered in Section 6.3.1.25.

6.3.5.8.5.5 Radiation-induced damage to a facility SSC

Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization as explained in Section 6.3.2.5.2.

6.3.5.8.6 Fissile

6.3.5.8.6.1 Criticality associated with an MSC trolley collision or trolley derailment followed by a load tipover or fall and a rearrangement of the MSC internals

A criticality in an MSC is not credible because a design requirement will ensure that MSCs remain subcritical even with the most reactive credible configuration of the fissile material and optimal moderation (Assumption 5.1.1.4).

6.3.5.8.6.2 Criticality associated with a drop or slapdown of a loaded MSC from an overhead crane and a rearrangement of cask internals

A criticality in an MSC is not credible because a design requirement will ensure that MSCs remain subcritical even with the most reactive credible configuration of the fissile material and optimal moderation (Assumption 5.1.1.4).

6.3.5.8.6.3 Criticality associated with the drop of heavy equipment onto an unsealed MSC and a rearrangement of the container internals

Equipment drop onto an MSC will not lead to a criticality because MSCs must be subcritical even with the most reactive credible configuration of the fissile material and moderation to the most reactive credible extent (Assumption 5.1.1.4).

6.3.5.9 FHF Main Transfer Room, Preparation Room, Entrance Vestibule (Empty Transportation Cask, MSC Removal)

6.3.5.9.1 Collision/Crushing

No potential event sequences have been identified that affect a waste form.

6.3.5.9.2 Chemical Contamination/Flooding

No potential event sequences have been identified that affect a waste form.

6.3.5.9.3 Explosion/Implosion

No potential event sequences have been identified that affect a waste form.

6.3.5.9.4 Fire, Thermal

No potential event sequences have been identified that affect a waste form.

6.3.5.9.5 Radiation

6.3.5.9.5.1 Radiation exposure of a facility worker and/or the offsite public

Exposure of workers or the public to radiation is a hazard for the potential event sequences considered in the present analysis. The consequence analysis will evaluate this hazard for event sequences and normal operations, as applicable.

6.3.5.9.5.2 Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation

This potential event is covered in Section 6.3.1.25.

6.3.5.9.6 Fissile

No potential event sequences have been identified that affect a waste form.

6.3.6 Surface and Subsurface Facilities: WP Subsurface Transport and Emplacement

In this functional area, WPs seated horizontally on pallets are transported to the emplacement drifts in the underground repository on a rail-based transporter. An emplacement gantry meets the transporter at the mouth of the emplacement drift, lifts the WP and its pallet, and carries them to a disposal location within the appropriate drift. A further description of the operations in this area and a listing of the hazards and potential events is provided in *Internal Hazards Analysis for License Application* (BSC 2005 [DIRS 171428], Section 6.6.5).

6.3.6.1 Collision/Crushing

6.3.6.1.1 Collision involving the transport locomotive and the WP transporter (holding the sealed WP on a pallet) during coupling, prior to entering the North Portal

The likelihood of a collision involving the locomotive and the WP transporter during coupling, prior to entering the North Portal, has not been estimated. Instead, the consequences of that event are discussed. The collision would occur at the low speed typically required for the coupling operation. Also, the collision would impact the transporter itself, rather than the WP. Therefore, the energy of the impact would mainly be absorbed by the transporter. At worst, the collision may cause the derailment of the transporter, which is investigated in Section 6.3.6.1.3. In that section, it is shown that a transporter derailment will not cause the breach of the transported WP. Therefore, the event analyzed in the present section will not initiate a Category 1 or Category 2 event sequence.

6.3.6.1.2 Derailment of a WP transporter outdoors, prior to entering the north ramp, followed by a load tipover or fall

A distinction between a transporter derailment outdoors, prior to entering the North Portal, and a transporter derailment in the subsurface facilities is to be made only if the WP breaches, because in that case, the two events may result in different doses to workers and the public, due to the difference between the surface environment and the subsurface environment. However, a breach of the WP following a derailment is shown to be a Beyond Category 2 event sequence (Section 6.3.6.1.3), which makes it unnecessary to distinguish these two kinds of derailment further.

6.3.6.1.3 Derailment of a WP transporter while on the north ramp, in a main drift, or in an emplacement drift turnout, after passing through the North Portal, followed by a load tipover or fall

Several initiating events, such as a seismic event, or an object located on the railway may conceivably result in the derailment of the WP transporter, including a tipover.

The approach chosen to address derailment events is to mitigate their consequences so that no WP breach occurs.

It is assumed that the transporter will transport the WP in a manner such that if a derailment occurs, the WP impact energy will be low enough to preclude a WP breach (Assumptions 5.1.7.3 and 5.1.7.7). This can be done in part by controlling the speed of the transporter. For example, Assumption 5.1.7.3 indicates that the maximum speed of the transporter required to preclude a waste package breach in case of a transporter collision or derailment (excluding tipover) is 15 mph. Alternatively, should a tipover occur, the fact that the transporter speed is controlled will help limit the severity of the consequences of a tipover. Transporter speed exceeding what is allowable corresponds to transporter runaway situations, investigated in Section 6.3.6.1.4, which are shown to be Beyond Category 2. In addition, the transporter may be designed to limit the height of a WP during transportation such that a drop results in an impact energy lower than the energy corresponding to a WP without trunnion free falling from its design basis drop height.

In order to mitigate the consequences of a derailment, additional design requirements are assumed on the transporter, namely that the restraints used to immobilize the bedplate inside the shielded compartment of the transporter, and the mechanism for locking the doors of the shielded compartment withstand a credible derailment and the subsequent collision of the transporter without resulting in a Category 1 or Category 2 event sequence (Assumption 5.1.7.4). A credible derailment (or collision) is defined as a derailment (collision) that will occur at a speed less than or equal to the maximum allowable speed of the transporter. Limiting the speed of the transporter makes it possible to design restraints and door locking mechanisms that do not fail as a result of a derailment or collision. These additional design requirements will ensure that no ejection of the WP will occur. This will make it possible to control the severity of the potential impacts that a WP may undergo as a consequence of a derailment.

Therefore, the failure of the WP is preventable, and the event analyzed in this section will not initiate a Category 1 or Category 2 event sequence.

6.3.6.1.4 Runaway of a loaded WP transporter while proceeding down the north ramp

The north ramp leads from the surface facilities to the underground facilities. It is the primary location considered for analyzing runaways because of its length and slope. However, a runaway can be defined as an uncontrolled descent in the repository and therefore it may also occur in other locations than on the north ramp. Therefore, the analysis of the runaway event performed in this section should be viewed as applying to other locations of the repository where an uncontrolled descent may occur.

Based on results reported in Section 4.1.17, it is concluded that waste package transporter runaway events will not initiate any Category 1 or Category 2 event sequence.

6.3.6.1.5 Collision involving a WP transporter (holding a sealed WP on a pallet) and other stationary or moving equipment

Several events can be categorized as transporter collisions. Two main categories can be considered:

- (1) the object with which the transporter collides is stationary, or,
- (2) the object with which the transporter collides is in motion.

The first category encompasses the objects that may block the railway, such as doors of the surface or subsurface facilities accidentally left closed, some piece of equipment inadvertently left on the railway, etc. The bounding situation that may result from this type of collision is the derailment of the transporter. This event is analyzed in Section 6.3.6.1.3, and shown to be Beyond Category 2.

The second category varies according to the type of object that may impact the transporter. Impacts from rockfalls are investigated in Section 6.3.6.1.9. Tornado missiles are addressed in Section 6.2.7. Impacts of an aircraft crash are investigated in Section 6.2.1. The potential collision with the locomotive during coupling is analyzed in Section 6.3.6.1.1. Other vehicles could crash into the transporter, for example a surface vehicle. Based on Assumption 5.1.7.1, which ensures that vehicle crossings of the railway will be controlled, the potential for a surface vehicle to hit a transporter carrying the WP is minimized. Should somehow a surface vehicle lose control and impact the transporter, the collision would not impact the WP which is protected by the shielded compartment. Therefore, minimal kinetic energy of the impacting vehicle would be transferred to the WP. At worst, the collision may cause the derailment of the transporter, which is investigated in Section 6.3.6.1.3, and shown not to initiate a Category 1 or Category 2 event sequence.

6.3.6.1.6 Derailment of a WP transporter at the turnout drift switch, followed by a load tipover or fall

Derailment events have been grouped together and are addressed in Section 6.3.6.1.3, where it is shown that they will not initiate a Category 1 or Category 2 event sequence.

6.3.6.1.7 Collision involving a WP transporter (holding the sealed WP on a Pallet) and the emplacement access doors

At worst, collisions may cause the derailment of the transporter, which is investigated in Section 6.3.6.1.3. In that section, it is shown that no Category 1 or Category 2 event sequence will be initiated.

6.3.6.1.8 Emplacement access doors close on the WP transporter (holding the sealed WP on a pallet)

A design requirement is assumed to ensure that closure of the doors onto the WP transporter will not cause a tipover of the transporter or cause it to drop its load (Assumption 5.1.1.13).

6.3.6.1.9 Rockfall onto a WP transporter while in the subsurface

While in the subsurface, the WP transporter could be impacted by a rockfall. Because the WP is protected by the shielded compartment of the transporter, its structural integrity will be jeopardized only if the shielded compartment fails first because of the rockfall.

The first step in making such a determination is to evaluate the sets of bounding credible rockfalls that may hit the shielded compartment of the transporter. In *Bounding Characteristics of Credible Rockfalls of Preclosure Period* (BSC 2004 [DIRS 168508, Sections 1 and 6.1), no credit is taken for the ground support, which is conservative because ground support helps prevent rockfalls. The bounding rockfalls that may impact the transporter are triggered by the most severe seismic event considered for the preclosure period, which has a mean annual probability of exceedance equal to 10^{-4} (BSC 2004 [DIRS 168508], Section 6.1). The total exposure time during which the transporter carrying the WP may be hit by a rockfall is calculated based on an average exposure time of 6 hours per WP (Assumption 5.1.7.5).

A set of credible bounding rockfalls is defined as a rockfall set whose total mass is such that the probability of observing a heavier rockfall set impacting the shielded compartment of the transporter is less than 10^{-4} over the preclosure period. The bounding set mass is calculated based on the results of simulations that perform a static modeling of the key blocks forming in the non-emplacement drifts during the seismic event (BSC 2004 [DIRS 168508], Section 4.1.2.2). The size and layout of the non-emplacement drifts modeled in these simulations conform to what is currently considered for the repository. A conservative total mass of 5.4 MT for the sets of credible bounding rockfalls is found, and the sets are determined to include one to 25 rocks (BSC 2004 [DIRS 168508], Section 7).

A structural analysis is then performed to determine if a credible bounding rock falling from the crown of the non-emplacement drifts and impacting the shielded compartment of the transporter can damage it in a manner sufficient as to jeopardize the structural integrity of the WP. The results of this analysis show that this is not the case (BSC 2004 [DIRS 168963], Section 7). Therefore, the event analyzed in the present section will not initiate a Category 1 or Category 2 event sequence.

6.3.6.1.10 Collision involving a WP transporter (holding the sealed WP on a pallet) and the emplacement transfer dock (while entering the dock)

The likelihood of a collision involving the transporter and the emplacement drift transfer dock has not been estimated. Instead, the consequences of that event are discussed. The worst-case scenario resulting from the collision is a transporter derailment, which is investigated in Section 6.3.6.1.3. In that section, it is shown that a transporter derailment will not cause the breach of the transported WP. Therefore, the event analyzed in the present section will not initiate a Category 1 or Category 2 event sequence.

6.3.6.1.11 WP transporter doors close on the WP on a pallet

The likelihood of a collision between the transporter shielded enclosure doors and the WP sitting on the pallet has not been estimated. Instead, a design requirement is assumed to ensure that closure of the doors onto the WP would not breach it or cause it to fall from the bedplate of the

transporter (Assumption 5.1.7.2). Therefore, the event analyzed in the present section will not initiate a Category 1 or Category 2 event sequence.

6.3.6.1.12 WP rolls or slides out of a WP transporter on the surface (outdoors), in a ramp, in a main drift, or at the entrance of the emplacement drift

The WP has a bedplate that can be rolled in and out of the shielded compartment. The WP with its emplacement pallet sits on that bedplate. The bedplate is rolled inside the shielded compartment and the shielded compartment doors are closed when the transporter carrying a WP is in motion. The potential causes for a bedplate rollout while the transporter carrying a WP is in motion are: (a) a collision and its associated worst-case scenario, namely a derailment, (b) a spurious actuation of the system controlling the opening of the shielded compartment's doors and the bedplate rollout mechanism, or (c) an operator-induced actuation of these doors and of the rollout mechanism. Each of these causes is investigated in the following paragraphs.

The consequences of a transporter derailment are examined in Section 6.3.6.1.3. In that section, it is indicated that the transporter includes design features specifically aimed at mitigating the effect of the derailment by keeping the WP inside the shielded compartment. Thus, no breach of the transported WP is anticipated.

The approach chosen to address the spurious or operator-induced opening of the shielded compartment's doors and actuation of the bedplate rollout mechanism is to preclude, by design, the actual opening and actuation from occurring (Section 5.1.7.6). A scoping calculation is performed in the following to show that this is a realistic and attainable objective. This calculation explores possible design solutions to make the bedplate rollout event incredible. These design solutions, however, are given solely for illustration purposes, and should not be viewed as solutions formally accepted for the emplacement system design, which is still subject to evolution. The calculation will be updated as needed to reflect the latest design information available.

First, an estimate of the global frequency of initiation of the bedplate rollout event is calculated. The probability of the operator attempting to prematurely actuate the bedplate rollout mechanism while the transporter is still in motion is estimated at 0.01, based on Assumption 5.2.5.1.

In comparison, the probability of a spurious actuation of the door opening and bedplate rollout mechanisms is much smaller. For scoping purposes, this actuation is considered to be triggered by a process switch, for which a spurious operation rate on the order of magnitude of 10^{-6} per hour is used, based on Assumption 5.2.5.2. Because the travel time of the transporter underground is a few hours, the probability of observing a spurious signal during transportation will be in the 10^{-6} to 10^{-5} order of magnitude and therefore, much smaller than the 0.01 probability of human-induced actuation.

In addition, for this scoping calculation, it is reasonable to consider that the initiating event of the event sequence, namely an untimely bedplate rollout actuation, is independent from the response of the safety features controlling the transporter operation. This can be done for example by taking advantage of the many embedded redundancies and independent controls that safety systems typically have. Because of this independence, only the human-induced actuation of the

rollout mechanism needs further consideration in the quantification of the initiating event. This is because such a human error has a far greater probability than a spurious signal from a defective component.

With 11,184 WPs to be emplaced (Section 4.1.1), and accounting for a factor of conservatism of 1.1 (Section 6.1.4), this results in $11,184 \times 1.1 \times 0.01 = 123.02$ opportunities for operator error initiating a rollout event over the preclosure period. For the event sequence initiated by this rollout event to be categorized as Beyond Category 2, its probability must be lower than 10^{-4} over the preclosure period (Section 6.1.1). Consequently, the design features aimed at preventing the bedplate rollout must have a combined probability of failure less than $10^{-4}/123.02 = 8.1 \times 10^{-7}$.

This reliability objective is realistic and can be achieved by a variety of design features. Specifically, the safety controls may be designed such that a bedplate rollout signal is not permitted to go through if the transporter is recognized as being in motion, by a speed transducer for example. The typical failure probability for a speed transducer on the transporter is in the 10^{-5} order of magnitude (Assumption 5.2.5.3). Taking credit for multiple and diverse components used to monitor the speed of the transporter, the global probability of failure to have a "transporter is in motion" signal could be as low as the combination of independent failure probabilities, and therefore made smaller than 10^{-5} by several orders of magnitude. For example, the probability that two independent speed transducers with individual failure probability of 10^{-5} fail simultaneously is $10^{-5} \times 10^{-5} = 10^{-10}$. Of course, several other types of components intervene in the architecture of a computer-assisted control of transport operations, and therefore the definitive probability of failure to inhibit a rollout signal while the transporter is in motion cannot be evaluated at this time. However, a global failure probability meeting the 8.1×10^{-7} threshold mentioned previously appears to be achievable.

In conclusion, the event analyzed in the present section will not initiate a Category 1 or Category 2 event sequence.

6.3.6.1.13 WP and pallet drop from a WP emplacement gantry

In this section, emphasis is put on the scenario where the drop occurs in the emplacement drift. In addition to that scenario, Sections 6.3.6.1.16 and 6.3.6.1.17 analyze the particular cases where the drops occur at the extremities of the emplacement drifts.

The drop of a WP from the emplacement gantry is analyzed in a generalized event tree, shown in Section 6.3.1.24. It is determined that the corresponding event sequence can be categorized as Beyond Category 2.

6.3.6.1.14 Derailment of a WP emplacement gantry holding a WP on a pallet, followed by a load drop (drop of the WP and pallet)

In this section, emphasis is put on the scenario where the drop occurs in the emplacement drift. In addition to that scenario, Sections 6.3.6.1.16 and 6.3.6.1.17 analyze the particular cases where the drops occur at the extremities of the emplacement drifts.

The probability of a gantry derailment resulting in a drop of a WP is embedded in the failure rate of 10^{-5} drop/transfer considered in Assumption 5.1.8.1. Thus, the drop of a WP from the emplacement gantry due to gantry derailment is included as a subset of WP drops analyzed in Section 6.3.6.1.13. It is shown in that section that the corresponding event sequence is Beyond Category 2.

6.3.6.1.15 WP emplacement gantry carrying a WP collides with another WP in the drift

The gantry carrying a WP to its position in the emplacement drift could overshoot the mark and collide with a WP that is already in place. This scenario is analyzed in a generalized event tree, shown in Section 6.3.1.23. It is determined that the corresponding event sequence can be categorized as Beyond Category 2.

6.3.6.1.16 WP emplacement gantry carrying a WP travels to the end of the drift and drops off the end of the rails, falling to the ground below

Conceivably, due for example to a human error, a failure of the data communication system, or a failure of the gantry control system, the emplacement gantry carrying the first WP to be emplaced in a drift could fail to stop at the appropriate emplacement location, travel to the end of the drift, drop off the end of the rails and fall to the drift floor. This scenario does not apply to the WPs subsequent to a first emplacement in the drift since the gantry would collide first with the already emplaced WP. This latter scenario was analyzed in Section 6.3.6.1.15 and shown not to cause a WP breach.

It is assumed that design requirements will prevent this scenario from unfolding (Assumption 5.1.8.3). This can be done by installing rail stops at the end of the drift. These stops would block the way for the gantry and prevent it from progressing further into the drift, and therefore forestall a gantry drop off the rails. This would prevent Category 1 or Category 2 event sequences.

Alternatively, it is shown in the following that the potential event sequence could be rendered Beyond Category 2 by taking credit for the fault-detection features of the emplacement gantry. It is expected that the emplacement equipment will be capable of detecting several kinds of failures, such as data communication, drive, and control system failures, and that upon detection of a failure, the gantry will autonomously suspend its operation. Section 4.3.3 indicates that the emplacement equipment has the capability to identify the drift and location within the drift where the WP will be emplaced, and also that the emplacement equipment has the capability to determine its location and distance traveled within the emplacement drift. These features could be used by a protection signal to prevent the gantry from going too far in the drift.

The reliability threshold required for such a protection signal is now evaluated.

Of the causes that could propel the gantry too far in an emplacement drift, only the human error is considered further, for the same reasons as those presented in Section 6.3.6.1.12 for a comparable situation (namely an untimely bedplate rollout event). The probability of human failure is assumed to be 0.01 (Assumption 5.2.6.2).

Based on Section 4.1.7, there are 96 emplacement drifts in the repository. This number is conservatively rounded up to 150 for this scoping calculation. Therefore, the average number of times that the operator may inadvertently order the gantry too far in the drift when emplacing the first WP is $150 \times 0.01 = 1.5$. For the corresponding event sequence to be categorized as Beyond Category 2, its probability must be lower than 10^{-4} over the preclosure period (Section 6.1.1). This can be achieved by using a protection signal with a probability of failure less than $10^{-4}/1.5 = 6.7 \times 10^{-5}$. This reliability objective is attainable, based on the results of Section 6.3.6.1.12. In that section, it was shown that a more stringent reliability objective for a comparable design feature aimed at preventing a premature transporter bedplate rollout was attainable. A means to achieve the reliability objective is to use independent and diversified instrumentation and control.

In conclusion, the event analyzed in the present section will not initiate a Category 1 or Category 2 event sequence.

6.3.6.1.17 WP emplacement gantry holding a WP on a pallet rolls off the emplacement drift transfer dock and either falls onto the drift rails (or surrounding ground) or impacts the WP transporter (if the transporter has not been moved)

The generalized event tree of Section 6.3.1.24 is well adapted to describe drop scenarios that occur in the emplacement drift itself, because the WP drop height is only controlled by the lift height of the emplacement gantry. In contrast, when the gantry carrying the WP is located on the emplacement drift transfer dock, the WP drop height varies, depending on whether the transporter with its bedplate rolled out is present or not. If the transporter is present with its bedplate rolled out, the situation is comparable to when the gantry is in the emplacement drift. If the bedplate has been retracted or if the transporter has left the dock, the drop height of the WP will be higher than in the emplacement drift. The drop height of the WP may be reduced by having an emplacement drift transfer dock with raised floor. However, this may not be sufficient to meet the allowable WP drop heights outlined in Section 5.1.3.8. In the following, it is shown that it is possible to maintain the WP drop height within its design limits by use of protection features that meet the requirements outlined in Assumptions 5.1.8.1, 5.1.8.3, and 5.1.8.10. Two scenarios that result in a WP drop on the drift rails (or surrounding ground) are analyzed.

The first conceivable scenario involves the emplacement gantry dropping the WP after a premature retraction of the bedplate or a premature departure of the transporter (that is before the gantry has reached the emplacement drift transfer dock).

A possible cause for a premature bedplate retraction or transporter departure is an operator failure to observe the procedure that governs transport operations. A probability of 0.01 is associated with that failure, based on Assumption 5.2.5.1. A spurious operation of the control system is also conceivable, but for the same reasons as those presented in Section 6.3.6.1.12, the corresponding frequency of occurrence will be much smaller than the frequency of occurrence of an operator error, which is therefore the only event considered further.

With 11,184 WPs to be emplaced (Section 4.1.1), and accounting for a factor of conservatism of 1.1 (Section 6.1.4), the number of transfers during which a premature bedplate retraction or

transporter departure could happen from operator error is therefore, over the preclosure period: $11,184 \times 1.1 \times 10^{-2} = 123.02$.

This number is for 'normal' operating conditions. Another possible scenario would be an abnormal situation, where, for example, the emplacement gantry carrying the WP is immobilized over the transporter, due to a malfunction or a derailment. In that situation, it is conceivable that the transporter would have to be removed in order for some repair equipment to be dispatched to the emplacement drift. However, that would be done only after ensuring that the WP could not fall from the gantry, or, alternatively, after implementing safety measures aimed at ensuring that a drop of the WP could not cause its breach. Thus, these abnormal operating conditions can be eliminated from consideration.

Based on Assumption 5.1.8.1, the failure rate of the emplacement gantry is 10^{-5} per transfer. The probability of a WP drop on the transporter railway is therefore, over the preclosure period: $123.02 \times 10^{-5} = 1.2 \times 10^{-3}$. This is above the Category 2 threshold of 10^{-4} .

Therefore, if a protection signal, such as an interlock, was used to prevent a premature bedplate retraction or transporter departure, and consequently make the drop event Beyond Category 2, its failure probability would have to be lower than $10^{-4}/1.2 \times 10^{-3} = 8.3 \times 10^{-2}$, which is achievable, based on the results of Section 6.3.6.1.12. In that section, it was shown that a much more stringent reliability objective for a comparable interlock, aimed at preventing a premature transporter bedplate rollout, was attainable.

The use of a protection signal for precluding a premature bedplate retraction or transporter departure is a possible way to realize the requirements of Assumptions 5.1.8.1 and 5.1.8.10. The requirement of Assumption 5.1.8.1 is that the drop rate of the gantry be less than or equal to 10^{-5} drops per transfer. The requirement of Assumption 5.1.8.10 is that the conditional probability of having exceeded the WP lift height limit given that a drop has occurred be 10^{-4} or less. In the present scenario, the WP drop and having exceeded the lift height limits are two independent events. Therefore, the requirement of Assumption 5.1.8.10 can be restated as: ensuring (with a probability of failure equal to or less than 10^{-4}) that the gantry will not be put in a situation where the WP drop height would exceed its allowable limit. This failure probability associated with that requirement is stringent enough to meet the 8.3×10^{-2} probability with a comfortable margin.

Another conceivable scenario that may result in a WP with emplacement pallet drop on the drift rails (or surrounding ground) assumes that the transporter has left the emplacement drift transfer dock and that the gantry is on its way to emplace the WP. Because of a spurious signal, or alternatively an operator inadvertently selecting a wrong control from a control panel, the gantry is ordered back to the emplacement drift transfer dock. If no credit is taken for the control features of the emplacement system, this could lead to a situation where the gantry travels onto the emplacement drift transfer dock. Should this abnormal situation be accompanied with a derailment, a WP drop on the drift rails (or surrounding ground) may occur. Even if no derailment occurs, the gantry could travel to the end of the transfer dock rails and roll off.

Based on Assumption 5.1.8.3, the scenario where the emplacement gantry rolls off the emplacement drift transfer dock rails can be precluded. This can be done by installing rail stops

at the end of the dock rails. More generally, the premature return of the gantry to the emplacement drift transfer docks could be precluded by taking credit for the fault-detection features of the emplacement gantry. It is expected that the emplacement equipment will be capable of detecting several kinds of failures that could affect the emplacement gantry, such as data communication or control system failures. Section 4.3.3 also indicates that the emplacement equipment is capable of determining its location and distance traveled within the emplacement drift. This feature could be used by a protection signal, such as an interlock for example, to prevent the gantry, carrying the WP and coming from the emplacement drift, from entering the emplacement drift transfer dock if the transporter is not present. The reliability threshold required from such a protection signal is now calculated.

Of the causes that could initiate a return of the gantry carrying the WP to the emplacement drift transfer dock, only the human error, having a probability of 0.01 based on Section 5.2.6.1, is considered further. A premature return due to a spurious operation of the control system is also conceivable, but for the same reasons as those presented in Section 6.3.6.1.12, the corresponding frequency of occurrence will be much smaller than the frequency of occurrence of an operator-induced return.

With 11,184 WPs to be emplaced (Section 4.1.1), and accounting for a factor of conservatism of 1.1 (Section 6.1.4), there are $11,184 \times 1.1 \times 0.01 = 123.02$ transfers for which the operator may inadvertently order the gantry back to the emplacement drift transfer dock. For the corresponding event sequence to be categorized as Beyond Category 2, its probability must be lower than 10^{-4} over the preclosure period (Section 6.1.1). This can be achieved by using an interlock with a failure rate less than $10^{-4}/123.02 = 8.1 \times 10^{-7}$ per transfer. This is a reliability objective which is achievable, based on the results of Section 6.3.5.6.1.12. In this section, it was shown that the same reliability objective for a comparable interlock, aimed at preventing a premature transporter bedplate rollout, was attainable. A means to achieve the reliability objective is to use independent and diversified instrumentation and control.

The use of a protection signal for precluding a premature return of the gantry to the emplacement drift transfer dock is a possible way to realize the requirements of Assumptions 5.1.8.1 and 5.1.8.10. The requirement of Assumption 5.1.8.1 is that the drop rate of the gantry be less than or equal to 10^{-5} drops per transfer. The requirement of Assumption 5.1.8.10 is that the conditional probability of having exceeded the WP lift height limit given that a drop has occurred be 10^{-4} or less. When combined together, these two requirements are equivalent to making the rate of a WP drop from above the allowable heights less than or equal to 10^{-9} per transfer. This failure rate is stringent enough to meet the failure rate of 8.1×10^{-7} calculated above with a comfortable margin.

The investigation performed above shows that achievable design solutions can be implemented to prevent a WP drop from the gantry from exceeding the drop height limits outlined in Assumption 5.1.3.8.

As a consequence, the event analyzed in the present section will not initiate a Category 1 or Category 2 event sequence.

6.3.6.1.18 Empty WP emplacement gantry rolls off the emplacement transfer dock and falls onto the WP transporter, impacting the WP on the pallet on the extended bedplate

Once the WP transporter has docked the emplacement drift transfer dock and the bedplate has been rolled out, the gantry proceeds to the dock. The gantry has lift hooks that engage below the overhangs of the pallet and off-load it from the transporter bedplate. Should the gantry derail from the dock during this operation, it could fall onto the bedplate and impact the WP.

Based on Assumption 5.1.8.6, a design requirement ensures that this scenario will not jeopardize the structural integrity of the WP. Therefore, this event will not initiate a Category 1 or Category 2 event sequence.

6.3.6.1.19 Collision of a WP emplacement gantry holding a WP on a pallet with a fallen rock, fallen ground support, or other object, followed by a load drop (drop of the WP and pallet)

A collision of the gantry with an object in the emplacement drift could also impact the WP carried by the gantry. Of the objects voluminous enough to impact the WP, another WP or a fallen rock are the most likely candidates. A collision with another WP has been analyzed in Section 6.3.6.1.15, and shown not to cause a WP breach, mainly because of the low speed of the gantry. For the same reason, a collision with a fallen rock will not breach the WP.

The collision of the gantry could also cause its derailment and subsequent WP with emplacement pallet drop. Such a drop was analyzed in Section 6.3.6.1.13 and shown not to cause the breach of the WP.

Therefore, the event analyzed in the present section will not initiate a Category 1 or Category 2 event sequence.

6.3.6.1.20 Rockfall onto a WP

To determine if the rockfalls that could occur in the emplacement drifts during the preclosure period have the potential to jeopardize the integrity of the WPs, the characteristics of the credible bounding rockfalls have been evaluated in *Bounding Characteristics of Credible Rockfalls of Preclosure Period* (BSC 2004 [DIRS 168508], Section 7).

The approach chosen is similar to what was done for characterizing the rockfalls in the non-emplacement drifts (Section 6.3.6.1.9). For example, no credit is taken for the ground support (BSC 2004 [DIRS 168508], Section 6.1), which is conservative because ground support helps prevent rockfalls. Also, the credible bounding rockfalls are evaluated for the most severe seismic event of the preclosure period, which has a mean annual probability of exceedance equal to 10^{-4} (BSC 2004 [DIRS 168508], Sections 1 and 6.1). The size and layout of the modeled emplacement drifts conform to what is currently considered for the repository.

One major difference between the approaches for addressing rockfalls in the non-emplacement drifts and rockfalls in the emplacement drifts is that the emplacement drift rockfalls evaluated are based on the results of simulations providing for a dynamic modeling of the key blocks (BSC

2004 [DIRS 168508], Section 4.1.2.1). Thus, these rockfalls can be characterized not only by their mass, as was the case for the non-emplacement drift rockfalls, but also by their velocity and more importantly their kinetic energy, which is the driving quantity in determining whether a WP will breach due to the rockfall impact. Another major difference is that a distinction is made between single rockfalls and multiple rockfalls. Single rockfalls designate those rockfalls that fall sufficiently apart from each other for their effects on the impacted WP to be independent from one another. Multiple rockfalls designate those rockfalls that fall sufficiently close to each other for their effects on the WP to combine together (BSC 2004 [DIRS 168508], Section 1).

For single rockfalls, a conservative total kinetic energy of 1.2×10^5 joules is found (BSC 2004 [DIRS 168508], Section 7).

For multiple rockfalls, the most energetic configurations are found to be those that involve two rockfalls (BSC 2004 [DIRS 168508], Section 6.2.4.2). The credible bounding two-rockfall configuration has a total kinetic energy of 1.0×10^5 joules (BSC 2004 [DIRS 168508], Section 7).

Based on these results, a calculation was performed to determine whether credible bounding rockfalls impacting a WP could jeopardize its integrity. The results, reported in BSC (2004 [DIRS 167182]), Section 6), show that no WP failure is expected.

Another potential scenario involving a rockfall on a WP is now investigated. The rockfall is assumed to occur while the transporter carrying the WP is docked at the entrance of the emplacement drift, with the bedplate rolled out. This scenario needs to be investigated because the potential drop height of the rockfalls is higher in the emplacement drift turnouts (whose height is 7 m, see Section 4.1.6) than in the emplacement drifts (whose height is 5.5 m, see Section 4.1.6). The work performed in Attachment II shows that the rockfalls resulting from that scenario will not be more severe than the bounding credible rockfalls pertaining to the emplacement drifts, as long as the average exposure time of a WP transiting from the rolled out bedplate to the entrance of the emplacement drift does not exceed 4 hours. It is assumed that an operating requirement will ensure that this exposure time is not exceeded (Assumption 5.1.8.2). Therefore, this rockfall scenario will not cause a WP breach.

In conclusion, the rockfall scenarios analyzed in the present section will not initiate a Category 1 or Category 2 event sequence.

6.3.6.1.21 Rockfall onto a WP emplacement gantry holding a WP on a pallet

The consequences of a rockfall onto a loaded emplacement gantry are bounded by those of a rockfall onto a WP. The reason for this is that the sturdy structure of the gantry protects the WP from a direct hit by the rockfall. The consequences of a rockfall onto the WP are analyzed in Section 6.3.6.1.20, and shown not to cause the breach of the WP. Therefore, the event considered in this section will not initiate a Category 1 or Category 2 event sequence.

6.3.6.1.22 Ground support drop onto a WP

In the emplacement drifts, the recommended ground support consists of 3 m long Super Swellex rock bolts, spaced at 1.25 m, and Bernold-type perforated sheets, made of stainless steel and

installed in a 240° arc around the drift periphery (Section 4.1.3). Because the ground support is affixed to the rock, its drop onto a WP most likely would not occur without rock blocks attached to it, except in the case of an improper installation. The ground support drop scenario that would have the most serious consequences for the WP is that of a severe seismic event, causing a rockfall with elements of ground support attached to the rock blocks. This scenario, however, is not significantly more severe than a rockfall in which the ground support is neglected. This is because the steel sheets are only 3 mm thick, and the rock bolts are made of circular steel tube with a diameter of around 5 cm and a thickness of 3 mm (Section 4.1.3). Therefore, the ground support contributes only marginally to the mass of the credible bounding rock blocks that could fall in the emplacement drifts. Thus, the drop of failed ground support components is not expected to result in more severe consequences for the WP than the rockfalls resulting from seismic events considered in the preclosure period. It was shown in Section 6.3.6.1.20 that these credible bounding rockfalls would not cause the failure of the WP. Consequently, the event analyzed in the present section will not initiate a Category 1 or Category 2 event sequence.

6.3.6.1.23 Ground support drop onto a WP emplacement gantry holding a WP on a pallet

The consequences of a ground support drop onto a loaded emplacement gantry are bounded by those of a ground support drop onto a WP. The reason for this is that the sturdy structure of the gantry protects the WP from a direct hit by the ground support. The consequences of a ground support drop onto the WP are analyzed in Section 6.3.6.1.22, and are shown not to cause the breach of the WP. Therefore, the event considered in this section will not initiate a Category 1 or Category 2 event sequence.

6.3.6.1.24 Runaway WP transporter in an access main and a collision with the barrier isolating the development side of the repository from the emplacement side of the repository

Runaway events have been analyzed in Section 6.3.6.1.4, independently of their location of occurrence. In that section, it was shown that design features can render the initiation of a runaway event Beyond Category 2.

Therefore, the event considered in this section will not initiate a Category 1 or Category 2 event sequence.

6.3.6.2 Chemical Contamination/Flooding

6.3.6.2.1 Flooding from a water pipe break originating on the development side of the repository

Flooding of an emplacement drift is not expected to occur after the WPs are emplaced. Flooding is considered as a potential event in the drifts that are being excavated, and other subsurface areas of the repository, mainly because final decisions on the equipment, methods, and procedures to be used during the excavation phase have not been made. As a consequence, it is too early to preclude the use of water pipes for fire mitigation in some subsurface areas of the repository.

As a cautionary remark, it should be noted that the word "flooding" is employed for consistency with *Internal Hazards Analysis for License Application* (BSC 2005 [DIRS 171428], Section 6.6.5). It suggests that the amount of water that could be used during the excavation phase could be high enough to cause flooding. In reality, the amounts of water used would be small, and a water pipe break could not lead to a flood in the subsurface facilities.

No water pipes will be present in the drifts ready to receive WPs. Also, the underground layout of the repository is designed to ensure that water drainage is not towards the emplacement drifts (BSC 2003 [DIRS 165572], Section 7.2.5). Consequently, even if a water pipe break were to occur in the subsurface areas, the water drainage would lead away from the emplacement drifts. Thus, flooding will not initiate a Category 1 or Category 2 event sequence.

6.3.6.2.2 Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures or during off-normal condition (e.g., during a failure of the emplacement ventilation system)

Oxidation of the waste form in subsurface during the preclosure period is Beyond Category 2 because WPs are inerted and sealed before their transfer to the subsurface facility and because breach of the WP during the transfer and emplacement operations is Beyond Category 2 (Section 6.3.6).

6.3.6.3 Explosion/Implosion

6.3.6.3.1 Hydrogen explosion involving batteries on the transport locomotive

The waste is protected by casks or WPs while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to initiate an event sequence (Assumption 5.1.1.51).

6.3.6.3.2 Hydrogen explosion involving batteries on the WP emplacement gantry

The waste is protected by casks or WPs while in the presence of batteries for heavy equipment. The magnitude of a potential hydrogen explosion involving batteries for heavy equipment will be insufficient to initiate an event sequence (Assumption 5.1.1.51).

6.3.6.4 Fire, Thermal

6.3.6.4.1 Electrical fire associated with the transport locomotive

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.6.4.2 Fire/explosion (battery/electrical fire) associated with the transport locomotive

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9)

6.3.6.4.3 Fire/explosion (battery/electrical fire) associated with the WP emplacement gantry

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9)

6.3.6.4.4 Electrical fire associated with equipment on the WP transporter, including motors to extend the WP transporter bedplate

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.6.4.5 Electrical fire associated with the WP emplacement gantry or other subsurface equipment

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.6.4.6 WP overheating in the WP transporter due to solar insolation while stalled or stopped outdoors during transit from a surface facility to the Subsurface Facility

Preliminary results of a calculation evaluating the maximum temperature reached by the WP show that the WP surface would not reach 200°C (BSC 2004 [DIRS 171457], Table 3]. Results of structural calculations, reported in BSC (2004 [DIRS 169766], Section 7.1.1.2.5) show that at a temperature of 400°F (204°C), the waste package resting on an emplacement pallet maintains its structural integrity. As a consequence, the WP will not lose its structural integrity and this event will not initiate a Category 1 or Category 2 event sequence.

6.3.6.4.7 Extended loss of the subsurface ventilation system

This event has been analyzed in Section 6.2.4.7.1.7 and shown not to lead to a Category 1 or Category 2 event sequence.

6.3.6.5 Radiation

6.3.6.5.1 Radiation exposure of facility worker and/or the offsite public

Exposure of workers and/or public to radiation is a hazard for the potential event sequences considered in the present analysis. The consequence analysis will evaluate this hazard for event sequences and normal operations, as applicable.

6.3.6.5.2 Early WP failure while in the subsurface during the preclosure period and a resultant release of radioactive material

Manufacturing defects that could affect a WP and potentially lead to its early failure have been considered (BSC 2004 [DIRS 170024]). An early failure is defined as a through-wall penetration occurring at a time earlier than would be predicted by mechanistic degradation

models for a defect-free WP (BSC 2004 [DIRS 170024], Section 1). The report cited identifies two major types of defects. The first type is the presence of weld flaws in the closure welds. The second type involves several fabrication defects, among which the improper heat treatment of the outer barrier is the dominant one in terms of probability of occurrence (BSC 2004 [DIRS 170024], Section 7). The report concludes that despite their low probability of occurrence, these two types of defects could jeopardize the long-term integrity of the outer barrier of the WP. However, the report also indicates that a defective WP failure occurs only after degradation mechanisms take place, which may happen hundreds of years after emplacement in the repository (BSC 2004 [DIRS 170024], Section 7). Thus, it is anticipated that no significant degradation of a defective WP will take place during the 100-year preclosure period.

In conclusion, the event analyzed in the present section will not initiate a Category 1 or Category 2 event sequence.

6.3.6.5.3 Release of activated air and dust to the environment

This event is part of normal operations. Resulting exposure of workers to radiation will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. See Section 7.4 for a list of potential events and conditions that are treated as normal operations.

6.3.6.5.4 Inadvertent opening of the WP transporter shielded enclosure doors, leading to a worker exposure

This potential event could expose workers to radiation, but would not expose the public. The frequency of inadvertent actions that expose workers to radiation will be limited by design features and operating procedures that ensure that such events are not Category 1 (Assumption 5.1.1.57).

6.3.6.5.5 Radiation-induced damage to a facility SSC

Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization as explained in Section 6.3.2.5.2.

6.3.6.5.6 Inadvertent opening of the emplacement access doors, leading to a worker exposure

This potential event could expose workers to radiation, but would not expose the public. The frequency of inadvertent actions that expose workers (but not the public) to radiation will be limited by design features and operating procedures that ensure that such events are not Category 1 (Assumption 5.1.1.57).

6.3.6.6 Fissile

6.3.6.6.1 Criticality associated with a drop or collision of a WP and a rearrangement of the container internals

WPs and the facilities for handling them are designed such that drops, collisions, and other handling impacts that may affect the containers cannot lead to a nuclear criticality (Assumption 5.1.3.1). Also, once the WPs are emplaced in the repository, they are not expected to breach during the preclosure period (see Section 6.3.6). This precludes criticality events prompted by the possible presence of water.

6.3.7 Surface Facilities: SNF Aging System

All of the internal events for the SNF Aging System are Beyond Category 2 (Section 4.1.11).

6.3.8 Subsurface Facilities: Construction Hazards

A description of the operations in this area and a listing of the hazards and potential events is provided in *Internal Hazards Analysis for License Application* (BSC 2005 [DIRS 171428], Section 6.6.7).

6.3.8.1 Fire, Thermal

6.3.8.1.1 Diesel fire/explosion associated with subsurface development equipment resulting in damage to the subsurface isolation barriers

Construction activities are sufficiently isolated from emplacement activities that a diesel fire or explosion associated with development equipment will not initiate an event sequence (Assumption 5.1.10.1).

6.3.8.1.2 Electrical fire associated with subsurface development equipment or other equipment resulting in damage to the subsurface isolation barriers

Construction activities are sufficiently isolated from emplacement activities that an electrical fire associated with development equipment will not initiate an event sequence (Assumption 5.1.10.1).

6.3.8.1.3 Transient combustible fire in the development side of the subsurface facilities resulting in damage to the subsurface isolation barriers

Construction activities are sufficiently isolated from emplacement activities that a fire associated with transient combustibles on the development side will not initiate an event sequence (Assumption 5.1.10.1).

6.3.8.2 Flooding

6.3.8.2.1 Flooding from a pipe break originating on the development side of the repository

Construction activities are sufficiently isolated from emplacement activities that flooding from a pipe break on the development side will not initiate an event sequence (Assumption 5.1.10.1). See Section 6.3.6.2 for further discussion.

6.3.9 Surface Facilities: Construction Hazards

Construction of surface facilities will be done in stages so that transfer and emplacement operations can begin before construction of surface facilities is complete. Therefore, separation must be maintained between waste transfer and emplacement activities and activities that support surface construction or subsurface excavation. The erection of temporary physical barriers to separate construction activities from the rest of the site activities is an effective and common method of reducing, if not eliminating, interactions. In addition, administrative controls provide a means of preventing interactions. A further description of the operations in this area and a listing of the hazards and potential events is provided in *Internal Hazards Analysis for License Application* (BSC 2005 [DIRS 171428], Section 6.6.8).

6.3.9.1 Collision/Crushing

6.3.9.1.1 Impacts on a loaded transportation cask, a loaded MSC, or a loaded WP as a result of construction operations

Impacts on a loaded transportation cask, a loaded MSC, a loaded shuttle cask, or a loaded WP will be minimized by isolation of construction activities from emplacement activities (Assumption 5.1.10.1).

6.3.9.2 Fire, Thermal

6.3.9.2.1 Diesel fire/explosion associated with construction equipment

Operating requirements will ensure that construction operations are sufficiently isolated from surface and subsurface repository operations to preclude proximity interactions with waste receipt, handling, emplacement, or retrieval operations (Assumption 5.1.10.1).

6.3.9.2.2 Electrical fire associated with construction equipment or other equipment

Construction activities are sufficiently isolated from emplacement activities that an electrical fire associated with development equipment will not initiate an event sequence (Assumption 5.1.10.1). This event would be a Beyond Category 2 event.

6.3.9.2.3 Transient combustible fire

Construction activities are sufficiently isolated from emplacement activities that a transient combustible fire associated with construction activities will not initiate an event sequence (Assumption 5.1.10.1). This event would be a Beyond Category 2 event.

6.3.9.3 Radiation

6.3.9.3.1 Radiation exposure of a facility worker and/or the offsite public

Exposure of workers or the offsite public to radiation is a hazard for the potential event sequences considered in the present analysis. The consequence analysis will evaluate this hazard for event sequences and normal operations, as applicable.

6.3.9.4 Fissile

6.3.9.4.1 Criticality associated with an impact on a loaded transportation cask, a loaded MSC, or a loaded WP and a rearrangement of the container internals

A design requirement will ensure that WPs are designed such that drops, collisions, and other handling impacts within their design bases (allowing for rearrangement of container internals, proximity of other sealed waste packages, and without credit for burnup) cannot lead to a nuclear criticality (Assumption 5.1.3.1). Design requirements and waste acceptance criteria will ensure that transportation casks and MSCs remain subcritical even with reconfiguration of the fissile material due to a drop and optimal moderation (Assumption 5.1.1.4).

6.3.10 Subsurface Facility: Drip Shield Installation

A description of the associated operations and a listing of the hazards and potential events is provided in *Internal Hazards Analysis for License Application* (BSC 2005 [DIRS 171428], Section 6.6.9).

6.3.10.1 Collision/Crushing

6.3.10.1.1 Derailment of a drip shield emplacement gantry carrying a drip shield, followed by a load drop (drop of the drip shield); the drip shield and/or the gantry impacts a WP or several WPs

The drip shield and its emplacement gantry are designed to straddle the waste package during installation (Section 4.1.16). Therefore, if a derailment were to occur and the drip shield were to be dropped, the impact would mainly be between the drip shield and the ground. A contact between the drip shield (or the gantry) and the waste package, if any, would occur laterally and could only transfer a small fraction of the impact energy to the waste package. This energy would be dissipated through friction and would not be sufficient to cause a waste package breach. Thus, this event will not initiate an event sequence.

6.3.10.1.2 Drip shield emplacement gantry carrying a drip shield collides with a WP or WPs due to gantry failure

This event would lead to the same consequences as that of Section 6.3.10.1.1 and therefore would not initiate an event sequence.

6.3.10.1.3 Collision of a drip shield emplacement gantry holding a drip shield with a fallen rock, fallen ground support, or other object, followed by a load drop (drop of the drip shield) onto a WP or WPs

This event would lead to the same consequences as that of Section 6.3.10.1.1 and therefore would not initiate an event sequence.

6.3.10.1.4 Rockfall onto a drip shield emplacement gantry carrying a drip shield, leading to gantry damage or failure and impact of the rock or drip shield with a WP

Rockfall onto a WP is discussed in Section 6.3.6.1.20. For this potential event, the drip shield emplacement gantry protects the WP from rockfall by absorbing much of the impact energy.

6.3.10.1.5 Rockfall onto a WP

Rockfall onto a WP is discussed in Section 6.3.6.1.20.

6.3.10.1.6 Ground support drop onto a WP

Drop of ground support onto a WP is discussed in Section 6.3.6.1.22.

6.3.10.1.7 Ground support drop onto a drip shield emplacement gantry carrying a drip shield, leading to gantry damage or failure and impact of the ground support or drip shield with a WP

Drop of ground support onto a WP is discussed in Section 6.3.6.1.22. For this potential event, the drip shield emplacement gantry protects the WP from dropped ground support components by absorbing much of the impact energy.

6.3.10.2 Chemical Contamination/Flooding

6.3.10.2.1 Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures or during off-normal conditions (e.g., during a failure of the emplacement ventilation subsystem)

There are no Category 1 or Category 2 event sequences underground. Therefore, SNF will not be exposed to air and SNF oxidation will not occur.

6.3.10.3 Fire, Thermal

6.3.10.3.1 Electrical fire associated with the drip shield emplacement gantry or other subsurface equipment

A separate analysis identifies design and operational requirements to ensure that event sequences potentially initiated by fire are Beyond Category 2 (Section 4.1.9).

6.3.10.3.2 Loss of the subsurface ventilation system

This event has been analyzed in Section 6.2.4.7.1.7 and shown not to lead to a Category 1 or Category 2 event sequence.

6.3.10.4 Radiation

6.3.10.4.1 Early WP failure while in the subsurface during the preclosure period and a resultant release of radioactive material

Early failure of the WP is discussed in Section 6.3.6.5.2.

6.3.10.4.2 Release of activated air and dust to the environment

Activated air and dust will be released continuously into the environment by the subsurface ventilation system. Therefore, this event is a part of normal operations (see Section 7.4).

6.3.10.5 Fissile

6.3.10.5.1 Criticality associated with an impact or collision with a WP and a rearrangement of the container internals

A design requirement will ensure that WPs are designed such that drops, collisions, and other handling impacts within their design bases (allowing for rearrangement of container internals and without credit for burnup) cannot lead to a nuclear criticality (Assumption 5.1.3.1). The requirement is achievable because moderator is excluded by maintaining the integrity of the WP.

6.3.11 Subsurface Facility: Retrieval

A description of the operations associated with retrieval of a limited number of WPs is provided in *Internal Hazards Analysis for License Application* (BSC 2005 [DIRS 171428], Section 6.6.10). Permanent retrieval is beyond the scope of the present analysis, as stated in Section 1. The applicability of generic events and the potential events associated with retrieval operations for a limited number of WPs are the same as those for the emplacement operations because one process is the reverse of the other. The generic events associated with WP subsurface transport and emplacement are described in Section 6.3.6. If additional surface facilities are required for retrieval activities, the hazards associated with these facilities will be examined in a future hazards analysis.

6.3.12 Surface Facilities: Site-Generated Radiological Waste Disposal

A description of the associated operations and a listing of the hazards and potential events is provided in *Internal Hazards Analysis for License Application* (BSC 2005 [DIRS 171428], Section 6.6.11).

6.3.12.1 Collision/Crushing

6.3.12.1.1 Drop of a heavy load onto a tank, piping, or a container containing liquid or solid radioactive waste

Minor radioactive releases are expected as a part of normal operations. Resulting exposure of workers to radiation will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. See Section 7.4 for a list of potential events and conditions that are treated as normal operations. Resulting exposure of the public at the site boundary will be insignificant.

6.3.12.1.2 Drop of a container or drum containing solid low-level radioactive waste (LLW)

Minor radioactive releases are expected as a part of normal operations. Resulting exposure of workers to radiation will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. See Section 7.4 for a list of potential events and conditions that are treated as normal operations. Resulting exposure of the public at the site boundary will be insignificant.

6.3.12.2 Chemical Contamination/Flooding

6.3.12.2.1 Drop of a container or drum containing liquid LLW

Minor radioactive releases are expected as a part of normal operations. Resulting exposure of workers to radiation will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. See Section 7.4 for a list of potential events and conditions that are treated as normal operations. Resulting exposure of the public at the site boundary will be insignificant.

6.3.12.2.2 Release of radioactive gas from the gas filtration systems or cavity gas sampling systems, WP evacuating and inerting systems, cask evacuating and inerting systems, or the system involved with the cooling of casks prior to immersion in the DTF remediation area pool

Release of gases from these operations is to be expected as a part of normal operations. Resulting exposure of workers to radiation will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. See Section 7.4 for a list of potential events and conditions that are treated as normal operations. Resulting exposure of the public at the site boundary will be insignificant.

6.3.12.3 Fire

6.3.12.3.1 Transient combustible fire in areas where dry, flammable low-level radioactive waste is stored

Operating requirements will provide a control program limiting the presence of combustible and flammable materials in areas where dry, flammable low level radioactive waste is stored. These requirements will ensure that a fire that does occur in these areas will not be of significant intensity, duration, or magnitude to initiate an event sequence (Assumption 5.1.1.6). Such a program will limit a fire sequence to Beyond Category 2.

6.3.12.4 Radiation

6.3.12.4.1 Radiation exposure of a facility worker

Exposure of workers or the offsite public to radiation is a hazard for the potential event sequences considered in the present analysis. The consequence analysis will evaluate this hazard for event sequences and normal operations, as applicable.

7 RESULTS

The present analysis is based on the design of repository facilities described in *Internal Hazards Analysis for License Application* (BSC 2005 [DIRS 171428]). See Attachment III for a tabular compilation of results.

7.1 EXTERNAL EVENT SEQUENCES

A Category 2 seismic event sequence is identified in Section 6.2.6. To avoid including releases from HLW canisters in the Category 2 seismic event sequence, the HLW canisters are hereby upgraded to DBGM-2. The bounding material at risk for the Category 2 seismic event sequence is

- Sixteen BWR or nine PWR assemblies breached underwater in the remediation pool
- Six BWR or PWR assemblies breached in dry transfer cells in DTF and FHF
- Accumulated radioactive material in HEPA filters associated with the Surface Nuclear HVAC
- Accumulated radioactive material in exhaust ducting and dampers associated with the Surface Nuclear HVAC.

For other applicable external hazards, it has been shown in Section 6.2 that either

- External initiating-event frequencies are Beyond Category 2, or
- Features of the repository have been identified such that the external hazard will not initiate a Category 1 or Category 2 event sequence.

Thus, there are no Category 1 or Category 2 external event sequences, with the exception of the Category 2 seismic event sequence described above.

7.2 INTERNAL EVENT SEQUENCES

7.2.1 Category 1 Internal Event Sequences

The analysis in Section 6.3 identified two Category 1 internal event sequences (Section 6.3.1.3). They involve drops or collisions of bare CSNF assemblies. The numbers of assemblies affected and the annual frequencies of drops and collisions at the maximum rate of receipt for the repository are summarized in Table 51.

Table 51. Category 1 Event Sequences

Event Sequence Identifier	Description	Expected Number of Event Sequences Before Permanent Closure	Annual Event Frequency for Consequence Analysis	Bounding Material at Risk
GET-03D	Drop of a CSNF assembly in the DTF or FHF	9.7 drops	0.5 drops/y	2 PWR or 2 BWR assemblies
GET-03B	Collision involving a CSNF assembly in the DTF or FHF	9.7 collisions	0.5 collisions/y	1 PWR or 1 BWR assembly

7.2.2 Combinations of Category 1 Internal Event Sequences

Combinations of Category 1 event sequences that may occur within the same year are now investigated. This is done in view of the consequence analyses that will evaluate the radioactive releases of Category 1 event sequences.

The probability distribution on the number of collisions of CSNF assemblies that may occur within the same year can be described with a Poisson distribution having a mean equal to 0.5 collisions per year $\times$ 1 year = 0.5 collisions. This yields the following probability values (rounded to two significant figures): probability of no collision within a year: 0.61; probability of one collision within a year: 0.30; probability of two collisions within a year: 0.08.

The same values are found for the probability distribution on the number of drops of CSNF assemblies within a year, which can be described by a Poisson distribution having a mean equal to 0.5 drops.

The probability values of combinations of drop and collision events, for up to two collisions or drops occurring within a same year, are shown in Table 52. The table also presents the total numbers of events (drops and collisions occurring within the same year), along with their corresponding probabilities. The probabilities associated with three or four events within a same year are not calculated because they involve drop and collision combinations that are not shown in the table (namely the events involving at least three drops or three collisions). The probability values are presented with two significant figures.

Table 52. Collision and Drop Event Combinations and Probabilities

Number of Collisions within the Same Year	Number of Drops within the Same Year	Probability of the Combination of Collision and Drop Events	Total Number of Events (Drops plus Collisions)	Probability of the Total Number of Events	Cumulative Probability of the Total Number of Events
0	0	0.37	0	0.37	0.37
1	0	0.18	1	0.37	0.74
0	1	0.18			
1	1	0.092	2	0.18	0.92
2	0	0.046			
0	2	0.046			
2	1	0.023	3	N/A	N/A
1	2	0.023			
2	2	0.0057	4	N/A	N/A

Table 52 is used to determine the combinations of Category 1 event sequences occurring within the same year to consider for consequence analyses. It is seen that the probability of observing no more than two Category 1 event sequences (CSNF assembly collisions or drops) within the same year is 0.92. Based on this high probability value, it is reasonable to eliminate from further consideration the combinations of Category 1 event sequences that involve at least three events (collisions or drops). Thus, the combinations of Category 1 event sequences to consider for consequence analyses are:

- 1) Two drops occurring within the same year. Based on Table 51 this combination involves a total of 4 assemblies.
- 2) Two collisions occurring within the same year. Based on Table 51, this combination involves a total of 2 assemblies.
- 3) One drop and one collision within the same year. Based on Table 51, this combination involves a total of 3 assemblies.

7.2.3 Category 2 Internal Event Sequences

The Category 2 internal event sequences that were identified in Section 6.3 involve drops or collisions in the surface facilities resulting in radioactive releases from SNF, HLW, or naval SNF. A conservatively estimated number of occurrences over the life of the repository and the amount of material at risk were estimated for each of the Category 2 event sequences listed in Table 53. Some Category 2 event sequences, not listed in the table, were categorized by observing that the expected number of occurrences and the material at risk were bounded by one or more of the events listed in Table 53.

Table 53. Category 2 Internal Event Sequences

Internal Event Sequence Identifier	Description of Internal Event Sequence	Cross-Reference (Section Number)	Expected Number of Occurrences Before Permanent Closure	Bounding Material at Risk
GET-01A	Drop of a transportation or transfer cask without impact limiters in the TCRRF, DTF, CHF, or FHF	6.3.1.1	5.7E-01	74 BWR or 36 PWR assemblies, 5 HLW canisters, or 1 naval canister
GET-02B	Drop of inner lid of a transportation or transfer cask, MSC, or WP into a transportation cask, MSC, or WP in the DTF, CHF, or FHF	6.3.1.2	5.7E-01	74 BWR or 36 PWR assemblies, 5 HLW canisters, or 1 naval canister
GET-03E	Drop of a CSNF assembly during transfer in the DTF or FHF combined with HVAC failure	6.3.1.3	9.7E-02	2 BWR or 2 PWR assemblies

Table 53. Category 2 Event Sequences (Continued)

Internal Event Sequence Identifier	Description of Internal Event Sequence	Cross-Reference (Section Number)	Expected Number of Occurrences Before Permanent Closure	Bounding Material at Risk
GET-03C	Collision involving a CSNF assembly during transfer in the DTF or FHF combined with HVAC failure	6.3.1.3	9.7E-02	1 BWR or 1 PWR assembly
GET-04B	Drop or collision of handling equipment onto a CSNF assembly in the DTF or FHF	6.3.1.4	9.7E-02	1 BWR or PWR assembly
GET-05B	Drop of a canister during transfer by crane in the CHF, DTF, or FHF	6.3.1.5	5.7E-01	2 HLW, 1 naval, or 1 DPC canister
GET-06B	Drop of handling equipment onto a canister in the CHF, DTF, or FHF	6.3.1.6	5.7E-01	1 HLW, 1 naval, or 1 DPC canister
GET-07B	Drop of an unsealed WP in the DTF, CHF, or FHF	6.3.1.7	8.6E-02	44 BWR or 21 PWR assemblies, 1 naval canister, or 5 HLW canisters
GET-09C	Drop of a WP with a known closure defect in the CHF, DTF, or FHF	6.3.1.9	2.6E-02	44 BWR assemblies, 21 PWR assemblies, 1 naval canister, or 5 HLW canisters
GET-10C	Drop of a CSNF assembly during dry remediation activities in the DTF	6.3.1.10	4.9E-01	2 BWR or 2 PWR assemblies
GET-10B	Collision involving a CSNF assembly during dry remediation activities in the DTF	6.3.1.10	4.9E-01	1 BWR or 1 PWR assembly
GET-11B	Drop of a canister from a crane during WP remediation or dry remediation activities in the DTF	6.3.1.11	5.7E-02	2 HLW, 1 naval, or 1 DPC canister (74 BWR or 36 PWR assemblies)
GET-12B	Drop of CSNF assembly transfer/handling equipment onto CSNF assemblies in the DTF remediation pool	6.3.1.12	4.9E-03	1 BWR or 1 PWR assembly

Table 53. Category 2 Event Sequences (Continued)

Internal Event Sequence Identifier	Description of Internal Event Sequence	Cross-Reference (Section Number)	Expected Number of Occurrences Before Permanent Closure	Bounding Material at Risk
GET-13A	Drop of a loaded transportation cask or MSC in the DTF wet remediation area	6.3.1.13	1.1E-01	74 BWR or 36 PWR assemblies, 5 HLW canisters, or 1 naval canister
GET-15C	Drop of an empty or full canister for damaged CSNF assemblies (empty or full) onto or against a cask or basket in the DTF remediation pool	6.3.1.15	4.9E-02	2 BWR or 2 PWR assemblies
GET-15B	Collision of an empty or full canister for damaged CSNF assemblies (empty or full) onto or against a cask or basket in the DTF remediation pool	6.3.1.15	4.9E-02	1 BWR or 1 PWR assemblies
GET-16C	Drop of a CSNF assembly in the DTF remediation pool	6.3.1.16	4.9E-01	2 BWR or 2 PWR assemblies
GET-16B	Collision involving a CSNF assembly in the DTF remediation pool	6.3.1.16	4.9E-01	1 BWR or 1 PWR assemblies
GET-17B	Drop of a filled SNF basket from the spent fuel transfer machine onto the DTF remediation pool floor	6.3.1.17	5.4E-02	16 BWR or 9 PWR assemblies
GET-18B	Drop of handling equipment into or against an opened WP filled with CSNF during dry remediation activities in the DTF	6.3.1.18	4.9E-03	1 BWR or 1 PWR assembly
GET-19B	Drop of handling equipment into an open WP loaded with DOE canister or a naval canister during dry remediation activities in the DTF	6.3.1.19	3.6E-02	1 HLW canister or 1 naval canister
GET-20B	Drop of the severed DPC lid back onto the DPC in the DTF	6.3.1.20	1.0E-01	74 BWR or 36 PWR assemblies

7.2.4 Beyond Category 2 Internal Event Sequences

The remaining potential events or event sequences have been found to have no potential for exposure of individuals to radiation or to be Beyond Category 2.

7.3 PROPOSED REQUIREMENTS

This analysis makes a number of assumptions that recommend design and operational requirements that have not yet been established (Section 5). These assumptions were used in the analysis to categorize event sequences. A subsequent nuclear safety basis report will formalize the recommended design requirements.

7.4 POTENTIAL EVENTS CONSIDERED PART OF NORMAL OPERATIONS

Some potential events that were identified in *Internal Hazards Analysis for License Application* (BSC 2005 [DIRS 171428], Section 6) are identified in the present analysis as a part of normal operations (Table 54). An additional event or process that is considered part of normal operations is the dislodgement of radioactive crud from CSNF assembly surfaces. Dislodgement of crud could result from unplanned events such as collisions involving handling equipment, or from normal handling movements, vibrations, thermal expansion, or other normal conditions expected during normal operations. The potential events that are considered part of normal operations will not lead to further degradation or failure of SNF cladding. Exposure of workers to radiation will be managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. Requirements that may be needed to control normal operations doses are beyond the scope of the present analysis.

Table 54. Potential Events Considered Part of Normal Operations

Identifier	Description	Cross-Reference (Section Number)
CHF; Canister Transfer Cell (Canister Transfer)		
1	Damage or rupture of cask sampling and purging system, leading to a release of cask internal gases and radioactive material	6.3.3.2.5.3
2	Thermal expansion of gases or other loss of confinement in an unsealed cask or MSC, leading to radiological release	6.3.3.2.5.4
CHF; WP Closure		
3	Glovebox leak leads to a radiological release	6.3.3.4.5.2
DTF; Cask/MSC Turntable Room, Cask Preparation Room		
4	Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures	6.3.4.2.2.1 6.3.4.2.4.5
5	Damage or rupture of cask sampling and purging system, leading to a release of cask or MSC internal gases and radioactive material	6.3.4.2.5.2
6	Thermal expansion of gases or other loss of confinement in an unsealed cask or MSC, leading to radiological release	6.3.4.2.5.3
DTF; Cask and MSC Docking Room		
7	Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures	6.3.4.3.2.1 6.3.4.3.4.4
8	Thermal expansion of gases inside a cask or MSC leads to radiological release	6.3.4.3.5.4
DTF; Waste Transfer Cell, WP Docking Cell, WP Loading/Docking Ring Removal Cell		
9	Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures	6.3.4.7.2.1

Table 54 (Continued). Potential Events Considered Part of Normal Operations

Identifier	Description	Cross-Reference (Section Number)
10	Thermal expansion of gases or other loss of confinement in an unsealed cask or MSC, leading to radiological release	6.3.4.7.5.5
DTF; Loaded MSC Removal: Cask and MSC Docking Room, Cask/MSC Turntable Room, Cask Restoration Room, Cask and MSC to Trolley Transfer Room, Cask and MSC SRTC Receipt Area, Cask and MSC Entrance Vestibule		
11	Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures	6.3.4.9.2.1
12	Damage or rupture of cask inerting system leading to a release of MSC internal gases	6.3.4.9.5.2
13	Expansion of gases in the loaded, unsealed MSC, leading to radiological release	6.3.4.9.5.3
DTF; WP Handling and Staging Cell, WP Positioning Cells, WP Closure Cells, and the WP/Trolley Decontamination Room		
14	Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures	6.3.4.10.2.1
15	Flooding due to rupture of water line or clogging of drain associated with the high pressure water system used for decontamination activities in the WP/trolley decontamination room	6.3.4.10.2.2
16	Glovebox leak leads radiological release of airborne contamination	6.3.4.10.5.2
17	Thermal expansion of gases within WP (prior to seal of inner lid) leads to radiological release.	6.3.4.10.5.3
DTF; WP Remediation: DPC Cutting/WP Dry Remediation Cell		
18	Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures	6.3.4.12.2.1 6.3.4.12.4.4
19	Damage or rupture of the WP sampling and purging system, leading to a release of WP internal gases and radioactive material	6.3.4.12.5.2
20	Thermal expansion of gases or other loss of confinement in an unsealed cask, leading to radiological release	6.3.4.12.5.4
DTF; Dry Cask Remediation: Cask Docking/Dry Remediation Room, Tool Spare Transfer Room, DPC Cutting/WP Dry Remediation Cell		
21	Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures	6.3.4.13.2.1 6.3.4.13.4.3
22	Damage or rupture of the cask and MSC sampling and purging system, leading to a release of canister internal gases and radioactive material	6.3.4.13.5.2
23	Thermal expansion of gases or other loss of confinement in an unsealed cask or MSC, leading to radiological release	6.3.4.13.5.4
DTF; Wet Cask Remediation: Cask Wet Remediation/Laydown Area, Cask Wet Remediation Entrance Vestibule		
24	Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures	6.3.4.14.2.5 6.3.4.14.4.10
25	Damage or rupture of the cask sampling and purging system, leading to a release of internal gases and radioactive material	6.3.4.14.5.1
26	Uncontrolled pool water draindown/fill or leak of pool cooling or water treatment system resulting in flooding and radioactive contamination of adjoining areas	6.3.4.14.5.2
27	Insufficient cooling of a cask or loss of the cask cooling system prior to lowering of a cask into the pool, leading to a release of radiologically contaminated steam or gases	6.3.4.14.5.6

Table 54 (Continued). Potential Events Considered Part of Normal Operations

Identifier	Description	Cross-Reference (Section Number)
28	Thermal expansion of gases or other loss of confinement in an unsealed cask or MSC, leading to radiological release	6.3.4.14.5.7
DTF; DPC Cutting: DPC Preparation/Cask Dry Remediation Room, DPC Docking Room, DPC Cutting/WP Dry Remediation Cell		
29	Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures	6.3.4.15.2.1 6.3.4.15.4.5
30	Damage or rupture of the DPC sampling and purging system, leading to a release of canister internal gases and radioactive material	6.3.4.15.5.2
31	Thermal expansion of gases or other loss of confinement in an unsealed cask, leading to radiological release	6.3.4.15.5.4
FHF; FHF Preparation Room		
32	Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures	6.3.5.2.2.1 6.3.5.2.4.5
33	Damage or rupture of cask sampling and purging system, leading to a release of cask internal gases and radioactive material	6.3.5.2.5.2
34	Thermal expansion of gases or other loss of confinement in an unsealed cask or MSC, leading to radiological release	6.3.5.2.5.3
FHF; FHF Main Transfer Room, Fuel Transfer Bay, Fuel Transfer Room (SNF Assembly Transfer)		
35	Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures	6.3.5.4.2.1 6.3.5.4.4.7
36	Thermal expansion of gases or other loss of confinement in an unsealed cask or MSC, leading to radiological release	6.3.5.4.5.4
FHF Main Transfer Room (Canister Transfer)		
37	Thermal expansion of gases or other loss of confinement in an unsealed cask, leading to radiological release	6.3.5.5.5.3
FHF Main Transfer Room, WP Positioning Cell, WP Closure Cell (WP Closure)		
38	Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures	6.3.5.6.2.1
39	Glovebox leak leads to a radiological release	6.3.5.6.5.2
FHF Main Transfer Room, Preparation Room, Entrance Vestibule (Loaded MSC Removal)		
40	Damage or rupture of cask inerting system leading to a release of cask internal gases	6.3.5.8.5.2
41	Expansion of gases in the MSC, leading to radiological release	6.3.5.8.5.3
Subsurface		
42	Release of Activated Air and Dust to the Environment	6.3.6.5.3 6.3.10.4.2
Surface Facilities Site-Generated Radiological Waste Disposal		
43	Drop of a heavy load onto a tank, piping, or a container containing liquid or solid radioactive waste	6.3.12.1.1
44	Drop of a container or drum containing solid LLW	6.3.12.1.2
45	Drop of a container or drum containing liquid LLW	6.3.12.2.1
46	Release of radioactive gas from the gas filtration systems or cavity gas sampling systems, WP evacuating and inerting systems, cask evacuating and inerting systems, or the system involved with the cooling of casks prior to immersion in the DTF remediation area pool	6.3.12.2.2

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ATTACHMENT I

POTENTIAL CRITICALITY FOR NAVAL CANISTERS

I.1. PURPOSE

The purpose of this attachment is to evaluate the probability of the following event sequence, which may occur in the DTF, the CHF, and the FHF:

1. A crane failure causes a naval canister to be dropped while lifted, or a piece of equipment is dropped onto the canister.
2. The canister breaches.
3. The crane lubrication tank fails and oil enters the breached canister, leading to a potential criticality event.

The oil that is for lubrication can act as a moderator when it enters the canister from the crane. The use of a lubricant with low moderator properties would make the event sequence less likely.

I.2 QUALITATIVE EVALUATION

Conservatively, it is considered that the naval canister will breach when dropped from the crane or hit by some piece of equipment. Nevertheless, it is expected that the breached area will be small, because of the ductile nature of the canister, which is made of stainless steel (Naples 1999 [DIRS 109988], Enclosure 3, p. 4).

When accidentally released, the naval canister may drop back in the transportation cask or WP, or it could drop onto the concrete floor of the facility. When hit by some piece of equipment, a comparable chain of events could unfold: the canister could breach on impact, tip over, and fall onto the concrete floor. For oil from the crane to enter the canister, two scenarios for the position of the canister breach can be considered: 1) the breached part of the canister is in contact with, or very close to the ground, or 2) the canister takes other possible positions (i.e., there is a significant distance between the breached part of the canister and the ground).

In the first scenario, the oil released by the failed crane lubrication tank may reach the canister by flowing on the ground. In this scenario, the quantity of oil that could enter the canister is small because, to penetrate inside the canister, the oil needs to gain potential energy since the interior of the canister is higher in elevation than the ground. This can be done by transferring kinetic energy from the oil flow, but this would require a geometric configuration in which the oil would somehow be funneled to the canister breach without another way to escape, which is unrealistic for oil flowing freely on the ground. Also, a criticality event could occur only if a significant amount of oil was to enter the breached canister, and only if the oil was distributed in a particular manner inside the canister, which is implausible under these conditions. Another means for the oil to enter the canister is through capillary forces, but only an insignificant amount can enter the canister that way. Finally, with a maximum diameter of around 66 inches (Naples 1999 [DIRS 109988], Enclosure 3, p. 2), a naval canister that breaches on impacting the concrete floor and that rolls just a few degrees will be out of reach of oil flowing on the ground.

In the second scenario, a significant amount of oil released by the failed lubrication tank will enter the canister only if the canister breach is located directly under or in sufficient proximity to the pathway of the oil flowing down from the crane lubrication tank to the ground. Given the small dimensions of the canister breach, this scenario can be considered unlikely. Oil is likely to reach the canister breach only if it is splashed around a large area; but, in that case, the amount that will enter the canister will be small because only a small fraction will actually contact the breached area of the canister.

Based on this qualitative evaluation, the event sequence described in Section I.1 appears to be unlikely, because it requires that the flow of oil be somehow funneled to the breach, and the equipment configuration and surface facility layout do not promote such funneling.

Nevertheless, in the following section, it is considered that if there is an oil flow, it will enter the breached canister in a sufficient amount to cause criticality. When combined with the breached naval canister that results from a drop or impact to the canister, the criticality event sequence described in Section I.1 can be rewritten as follows:

1. Occurrence of a crane failure or equipment drop, conservatively assumed to cause a naval canister to be breached.
2. The crane lubrication tank fails and oil enters the breached canister, leading to a potential criticality event.

The probability of this event sequence is evaluated in Section I.3.

I.3 QUANTITATIVE EVALUATION

Only a catastrophic failure of the crane lubrication tank is considered in this assessment. This is because a minor failure, such as a small leakage occurring over time, would be noticed (through a low-oil-level alarm prompted by a level sensor on the lubrication tank for example, or simply by noticing oil drops on the floor or on equipment) and repaired by corrective maintenance. Also, a slow leak would cause the oil to be dispersed in space and in time, such that it would not be available to enter a canister. The following plausible causes of catastrophic failure of the lubrication tank have been identified:

- Thermal stress. When exposed to a significant heat flux, which would result from a fire, the seals or pressure relief valve of the tank could rupture.
- Mechanical stress. A seismic event or a random mechanical failure, such as the rupture of a manual valve normally used to drain the tank during maintenance could cause the catastrophic failure of the tank.

Because the drop of a piece of equipment is also the result of the failure of the crane to maintain its load-holding function, the events: "canister drop" or "handling equipment dropped onto the canister" do not need to be distinguished further and can be lumped together under the general description "failure of load-holding function of the crane." The following plausible causes of canister breach due to the failure of the load-holding function of the crane have been identified:

- Thermal stress caused by a fire. Fire events, however, do not require further consideration because a fire will cause the oil from the lubrication tank to be burned. Therefore, the oil cannot be available as a moderator.
- Mechanical stress. A seismic event or a random mechanical failure (hoist failure for example) could cause the crane to lose its load-holding function.

From the previous lists of causes of failures, fires (through thermal stress) and seismic events (through mechanical stress) are the only phenomena that would lead, through a common-cause mechanism, to the concurrent catastrophic failure of the lubrication tank and the failure of the load-holding function of the crane. Fires, however, would consume the oil of the lubrication tank and make it unavailable as a moderator, and cranes are designed such that no Category 1 or Category 2 event sequence that exceeds the dose limit in 10 CFR Part 63 [DIRS 158535] or leads to a criticality condition will unfold as a consequence of a seismic event (see Section 6.2.6).

A random failure of the lubrication tank followed by a dependent failure of the load-holding function of the crane can also be eliminated from further consideration. In this scenario, an oil leakage could cause the crane hoist mechanism to undergo unacceptable stresses due to lack of lubrication, resulting in a load drop. For unacceptable stresses to develop in the hoist mechanism, a prolonged lack of lubrication would be needed. This, however, is not plausible because it would require the oil leakage to go undetected for a long time, which is not compatible with the highly controlled conditions under which waste transfer operations will be performed.

Consequently, it is concluded that a concurrent catastrophic failure of the lubrication tank and the failure of the load-holding function of the crane could only result from concurrent independent failure mechanisms.

A simplified probability calculation is now carried out to show that the event sequence involving the independent (random) failures of both the crane lubrication tank and the load holding function of the crane is not a Category 1 or Category 2 event sequence. This is done based on the following inputs:

- The probability of failure of the load-holding function of the crane is calculated based on a crane failure rate of 10^{-5} drops per transfer (Assumption 5.1.1.10).
- The frequency of failure of the crane lubrication tank is estimated based on a likely cause of failure, namely the internal rupture of a manual valve (which would normally be used to drain the tank during maintenance). For this latter failure mode, a generic failure rate of $5.0 \times 10^{-8}/\text{h}$ is found (Eide and Calley 1993 [DIRS 146564], Table 1). This failure rate pertains to manual valves used in the nuclear industry, but is not incompatible with failure rates of manual valves used in other industries. A safety factor of 10 is applied to that number to account for the uncertainties related to the failure modes of the crane lubrication tank. This yields a failure rate of $5.0 \times 10^{-7}/\text{h}$.
- The naval canister is transferred twice: from the transportation cask to the WP, and, once inside the WP, to the welding cell.

- Approximately 300 naval canisters will be accepted by the repository (Assumption 5.2.1.9). A factor of conservatism C equal to 1.1 is applied to that number (Section 6.1.4).
- After the failure of the load-holding function of the crane, steps will be taken to recover the naval canister. Until such steps are taken, however, the lubrication tank of the crane might fail which could result in oil entering inside the canister (if it is breached). An exposure time of 24 hours is considered reasonable in this calculation, but it should be noted that the categorization of the event sequence is not sensitive to the numerical value used, because the resulting probability of criticality is much below the credibility threshold for a Category 2 event sequence, as shown in the calculation that follows.

The probability of a criticality event by failure of the load-holding function of the crane (i.e., drop of canister or drop of piece of equipment onto the canister), followed by a failure of the lubrication tank resulting in oil entering the canister is therefore, over the preclosure period:

$$300 \times 1.1 \times 10^{-5} \times 2 \times 5 \times 10^{-7} \times 24 = 7.9 \times 10^{-8}$$

This is below the Category 2 threshold of 10^{-4} over the preclosure period. Therefore, this event sequence can be eliminated from further consideration.

I.4 CONCLUSION

The probability of a criticality event sequence, consisting of a naval canister being breached because it is dropped during its transfer or, alternatively, because it is impacted by a dropped piece of equipment during its transfer, and into which oil leaking from a failed lubrication tank of the handling crane would enter, has been evaluated.

First, a qualitative analysis showed that this event is unlikely: for a significant amount of oil to enter the canister, the leaking oil would have to be somehow funneled to the breach. This is not plausible because the breach will be of a small size, given the ductile nature of stainless steel, which forms the outer wall of the canister.

Second, a quantitative analysis demonstrated that the potential for criticality from this event sequence is beyond Category 2. The analysis conservatively assumed that (1) the naval canister would breach whatever the drop height or the piece of equipment dropped, and (2) the leaking oil would enter the breached canister in a sufficient amount to induce criticality.

The scenarios considered in this evaluation use lubrication oil that can act as a moderator when it enters the canister. The use of a lubricant with low moderator properties would make these scenarios even less likely.

ATTACHMENT II.

**ALLOWABLE EXPOSURE TIME OF WP TRANSITING FROM TRANSPORTER
BEDPLATE TO EMPLACEMENT DRIFT ENTRANCE**

In the following, the allowable average exposure time of a WP transiting from the rolled-out bedplate to the entrance of the emplacement drift is calculated. This exposure time is determined as the span during which the WP could be impacted by a rockfall occurring in the emplacement drift turnout, such that this rockfall would not be more severe than the bounding credible rockfall that could occur in the emplacement drifts over the preclosure period. This attachment is aimed at supporting Section 6.3.6.1.20.

The calculation is based on the following equation (BSC 2004 [DIRS 168508], Equation 4), which, in the context of this attachment, is rewritten as follows:

$$P_{se} \times N \times P_{ck}(K) = 10^{-4} \quad (\text{Eq. II-1})$$

where:

- P_{se} = probability of having at least one 10^{-4} per year seismic event while a WP is being transported from the transporter bedplate to the emplacement drift entrance
- N = number of rockfalls impacting the WP during the 10^{-4} per year seismic event
- $P_{ck}(K)$ = complementary cumulative distribution function of the rockfall kinetic energy K , that is, the probability that a given rockfall has a kinetic energy greater than K (in joules)

As was done for the rockfalls in the emplacement drifts (Section 6.3.6.1.20), or the rockfalls impacting the transporter's shielded compartment (Section 6.3.6.1.9), only the 10^{-4} per year seismic event is considered as an initiating event for rockfall. This is because this seismic event is the most severe considered during the preclosure period. Therefore, this seismic event is the one that will cause the most severe potential rockfalls on the WP (in terms of number of rocks that could impact the WP, but also in terms of their kinetic energy). To evaluate the probability P_{se} , the Poisson distribution is used because it is adequate to evaluate the probability of occurrence of rare events, such as earthquakes. P_{se} is calculated as a function of three parameters: f_{se} , the frequency of the seismic event considered ($f_{se} = 10^{-4} \text{ y}^{-1}$, or equivalently $10^{-4}/8760 = 1.14 \times 10^{-8} \text{ h}^{-1}$), N_{wp} , the number of WPs to be transferred ($N_{wp} = 11,184$ based on Table 1), and t , the average exposure time of a given WP. Determining the maximum allowable value of t is the purpose of this attachment. That is why P_{se} is now written as $P_{se}(t)$ and, based on the formula for the Poisson distribution given by Mood et al. (1974 [DIRS 122506], pp. 93-95), $P_{se}(t)$ can be expressed as:

$$P_{se}(t) = 1 - \exp(-N_{wp} \times f_{se} \times t) \quad (\text{Eq. II-2})$$

Because of the low value of f_{se} and expected small exposure time t , $P_{se}(t)$ is simplified, by approximation to the first order, $\exp(x) \cong 1 + (x / 1!)$, as:

$$P_{se}(t) = N_{wp} \times f_{se} \times t \quad (\text{Eq. II-3})$$

The number N of rockfalls impacting the WP during the 10^{-4} per year seismic event is evaluated based on the rockfall frequency (number of rockfalls per square meter) and the projected area of the WP. An upper value of the rockfall frequency is given by BSC (2004 [DIRS 168508], Section 6.3.2) as 1.251 rockfalls per square meter. The maximum projected area of the WP is that of the Naval Long WP, which has envelope dimensions of 75.8 inches (diameter of the outer barrier) by 236.3 inches (total length), as indicated in Section 4.1.2. This yields an overhead cross-sectional area of 11.6 square meters. Therefore, N is equal to $1.251 \times 11.6 = 14.5$, which is rounded up to 15 rockfalls in the following.

In the context of this attachment, $P_{ck}(K)$ corresponds to the probability that a rockfall occurring in the emplacement drift turnouts has a kinetic energy greater than K . BSC (2004 [DIRS 168508]) does not provide the probability distribution for the kinetic energy of those non-emplacement drift rockfalls, but only their mass distribution. That is why $P_{ck}(K)$ cannot be used directly. Instead, the probability $P_{cm}(M)$ of having an emplacement drift turnout rockfall exceeding a mass M is substituted to $P_{ck}(K)$ in Equation II-1. Information for that distribution exists and is given by BSC (2004 [DIRS 168508], Section 6.3.3 as well as Attachments I and III).

The approach used to make the transfer from $P_{ck}(K)$ to $P_{cm}(M)$ is given in the following.

Based on Section 6.3.6.1.20, the WP is able to withstand the impact of a 1.2×10^5 -joule rockfall without breaching. The velocity at impact of a rockfall falling from the emplacement drift turnouts will be governed by its free-drop height. A free-drop height of 7 m, the height of the turnouts (Section 4.1.6), is used. This value is conservative because BSC (2004 [DIRS 168963], Figure 6-2) gives the distance between the crown of the access mains and the bottom of the transporter steel shield that carries the WP as $2.52 + 2.93 = 5.45$ m. Given that the diameter of the access mains is 7.62 m (BSC 2004 [DIRS 168963], Section 4.2.2.1), which is larger than the 7 m of the nonemplacement turnouts, the 5.45 m value is already conservative. In addition, the 5.45 m distance was calculated without taking credit for the height of the WP, which will decrease the available free-drop height of the potential rockfall. The velocity reached after a free drop of 7 m is equal to $\sqrt{2 \times 9.8 \times 7} = 11.7$ m/s (Weast 1978 [DIRS 128733], pp. F-104 and F-335), where 9.8 is the standard acceleration of gravity (in m/s^2).

The rockfall mass corresponding to a kinetic energy of 1.2×10^5 joules and a rock velocity of 11.7 m/s is, by definition of kinetic energy: $\frac{2 \times 1.2 \times 10^5}{11.7^2} = 1.8 \times 10^3$ kg, or 1.8 metric tons. This value is assigned to M . Therefore, it can be concluded that the emplacement drift turnout rockfalls that have a mass of 1.8 metric tons or less will not jeopardize the structural integrity of the WP. The probability $P_{cm}(M)$ of observing bigger rockfalls can be calculated (BSC 2004 [DIRS 168508], Section 6.3.3 as well as Attachments I and III), and is found to be equal to 1.2×10^{-2} . Note that $P_{cm}(M)$ is a decreasing function of M , therefore a larger value of M will result in a smaller probability.

Combining Equation II-1 and II-3 and substituting $P_{ck}(K)$ with $P_{cm}(M)$ yields the following new equation:

$$t = \frac{10^{-4}}{N_{wp} \times f_{se} \times N \times P_{cm}(M)} \quad (\text{Eq. II-4})$$

Substituting the numerical values of N_{wp} , f_{se} , N and $P_{cm}(M)$ yields an approximate value: $t = 4.5$ h (which corresponds to 4 hours and 30 minutes). This value t corresponds to the allowable average time during which a WP should be transferred from the transporter bedplate to the entrance of the emplacement drifts. If the exposure time is less than t , the maximum credible size for a rockfall onto the WP will be less than 1.8 metric tons, which will not cause a WP breach.

Conservatively, t is rounded down to 4 h to support Section 6.3.6.1.20.

ATTACHMENT III.

SUMMARY OF CATEGORIZATION RESULTS AND DERIVED REQUIREMENTS

The results of the categorization calculations are presented in a series of tables that are contained in this attachment. Table III-1 lists the tables. Tables III-2 through III-37 summarize the potential event sequences and state the design and operational requirements that were credited in the categorization assignments. To avoid duplication, the requirements listed are the generalized requirements that address many similar events based on the assumptions in Section 5 and have not necessarily been customized for each specific potential event. The room numbers listed in Tables III-1 through III-37 are taken from the corresponding event descriptions in *Internal Hazards Analysis for License Application* (BSC 2005 [DIRS 171428]).

Table III-1. List of Summary Tables

Table Number	Cross-Reference (Section)	Title of Table
III-2	6.2	Disposition of External Events
III-3	6.3.2	Disposition of Internal Events That Occur Inside the Cask and Waste Package Receipt Building: Transportation Cask Receipt/Return Area (Room 1034), Transportation Cask Buffer Area (Room 1035)
III-4	6.3.3.1	Disposition of Internal Events That Occur Inside the Canister Handling Facility: Entrance Vestibule (Room 1036), Tools/Parts Storage Room (Room 1035)
III-5	6.3.3.2	Disposition of Internal Events That Occur Inside the Canister Handling Facility (Canister Transfer): Canister Transfer Cell (Room 1033)
III-6	6.3.3.3	Disposition of Internal Events That Occur Inside the Canister Handling Facility (Waste Package Transfer to Waste Package Closure, Site-specific Cask Closure and Removal): Canister Transfer Cell (Room 1033)
III-7	6.3.3.4	Disposition of Internal Events That Occur Inside the Canister Handling Facility (Waste Package Closure): Waste Package Positioning Cells (Rooms 1011 and 1042), and Closure Cells (Rooms 2010 and 2032)
III-8	6.3.3.5	Disposition of Internal Events That Occur Inside the Canister Handling Facility (Waste Package Loadout): Canister Transfer Cell. (Room 1033), Waste Package Tool Storage Room. (Room 1032), Exit Vestibule. (Room 1031)
III-9	6.3.4.1	Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Cask and Site-specific Cask Entrance Vestibule (Room 1079), Cask and Site-specific Cask SRTC Receipt Area (Room 1077), Cask and Site-specific Cask to Trolley Transfer Room (Room 1076)
III-10	6.3.4.2	Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Cask/Site-specific Cask Turntable Room (Room 1073), Cask Preparation Room (Room 1074), Cask Docking Ring Installation Room (Room 2051)
III-11	6.3.4.3	Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Cask and Site-specific Cask Docking Room. (Room 1069)
III-12	6.3.4.5	Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Naval Spent Nuclear Fuel Receipt): Waste Package and Navy Cask Entrance Vestibule. (Room 1060), Waste Package/Naval Cask SRTC Receipt Area. (Room 1058), Waste Package/Naval to Trolley Transfer Room (Room 1057), Waste Package/Naval Cask Preparation Room (Room 1053).

Table III-1. Summary Tables on Compact Disk (Continued)

Table Number	Cross-Reference (Section)	Title of Table
III-13	6.3.4.6	Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Naval Spent Nuclear Fuel Processing): Waste Package Docking Cell (Rooms 1052 and 1055), Waste Package Loading (Navy Canister)/Docking Ring Removal Cell (Room 1051)
III-14	6.3.4.7	Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Cask and MSC Docking Room (Room 1069), Waste Transfer Cell (Room 2048), Waste Package Docking Cells (Rooms 1052 and 1055), Waste Package Loading/Docking Ring Removal Cell (Room 1054)
III-15	6.3.4.8	Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Empty Transportation Cask/Site-specific Cask/Dual-purpose Canister Removal): Cask and Site-specific Cask Docking Room (Room 1069), Cask/Site-specific Cask Turntable Room (Room 1073), Cask Restoration Room (Room 1072), Cask and Site-specific Cask to Trolley Transfer Room (Room 1076), Cask and Site-specific Cask SRTC Receipt Area (Room 1077), Cask and Site-specific Cask Entrance Vestibule (Room 1079)
III-16	6.3.4.9	Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Loaded Site-specific Cask Removal): Cask and Site-specific Cask Docking Room (Room 1069), Cask/Site-specific Cask Turntable Room (Room 1073), Cask Preparation Room (Room 1074), Cask and Site-specific Cask to Trolley Transfer Room (Room 1076), Cask and Site-specific Cask Site Rail Transfer Cart Receipt Area (Room 1077), Cask and Site-specific Cask Entrance Vestibule (Room 1079)
III-17	6.3.4.10	Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Waste Package Handling and Staging Cell (Room 1044), Waste Package Positioning Cells (Rooms 1039, 1040 and 1041), Waste Package Closure Cells (Rooms 2032, 2033, and 2035), and the Waste Package/Trolley Decontamination Room (Room 1094)
III-18	6.3.4.11	Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Waste Package Loadout Cell (Room 1088), Waste Package Transporter Vestibule (Room 1087), Exit Vestibule (Room 1086)
III-19	6.3.4.12	Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Waste Package Remediation): Dual-purpose Canister Cutting/Waste Package Dry Remediation Cell (Room 1097)
III-20	6.3.4.13	Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Dry Remediation): Cask Docking/Dry Remediation Room (Room 1109), Tool Spare Transfer Room (Room 1127), Dual-purpose Canister Cutting/Waste Package Dry Remediation Cell (Room 1097)
III-21	6.3.4.14	Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Wet Remediation): Cask Wet Remediation-Laydown Area (Room 1117), Cask Wet Remediation Entrance Vestibule (Room 1120)
III-22	6.3.4.15	Disposition of Internal Events That Occur Inside the Dry Transfer Facility Dual-purpose Canister Preparation-Cask Dry Remediation Room (Room 1100), Dual-purpose Canister Docking Room (Room 1101), and Dual-purpose Canister Cutting/Waste Package Dry Remediation Cell (Room 1097)
III-23	6.3.5.1	Disposition of Internal Events That Occur Inside the Fuel Handling Facility (Cask and Site-specific Cask Receipt): Entrance Vestibule (Room 1001)
III-24	6.3.5.2	Disposition of Internal Events That Occur Inside the Fuel Handling Facility: Preparation Room (Room 1002)
III-25	6.3.5.4	Disposition of Internal Events That Occur Inside the Fuel Handling Facility (Commercial Spent Nuclear Fuel Assembly Transfer): Main Transfer Room (Room 1003), Fuel Transfer Bay (Rooms 1004, 1005 and 1006), Fuel Transfer Room (Room 2001)

Table III-1. Summary Tables on Compact Disk (Continued)

Table Number	Cross-Reference (Section)	Title of Table
III-26	6.3.5.5	Disposition Internal Events That Occur Inside the Fuel Handling Facility (Canister Transfer): Main Transfer Room (Room 1003)
III-27	6.3.5.6	Disposition of Internal Events That Occur Inside the Fuel Handling Facility (Waste Package Closure): Main Transfer Room (Room 1003), Waste Package Positioning Cell (Room 1013), Waste Package Closure Cell (Room 2006)
III-28	6.3.5.7	Disposition of Internal Events That Occur Inside the Fuel Handling Facility (Waste Package Loadout): Main Transfer Room (Room 1003), Preparation Room (Room 1002), Entrance Vestibule (Room 1001)
III-29	6.3.5.8	Disposition of Internal Events That Occur Inside the FHF (Loaded Site-specific Cask Removal): Main Transfer Room (Room 1003), Preparation Room (Room 1002), Entrance Vestibule (Room 1001)
III-30	6.3.5.9	Disposition Internal Events That Occur Inside the Fuel Handling Facility (Empty Site-specific Cask Removal): Main Transfer Room (Room 1003), Preparation Room (Room 1002), Entrance Vestibule (Room 1001)
III-31	6.3.6	Disposition of Internal Events That Occur During Waste Package Subsurface Transport and Emplacement
III-32	6.3.8	Disposition of Internal Events That Occur During Subsurface Construction
III-33	6.3.9	Disposition of Internal Events That Occur During Surface Construction
III-34	6.3.10	Disposition of Internal Events That Occur During Subsurface Drip Shield Installation
III-35	6.3.12	Disposition of Internal Events That Occur During Disposal of Low-Level Radioactive Waste
III-36	6.3.7	Disposition of Internal Events That Occur in the Spent Nuclear Fuel Aging System: Vertical Aging Systems
III-37	6.3.7	Disposition of Internal Events That Occur in the SNF Aging System: Horizontal Aging Systems

Table III-2. Disposition of External Events

External Event Hazards	Potential Event	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Aircraft Crash	Aircraft operations near enough to the repository to pose a hazard to surface structures have been identified as an external hazard. Aircraft operations considered are from the Beatty Corridor and the restricted airspace of the Nevada Test Site and the Nevada Test and Training Range. The hazards considered are DOE aircraft, small military aircraft, large military aircraft, dropped objects from aircraft, and aircraft in public air space.	EXT-AC	Beyond Category 2	Facility and component structural design requirements and operational restrictions on aircraft operations ensure that event sequences initiated by aircraft hazards are beyond Category 2.	Preventive	Design- Procedural Safety
Rainstorm and Flooding	Rainstorm has been identified as an external hazard.	EXT-RNFL	Beyond Category 2	Design requirements prevent initiation of event sequences caused by precipitation (including rainstorm) during the preclosure period by specifying reasonable maximum annual, daily, and hourly precipitation rates that the repository is designed to withstand while operating.	Preventive	Design
Range Fire	Range fire has been identified as an external hazard.	EXT-RGFIR	Beyond Category 2	Separation distance between combustible vegetation and nearest structure containing radiological materials is at least 33 ft and complies with applicable fire protection codes and standards for protection of structures from wildfire exposure and hazards. Compliance with regulatory requirements and adherence to fire protection codes and standards ensure that range fires are mitigated before they pose a hazard that could involve a release of radioactive material. Thus, range fire is screened out as an initiating event.	Preventive- Mitigative	Design- Procedural Safety
Loss of Offsite-Onsite Power	Loss of offsite-onsite power has been identified as an external hazard.	EXT-LOSP	Beyond Category 2	Design requirements ensure that surface facilities are designed so that a loss of offsite or onsite electrical power does not initiate an event sequence.	Preventive	Design
Nearby Industrial and Military Facilities	Nearby military and industrial activities have been identified as an external hazard.	EXT-NIMF	NA	There are no known existing or planned military or industrial activities that might be expected to initiate an event sequence with potential radiological consequences to offsite individuals or workers during the preclosure period.	NA	NA
Seismic Activity	Seismic activity has been identified as an external hazard.	EXT-SEISMIC-A EXT-SEISMIC-B	Category 2 Beyond Category 2	<p>Design requirements ensure that facilities are designed so that seismic events do not initiate a Category 1 or Category 2 event sequence that leads to a potential dose to workers or the public that exceed the performance objectives of 10 CFR 63.111 or that leads to a criticality condition. The application of the seismic design requirements precludes the occurrence of any seismically initiated event sequence having a mean annual probability of 10^{-3} or greater and, therefore, precludes the occurrence of a Category 1 seismically initiated event sequence.</p> <p>A - Seismically initiated event sequences that are mitigated or prevented by the use of a DBGM-1 assignment to a SSC are less probable than the Category 1 occurrence criterion, implicitly, such event sequences are Category 2. The only seismically initiated Category 2 event sequences of concern are 1) failure of the spent fuel transfer machines in the DTF and FHF leading to dropped CSNF fuel assemblies, 2) failure of the fuel handling machine in wet remediation leading to a dropped CSNF fuel assembly or basket loaded with fuel assemblies, 3) failure of HEPA filters leading to discharge of accumulated activity, and 4) failure of ducting and dampers leading to discharge of accumulated activity.</p> <p>B - A DBGM-2 assignment to a SSC ensures that the corresponding seismically initiated event sequences are Beyond Category 2.</p> <p>Further, design requirements ensure that portions of a non-ITS SSC which, upon failure, could adversely interact with an ITS SSC and prevent its safety function from being performed are classified as ITS, redesigned to eliminate the potential unacceptable interaction with the identified ITS SSC, or, for seismic interactions, designed to the same seismic DBGM as the ITS SSCs subjected to the potential unacceptable interaction.</p>	Preventive	Design

Table III-2. Disposition of External Events (Continued)

External Event Hazards	Potential Event	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Tornado and Extreme Wind	Tornado and extreme wind have been identified as an external hazard.	EXT-WDTONADO	Beyond Category 2	To render event sequences involving tornado and extreme wind Beyond Category 2, design requirements ensure that stationary ITS (important to safety) structures, as well as aging casks, are designed for tornado missiles, extreme straight wind, and tornado wind. Tornado missiles and tornado wind are screened out for transporters (including WP transporters and transporters used to carry waste to and from the aging pads); however, transporters must be designed to function in extreme straight wind. For transportation and transfer casks on the repository site, the certification process for transportation casks under 10 CFR Part 71 and similarity of transfer cask design requirements ensure that casks provide adequate protection against external hazards.	Preventive	Design
Lightning	Lightning has been identified as an external hazard.	EXT-LIGHTN	Beyond Category 2	Design requirements ensure that surface buildings and elevated structures, and the SNF aging system are designed so that a lightning strike does not initiate an event sequence. For transportation and transfer casks on the repository site, the certification process for transportation casks under 10 CFR Part 71 and similarity of transfer cask design requirements ensure that casks provide adequate protection against external hazards.	Preventive	Design
Volcanism-Ash Fall	Volcanism-ash fall has been identified as an external hazard. Ash fall could occur at the North Portal facilities as the result of a regional volcanic eruption.	EXT-ASHFAL	Beyond Category 2	A design requirement ensures that surface facilities, including the SNF aging system, where SNF and HLW are handled or stored are designed to withstand the effects of ash fall from a regional volcanic eruption without loss of capability to perform their safety function.	Preventive	Design
Drift Degradation	Drift degradation has been identified as an external hazard. Drift degradation in the partial or complete collapse of main, turnout, or emplacement drifts can occur as a result of rockfall.	EXT-DRFDEG	Beyond Category 2	Credible rockfall scenarios do not damage the waste package in a manner sufficient to jeopardize the structural integrity of the waste package. Therefore, a credible rockfall does not initiate a Category 1 or Category 2 event sequence. See disposition of internal event sequences SS-TE-CC9, SS-TE-CC20, and SS-TE-CC21 (Table III-31) for rockfall evaluations.	Preventive	Design
Extreme Weather Fluctuation-Temperature	Extreme weather fluctuation-temperature has been identified as an external hazard.	EXT-EXTRWEATH	Beyond Category 2	A design requirement for SNF aging casks (including MSCs and HAMS) on the aging pads ensures that temperature extremes do not initiate a Category 1 or Category 2 event sequence. For transportation and transfer casks on the repository site, the certification process for transportation casks under 10 CFR Part 71 and similarity of transfer cask design requirements ensure that casks provide adequate protection against external hazards.	Preventive	Design
Sandstorm	Sandstorm has been identified as an external hazard.	EXT-SANDSTRM	Beyond Category 2	An operational requirement ensures that filters or natural circulation vent paths of SNF aging casks (including MSCs and HAMS), that could be clogged as a result of a sandstorm, other events, or chronic conditions, are inspected and maintained in an operable condition.	Preventive	Procedural Safety

NOTES: AC = aircraft crash; ASHFAL = volcanism-ash fall; DOE = U.S. Department of Energy; DRFDEG = drift degradation; EXT = external; EXTRWEATH = extreme weather fluctuation-temperature; HLW = high-level radioactive waste; LIGHTN = lightning; LOSP = loss of offsite-on-site power; NA = not applicable; NIMF = nearby industrial and military facilities; RGFIR = range fire; RNFL = rainstorm and flooding; SANDSTRM = sandstorm; SNF = spent nuclear fuel; SS = subsurface; TE = transport and emplacement; WDTONADO = Tornado and Extreme Wind.

The Event Sequence Designator is a unique event sequence index for each event. The prefix identifies the location, for example "EXT." The next letters, identify an event, for example "SANDSTRM." For events with multiple sequences, the last letter is the event identifier, for example "A."

Table III-3. Disposition of Internal Events That Occur Inside the Cask and Waste Package Receipt Building: Transportation Cask Receipt/Return Area (Room 1034), Transportation Cask Buffer Area (Room 1035) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Event Sequence Category	Disposition of Event		Design or Mitigative Requirement	Preventive or Mitigative Safety Control																				
				Design, Procedural Safety, or Operational Requirement	Preventive																						
								Design	Procedural Safety																		
9. Drop of a transportation cask containing a horizontal DPC (with impact limiters and personnel barrier removed) from the cask receipt and return area overhead crane during transfer to a horizontal cask transfer trailer (for subsequent emplacement in a HAM) (Room 1034).	10. Drop or collision of a transportation cask containing a horizontal DPC (with impact limiters and personnel barrier removed) from the cask receipt and return area overhead crane onto or against a sharp object during transfer to horizontal cask transfer trailer (for subsequent emplacement in a HAM) (Room 1034).	CWPRB-TCBA-CC10	Beyond Category 2	Same disposition as Potential Event CWPRB-TCBA-CC6.	Preventive	Design- Procedural Safety	Design- Procedural Safety																				
								(See GET-01 Sequence A) Design and operational requirements reduce the drop probability.	Category 2	Beyond Category 2	Preventive	Design- Procedural Safety															
													Design, Procedural Safety, or Operational Requirement	Preventive	Design- Procedural Safety												
																Design	Procedural Safety										
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14. Overturning or collision involving the site prime mover pulling a horizontal cask transfer trailer holding a transportation cask (without impact limiters) containing a horizontal DPC at the TCRRF or departing the TCRRF for the HAM (Room 1034).	13. Slapdown of a transportation cask holding a horizontal DPC (with impact limiters removed) from the cask receipt and return area overhead crane onto the horizontal cask transfer trailer or the site prime mover (forward slapdown) or the ground (backward slapdown) during the downending of the cask from a vertical to a horizontal orientation after cask removal from the offsite railcar or other transport (Room 1034).	CWPRB-TCBA-CC13A	Category 2	(See GET-01 Sequence A) Same disposition as Potential Event CWPRB-TCBA-CC9.	Preventive	Design- Procedural Safety	Design																				
								Design	Procedural Safety																		
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																								Design	Procedural Safety		
15. Runaway of a site prime mover pulling a horizontal cask transfer trailer holding a transportation cask (with no impact limiters) containing a horizontal DPC (Room 1034).	14. Overturning or collision involving the site prime mover pulling a horizontal cask transfer trailer holding a transportation cask (without impact limiters) containing a horizontal DPC at the TCRRF or departing the TCRRF for the HAM (Room 1034).	CWPRB-TCBA-CC15	Beyond Category 2	Design requirements ensure that reliable means to stop and maintain stability of the MSC Transporter and HTC Trailer/Tractor is provided.	Preventive	Design	Design																				
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Table III-3. Disposition of Internal Events That Occur Inside the Cask and Waste Package Receipt Building: Transportation Cask Receipt/Return Area (Room 1034), Transportation Cask Buffer Area (Room 1035) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	16. Drop or collision of handling equipment onto or against a transportation cask (with impact limiters and personnel barrier installed) (Room 1034).	CWPRB-TCBA-CC16	Beyond Category 2	Operational requirements for cask preparation and handling ensure that a drop of or collision involving equipment would not breach a transportation cask, transfer cask, or an MSC.	Preventive	Procedural Safety
	17. Drop or collision of handling equipment onto or against a transportation cask (without impact limiters or personnel barrier installed) (Room 1034).	CWPRB-TCBA-CC17	Beyond Category 2	Same disposition as Potential Event CWPRB-TCBA-CC16.	Preventive	Procedural Safety
	18. Drop or collision of heavy loads from the maintenance crane onto or against a transportation cask (with or without impact limiters or personnel barrier installed) (Room 1034).	CWPRB-TCBA-CC18	Beyond Category 2	An operational requirement ensures that heavy loads, that could potentially initiate an event sequence if dropped onto a transportation cask, transfer cask or waste package, can not be lifted over or near a transportation cask, transfer cask, or waste package, except as needed for transfer and closure operations.	Preventive	Procedural Safety
	19. Derailment of the SRTC positioner moving an SRTC holding a transportation cask (with impact limiters and personnel barrier installed) resulting in an SRTC collision or derailment followed by a load tipover or fall (Rooms 1034 and 1035).	CWPRB-TCBA-CC19	Beyond Category 2	Same disposition as Potential Event CWPRB-TCBA-CC1.	Preventive	Design
	20. Derailment of the SRTC positioner moving an SRTC holding a transportation cask (with impact limiters and personnel barrier installed) due to a malfunction of the turntable in the TCBA, resulting in an SRTC collision or derailment followed by a load tipover or fall (Rooms 1034 and 1035).	CWPRB-TCBA-CC20	Beyond Category 2	Same disposition as Potential Event CWPRB-TCBA-CC1.	Preventive	Design
	21. Roll-off and/or derailment of an SRTC holding a transportation cask (with impact limiters and personnel barrier installed) from the SRTC positioner followed by a load tipover or fall (Rooms 1034 and 1035).	CWPRB-TCBA-CC21	Beyond Category 2	Same disposition as Potential Event CWPRB-TCBA-CC1.	Preventive	Design
	22. Collision of an SRTC tractor and an SRTC holding a transportation cask (with impact limiters and personnel barrier installed) (Room 1034).	CWPRB-TCBA-CC22	Beyond Category 2	Same disposition as Potential Event CWPRB-TCBA-CC1.	Preventive	Design
	23. Derailment or collision involving an SRTC holding a transportation cask (with impact limiters and personnel barrier installed) being pushed or pulled by an SRTC tractor followed by a load tipover or fall (Room 1034).	CWPRB-TCBA-CC23	Beyond Category 2	Same disposition as Potential Event CWPRB-TCBA-CC1.	Preventive	Design
	24. An SRTC carrying a transportation cask (with impact limiters installed) from the CWPRB to the TCBA, the DTF, or the CHF is pushed by the SRTC tractor into the SRTC positioner trench (Room 1034).	CWPRB-TCBA-CC24	Beyond Category 2	Same disposition as Potential Event CWPRB-TCBA-CC1.	Preventive	Design
	25. Drop of a transfer cask containing a horizontal DPC (with impact limiters removed) from the cask receipt and return area overhead crane during transfer from a horizontal cask transfer trailer (after retrieval from a HAM) to an SRTC for processing in the DTF (Room 1034).	CWPRB-TCBA-CC25A	Category 2	(See GET-01 Sequence A) Same disposition as Potential Event CWPRB-TCBA-CC9.	Preventive	Design-Procedural Safety
	26. Drop or collision of a transfer cask containing a horizontal DPC (with impact limiters removed) from the cask receipt and return area overhead crane onto or against a sharp object during transfer from a horizontal cask transfer trailer (after retrieval from a HAM) to an SRTC for processing in the DTF (Room 1034).	CWPRB-TCBA-CC26	Beyond Category 2	Same disposition as Potential Event CWPRB-TCBA-CC6.	Preventive	Design-Procedural Safety

Table III-3. Disposition of Internal Events That Occur Inside the Cask and Waste Package Receipt Building: Transportation Cask Receipt/Return Area (Room 1034), Transportation Cask Buffer Area (Room 1035) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	27. Slapdown of a transfer cask holding a horizontal DPC (without impact limiters) from the cask receipt and return area overhead crane back onto the horizontal cask transfer trailer or the site prime mover (forward slapdown) or the ground (backward slapdown) during the upending of the cask to a vertical orientation from a horizontal orientation during the transfer of the cask from the horizontal cask transfer trailer to an SRTC (Room 1034).	CWPRB-TCBA-CC27A	Category 2	(See GET-01 Sequence A) Same disposition as Potential Event CWPRB-TCBA-CC9.	Preventive	Design- Procedural Safety
	28. Slapdown of a transfer cask holding a horizontal DPC (without impact limiters) from the cask receipt and return area overhead crane onto an SRTC or SRTC Tractor (forward slapdown) or the ground (backward slapdown) during the downending of the cask to a vertical orientation from a horizontal orientation after removal from the horizontal cask transfer trailer (Room 1034).	CWPRB-TCBA-CC28A	Category 2	(See GET-01 Sequence A) Same disposition as Potential Event CWPRB-TCBA-CC9.	Preventive	Design- Procedural Safety
	29. Overturning or collision involving the site prime mover pulling a horizontal cask transfer trailer holding a transfer cask (without impact limiters) containing a horizontal DPC in transit to, or at, the TCRRF (Room 1034).	CWPRB-TCBA-CC29	Beyond Category 2	Same disposition as Potential Event CWPRB-TCBA-CC14.	Preventive	Design
	30. Runaway of a site prime mover pulling a horizontal cask transfer trailer holding a transfer cask (with no impact limiters) containing a horizontal DPC (Room 1034).	CWPRB-TCBA-CC30	Beyond Category 2	Same disposition as Potential Event CWPRB-TCBA-CC15.	Preventive	Design
Chemical Contamination-Flooding	1. Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures (Rooms 1034 and 1035).	CWPRB-TCBA-CCF1	NA—Accounted for in consequence analyses, if applicable	NA—SNF is contained inside a sealed cask, therefore this event does not occur unless an event sequence leads to a potential exposure of SNF to air. Oxidation of the fuel matrix is a possible outcome of any event that potentially exposes SNF to air. Consequence analyses account for the possibility of oxidation, as applicable	NA	NA
Explosion-Implosion	1. Hydrogen explosion involving batteries on a forklift (Room 1034).	CWPRB-TCBA-EI1	Beyond Category 2	Operational controls pertaining to batteries for powering heavy equipment ensure the prevention of the generation or accumulation of enough hydrogen gas to cause an explosion that could breach a transportation cask, site-specific cask, or waste package.	Preventive	Procedural Safety
	2. Hydrogen explosion involving batteries on a mobile elevated platform (Room 1034).	CWPRB-TCBA-EI2	Beyond Category 2	Same disposition as Potential Event CWPRB-TCBA-EI1.	Preventive	Procedural Safety
	3. Hydrogen explosion involving batteries on a site prime mover (Room 1034).	CWPRB-TCBA-EI3	Beyond Category 2	Same disposition as Potential Event CWPRB-TCBA-EI1.	Preventive	Procedural Safety
Fire-Thermal	1. Fire/explosion (battery/electrical fire) involving a site prime mover moving an LWT or an OWT trailer holding a transportation cask (Room 1034).	CWPRB-TCBA-FT1	Beyond Category 2	Design and operational requirements ensure control of the presence and amount of combustibles in the different areas of the repository to preclude any Category 1 or Category 2 event sequences potentially initiated by a fire.	Preventive	Design- Procedural Safety
	2. Fire/explosion (battery/electrical fire) involving a site prime mover moving a railroad car holding a rail transportation cask (Room 1034).	CWPRB-TCBA-FT2	Beyond Category 2	Same disposition as Potential Event CWPRB-TCBA-FT1.	Preventive	Design- Procedural Safety
	3. Fire/explosion (battery/electrical fire) involving a site prime mover pulling or pushing a horizontal cask transfer trailer holding a transportation cask containing a horizontal DPC (at the TCRRF or in transit to the HAM) (Room 1034).	CWPRB-TCBA-FT3	Beyond Category 2	Same disposition as Potential Event CWPRB-TCBA-FT1.	Preventive	Design- Procedural Safety
	4. Fire/explosion (battery/electrical fire) involving a site prime mover pulling or pushing a horizontal cask transfer trailer holding a transfer cask containing a horizontal DPC (at the TCRRF or in transit from the HAM) (Room 1034).	CWPRB-TCBA-FT4	Beyond Category 2	Same disposition as Potential Event CWPRB-TCBA-FT1.	Preventive	Design- Procedural Safety

Table III-3. Disposition of Internal Events That Occur Inside the Cask and Waste Package Receipt Building: Transportation Cask Receipt/Return Area (Room 1034), Transportation Cask Buffer Area (Room 1035) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	5. Diesel fuel fire/explosion involving an SRTC tractor pushing or pulling an SRTC holding a transportation cask (Room 1034).	CWPRB-TCBA-FT5	Beyond Category 2	Same disposition as Potential Event CWPRB-TCBA-FT1.	Preventive	Design-Procedural Safety
	6. Electrical fire involving the cask receipt and return area overhead crane, handling equipment, or other electrical equipment (Room 1034).	CWPRB-TCBA-FT6	Beyond Category 2	Same disposition as Potential Event CWPRB-TCBA-FT1.	Preventive	Design-Procedural Safety
	7. Electrical fire involving the SRTC positioner holding an SRTC loaded with a transportation cask (Rooms 1034 and 1035).	CWPRB-TCBA-FT7	Beyond Category 2	Same disposition as Potential Event CWPRB-TCBA-FT1.	Preventive	Design-Procedural Safety
	8. Electrical fire involving the turntable carrying the SRTC positioner holding an SRTC loaded with a transportation cask (Rooms 1034 and 1035).	CWPRB-TCBA-FT8	Beyond Category 2	Same disposition as Potential Event CWPRB-TCBA-FT1.	Preventive	Design-Procedural Safety
	9. Fire/explosion (battery/electrical fire) associated with a forklift (Room 1034).	CWPRB-TCBA-FT9	Beyond Category 2	Same disposition as Potential Event CWPRB-TCBA-FT1.	Preventive	Design-Procedural Safety
	10. Fire/explosion (battery/electrical fire) associated with a mobile elevated platform (Room 1034).	CWPRB-TCBA-FT10	Beyond Category 2	Same disposition as Potential Event CWPRB-TCBA-FT1.	Preventive	Design-Procedural Safety
	11. Transient combustible fire in CWPRB or the TCBA (Room 1034).	CWPRB-TCBA-FT11	Beyond Category 2	Same disposition as Potential Event CWPRB-TCBA-FT1.	Preventive	Design-Procedural Safety
	12. Cask overheating due to solar insolation while on an offsite transport or an SRTC (Rooms 1034 and 1035).	CWPRB-TCBA-FT12	NA – Bounded by normal and hypothetical accident conditions	Transportation casks must be evaluated under normal conditions of transport and hypothetical accident conditions, such as a potential exposure to insolation under normal conditions, or fires under hypothetical accident conditions. The normal and hypothetical accident conditions bound insolation on site. Therefore, the incidence of solar radiation on transportation casks will not initiate an event sequence.	NA	NA
Radiation	1. Radiation exposure of a facility worker and/or the offsite public (Rooms 1034 and 1035).	CWPRB-TCBA-R1	NA—Accounted for in consequence analyses, if applicable	NA—Potential exposure of workers or the public to radiation is a hazard for the event sequences considered in this analysis. Consequence analyses evaluate this hazard for Category 1 and Category 2 event sequences, as applicable.	NA	NA
			Normal Operations	Some exposure to radiation is expected as a part of normal facility operations. Exposures are managed by design features and procedures that ensure that workers or the public do not receive excessive radiation doses.	Mitigative	Design-Procedural Safety
	2. Radiation-induced damage to a facility SSC (Rooms 1034 and 1035).	CWPRB-TCBA-R2	NA	Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization.	NA	NA
Fissile	1. Criticality associated with a transportation cask collision, drop, or slapdown (involving a crane) and a rearrangement of the cask internals (Room 1034).	CWPRB-TCBA-F1	Beyond Category 2	Design requirements and waste acceptance criteria ensure that transportation casks, transfer casks, MSCs, and dual-purpose canisters (DPCs) are designed to ensure nuclear criticality safety with optimum moderation and most-reactive waste forms. Criticality safety will be maintained despite geometric rearrangements due to a drop or other handling incident.	Preventive	Design
	2. Criticality associated with an offsite railcar collision or derailment (holding a transportation cask) followed by a load tipover or fall and a rearrangement of the cask internals (Room 1034).	CWPRB-TCBA-F2	Beyond Category 2	Same disposition as Potential Event CWPRB-TCBA-F1.	Preventive	Design

Table III-3. Disposition of Internal Events That Occur Inside the Cask and Waste Package Receipt Building: Transportation Cask Receipt/Return Area (Room 1034), Transportation Cask Buffer Area (Room 1035) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	3. Criticality associated with a collision or overturning of an LWT or an OWT trailer (holding a transportation cask) and a rearrangement of the cask internals (Room 1034).	CWPRB-TCBA-F3	Beyond Category 2	Same disposition as Potential Event CWPRB-TCBA-F1.	Preventive	Design
	4. Criticality associated with an SRTC collision or derailment (holding a transportation cask) followed by a load tipover or fall and a rearrangement of the cask internals (Room 1034).	CWPRB-TCBA-F4	Beyond Category 2	Same disposition as Potential Event CWPRB-TCBA-F1.	Preventive	Design
	5. Criticality associated with an SRTC positioner collision or derailment (carrying an SRTC holding a transportation cask) followed by a load tipover or fall and rearrangement of the cask internals (Rooms 1034 and 1035).	CWPRB-TCBA-F5	Beyond Category 2	Same disposition as Potential Event CWPRB-TCBA-F1.	Preventive	Design
	6. Criticality associated with a transportation cask (holding a horizontal DPC) collision or derailment (involving a horizontal cask transfer trailer or railcar) followed by a load tipover or fall and a rearrangement of the cask internals (Room 1034).	CWPRB-TCBA-F6	Beyond Category 2	Same disposition as Potential Event CWPRB-TCBA-F1.	Preventive	Design
	7. Criticality associated with a transportation cask (holding a horizontal DPC) drop or slapdown from the cask receipt and return area overhead crane and a rearrangement of the cask internals (Room 1034).	CWPRB-TCBA-F7	Beyond Category 2	Same disposition as Potential Event CWPRB-TCBA-F1.	Preventive	Design
	8. Criticality associated with a transfer cask (holding a horizontal DPC) collision or derailment (involving a horizontal cask transfer trailer or an SRTC) followed by a load tipover or fall and a rearrangement of the cask internals (Room 1034).	CWPRB-TCBA-F8	Beyond Category 2	Same disposition as Potential Event CWPRB-TCBA-F1.	Preventive	Design
	9. Criticality associated with a transfer cask (holding a horizontal DPC) drop or slapdown from the cask receipt and return area overhead crane and a rearrangement of the cask internals (Room 1034).	CWPRB-TCBA-F9	Beyond Category 2	Same disposition as Potential Event CWPRB-TCBA-F1.	Preventive	Design

NOTES: CC = collision-crushing; CCF = chemical-contamination flooding; CHF = Canister Handling Facility; CWPRB = Cask and Waste Package Receipt Building; DOE = U.S. Department of Energy; DTF = dry transfer facility (DTF 1 and DTF 2); EI = explosion-implosion; F = fissile; FT = fire-thermal; GET = generalized event tree; HVAC = heating, ventilation, and air-conditioning; LWT = legal-weight truck; NA = not applicable; OWT = overweight truck; R = radiation; SNF = spent nuclear fuel; SRTC = site rail transfer cart; TCBA = transfer cask buffer area; TCRRF = Transportation Cask Receipt/Return Facility.

The Event Sequence Designator is a unique event sequence index for each event. The prefix identifies the building or facility, for example "CWPRB," the middle characters identify an activity, room, or area, for example "TCBA," and the suffix identifies the hazard category and event number, for example "CC1." When an event sequence has been evaluated in a GET, the GET number is identified in the Disposition of Event column; the GET sequence alpha character is shown at the end of the Event Sequence Designator, for example "A."

GETs are discussed in Sections 6.3.1.1 to 6.3.1.24.

Table III-4. Disposition of Internal Events That Occur Inside the Canister Handling Facility: Entrance Vestibule (Room 1036), Tools/Parts Storage Room (Room 1035)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Collision-Crushing	1. SRTC derailment, overturning, or collision involving a loaded cask followed by a load tipover or fall (Rooms 1035 and 1036).	CHF-EVTSR-CC1	Beyond Category 2	Transportation casks with impact limiters are designed to withstand, without breaching, the bounding drops that could occur during cask handling at the repository. A derailment, overturning, or collision does not breach a transportation cask.	Preventive	Design
	2. Overturning or collision involving an LWT trailer or an OWT trailer holding a cask (Rooms 1035 and 1036).	CHF-EVTSR-CC2	Beyond Category 2	Same disposition as Potential Event CHF-EVTSR-CC1.	Preventive	Design
	3. SRTC derailment, overturning, or collision involving a loaded MSC followed by a load tipover or fall (Rooms 1035 and 1036).	CHF-EVTSR-CC3	Beyond Category 2	A design requirement ensures that an SRTC carrying a cask without impact limiters (typically only within structures) or site-specific cask does not derail and the cask or site-specific cask does not fall from the SRTC under normal operating conditions or as the result of a collision.	Preventive	Design
	4. Collision of an SRTC, an LWT trailer, or OWT trailer carrying a loaded cask with the entrance vestibule doors, tool/parts storage room doors, or the canister transfer cell shield doors (Rooms 1035 and 1036).	CHF-EVTSR-CC4	Beyond Category 2	Same disposition as Potential Event CHF-EVTSR-CC1.	Preventive	Design
	5. The entrance vestibule doors, tool/parts storage room doors, or the canister transfer cell shield doors close on an SRTC, an LWT trailer, or an OWT trailer carrying a loaded cask (Rooms 1035 and 1036).	CHF-EVTSR-CC5	Beyond Category 2	Same disposition as Potential Event CHF-EVTSR-CC1.	Preventive	Design
	6. Collision of an SRTC carrying a loaded MSC with the entrance vestibule doors, tool/parts storage room doors, or the canister transfer cell shield doors (Rooms 1035 and 1036).	CHF-EVTSR-CC6	Beyond Category 2	Design and operational requirements establish speed limits such that a collision with shield or airlock doors or other heavy objects would not overturn an SRTC, or site-specific cask transporter or cause it to lose its load.	Preventive	Design- Procedural Safety
	7. The entrance vestibule doors, tool/parts storage room doors, or the canister transfer cell shield doors close on an SRTC carrying a loaded MSC (Rooms 1035 and 1036).	CHF-EVTSR-CC7	Beyond Category 2	A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transfer trolley, site-rail transfer cart (SRTC), MSC transporter, WP transporter, would not cause a tipover of the conveyance or cause the conveyance to drop its load. A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transportation cask, transfer cask, or MSC suspended from an overhead crane would not cause the crane to drop its load.	Preventive	Design
	8. Collision of a mobile elevated platform with a cask during removal of personnel barriers and impact limiters or during survey activities (Room 1036).	CHF-EVTSR-CC8	Beyond Category 2	Operational requirements ensure that the portable platforms, access platforms, mobile elevated platforms, and forklifts operated in the facility are not operated in a manner that could breach or overturn a loaded transportation cask or site-specific cask.	Preventive	Procedural Safety
	9. Drop or collision of personnel barriers or impact limiters from the entrance vestibule overhead crane onto or against a cask (Room 1036).	CHF-EVTSR-CC9	Beyond Category 2	Operational requirements for cask preparation and handling ensure that a drop of or collision involving equipment would not breach a transportation cask, transfer cask, or an MSC.	Preventive	Procedural Safety
	10. Collision between a forklift and a cask on an SRTC, an LWT trailer or the conveyance holding the cask (Room 1036).	CHF-EVTSR-CC10	Beyond Category 2	Same disposition as Potential Event CHF-EVTSR-CC8.	Preventive	Procedural Safety
	11. Collision between a mobile elevated platform and a cask on an SRTC, an LWT trailer or an OWT trailer or the conveyance holding the cask (Room 1036).	CHF-EVTSR-CC11	Beyond Category 2	Same disposition as Potential Event CHF-EVTSR-CC8.	Preventive	Procedural Safety
	12. Collision between a forklift and an MSC on an SRTC or the SRTC holding the cask (Room 1036).	CHF-EVTSR-CC12	Beyond Category 2	Same disposition as Potential Event CHF-EVTSR-CC8.	Preventive	Procedural Safety

Table III-4. Disposition of Internal Events That Occur Inside the Canister Handling Facility: Entrance Vestibule (Room 1036), Tools/Parts Storage Room (Room 1035) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	13. Collision between a mobile elevated platform and an MSC on an SRTC or the SRTC holding the MSC (Room 1036).	CHF-EVTSR-CC13	Beyond Category 2	Same disposition as Potential Event CHF-EVTSR-CC8.	Preventive	Procedural Safety
	14. Drop or collision of equipment from the entrance vestibule overhead bridge crane (including handling equipment for personnel barrier, impact limiters, etc.) onto or against a cask or MSC (Room 1036).	CHF-EVTSR-CC14	Beyond Category 2	Same disposition as Potential Event CHF-EVTSR-CC9.	Preventive	Procedural Safety
Chemical Contamination-Flooding	1. Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures (Rooms 1035 and 1036).	CHF-EVTSR-CCF1	NA—Accounted for in consequence analyses, if applicable	NA—SNF is contained inside a sealed cask, therefore this event does not occur unless an event sequence leads to exposure of SNF to air. Oxidation of the fuel matrix is a possible outcome of any event that exposes SNF to air. Consequence analyses account for the possibility of oxidation, as applicable.	NA	NA
Explosion-Impllosion	1. Hydrogen explosion involving batteries on a forklift (Room 1036).	CHF-EVTSR-EI1	Beyond Category 2	Operational controls pertaining to batteries for powering heavy equipment ensure the generation or accumulation of enough hydrogen gas to cause an explosion that could breach a transportation cask, site-specific cask, or waste package is prevented.	Preventive	Procedural Safety
	2. Hydrogen explosion involving batteries on a mobile elevated platform (Room 1036).	CHF-EVTSR-EI2	Beyond Category 2	Same disposition as Potential Event CHF-EVTSR-EI1.	Preventive	Procedural Safety
	3. Hydrogen explosion involving batteries on a site prime mover (Room 1036).	CHF-EVTSR-EI3	Beyond Category 2	Same disposition as Potential Event CHF-EVTSR-EI1.	Preventive	Procedural Safety
Fire-Thermal	1. Electrical fire associated with the entrance vestibule overhead crane (Room 1036).	CHF-EVTSR-FT1	Beyond Category 2	Design and operational requirements ensure control of the presence and amount of combustibles in the different areas of the repository to preclude any Category 1 or Category 2 event sequences potentially initiated by a fire.	Preventive	Design-Procedural Safety
	2. Electrical fire associated with handling equipment or other entrance vestibule electrical equipment (Room 1036).	CHF-EVTSR-FT2	Beyond Category 2	Same disposition as Potential Event CHF-EVTSR-FT1.	Preventive	Design-Procedural Safety
	3. Diesel fuel fire/explosion involving a diesel-powered SRTC tractor pulling or pushing an SRTC holding a loaded cask or MSC (Room 1036).	CHF-EVTSR-FT3	Beyond Category 2	Same disposition as Potential Event CHF-EVTSR-FT1.	Preventive	Design-Procedural Safety
	4. Fire/explosion (battery/electrical fire) involving a site prime mover pulling or pushing an LWT or an OWT trailer holding a loaded cask (Room 1036).	CHF-EVTSR-FT4	Beyond Category 2	Same disposition as Potential Event CHF-EVTSR-FT1.	Preventive	Design-Procedural Safety
	5. Fire/explosion (battery/electrical fire) associated with a forklift (Room 1036).	CHF-EVTSR-FT5	Beyond Category 2	Same disposition as Potential Event CHF-EVTSR-FT1.	Preventive	Design-Procedural Safety
	6. Fire/explosion (battery/electrical fire) associated with a mobile elevated platform (Room 1036).	CHF-EVTSR-FT6	Beyond Category 2	Same disposition as Potential Event CHF-EVTSR-FT1.	Preventive	Design-Procedural Safety
	7. Transient combustible fire in the entrance vestibule or the tools/parts storage room (Rooms 1035 and 1036).	CHF-EVTSR-FT7	Beyond Category 2	Same disposition as Potential Event CHF-EVTSR-FT1.	Preventive	Design-Procedural Safety

Table III-4. Disposition of Internal Events That Occur Inside the Canister Handling Facility: Entrance Vestibule (Room 1036), Tools/Parts Storage Room (Room 1035) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Radiation	1. Radiation exposure of a facility worker and/or the offsite public (Rooms 1035 and 1036).	CHF-EVTSR-R1	NA—Accounted for in consequence analyses, if applicable Normal Operations	NA—Potential exposure of workers or the public to radiation is a hazard for the event sequences considered in this analysis. Consequence analyses evaluate this hazard for Category 1 and Category 2 event sequences, as applicable. Some exposure to radiation is expected as a part of normal facility operations. Exposures are managed by design features and procedures that ensure that workers or the public do not receive excessive radiation doses.	NA Mitigative	NA Design-Procedural Safety
	2. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation (Rooms 1035 and 1036).	CHF-EVTSR-R2	NA (no significant exposure)	Operating procedures ensure that a loss of confinement during otherwise normal operations does not cause individuals to be exposed to significant amounts of radioactivity.	Mitigative	Procedural Safety
	3. Radiation-induced damage to a facility SSC (Rooms 1035 and 1036).	CHF-EVTSR-R3	NA	Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization.	NA	NA
Fissile	1. Criticality associated with an SRTC (holding a cask) derailment or collision followed by a load tipover or fall and rearrangement of the cask internals (Rooms 1035 and 1036).	CHF-EVTSR-F1	Beyond Category 2	Design requirements and waste acceptance criteria ensure that transportation casks, transfer casks, MSCs, and dual-purpose canisters (DPCs) are designed to ensure nuclear criticality safety with optimum moderation and most-reactive waste forms. Criticality safety will be maintained despite geometric rearrangements due to a drop or other handling incident.	Preventive	Design
	2. Criticality associated with overturning or collision involving an LWT or an OWT trailer holding a cask and rearrangement of cask internals (Rooms 1035 and 1036).	CHF-EVTSR-F2	Beyond Category 2	Same disposition as Potential Event CHF-EVTSR-F1.	Preventive	Design
	3. Criticality associated with an SRTC (holding a loaded MSC) derailment or collision followed by a load tipover or fall and rearrangement of the cask internals (Rooms 1035 and 1036).	CHF-EVTSR-F3	Beyond Category 2	Same disposition as Potential Event CHF-EVTSR-F1.	Preventive	Design

NOTES: CC = collision-crushing; CCF = chemical-contamination flooding; CHF = Canister Handling Facility; EI = explosion-implosion; EVTSR = entrance vestibule tools/parts storage room; F = fissile; FT = fire-thermal; HLW = high-level radioactive waste; HVAC = heating, ventilation, and air-conditioning; LWT = legal-weight truck; NA = not applicable; OWT = overweight truck; R = radiation; SNF = spent nuclear fuel; SRTC = site rail transfer cart.

The Event Sequence Designator is a unique event sequence index for each event in this table. The prefix identifies the building or facility, for example "CHF," the middle identifies an activity, room, or area, for example "EVTSR," and the suffix identifies the hazard category and event number, for example "CC1."

Table III-5. Disposition of Internal Events That Occur Inside the Canister Handling Facility (Canister Transfer): Canister Transfer Cell (Room 1033)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Collision-Crushing	1. Slapdown of a cask onto an SRTC, a truck trailer, or the floor during upending of the cask to the vertical orientation (Room 1033).	CHF-CTC-CC1A CHF-CTC-CC1B CHF-CTC-CC1C CHF-CTC-CC1D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-01) Design and operational requirements reduce the drop probability. Design requirements limit the lift height for transportation and transfer casks without impact limiters and site-specific casks. Design and operational requirements limit the probability of exceeding the lift height. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multiccanister overpack is defective.	Preventive	Design-Procedural Safety
	2. Drop of a cask from a canister transfer cell overhead crane onto the floor during the transfer from an SRTC or truck trailer to the cask preparation pit (Room 1033).	CHF-CTC-CC2A CHF-CTC-CC2B CHF-CTC-CC2C CHF-CTC-CC2D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-01) Same disposition as Potential Event CHF-CTC-CC1.	Preventive	Design-Procedural Safety
	3. Drop or collision of a cask from a canister transfer cell overhead crane onto or against a sharp object during the transfer from an SRTC or truck trailer to the cask preparation pit (Room 1033).	CHF-CTC-CC3	Beyond Category 2	Design and operational requirements ensure that surfaces in the load paths through which WPs, DOE SNF canisters, naval canisters, DPCs, transportation casks, transfer casks, or MSCs are transferred by crane are kept free of structures, such as posts and curbs, that could puncture a container in case of a drop. An operational requirement ensures that the load paths are kept free of movable puncture hazards. A design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design-Procedural Safety
	4. Drop of a loaded MSC from a canister transfer cell overhead crane onto the floor during the transfer from an SRTC to the cask preparation pit (Room 1033).	CHF-CTC-CC4A CHF-CTC-CC4B CHF-CTC-CC4C CHF-CTC-CC4D	Category 2 No breach Beyond Category 2 Beyond Category 2	(Bounded by GET-01) Same disposition as Potential Event CHF-CTC-CC1.	Preventive	Design-Procedural Safety
	5. Drop or collision of a loaded MSC from a canister transfer cell overhead crane onto or against a sharp object during the transfer from an SRTC to the cask preparation pit (Room 1033).	CHF-CTC-CC5	Beyond Category 2	Same disposition as Potential Event CHF-CTC-CC3.	Preventive	Design-Procedural Safety
	6. Drop or collision of a cask from a canister transfer cell overhead crane into or against the cask preparation pit or an MSC/WP loading pit during the transfer from an SRTC or truck trailer to the cask preparation pit (Room 1033).	CHF-CTC-CC6A CHF-CTC-CC6B CHF-CTC-CC6C CHF-CTC-CC6D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-01) Same disposition as Potential Event CHF-CTC-CC1. For collisions, a design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design-Procedural Safety
	7. Drop or collision of a loaded MSC from a canister transfer cell overhead crane into or against the cask preparation pit or an MSC/WP loading pit during the transfer from the SRTC to the cask preparation pit (Room 1033).	CHF-CTC-CC7A CHF-CTC-CC7B CHF-CTC-CC7C CHF-CTC-CC7D	Category 2 No breach Beyond Category 2 Beyond Category 2	(Bounded by GET-01) Same disposition as Potential Event CHF-CTC-CC1. For collisions, a design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design-Procedural Safety

Table III-5. Disposition of Internal Events That Occur Inside the Canister Handling Facility (Canister Transfer): Canister Transfer Cell (Room 1033) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	8. Slapdown of a cask or MSC in the pit area due to off-center cask or MSC lowering into the cask preparation pit and followed by a cask or MSC corner drop onto the edge of the pit and slapdown (Room 1033).	CHF-CTC-CC8A CHF-CTC-CC8B CHF-CTC-CC8C CHF-CTC-CC8D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-01) Same disposition as Potential Event CHF-CTC-CC1.	Preventive	Design- Procedural Safety
	9. Drop or collision involving the pit moveable platform onto or against a cask or MSC in the cask preparation pit (Room 1033).	CHF-CTC-CC9	Beyond Category 2	Operational requirements ensure that the portable platforms, access platforms, mobile elevated platforms, and forklifts operated in the facility are not operated in a manner that could breach or overturn a loaded transportation cask or site-specific cask.	Preventive	Procedural Safety
	10. Handling equipment drop onto or against a cask or MSC (Room 1033).	CHF-CTC-CC10	Beyond Category 2	Operational requirements for cask preparation and handling ensure that a drop of or collision involving equipment would not breach a transportation cask, transfer cask, or an MSC.	Preventive	Procedural Safety
	11. Drop of a cask or MSC outer lid from a canister transfer cell overhead crane onto a cask or MSC inner lid, as applicable (Room 1033).	CHF-CTC-CC11A CHF-CTC-CC11B CHF-CTC-CC11C CHF-CTC-CC11D CHF-CTC-CC11E CHF-CTC-CC11F	No drop Category 2 No drop No drop No breach Beyond Category 2 Beyond Category 2	(Bounded by GET-02) Design and operational requirements reduce the drop probability. Operational requirements limit the lift height of the inner lid of a transportation cask, transfer cask, site-specific cask, or waste package to ensure that a lid drop onto a DOE canister within that breaches the canister is a beyond Category 2 event sequence. Design and operational requirements limit the probability of exceeding the lift height. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multicasker overpack is defective.	Preventive	Design- Procedural Safety
	12. Drop of a cask or MSC inner lid from a canister transfer cell overhead crane onto a canister inside the cask or MSC, as applicable (Room 1033).	CHF-CTC-CC12A CHF-CTC-CC12B CHF-CTC-CC12C CHF-CTC-CC12D CHF-CTC-CC12E CHF-CTC-CC12F	No drop Category 2 No drop No drop No breach Beyond Category 2 Beyond Category 2	(Bounded by GET-02) Same disposition as Potential Event CHF-CTC-CC11.	Preventive	Design- Procedural Safety
	13. Drop or collision of tools or handling equipment (including the outer lid-lifting fixture, inner lid-lifting fixture, etc.) onto or against a cask or MSC outer lid or a cask or MSC inner lid, as applicable (Room 1033).	CHF-CTC-CC13	Beyond Category 2	An operational requirement limits lift heights for tools and equipment associated with transportation cask, transfer cask, MSC, and DPC handling and preparation to the minimum necessary for operational purposes. The operational requirement ensures that tools and equipment, including handling equipment, if dropped from the height limit, can not initiate an event sequence if dropped onto or collided against (1) a transportation cask or site-specific cask with its outer lid removed and its inner lid in place but unbolted, (2) an exposed sealed dual-purpose canister, or (3) a dual-purpose canister with its severed lid in place.	Preventive	Procedural Safety
	14. Drop or collision of tools or handling equipment, including a lift fixture with pintle or a shield ring, onto or against a canister inside an open cask or MSC (Room 1033).	CHF-CTC-CC14A CHF-CTC-CC14B CHF-CTC-CC14C CHF-CTC-CC14D CHF-CTC-CC14E CHF-CTC-CC14F	No drop Category 2 No drop No drop No breach Beyond Category 2 Beyond Category 2	(See GET-06) In this potential event, a drop has to occur to cause a collision because the equipment would be suspended above the canister. Design and operational requirements reduce the drop probability. An operational requirement ensures the establishment of a maximum lift height limit for handling equipment suspended above DOE SNF canisters. A design requirement ensures that the handling equipment is not capable of causing an event sequence due to a breach of a DOE SNF canister if dropped from within the lift-height limit. Design and operational requirements limit the probability of exceeding the lift height.	Preventive	Design- Procedural Safety

Table III-5. Disposition of Internal Events That Occur Inside the Canister Handling Facility (Canister Transfer): Canister Transfer Cell (Room 1033) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	15. Drop of a canister from a canister transfer cell overhead crane back into the cask or MSC being unloaded (including a naval SNF canister, a DOE SNF MCO, a DPC, a DOE HLW canister, or a [standardized] DOE SNF canister) (Room 1033).	CHF-CTC-CC15A CHF-CTC-CC15B CHF-CTC-CC15C CHF-CTC-CC15D CHF-CTC-CC15E CHF-CTC-CC15F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-05) Design and operational requirements reduce the drop probability. A design requirement limits lift heights for DOE SNF canisters, DOE HLW canisters, naval canisters, DPCs, and DOE SNF multicarrier overpacks. Design and operational requirements limit the probability of exceeding the lift height. Design requirements ensure that standardized DOE SNF canisters would withstand without breach a drop of another standardized DOE SNF canister and that MCOs would withstand without breach a drop of another MCO dropped from within its lift-height limits. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multicarrier overpack is defective. Operational controls render dropping a DOE SNF canister on a DOE HLW canister Beyond Category 2. A design requirement ensures that a DOE SNF canister in a cask, WP, staging rack, or staging pit would withstand without breach the drop of a DOE HLW canister on top of the DOE SNF canister from within their lift height limits. Neither naval canisters nor MCOs are staged in staging racks.	Preventive	Design- Procedural Safety
	16. Drop or collision of a DOE HLW canister or a [standardized] DOE SNF canister from a canister transfer cell overhead crane onto or against another [standardized] DOE SNF canister, or DOE HLW canister in the cask being unloaded, as applicable (Room 1033).	CHF-CTC-CC16A CHF-CTC-CC16B CHF-CTC-CC16C CHF-CTC-CC16D CHF-CTC-CC16E CHF-CTC-CC16F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-05) Same disposition as Potential Event CHF-CTC-CC15. For collisions, a design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design- Procedural Safety
	17. Horizontal movement of a canister before it is fully vertically lifted out of a cask or MSC (Room 1033).	CHF-CTC-CC17	Beyond Category 2	A design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design
	18. Drop of a canister from a canister transfer cell overhead crane onto the cell floor or other flat object during transfer from the cask or MSC to a WP or an MSC, as applicable, or during transfer to a canister staging pit (Room 1033).	CHF-CTC-CC18A CHF-CTC-CC18B CHF-CTC-CC18C CHF-CTC-CC18D CHF-CTC-CC18E CHF-CTC-CC18F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-05) Same disposition as Potential Event CHF-CTC-CC15.	Preventive	Design- Procedural Safety
	19. Drop or collision of a canister from a canister transfer cell overhead crane onto or against a sharp object during transfer from the cask or MSC to a WP or an MSC, as applicable, or during transfer to a canister staging pit (Room 1033).	CHF-CTC-CC19	Beyond Category 2	Same disposition as Potential Event CHF-CTC-CC3.	Preventive	Design- Procedural Safety
	20. Slapdown of a canister in an MSC/WP loading pit or the pit areas due to off-center canister lowering into the WP or MSC, followed by a canister corner drop onto the edge of the pit and slapdown (Room 1033).	CHF-CTC-CC20A CHF-CTC-CC20B CHF-CTC-CC20C CHF-CTC-CC20D CHF-CTC-CC20E CHF-CTC-CC20F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-05) Same disposition as Potential Event CHF-CTC-CC15.	Preventive	Design- Procedural Safety
	21. Drop or collision of a DPC, DOE HLW canister, or [standardized] DOE SNF canister from a canister transfer cell overhead crane into or against the empty MSC being loaded (Room 1033).	CHF-CTC-CC21A CHF-CTC-CC21B CHF-CTC-CC21C CHF-CTC-CC21D CHF-CTC-CC21E CHF-CTC-CC21F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-05) Same disposition as Potential Event CHF-CTC-CC16. For collisions, a design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design- Procedural Safety

Table III-5. Disposition of Internal Events That Occur Inside the Canister Handling Facility (Canister Transfer): Canister Transfer Cell (Room 1033) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	22. Drop or collision of a naval SNF canister, a DOE HLW canister, a DOE SNF MCO, or a [standardized] DOE SNF canister from a canister transfer cell overhead crane into or against the WP being loaded (Room 1033).	CHF-CTC-CC22A CHF-CTC-CC22B CHF-CTC-CC22C CHF-CTC-CC22D CHF-CTC-CC22E CHF-CTC-CC22F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-05) Same disposition as Potential Event CHF-CTC-CC16.	Preventive	Design-Procedural Safety
	23. Drop or collision of a DOE HLW canister from a canister transfer cell overhead crane onto or another DOE HLW canister, a DOE SNF MCO, or a [standardized] DOE SNF canister in a WP (Room 1033).	CHF-CTC-CC23A CHF-CTC-CC23B	No drop Category 2	(See GET-05 Sequences A and B only) Design and operational requirements reduce the drop probability. For collisions, a design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design-Procedural Safety
	24. Drop or collision of a DOE HLW canister from a canister transfer cell overhead crane onto or against another DOE HLW canister or a [standardized] DOE SNF canister in an MSC (Room 1033).	CHF-CTC-CC24A CHF-CTC-CC24B	No drop Category 2	(See GET-05 Sequences A and B only) Same disposition as Potential Event CHF-CTC-CC23.	Preventive	Design-Procedural Safety
	25. Drop or collision of a [standardized] DOE SNF canister from a canister transfer cell overhead crane onto or against a DOE HLW canister in a WP or MSC (Room 1033).	CHF-CTC-CC25C CHF-CTC-CC25D CHF-CTC-CC25E CHF-CTC-CC25F	No drop No breach Beyond Category 2 Beyond Category 2	(See GET-05 Sequences C to F only) Same disposition as Potential Event CHF-CTC-CC16.	Preventive	Design-Procedural Safety
	26. Drop or collision of a DOE SNF MCO from a canister transfer cell overhead crane onto or against another DOE SNF MCO or onto a DOE HLW canister in a WP (Room 1033).	CHF-CTC-CC26C CHF-CTC-CC26D CHF-CTC-CC26E CHF-CTC-CC26F	No drop No breach Beyond Category 2 Beyond Category 2	(See GET-05 Sequences C to F only) Same disposition as Potential Event CHF-CTC-CC16.	Preventive	Design-Procedural Safety
	27. Drop or collision of a DOE SNF MCO from a canister transfer cell overhead crane onto or against a [standardized] DOE SNF canister or a drop of a [standardized] DOE SNF canister onto or against another [standardized] DOE SNF canister in a WP due to a misload (Room 1033).	CHF-CTC-CC27C CHF-CTC-CC27D CHF-CTC-CC27E CHF-CTC-CC27F	No drop No breach Beyond Category 2 Beyond Category 2	(See GET-05 Sequences C to F only) Same disposition as Potential Event CHF-CTC-CC16..	Preventive	Design-Procedural Safety
	28. Drop or collision of a DOE SNF MCO from a canister transfer cell overhead crane onto or against a [standardized] DOE SNF canister or onto or against a DOE HLW canister or another misloaded DOE SNF MCO in an MSC due to a misload (Room 1033).	CHF-CTC-CC28C CHF-CTC-CC28D CHF-CTC-CC28E CHF-CTC-CC28F	No drop No breach Beyond Category 2 Beyond Category 2	(See GET-05 Sequences C to F only) Same disposition as Potential Event CHF-CTC-CC16.	Preventive	Design-Procedural Safety
	29. Drop or collision of a DOE HLW canister or a [standardized] DOE SNF canister from a canister transfer cell overhead crane into or against a canister staging pit (Room 1033).	CHF-CTC-CC29A CHF-CTC-CC29B CHF-CTC-CC29C CHF-CTC-CC29D CHF-CTC-CC29E CHF-CTC-CC29F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-05) Same disposition as Potential Event CHF-CTC-CC16.	Preventive	Design-Procedural Safety

Table III-5. Disposition of Internal Events That Occur Inside the Canister Handling Facility (Canister Transfer): Canister Transfer Cell (Room 1033) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	30. Slapdown of a DOE HLW canister or a [standardized] DOE SNF canister in the staging pit area due to off-center canister lowering into the pit and followed by a canister corner drop onto the edge of the staging pit and a slapdown (Room 1033).	CHF-CTC-CC30A CHF-CTC-CC30B CHF-CTC-CC30C CHF-CTC-CC30D CHF-CTC-CC30E CHF-CTC-CC30F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-05) Same disposition as Potential Event CHF-CTC-CC15.	Preventive	Design- Procedural Safety
	31. Drop or collision of a DOE HLW canister or a [standardized] DOE SNF canister from a canister transfer cell overhead crane onto or against the top of another DOE HLW canister or [standardized] DOE SNF canister in a canister staging pit (Room 1033).	CHF-CTC-CC31A CHF-CTC-CC31B CHF-CTC-CC31C CHF-CTC-CC31D CHF-CTC-CC31E CHF-CTC-CC31F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-05) Same disposition as Potential Event CHF-CTC-CC16.	Preventive	Design- Procedural Safety
	32. Impact due to horizontal movement of a canister before it is fully vertically lifted out of a canister staging pit (Room 1033).	CHF-CTC-CC32	Beyond Category 2	Same disposition as Potential Event CHF-CTC-CC17.	Preventive	Design
	33. Drop of or collision of handling equipment onto or against a DOE HLW canister or a [standardized] DOE SNF canister in a canister staging pit (Room 1033).	CHF-CTC-CC33A CHF-CTC-CC33B CHF-CTC-CC33C CHF-CTC-CC33D CHF-CTC-CC33E CHF-CTC-CC33F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-06) Same disposition as Potential Event CHF-CTC-CC14.	Preventive	Design- Procedural Safety
	34. Drop of or collision of a canister staging pit shield plug onto or against a canister in the canister staging pit (Room 1033).	CHF-CTC-CC34	Beyond Category 2	A design requirement ensures that the shield plugs for the canister staging pits or racks do not fit far enough into the opening to breach a canister inside the pit if the shield plug is dropped.	Preventive	Design
	35. Drop or collision involving the pit moveable platform onto or against a loaded MSC in an MSC/WP loading pit (Room 1033).	CHF-CTC-CC35	Beyond Category 2	Same disposition as Potential Event CHF-CTC-CC9.	Preventive	Procedural Safety
	36. Drop of a WP inner lid into an open, loaded WP (Room 1033).	CHF-CTC-CC36A CHF-CTC-CC36B CHF-CTC-CC36C CHF-CTC-CC36D CHF-CTC-CC36E CHF-CTC-CC36F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-02) Same disposition as Potential Event CHF-CTC-CC11.	Preventive	Design- Procedural Safety
	37. Drop of the MSC lid into an open, loaded MSC (Room 1033).	CHF-CTC-CC37A CHF-CTC-CC37B CHF-CTC-CC37C CHF-CTC-CC37D CHF-CTC-CC37E CHF-CTC-CC37F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-02) Same disposition as Potential Event CHF-CTC-CC11.	Preventive	Design- Procedural Safety

Table III-5. Disposition of Internal Events That Occur Inside the Canister Handling Facility (Canister Transfer): Canister Transfer Cell (Room 1033) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	38. Drop or collision of tools or handling equipment into or against an open, loaded or partially loaded, WP (Room 1033).	CHF-CTC-CC38A CHF-CTC-CC38B CHF-CTC-CC38C CHF-CTC-CC38D CHF-CTC-CC38E CHF-CTC-CC38F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-06) Same disposition as Potential Event CHF-CTC-CC14.	Preventive	Design- Procedural Safety
	39. Drop or collision of tools or handling equipment into or against an open, loaded or partially loaded MSC (Room 1033).	CHF-CTC-CC39A CHF-CTC-CC39B CHF-CTC-CC39C CHF-CTC-CC39D CHF-CTC-CC39E CHF-CTC-CC39F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-06) Same disposition as Potential Event CHF-CTC-CC14.	Preventive	Design- Procedural Safety
	40. Drop or collision of tools or equipment (including a lid-lifting fixture) onto or against a loaded WP inner lid (Room 1033).	CHF-CTC-CC40	Beyond Category 2	Operational requirements establish lift-height limits for handling equipment and other equipment associated with the WP, including lifting collars (or trunnion collars), yokes, docking rings, and WP-closure equipment. The lift-height limits ensure that the handling equipment can not breach a sealed WP if dropped onto or collided into the WP from within the lift-height limit. Furthermore, the lift-height limits ensure that a drop of equipment from within the lift-height limit can not initiate an event sequence if the WP inner lid is in place, but unsealed. An operational requirement ensures that the inner lid, once set in place, is not removed from the WP except in a remediation situation.	Preventive	Procedural Safety
	41. Drop or collision of tools or equipment (including a lid-lifting fixture) onto or against the lid of a loaded, unsealed or sealed MSC (Room 1033).	CHF-CTC-CC41	Beyond Category 2	Same disposition as Potential Event CHF-CTC-CC13.	Preventive	Procedural Safety
Chemical Contamination-Flooding	1. Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures (Room 1033).	CHF-CTC-CCF1	NA—Accounted for in consequence analyses, if applicable	NA—SNF is contained inside a sealed canister, therefore this event does not occur unless an event sequence leads to exposure of SNF to air. Oxidation of the fuel matrix is a possible outcome of any event that exposes SNF to air. Consequence analyses account for the possibility of oxidation, as applicable.	NA	NA
Explosion-Implosion	1. Cask sampling and purging system or decontamination (or other pneumatic or pressurized system) missile due to a fractured nozzle/valve stem/pneumatic device (Room 1033).	CHF-CTC-EI1	Beyond Category 2	An operational requirement ensures that pressurized systems that could generate missiles, energetic enough to penetrate a transportation cask with or without impact limiters, a transfer cask, a DOE canister, a naval SNF canister, a dual-purpose canister, the inner lid of a transportation cask, a site-specific cask, a waste package, or the inner lid of a site-specific cask or waste package are not present in areas where potentially vulnerable items may be exposed.	Preventive	Procedural Safety
	2. Explosion hazard associated with the cask sampling and purging system and the ignition of hydrogen that may have accumulated in the cask or MSC (Room 1033).	CHF-CTC-EI2	Beyond Category 2	Operational requirements ensure that precautions taken during the cask sampling and purging process provide reasonable assurance that such hydrogen explosions would not occur.	Preventive	Procedural Safety
	3. Hydrogen explosion involving batteries on a forklift (Room 1033).	CHF-CTC-EI3	Beyond Category 2	Operational controls pertaining to batteries for powering heavy equipment ensure the generation or accumulation of enough hydrogen gas to cause an explosion that could breach a transportation cask, site-specific cask, or waste package is prevented.	Preventive	Procedural Safety
	4. Hydrogen explosion involving batteries on a site prime mover (Room 1033).	CHF-CTC-EI4	Beyond Category 2	Same disposition as Potential Event CHF-CTC-EI3.	Preventive	Procedural Safety

Table III-5. Disposition of Internal Events That Occur Inside the Canister Handling Facility (Canister Transfer): Canister Transfer Cell (Room 1033) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Fire-Thermal	1. Electrical fire associated with the canister transfer cell overhead cranes (Room 1033).	CHF-CTC-FT1	Beyond Category 2	Design and operational requirements ensure control of the presence and amount of combustibles in the different areas of the repository to preclude any Category 1 or Category 2 event sequences potentially initiated by a fire.	Preventive	Design-Procedural Safety
	2. Electrical fire associated with handling equipment or other canister transfer cell electrical equipment (Room 1033).	CHF-CTC-FT2	Beyond Category 2	Same disposition as Potential Event CHF-CTC-FT1.	Preventive	Design-Procedural Safety
	3. Diesel fuel fire/explosion on an SRTC tractor pushing an SRTC holding a loaded cask into the canister transfer cell (Room 1033).	CHF-CTC-FT3	Beyond Category 2	Same disposition as Potential Event CHF-CTC-FT1.	Preventive	Design-Procedural Safety
	4. Fire/explosion (battery/electrical fire) involving a site prime mover pulling or pushing an LWT or an OWT trailer holding a loaded cask (Room 1033).	CHF-CTC-FT4	Beyond Category 2	Same disposition as Potential Event CHF-CTC-FT1.	Preventive	Design-Procedural Safety
	5. Diesel fuel fire/explosion associated with the SRTC tractor pushing an SRTC holding an MSC (Room 1033).	CHF-CTC-FT5	Beyond Category 2	Same disposition as Potential Event CHF-CTC-FT1.	Preventive	Design-Procedural Safety
	6. Fire/explosion (battery/electrical fire) associated with a forklift (Room 1033).	CHF-CTC-FT6	Beyond Category 2	Same disposition as Potential Event CHF-CTC-FT1.	Preventive	Design-Procedural Safety
	7. High-efficiency particulate air (HEPA) filter fire due to excessive radioactive decay within the filter bed (Room 1033).	CHF-CTC-FT7	Beyond Category 2	Operation requirements ensure that the operating surface temperatures of high-efficiency particulate air (HEPA) filters is maintained such that they can not catch on fire under normal operation or in the event of a shutdown of the HVAC system.	Preventive	Procedural Safety
	8. Canister overheating in the canister staging pit due to a loss of cooling resulting in excessive temperature and possible damage to canister contents and/or confinement (Room 1033).	CHF-CTC-FT8	Beyond Category 2	If ventilation is lost in areas where DOE or naval canisters are handled, no radiological release occurs from the canisters because containment within the canisters is maintained. Design and operational requirements ensure that the thermal response of areas where CSNF assemblies are handled or staged to a loss of HVAC would not cause radiological releases in excess of those considered in the consequence analysis for normal operations.	Preventive	Design-Procedural Safety
	9. Transient combustible fire in the canister transfer cell (Room 1033).	CHF-CTC-FT9	Beyond Category 2	Same disposition as Potential Event CHF-CTC-FT1.	Preventive	Design-Procedural Safety
	10. Overheating of a loaded cask, WP, or MSC while staged in a pit due to a loss of cooling resulting in excessive temperature and possible damage to canister contents (Room 1033).	CHF-CTC-FT10	Beyond Category 2	Same disposition as Potential Event CHF-CTC-FT8.	Preventive	Design-Procedural Safety
Radiation	1. Radiation exposure of a facility worker and/or the offsite public (Room 1033).	CHF-CTC-R1	NA—Accounted for in consequence analyses, if applicable Normal Operations	NA—Potential exposure of workers or the public to radiation is a hazard for the event sequences considered in this analysis. Consequence analyses evaluate this hazard for Category 1 and Category 2 event sequences, as applicable. Some exposure to radiation is expected as a part of normal facility operations. Exposures are managed by design features and procedures that ensure that workers or the public do not receive excessive radiation doses.	NA Mitigative	NA Design-Procedural Safety
	2. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation (Room 1033).	CHF-CTC-R2	NA (no significant exposure)	Operating procedures ensure that a loss of confinement during otherwise normal operations does not cause individuals to be exposed to significant amounts of radioactivity.	Mitigative	Procedural Safety

Table III-5. Disposition of Internal Events That Occur Inside the Canister Handling Facility (Canister Transfer): Canister Transfer Cell (Room 1033) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	3. Damage or rupture of cask sampling and purging system, leading to a release of cask internal gasses and radioactive material (Room 1033).	CHF-CTC-R3	Normal Operations	The sampling operation is conducted so that exposure of workers to radiation is managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. Although a rupture leading to a radiological release would be an off-normal occurrence, any release and related dose would be managed as part of routine radiation protection operations.	Mitigative	Procedural Safety
	4. Thermal expansion of gases or other loss of confinement in an unsealed cask or MSC, leading to radiological release (Room 1033).	CHF-CTC-R4	Normal Operations	Thermal expansion of gases is to be expected as a part of normal operations. Any resulting exposure of workers to radiation is managed as a normal-operations dose by procedures that ensure that workers do not receive excessive radiation doses.	Mitigative	Procedural Safety
	5. Inadvertent opening of a canister transfer cell shield door or a cask preparation pit cover or an MSC/WP pit cover, leading to a worker exposure (Room 1033).	CHF-CTC-R5	Beyond Category 2	Design and operational requirements ensure that exposure of workers due to inadvertent actuation of shield doors or pit protective covers is not Category 1.	Preventive	Design-Procedural Safety
	6. Radiation-induced damage to a facility SSC (Room 1033).	CHF-CTC-R6	NA	Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization.	NA	NA
Fissile	1. Criticality associated with a drop or slapdown of a loaded cask from a canister transfer cell overhead crane and a rearrangement of cask internals (Room 1033).	CHF-CTC-F1	Beyond Category 2	Design requirements and waste acceptance criteria ensure that transportation casks, transfer casks, MSCs, and dual-purpose canisters (DPCs) are designed to ensure nuclear criticality safety with optimum moderation and most-reactive waste forms. Criticality safety will be maintained despite geometric rearrangements due to a drop or other handling incident.	Preventive	Design
	2. Criticality associated with a drop or slapdown of a loaded MSC from a canister transfer cell overhead crane and a rearrangement of cask internals (Room 1033).	CHF-CTC-F2	Beyond Category 2	Same disposition as Potential Event CHF-CTC-F1.	Preventive	Design-
	3. Criticality associated with a drop or slapdown of a loaded WP (unsealed) from a canister transfer cell overhead crane and a rearrangement of WP internals (Room 1033).	CHF-CTC-F3	Beyond Category 2	A design requirement ensures that an unsealed WP that is dropped onto an essentially unyielding surface from within its lift-height limits would not spill its contents. A design requirement ensures that waste packages are designed to preclude criticality with credit for moderator control and without credit for burnup. Demonstration of compliance must account for the bowing of fuel rods or other rearrangement of fissile material that may occur due to a drop or other handling incident. Design and operational requirements ensure that moderator control is in effect.	Preventive	Design-Procedural Safety
	4. Criticality associated with a drop or slapdown of a [standardized] DOE SNF canister, a naval SNF canister, a DOE SNF MCO, a DPC, or a DOE HLW canister and a rearrangement of canister internals (Room 1033).	CHF-CTC-F4	Beyond Category 2	Same disposition as Potential Event CHF-CTC-F1. Additionally, a design requirement ensures that dropping a DOE SNF canister within its design basis does not lead to a criticality. Demonstration of compliance for the staging rack must account for the most reactive configuration of DOE SNF canisters with credit for moderator control. There is no potential for criticality of DOE HLW canisters. Criticality of a naval canister following a drop, or other impact event, has been evaluated to be Beyond Category 2 based upon probabilities of independent events required for criticality. Design and operational requirements ensure that moderator control is in effect.	Preventive	Design-Procedural Safety
	5. Criticality associated with a misload of a WP or an MSC (Room 1033).	CHF-CTC-F5	Beyond Category 2	Same disposition as Potential Event CHF-CTC-F1. Additionally, a design requirement ensures that criticality caused by a misload of a waste package is not credible because waste packages can be loaded with canisters that are acceptable for disposal without leading to a preclosure nuclear criticality with credit for moderator control. Design and operational requirements ensure that moderator control is in effect.	Preventive	Design-Procedural Safety
	6. Criticality associated with a misload of a canister staging pit (Room 1033).	CHF-CTC-F6	Beyond Category 2	A design requirement ensures that the most reactive configuration of standardized DOE SNF canisters can be loaded into canister staging pits or racks with credit for moderator control without causing a nuclear criticality. Neither naval canisters nor MCOs are staged in staging racks. There is no potential for criticality of DOE HLW canisters. Design and operational requirements ensure that moderator control is in effect.	Preventive	Design-Procedural Safety

Table III-5. Disposition of Internal Events That Occur Inside the Canister Handling Facility (Canister Transfer): Canister Transfer Cell (Room 1033) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	7. Criticality associated with a drop of heavy equipment onto an unsealed, loaded cask, WP, or MSC and a rearrangement of the container internals (Room 1033).	CHF-CTC-F7	Beyond Category 2	Same disposition as Potential Events CHF-CTC-F1 and CHF-CTC-F3.	Preventive	Design-Procedural Safety

NOTES: CC = collision-crushing; CCF = chemical-contamination flooding; CHF = Canister Handling Facility; CTC = canister transfer cell; DBGm = design basis ground motion; DOE = U.S. Department of Energy; EI = explosion-implosion; F = fissile; FT = fire-thermal; GET = generalized event tree; HLW = high-level radioactive waste; NA = not applicable; R = radiation; SNF = spent nuclear fuel; SRTC = site rail transfer cart.

The Event Sequence Designator is a unique event sequence index for each event in this table. The prefix identifies the building or facility, for example "CHF," the middle identifies an activity, room, or area, for example "CTC," and the suffix identifies the hazard category and event number, for example "CC1." When an event sequence has been evaluated in a GET, the GET number is identified in the Disposition of Event column; the GET sequence alpha character is shown at the end of the Event Sequence Designator, for example "A."

GETs are discussed in Sections 6.3.1.1 to 6.3.1.24.

Table III-6. Disposition of Internal Events That Occur Inside the Canister Handling Facility (Waste Package Transfer to Waste Package Closure, Site-specific Cask Closure and Removal): Canister Transfer Cell (Room 1033)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Collision-Crushing	1. Drop or collision of handling equipment or a lifting fixture onto or against a loaded WP inner lid (Room 1033).	CHF-WPTC-CC1	Beyond Category 2	Operational requirements establish lift-height limits for handling equipment and other equipment associated with the WP, including lifting collars (or trunnion collars), yokes, docking rings, and WP-closure equipment. The lift-height limits ensure that the handling equipment can not breach a sealed WP if dropped onto or collided into the WP from within the lift-height limit. Furthermore, the lift-height limits ensure that a drop of equipment from within the lift-height limit can not initiate an event sequence if the WP inner lid is in place, but unsealed. An operational requirement ensures that the inner lid, once set in place, is not removed from the WP except in a remediation situation.	Preventive	Procedural Safety
	2. Drop or collision of handling equipment or a lifting fixture onto or against a loaded MSC lid (Room 1033).	CHF-WPTC-CC2	Beyond Category 2	An operational requirement limits lift heights for tools and equipment associated with transportation cask, transfer cask, MSC, and DPC handling and preparation to the minimum necessary for operational purposes. The operational requirement ensures that tools and equipment, including handling equipment, if dropped from the height limit, does not initiate an event sequence if dropped onto or collided against (1) a transportation cask or site-specific cask with its outer lid removed and its inner lid in place but unbolted, (2) an exposed sealed dual-purpose canister, or (3) a dual-purpose canister with its severed lid in place.	Preventive	Procedural Safety
	3. Impact due to horizontal movement of a loaded WP by a canister transfer cell overhead crane before it is fully lifted vertically out of the MSC/WP loading pit (Room 1033).	CHF-WPTC-CC3	Beyond Category 2	A design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design
	4. Drop or collision of an unsealed, loaded WP from a canister transfer cell overhead crane back into or against the MSC/WP loading pit (Room 1033).	CHF-WPTC-CC4A CHF-WPTC-CC4B CHF-WPTC-CC4C CHF-WPTC-CC4D CHF-WPTC-CC4E	No drop Category 2 No waste form breach Beyond Category 2 Beyond Category 2	(See GET-07) Design and operational requirements reduce the drop probability. Design and operational requirements specify lift-height limits for unsealed waste packages whenever waste packages are transferred. If the limit can not be met, impact absorbers are provided. Design and operational requirements limit the probability of exceeding the lift-height limit. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multicask overpack is defective. For collisions, a design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design-Procedural Safety
	5. Drop of an unsealed, loaded WP from a canister transfer cell overhead crane onto the cell floor or a pit cover during the lift and transfer to the WP positioning cell pedestal and trolley(Room 1033).	CHF-WPTC-CC5A CHF-WPTC-CC5B CHF-WPTC-CC5C CHF-WPTC-CC5D CHF-WPTC-CC5E	No drop Category 2 No waste form breach Beyond Category 2 Beyond Category 2	(See GET-07) Same disposition as Potential Event CHF-WPTC-CC4. Additionally, a design requirement ensures that pit covers for the waste-package and MSC pits are sturdy enough to prevent a WP or MSC that is dropped on the pit cover from penetrating the pit cover and falling into the pit.	Preventive	Design-Procedural Safety
	6. Drop or collision of an unsealed, loaded WP from a canister transfer cell overhead crane onto or against a sharp object during the lift and transfer to the WP positioning cell pedestal and trolley(Room 1033).	CHF-WPTC-CC6	Beyond Category 2	Design and operational requirements ensure that surfaces in the load paths through which WPs, DOE SNF canisters, naval canisters, DPCs, transportation casks, transfer casks, or MSCs are transferred by crane are kept free of structures, such as posts and curbs, that could puncture a container in case of a drop. An operational requirement ensures that the load paths are kept free of movable puncture hazards. A design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design-Procedural Safety

Table III-6. Disposition of Internal Events That Occur Inside the Canister Handling Facility (Waste Package Transfer to Waste Package Closure, Site-specific Cask Closure and Removal): Canister Transfer Cell (Room 1033) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	7. Slapdown of a loaded, unsealed WP onto the cell floor, into a wall, or onto a pit cover following a drop from a canister transfer cell overhead crane onto the edge of the trolley, a pit edge, or pit cover during the lift and transfer to the WP positioning cell pedestal and trolley (Room 1033).	CHF-WPTC-CC7A CHF-WPTC-CC7B CHF-WPTC-CC7C CHF-WPTC-CC7D CHF-WPTC-CC7E	No drop Category 2 No waste form breach Beyond Category 2 Beyond Category 2	(See GET-07) Same disposition as Potential Event CHF-WPTC-CC5.	Preventive	Design- Procedural Safety
	8. Drop or collision of an unsealed, loaded WP from a canister transfer cell overhead crane onto or against a loaded or partially loaded MSC or WP (with no lid in place) in an MSC/WP loading pit (with no pit cover in place) during the lift and transfer to the WP positioning cell pedestal and trolley (Room 1033).	CHF-WPTC-CC8	Beyond Category 2	An operational requirement ensures that a loaded waste package is not carried over a loaded site-specific cask/waste package in a loading pit. An operational requirement ensures that covers for the waste-package and site-specific cask pits are replaced whenever individual waste-form handling operations are suspended unless loading operation in that particular pit is complete and the next operation involving the overhead crane is to remove the waste package or site-specific cask from the pit.	Preventive	Procedural Safety
	9. Drop or collision of an unsealed, loaded WP from a canister transfer cell overhead crane onto or against a loaded MSC or WP (with lid in place) in an MSC/WP loading pit (with no pit cover in place) during the lift and transfer to the WP positioning cell pedestal and trolley (Room 1033).	CHF-WPTC-CC9	Beyond Category 2	Same disposition as Potential Event CHF-WPTC-CC8.	Preventive	Procedural Safety
	10. Drop or collision of an unsealed, loaded WP from a canister transfer cell overhead crane onto or against a loaded, unsealed WP on the opposite WP positioning cell pedestal and trolley during the lift and transfer to a WP positioning cell pedestal and trolley (Room 1033).	CHF-WPTC-CC10	Beyond Category 2	An operational requirement ensures that whenever a waste-package trolley is being loaded onto a trolley or is already on the trolley but not in the waste package positioning cell, the opposite trolley remains in its positioning cell or is otherwise out of the way. A design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design- Procedural Safety
	11. Drop or collision of an unsealed, loaded WP from a canister transfer cell overhead crane onto or against a loaded, sealed WP on the opposite WP positioning cell pedestal and trolley during the lift and transfer to a WP positioning cell pedestal and trolley (Room 1033).	CHF-WPTC-CC11	Beyond Category 2	Same disposition as Potential Event CHF-WPTC-CC10.	Preventive	Design- Procedural Safety
	12. Slapdown of a loaded, unsealed WP onto the floor and then across or into an empty MSC/WP loading pit (with no pit cover in place) following a drop from a canister transfer cell overhead crane onto the edge of the trolley or pit edge during the lift and transfer to the WP positioning cell pedestal and trolley (Room 1033).	CHF-WPTC-CC12A CHF-WPTC-CC12B CHF-WPTC-CC12C CHF-WPTC-CC12D CHF-WPTC-CC12E	No drop Category 2 No waste form breach Beyond Category 2 Beyond Category 2	(See GET-07) Same disposition as Potential Event CHF-WPTC-CC4.	Preventive	Design- Procedural Safety
	13. Slapdown of a loaded, unsealed WP onto the floor and then across or into an MSC/WP loading pit (with no pit cover in place) and a loaded or partially loaded, sealed or unsealed MSC or WP in place) following a drop from a canister transfer cell overhead crane onto the edge of the trolley or pit edge during the lift and transfer to the WP positioning cell pedestal and trolley (Room 1033).	CHF-WPTC-CC13A CHF-WPTC-CC13B CHF-WPTC-CC13C CHF-WPTC-CC13D CHF-WPTC-CC13E	No drop Category 2 No waste form breach Beyond Category 2 Beyond Category 2	(See GET-07) Same disposition as Potential Event CHF-WPTC-CC4. Additionally, operational requirements cited in the disposition of Potential Event CHF-WPTC-CC8 preclude a drop into an occupied loading pit.	Preventive	Design- Procedural Safety
	14. Slapdown of a loaded, unsealed WP that subsequently impacts a loaded, unsealed WP on the opposite WP positioning cell trolley following a drop from a canister transfer cell overhead crane onto the edge of the opposite WP positioning cell trolley, a pit edge, or other object during the lift and transfer to the WP positioning cell pedestal and trolley (Room 1033).	CHF-WPTC-CC14	Beyond Category 2	Same disposition as Potential Event CHF-WPTC-CC10.	Preventive	Design- Procedural Safety

Table III-6. Disposition of Internal Events That Occur Inside the Canister Handling Facility (Waste Package Transfer to Waste Package Closure, Site-specific Cask Closure and Removal): Canister Transfer Cell (Room 1033) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	15. Slapdown of a loaded, unsealed WP that subsequently impacts a loaded, sealed WP on the opposite WP positioning cell trolley following a drop from a canister transfer cell overhead crane onto the edge of the WP positioning cell trolley, a pit edge, or other object during the lift and transfer to the WP positioning cell pedestal and trolley (Room 1033).	CHF-WPTC-CC15	Beyond Category 2	Same disposition as Potential Event CHF-WPTC-CC10.	Preventive	Design- Procedural Safety
	16. Impact due to horizontal movement of a loaded, sealed MSC by a canister transfer cell overhead crane before it is fully vertically lifted out of the MSC/WP loading pit (Room 1033).	CHF-WPTC-CC16	Beyond Category 2	Same disposition as Potential Event CHF-WPTC-CC3.	Preventive	Design
	17. Drop or collision of a loaded, sealed MSC from a canister transfer cell overhead crane back into or against the MSC/WP loading pit during MSC removal and transfer to the SRTC (Room 1033).	CHF-WPTC-CC17A CHF-WPTC-CC17B CHF-WPTC-CC17C CHF-WPTC-CC17D	Category 2 No breach Beyond Category 2 Beyond Category 2	(Bounded by GET-01) Design and operational requirements reduce the drop probability. Design and operational requirements limit the lift height for transportation and transfer casks without impact limiters and site-specific casks. Design and operational requirements limit the probability of exceeding the lift height. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multicask overpack is defective. For collisions, a design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design- Procedural Safety
	18. Slapdown of a loaded, sealed MSC onto the cell floor, into a wall, or onto a pit cover following a drop from a canister transfer cell overhead crane onto the edge of the MSC/WP loading pit or the SRTC during MSC removal from the pit and transfer to the SRTC (Room 1033).	CHF-WPTC-CC18A CHF-WPTC-CC18B CHF-WPTC-CC18C CHF-WPTC-CC18D	Category 2 No breach Beyond Category 2 Beyond Category 2	(Bounded by GET-01) Same disposition as Potential Event CHF-WPTC-CC17.	Preventive	Design- Procedural Safety
	19. Drop or collision of a loaded, sealed MSC from a canister transfer cell overhead crane onto or against the SRTC following removal of the MSC from the MSC/WP loading pit during transfer to the SRTC for removal from the building (Room 1033).	CHF-WPTC-CC19A CHF-WPTC-CC19B CHF-WPTC-CC19C CHF-WPTC-CC19D	Category 2 No breach Beyond Category 2 Beyond Category 2	(Bounded by GET-01) Same disposition as Potential Event CHF-WPTC-CC17. For collisions, a design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design- Procedural Safety
	20. Drop of a loaded, sealed MSC from a canister transfer cell overhead crane onto the canister transfer cell floor or a pit cover following removal of the MSC from the MSC/WP loading pit (Room 1033).	CHF-WPTC-CC20A CHF-WPTC-CC20B CHF-WPTC-CC20C CHF-WPTC-CC20D	Category 2 No breach Beyond Category 2 Beyond Category 2	(Bounded by GET-01) Same disposition as Potential Event CHF-WPTC-CC17. Additionally, a design requirement ensure that pit covers for the waste-package and MSC pits are sturdy enough to prevent a WP or MSC that is dropped on the pit cover from penetrating the pit cover and falling into the pit.	Preventive	Design- Procedural Safety
	21. Drop or collision of a loaded, sealed MSC from a canister transfer cell overhead crane onto or against a sharp object following removal of the MSC from the MSC/WP loading pit (Room 1033).	CHF-WPTC-CC21	Beyond Category 2	Same disposition as Potential Event CHF-WPTC-CC6.	Preventive	Design- Procedural Safety
	22. Collision of the SRTC (holding a loaded, sealed MSC) with the entrance vestibule doors, the tool/parts storage room doors, or the canister transfer cell shield doors (Room 1033).	CHF-WPTC-CC22	Beyond Category 2	Design and operational requirements establish speed limits such that a collision with shield or airlock doors or other heavy objects would not overturn an SRTC, or site-specific cask transporter or cause it to lose its load.	Preventive	Design- Procedural Safety
	23. The entrance vestibule doors, the tool/parts storage room doors, or the canister transfer cell shield doors close on the SRTC holding a loaded, sealed MSC (Room 1033).	CHF-WPTC-CC23	Beyond Category 2	A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transfer trolley, site-rail transfer cart (SRTC), MSC transporter, WP transporter, would not cause a tipover of the conveyance or cause the conveyance to drop its load. A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transportation cask, transfer cask, or MSC suspended from an overhead crane would not cause the crane to drop its load.	Preventive	Design

Table III-6. Disposition of Internal Events That Occur Inside the Canister Handling Facility (Waste Package Transfer to Waste Package Closure, Site-specific Cask Closure and Removal): Canister Transfer Cell (Room 1033) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Chemical Contamination-Flooding	1. Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures (Room 1033).	CHF-WPTC-CCF1	NA—Accounted for in consequence analyses, if applicable	NA—SNF is contained inside a sealed canister, therefore this event does not occur unless an event sequence leads to exposure of SNF to air. Oxidation of the fuel matrix is a possible outcome of any event that exposes SNF to air. Consequence analyses account for the possibility of oxidation, as applicable.	NA	NA
Explosion-Impllosion	1. MSC inerting system (or other pneumatic or pressurized system) missile due to a fractured nozzle/valve stem/pneumatic device (Room 1033).	CHF-WPTC-EI1	Beyond Category 2	An operational requirement ensures that pressurized systems that could generate missiles, energetic enough to penetrate a transportation cask with or without impact limiters, a transfer cask, a DOE canister, a naval SNF canister, a dual-purpose canister, the inner lid of a transportation cask, a site-specific cask, a waste package, or the inner lid of a site-specific cask or waste package are not present in areas where potentially vulnerable items may be exposed.	Preventive	Procedural Safety
Fire-Thermal	1. Electrical fire associated with the canister transfer cell overhead cranes (Room 1033).	CHF-WPTC-FT1	Beyond Category 2	Design and operational requirements ensure control of the presence and amount of combustibles in the different areas of the repository to preclude any Category 1 or Category 2 event sequences potentially initiated by a fire.	Preventive	Design-Procedural Safety
	2. Electrical fire associated with handling equipment or other canister transfer cell electrical equipment (Room 1033).	CHF-WPTC-FT2	Beyond Category 2	Same disposition as Potential Event CHF-WPTC-FT1.	Preventive	Design-Procedural Safety
	3. Diesel fuel fire/explosion associated with the SRTC tractor pulling an SRTC holding an MSC (Room 1033).	CHF-WPTC-FT3	Beyond Category 2	Same disposition as Potential Event CHF-WPTC-FT1.	Preventive	Design-Procedural Safety
	4. HEPA filter fire due to excessive radioactive decay within the filter bed (Room 1033).	CHF-WPTC-FT4	Beyond Category 2	Operation requirements ensure that the operating surface temperatures of high-efficiency particulate air (HEPA) filters is maintained such that they can not catch on fire under normal operation or in the event of a shutdown of the HVAC system.	Preventive	Procedural Safety
	5. Transient combustible fire in the canister transfer cell (Room 1033).	CHF-WPTC-FT5	Beyond Category 2	Same disposition as Potential Event CHF-WPTC-FT1.	Preventive	Design-Procedural Safety
	6. Thermal hazard (from decay heat) associated with a vertical orientation of a non-inerted, loaded, unsealed WP with normal cooling (Room 1033).	CHF-WPTC-FT6	NA—Accounted for in consequence analyses, if applicable	Same disposition as Potential Event CHF-WPTC-CCF1.	NA	NA
	7. Overheating of a loaded, unsealed (and uninerted) WP or MSC due to a loss of cooling resulting in excessive temperature and possible damage to canister contents (Room 1033).	CHF-WPTC-FT7	Beyond Category 2	If ventilation is lost in areas where DOE or naval canisters are handled, no radiological release occurs from the canisters because containment within the canisters is maintained. Design and operational requirements ensure that the thermal response of areas where CSNF assemblies are handled or staged to a loss of HVAC would not cause radiological releases in excess of those considered in the consequence analysis for normal operations.	Preventive	Design-Procedural Safety
Radiation	1. Radiation exposure of a facility worker and/or the offsite public (Room 1033).	CHF-WPTC-R1	NA—Accounted for in consequence analyses, if applicable Normal Operations	NA—Potential exposure of workers or the public to radiation is a hazard for the event sequences considered in this analysis. Consequence analyses evaluate this hazard for Category 1 and Category 2 event sequences, as applicable. Some exposure to radiation is expected as a part of normal facility operations. Exposures are managed by design features and procedures that ensure that workers or the public do not receive excessive radiation doses.	NA Mitigative	NA Design-Procedural Safety
	2. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation (Room 1033).	CHF-WPTC-R2	NA (no significant exposure)	Operating procedures ensure that a loss of confinement during otherwise normal operations does not cause individuals to be exposed to significant amounts of radioactivity.	Mitigative	Procedural Safety

Table III-6. Disposition of Internal Events That Occur Inside the Canister Handling Facility (Waste Package Transfer to Waste Package Closure, Site-specific Cask Closure and Removal): Canister Transfer Cell (Room 1033) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	3. Inadvertent opening of a canister transfer cell shield door or a WP positioning cell shield door, leading to a worker exposure (Room 1033).	CHF-WPTC-R3	Beyond Category 2	Design and operational requirements ensure that exposure of workers due to inadvertent actuation of shield doors or pit protective covers is not Category 1.	Preventive	Design- Procedural Safety
	4. Radiation-induced damage to a facility SSC (Room 1033).	CHF-WPTC-R4	NA	Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization.	NA	NA
Fissile	1. Criticality associated with a drop or slakedown of a loaded MSC from a canister transfer cell overhead crane and a rearrangement of cask internals (Room 1033).	CHF-WPTC-F1	Beyond Category 2	Design requirements and waste acceptance criteria ensure that transportation casks, transfer casks, MSCs, and dual-purpose canisters (DPCs) are designed to ensure nuclear criticality safety with optimum moderation and most-reactive waste forms. Criticality safety will be maintained despite geometric rearrangements due to a drop or other handling incident.	Preventive	Design
	2. Criticality associated with an SRTC (holding a loaded MSC) derailment or collision followed by a load tipover or fall and rearrangement of the cask internals (Room 1033).	CHF-WPTC-F2	Beyond Category 2	Same disposition as Potential Event CHF-WPTC-F1.	Preventive	Design
	3. Criticality associated with a drop or slakedown of a loaded, unsealed WP from a canister transfer cell overhead crane and a rearrangement of WP internals (Room 1033).	CHF-WPTC-F3	Beyond Category 2	A design requirement ensures that an unsealed WP that is dropped onto an essentially unyielding surface from within its lift-height limits would not spill its contents. A design requirement ensures that waste packages are designed to preclude criticality with credit for moderator control and without credit for burnup. Demonstration of compliance must account for the bowing of fuel rods or other rearrangement of fissile material that may occur due to a drop or other handling incident. An unsealed waste package remains subcritical with credit for moderator control. Design and operational requirements ensure that moderator control is in effect.	Preventive	Design- Procedural Safety
	4. Criticality associated with a drop of heavy equipment onto an unsealed, loaded WP or MSC and a rearrangement of the container internals (Room 1033).	CHF-WPTC-F4	Beyond Category 2	Same disposition as Potential Events CHF-WPTC-F1 and CHF-WPTC-F3.	Preventive	Design- Procedural Safety

NOTES: CC = collision-crushing; CCF = chemical-contamination flooding; CHF = Canister Handling Facility; DTF = dry transfer facility (DTF 1 and DTF 2); EI = explosion-implosion; F = fissile; FT = fire-thermal; GET = generalized event tree; NA = not applicable; R = radiation; SNF = spent nuclear fuel; SRTC = site rail transfer cart; WPTC = waste package transfer to waste package closure.

The Event Sequence Designator is a unique event sequence index for each event in this table. The prefix identifies the building or facility, for example "CHF," the middle identifies an activity, room, or area, for example "WPTC," and the suffix identifies the hazard category and event number, for example "CC1." When an event sequence has been evaluated in a GET, the GET number is identified in the Disposition of Event column; the GET sequence alpha character is shown at the end of the Event Sequence Designator, for example "A."

GETs are discussed in Sections 6.3.1.1 to 6.3.1.24.

Table III-7. Disposition of Internal Events That Occur Inside the Canister Handling Facility (Waste Package Closure): Waste Package Positioning Cells (Rooms 1011 and 1042), and Closure Cells (Rooms 2010 and 2032)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Collision-Crushing	1. Derailment of a trolley holding a loaded, unsealed WP followed by a load tipover or fall. (Rooms 1011 and 1042).	CHF-WPC-CC1	Beyond Category 2	A design requirement ensures that loaded transfer trolleys do not derail or drop their loads. Design requirements apply to trolleys for casks, waste packages, site-specific casks, and dual-purpose canisters.	Preventive	Design
	2. Drop or collision of equipment from a canister transfer cell overhead crane onto or against a loaded, unsealed WP positioned on a pedestal on a trolley (Rooms 2010 and 2032).	CHF-WPC-CC2	Beyond Category 2	Operational requirements establish lift-height limits for handling equipment and other equipment associated with the WP, including lifting collars (or trunnion collars), yokes, docking rings, and WP-closure equipment. The lift-height limits ensure that the handling equipment can not breach a sealed WP if dropped onto or collided into the WP from within the lift-height limit. Furthermore, the lift-height limits ensure that a drop of equipment from within the lift-height limit can not initiate an event sequence if the WP inner lid is in place, but unsealed. An operational requirement ensures that the inner lid, once set in place, is not removed from the WP except in a remediation situation.	Preventive	Procedural Safety
	3. Collision involving the trolley holding the loaded, unsealed WP and the shield doors between the canister transfer cell and the WP positioning cell (Rooms 1011 and 1042).	CHF-WPC-CC3	Beyond Category 2	(See GET-22) A design requirement limits the speed of trolley movements such that a collision at the speed limit would not cause the trolley to drop its load.	Preventive	Design
	4. Shield doors between the canister transfer cell and the WP positioning cell close on the trolley holding the loaded, unsealed WP (Rooms 1011 and 1042).	CHF-WPC-CC4	Beyond Category 2	A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transfer trolley, site-rail transfer cart (SRTC), MSC transporter, WP transporter, would not cause a tipover of the conveyance or cause the conveyance to drop its load. A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transportation cask, transfer cask, or MSC suspended from an overhead crane would not cause the crane to drop its load.	Preventive	Design
	5. Lid drop onto a WP from the lid placement fixture equipment during the welding process (Rooms 2010 and 2032).	CHF-WPC-CC5A CHF-WPC-CC5B CHF-WPC-CC5C CHF-WPC-CC5D CHF-WPC-CC5E CHF-WPC-CC5F	No Drop Category 2 No Drop No Breach Beyond Category 2 Beyond Category 2	(See GET-02) Design and operational requirements reduce the drop probability. Operational requirements limit the lift height of the inner lid of a transportation cask, transfer cask, site-specific cask, or waste package to ensure that a lid drop onto a DOE canister within that breaches the canister is a beyond Category 2 event sequence. Design and operational requirements limit the probability of exceeding the lift height. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multiccanister overpack is defective.	Preventive	Design- Procedural Safety
	6. Equipment drop onto a WP during the welding process (Rooms 2010 and 2032).	CHF-WPC-CC6	Beyond Category 2	Same disposition as Potential Event CHF-WPC-CC2.	Preventive	Procedural Safety
	7. Drop or collision of equipment from a canister transfer cell overhead crane onto or against a loaded, sealed WP positioned on a pedestal on a trolley (Rooms 2010 and 2032).	CHF-WPC-CC7	Beyond Category 2	Same disposition as Potential Event CHF-WPC-CC2.	Preventive	Procedural Safety
	8. Collision involving the trolley holding the loaded, sealed WP and the shield doors between the WP positioning cell and the canister transfer cell (Rooms 1011 and 1042).	CHF-WPC-CC8	Beyond Category 2	(See GET-22) Same disposition as Potential Event CHF-WPC-CC3.	Preventive	Design

Table III-7. Disposition of Internal Events That Occur Inside the Canister Handling Facility (Waste Package Closure): Waste Package Positioning Cells (Rooms 1011 and 1042), and Closure Cells (Rooms 2010 and 2032) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	9. Shield doors between the WP positioning cell and the canister transfer cell close on the trolley holding the loaded, sealed WP (Rooms 1011 and 1042).	CHF-WPC-CC9	Beyond Category 2	Same disposition as Potential Event CHF-WPC-CC4.	Preventive	Design
Chemical Contamination-Flooding	1. Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures (Rooms 1011, 1042, 2010, and 2032).	CHF-WPC-CCF1	NA—Accounted for in consequence analyses, if applicable	NA—SNF is contained inside a sealed canister, therefore this event does not occur unless an event sequence leads to exposure of SNF to air. Oxidation of the fuel matrix is a possible outcome of any event that exposes SNF to air. Consequence analyses account for the possibility of oxidation, as applicable.	NA	NA
Explosion-Implosion	1. WP inerting system (or other pneumatic or pressurized system) missile due to a fractured nozzle/valve stem/pneumatic device (Rooms 1011, 1042, 2010, and 2032).	CHF-WPC-EI1	Beyond Category 2	An operational requirement ensures that pressurized systems that could generate missiles, energetic enough to penetrate a transportation cask with or without impact limiters, a transfer cask, a DOE canister, a naval SNF canister, a dual-purpose canister, the inner lid of a transportation cask, a site-specific cask, a waste package, or the inner lid of a site-specific cask or waste package are not present in areas where potentially vulnerable items may be exposed.	Preventive	Procedural Safety
	2. Explosion hazard associated with the WP purging and inerting system and the ignition of hydrogen that may have accumulated in the WP (Rooms 1011, 1042, 2010, and 2032).	CHF-WPC-EI2	Beyond Category 2	Operational requirements ensure that precautions taken during the cask sampling and purging process provide reasonable assurance that such hydrogen explosions would not occur.	Preventative	Procedural Safety
Fire-Thermal	1. Electrical fire associated with handling equipment and other electrically powered equipment in the WP closure cell or the WP positioning cell, including the overhead cranes and the welding subsystem in the WP closure cells (Rooms 2010 and 2032).	CHF-WPC-FT1	Beyond Category 2	Design and operational requirements ensure control of the presence and amount of combustibles in the different areas of the repository to preclude any Category 1 or Category 2 event sequences potentially initiated by a fire.	Preventive	Design-Procedural Safety
	2. Electrical fire associated with a motor on a WP trolley (Rooms 1011 and 1042).	CHF-WPC-FT2	Beyond Category 2	Same disposition as Potential Event CHF-WPC-FT1.	Preventive	Design-Procedural Safety
	3. Canister/SNF damage by burn-through during welding process/heat damage (Rooms 2010 and 2032).	CHF-WPC-FT3	NA	Burn-through of the inner lid is not possible with the gas tungsten arc welding process used for the closure welds.	NA	NA
	4. Thermal hazard/canister/SNF overheating in a WP during the welding process resulting in excessive cladding temperature and possible zircaloy cladding (or other cladding) unzipping (Rooms 1011, 1042, 2010, and 2032).	CHF-WPC-FT4	NA	Overheating of the waste package contents due to welding is not possible using the gas tungsten arc welding process which used for the closure welds.	NA	NA
	5. Overheating of a loaded WP due to a loss of cooling resulting in excessive temperature and possible damage to the canister contents (Rooms 1011, 1042, 2010, and 2032).	CHF-WPC-FT5	Beyond Category 2	If ventilation is lost in areas where DOE or naval canisters are handled, no radiological release occurs from the canisters because containment within the canisters is maintained. Design and operational requirements ensure that the thermal response of areas where CSNF assemblies are handled or staged to a loss of HVAC would not cause radiological releases in excess of those considered in the consequence analysis for normal operations.	Preventive	Design-Procedural Safety
	6. Transient combustible fire in the WP closure cell or the WP positioning cell (Rooms 1011, 1042, 2010, and 2032).	CHF-WPC-FT6	Beyond Category 2	Same disposition as Potential Event CHF-WPC-FT1.	Preventive	Design-Procedural Safety

Table III-7. Disposition of Internal Events That Occur Inside the Canister Handling Facility (Waste Package Closure): Waste Package Positioning Cells (Rooms 1011 and 1042), and Closure Cells (Rooms 2010 and 2032) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Radiation	1. Radiation exposure of a facility worker and/or the offsite public (Rooms 1011, 1042, 2010, and 2032).	CHF-WPC-R1	NA—Accounted for in consequence analyses, if applicable	NA—Potential exposure of workers or the public to radiation is a hazard for the event sequences considered in this analysis. Consequence analyses evaluate this hazard for Category 1 and Category 2 event sequences, as applicable.	NA	NA
			Normal Operations	Some exposure to radiation is expected as a part of normal facility operations. Exposures are managed by design features and procedures that ensure that workers or the public do not receive excessive radiation doses.	Mitigative	Design- Procedural Safety
	2. Glovebox leak leads to a radiological release (Rooms 2007 and 2029).	CHF-WPC-R2	Normal Operations	Potential exposure of workers to radiation from a glovebox leak is managed as a normal-operations dose by routine procedures that ensure that workers do not receive excessive radiation doses.	Mitigative	Procedural Safety
	3. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation (Rooms 1011, 1042, 2010, and 2032).	CHF-WPC-R3	NA (no significant exposure)	Operating procedures ensure that a loss of confinement during otherwise normal operations does not cause individuals to be exposed to significant amounts of radioactivity.	Mitigative	Procedural Safety
	4. Inadvertent opening of a canister transfer cell shield door or a WP positioning cell shield door, leading to a worker exposure (Rooms 1011, 1042, 2010, and 2032).	CHF-WPC-R4	Beyond Category 2	Design and operational requirements ensure that exposure of workers due to inadvertent actuation of shield doors or pit protective covers is not Category 1.	Preventive	Design- Procedural Safety
	5. Radiation-induced damage to a facility SSC (Rooms 1011, 1042, 2010, and 2032).	CHF-WPC-R5	NA	Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization.	NA	NA
Fissile	1. Criticality associated with a trolley holding a sealed or unsealed WP derailment followed by a load tipover or fall and rearrangement of the container internals (Rooms 1011 and 1042).	CHF-WPC-F1	Beyond Category 2	A design requirement ensures that the trolley can not derail or allow the unsealed waste package to fall off the trolley. If the waste package remains upright, there would be no event sequence.	Preventive	Design
	2. Criticality associated with a drop of heavy equipment onto an unsealed, loaded WP and a rearrangement of the container internals (Rooms 2010 and 2032).	CHF-WPC-F2	Beyond Category 2	A design requirement ensures that an unsealed WP that is dropped onto an essentially unyielding surface from within its lift-height limits would not spill its contents. Demonstration of compliance must account for the bowing of fuel rods or other rearrangement of fissile material that may occur due to a drop or other handling incident. An unsealed waste package remains subcritical with credit for moderator control and without credit for burnup. Design and operational requirements ensure that moderator control is in effect.	Preventive	Design- Procedural Safety

NOTES: CC = collision-crushing; CCF = chemical-contamination flooding; CHF = Canister Handling Facility; EI = explosion-implosion; F = fissile; FT = fire-thermal; GET = generalized event tree; HVAC = heating, ventilation, and air-conditioning; NA = not applicable; R = radiation; SNF = spent nuclear fuel; WPC = waste package closure.

The Event Sequence Designator is a unique event sequence index for each event in this table. The prefix identifies the building or facility, for example "CHF," the middle identifies an activity, room, or area, for example "WPC," and the suffix identifies the hazard category and event number, for example "CC1." When an event sequence has been evaluated in a GET, the GET number is identified in the Disposition of Event column; the GET sequence alpha character is shown at the end of the Event Sequence Designator, for example "A."

GETs are discussed in Sections 6.3.1.1 to 6.3.1.24.

Table III-8. Disposition of Internal Events That Occur Inside the Canister Handling Facility (Waste Package Loadout): Canister Transfer Cell. (Room 1033), Waste Package Tool Storage Room. (Room 1032), Exit Vestibule. (Room 1031)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Collision-Crushing	1. Derailment of a trolley holding a loaded, sealed WP followed by a load tipover or fall (Room 1033).	CHF-WPL-CC1	Beyond Category 2	A design requirement ensures that loaded transfer trolleys do not derail or drop their loads. Design requirements apply to trolleys for casks, waste packages, site-specific casks, and dual-purpose canisters.	Preventive	Design
	2. Drop of a loaded, sealed WP from a canister transfer cell overhead crane onto the floor during transfer from the trolley to the survey area (Room 1033).	CHF-WPL-CC2A CHF-WPL-CC2B CHF-WPL-CC2C	No drop No breach Beyond Category 2	(See GET-08) Design and operational requirements reduce the drop probability. Design and operational requirement limits the lift height of waste packages in horizontal and vertical orientations. Design requirements ensure that waste packages withstand without breaching drops and tipovers within their lift height limits. Design and operational requirements limit the probability of exceeding the lift height.	Preventive	Design- Procedural Safety
	3. Drop or collision of a loaded, sealed WP from a canister transfer cell overhead crane onto or against a sharp object during transfer from the trolley to the survey area (Room 1033).	CHF-WPL-CC3	Beyond Category 2	Design and operational requirements ensure that surfaces in the load paths through which WPs, DOE SNF canisters, naval canisters, DPCs, transportation casks, transfer casks, or MSCs are transferred by crane are kept free of structures, such as posts and curbs, that could puncture a container in case of a drop. An operational requirement ensures that the load paths are kept free of movable puncture hazards. A design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design- Procedural Safety
	4. Slapdown of a loaded, sealed WP that subsequently impacts a loaded, unsealed WP on the opposite WP positioning cell trolley following a drop from a canister transfer cell overhead crane onto the edge of the opposite WP positioning cell trolley, a pit edge, or other object during the lift and transfer to the survey area (Room 1033).	CHF-WPL-CC4	Beyond Category 2	An operational requirement ensures that whenever a waste-package trolley is being loaded onto a trolley or is already on the trolley but not in the waste package positioning cell, the opposite trolley remains in its positioning cell or is otherwise out of the way.	Preventive	Design- Procedural Safety
	5. Slapdown of a loaded, sealed WP that subsequently impacts a loaded, sealed WP on the opposite WP positioning cell trolley following a drop from a canister transfer cell overhead crane onto the edge of the WP positioning cell trolley, a pit edge, or other object during the lift and transfer to the survey area (Room 1033).	CHF-WPL-CC5	Beyond Category 2	Same disposition as Potential Event CHF-WPL-CC4.	Preventive	Design- Procedural Safety
	6. Drop or collision of a sealed, loaded WP from a canister transfer cell overhead crane onto or against a loaded, unsealed WP on the opposite WP positioning cell pedestal and trolley during the lift and transfer to the survey area. (Room 1033).	CHF-WPL-CC6	Beyond Category 2	Same disposition as Potential Event CHF-WPL-CC4. Additionally, a design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design- Procedural Safety
	7. Drop or collision of a sealed, loaded WP from a canister transfer cell overhead crane onto or against a loaded, sealed WP on the opposite WP positioning cell pedestal and trolley during the lift and transfer to the survey area (Room 1033).	CHF-WPL-CC7	Beyond Category 2	Same disposition as Potential Event CHF-WPL-CC6.	Preventive	Design- Procedural Safety

Table III-8. Disposition of Internal Events That Occur Inside the Canister Handling Facility (Waste Package Loadout): Canister Transfer Cell. (Room 1033), Waste Package Tool Storage Room. (Room 1032), Exit Vestibule. (Room 1031) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	8. Drop of a loaded, sealed WP from a canister transfer cell overhead crane onto the floor during the transfer from the survey area to the tilting machine (Room 1033).	CHF-WPL-CC8A CHF-WPL-CC8B CHF-WPL-CC8C	No drop No breach Beyond Category 2	(See GET-08) Same disposition as Potential Event CHF-WPL-CC2.	Preventive	Design-Procedural Safety
	9. Drop of a loaded, sealed WP from a canister transfer cell overhead crane back onto the pedestal on the trolley during the transfer from the survey area to the tilting machine (Room 1033).	CHF-WPL-CC9A CHF-WPL-CC9B CHF-WPL-CC9C	No drop No breach Beyond Category 2	(See GET-08) Same disposition as Potential Event CHF-WPL-CC2.	Preventive	Design-Procedural Safety
	10. Drop or collision of a loaded, sealed WP from a canister transfer cell overhead crane onto or against a sharp object (including the tilting machine) during transfer from the survey area to the tilting machine (Room 1033).	CHF-WPL-CC10A CHF-WPL-CC10B CHF-WPL-CC10C	No drop No breach Beyond Category 2	(See GET-08) Same disposition as Potential Event CHF-WPL-CC2. For collisions, a design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design-Procedural Safety
	11. Slapdown (either forward into the WP turntable or backward onto the floor) of a loaded, sealed WP in the tilting machine from a canister transfer cell overhead crane during the lowering of the WP to the horizontal position on the pallet previously placed on the WP turntable (Room 1033).	CHF-WPL-CC11	Beyond Category 2	Design requirements ensure that WPs withstand without breaching tipover during placement onto the tilting machine, including contact with trunnion cradles or the floor (trunnion collars installed). A design requirement prevents backward slapdowns associated with the tilting machine for waste packages.	Preventive	Design
	12. Collision of the tilting machine against a loaded, sealed WP on a pallet on the WP turntable (Room 1033).	CHF-WPL-CC12	Beyond Category 2	A design or operational requirement ensures that an impact or collision between the trunnion collar removal machine, WP turntable, or WP tilting machine and a WP will not breach the WP or cause it to fall off the emplacement pallet.	Preventive	Design-Procedural Safety
	13. Drop or collision of a lifting collar from a canister transfer cell overhead crane onto or against a WP after removal of the collar from the WP collar removal machine (Room 1033).	CHF-WPL-CC13	Beyond Category 2	Operational requirements establish lift-height limits for handling equipment and other equipment associated with the WP, including lifting collars (or trunnion collars), yokes, docking rings, and WP-closure equipment. The lift-height limits ensure that the handling equipment can not breach a sealed WP if dropped onto or collided into the WP from within the lift-height limit. Furthermore, the lift-height limits ensure that a drop of equipment from within the lift-height limit can not initiate an event sequence if the WP inner lid is in place, but unsealed. An operational requirement ensures that the inner lid, once set in place, is not removed from the WP except in a remediation situation.	Preventive	Procedural Safety
	14. Collision or impact of the trunnion collar removal machine and a loaded, sealed WP positioned on a pallet positioned on the WP turntable (Room 1033).	CHF-WPL-CC14	Beyond Category 2	Same disposition as Potential Event CHF-WPL-CC12.	Preventive	Design-Procedural Safety
	15. Drop of a loaded, sealed WP positioned on a pallet (from a horizontal position) from a canister transfer cell overhead crane onto the floor or the bedplate during transfer of the WP and pallet from the WP turntable to the WP transporter bedplate (Room 1033).	CHF-WPL-CC15A CHF-WPL-CC15B CHF-WPL-CC15C	No drop No breach Beyond Category 2	See GET-08) Same disposition as Potential Event CHF-WPL-CC2.	Preventive	Design-Procedural Safety
	16. Drop or collision of a loaded, sealed WP positioned on a pallet (from a horizontal position) from a canister transfer cell overhead crane onto or against a sharp object during transfer of the WP and pallet from the WP turntable to the WP transporter bedplate (Room 1033).	CHF-WPL-CC16	Beyond Category 2	Same disposition as Potential Event CHF-WPL-CC3.	Preventive	Design-Procedural Safety
	17. Equipment drop or collision (including lifting yokes) onto or against a loaded, sealed WP when the WP is on the pallet on the WP turntable or when the WP is on the pallet on the WP transporter bedplate (Room 1033).	CHF-WPL-CC17	Beyond Category 2	Same disposition as Potential Event CHF-WPL-CC13.	Preventive	Procedural Safety

Table III-8. Disposition of Internal Events That Occur Inside the Canister Handling Facility (Waste Package Loadout): Canister Transfer Cell. (Room 1033), Waste Package Tool Storage Room. (Room 1032), Exit Vestibule. (Room 1031) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	18. Collision involving a WP transporter (holding the sealed WP on a pallet) and the shield doors between the canister transfer cell and the WP tool storage room (Room 1033).	CHF-WPL-CC18	Beyond Category 2	A design requirement ensures that the WP transporter transports the WP in a manner such that if a collision or derailment (excluding tipover) occurs, the WP impact energy would be low enough to preclude a WP breach. A design requirement ensures that the WP transporter transports the WP in a manner such that if a collision or derailment leading to a transporter tipover occurs, the WP impact energy would be low enough to preclude a WP breach.	Preventive	Design
	19. The shield doors between the canister transfer cell and the WP tool storage room close on the WP transporter (holding the sealed WP on a pallet) (Room 1032).	CHF-WPL-CC19	Beyond Category 2	A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transfer trolley, site-rail transfer cart (SRTC), MSC transporter, WP transporter, would not cause a tipover of the conveyance or cause the conveyance to drop its load. A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transportation cask, transfer cask, or MSC suspended from an overhead crane would not cause the crane to drop its load.	Preventive	Design
	20. Collision involving WP transporter (holding the sealed WP on a pallet) and the doors between the WP tool storage room and the exit vestibule (Room 1032).	CHF-WPL-CC20	Beyond Category 2	Same disposition as Potential Event CHF-WPL-CC18.	Preventive	Design
	21. The doors between the WP tool storage room and the exit vestibule close on the WP transporter (holding the sealed WP on a pallet) (Room 1031).	CHF-WPL-CC21	Beyond Category 2	Same disposition as Potential Event CHF-WPL-CC19.	Preventive	Design
	22. Collision involving WP transporter (holding the sealed WP on a pallet) and the doors between the exit vestibule and the ambient air (outside) (Room 1031).	CHF-WPL-CC22	Beyond Category 2	Same disposition as Potential Event CHF-WPL-CC18.	Preventive	Design
	23. Doors between the exit vestibule and the ambient air (outside) close on the WP transporter (holding the sealed WP on a pallet) (Room 1031).	CHF-WPL-CC23	Beyond Category 2	Same disposition as Potential Event CHF-WPL-CC19.	Preventive	Design
	24. Derailment of a WP transporter in the exit vestibule, WP tool storage room, or WP loadout area of the canister transfer cell followed by a load tipover or fall (Room 1031).	CHF-WPL-CC24	Beyond Category 2	Same disposition as Potential Event CHF-WPL-CC18.	Preventive	Design
Chemical Contamination-Flooding	1. Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures. (Rooms 1031, 1032, and 1033).	CHF-WPL-CCF1	NA—Accounted for in consequence analyses, if applicable	NA—SNF is contained in a sealed canister, therefore this event does not occur unless an event sequence leads to exposure of SNF to air. Oxidation of the fuel matrix is a possible outcome of any event that exposes SNF to air. Consequence analyses account for the possibility of oxidation, as applicable.	NA	NA
Explosion-Implosion	1. Hydraulic system or other pneumatic or pressurized system missile due to a fractured nozzle/valve stem/pneumatic device (Rooms 1031, 1032, and 1033).	CHF-WPL-EI1	Beyond Category 2	An operational requirement ensures that pressurized systems that could generate missiles, energetic enough to penetrate a transportation cask with or without impact limiters, a transfer cask, a DOE canister, a naval SNF canister, a dual-purpose canister, the inner lid of a transportation cask, a site-specific cask, a waste package, or the inner lid of a site-specific cask or waste package are not present in areas where potentially vulnerable items may be exposed.	Preventive	Procedural Safety
Fire-Thermal	1. Electrical fire associated with the WP transporter loadout area housing the equipment for WP tilt and WP transporter loading, as well as the WP tool storage room and the exit vestibule (including the WP trunnion collar removal machine, the tilting machine, and the WP turntable) (Rooms 1031, 1032, and 1033).	CHF-WPL-FT1	Beyond Category 2	Design and operational requirements ensure control of the presence and amount of combustibles in the different areas of the repository to preclude any Category 1 or Category 2 event sequences potentially initiated by a fire.	Preventive	Design-Procedural Safety
	2. Electrical fire associated with the overhead bridge cranes (Rooms 1031, 1032, and 1033).	CHF-WPL-FT2	Beyond Category 2	Same disposition as Potential Event CHF-WPL-FT1.	Preventive	Design-Procedural Safety

Table III-8. Disposition of Internal Events That Occur Inside the Canister Handling Facility (Waste Package Loadout): Canister Transfer Cell. (Room 1033), Waste Package Tool Storage Room. (Room 1032), Exit Vestibule. (Room 1031) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	3. Electrical fire associated with equipment on the WP transporter, including motors to extend the WP transporter bedplate (Rooms 1031, 1032, and 1033).	CHF-WPL-FT3	Beyond Category 2	Same disposition as Potential Event CHF-WPL-FT1.	Preventive	Design-Procedural Safety
	4. Electrical fire associated with the WP transport locomotive (Rooms 1031, 1032, and 1033).	CHF-WPL-FT4	Beyond Category 2	Same disposition as Potential Event CHF-WPL-FT1.	Preventive	Design-Procedural Safety
	5. Electrical fire associated with a motor on a WP trolley (Rooms 1031, 1032, and 1033).	CHF-WPL-FT5	Beyond Category 2	Same disposition as Potential Event CHF-WPL-FT1.	Preventive	Design-Procedural Safety
	6. Overheating of a loaded, sealed WP due to a loss of cooling resulting in excessive temperature and possible damage to the canister contents (Rooms 1031, 1032, and 1033).	CHF-WPL-FT6	Beyond Category 2	If ventilation is lost in areas where DOE or naval canisters are handled, no radiological release occurs from the canisters because containment within the canisters is maintained. Design and operational requirements ensure that the thermal response of areas where CSNF assemblies are handled or staged to a loss of HVAC would not cause radiological releases in excess of those considered in the consequence analysis for normal operations.	Preventive	Design-Procedural Safety
	7. Transient combustible fire in the canister transfer area, the WP tool storage room, or the exit vestibule (Rooms 1031, 1032, and 1033).	CHF-WPL-FT7	Beyond Category 2	Same disposition as Potential Event CHF-WPL-FT1.	Preventive	Design-Procedural Safety
Radiation	1. Radiation exposure of a facility worker and/or the offsite public (Rooms 1031, 1032, and 1033).	CHF-WPL-R1	NA—Accounted for in consequence analyses, if applicable	NA—Potential exposure of workers or the public to radiation is a hazard for the event sequences considered in this analysis. Consequence analyses evaluate this hazard for Category 1 and Category 2 event sequences, as applicable.	NA	NA
			Normal Operations	Some exposure to radiation is expected as a part of normal facility operations. Exposures are managed by design features and procedures that ensure that workers or the public do not receive excessive radiation doses.	Mitigative	Design-Procedural Safety
	2. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation (Rooms 1031, 1032, and 1033).	CHF-WPL-R2	NA (no significant exposure)	Operating procedures ensure that a loss of confinement during otherwise normal operations does not cause individuals to be exposed to significant amounts of radioactivity.	Mitigative	Procedural Safety
	3. Inadvertent opening of a canister transfer cell shield door, leading to a worker exposure (Rooms 1031, 1032, and 1033).	CHF-WPL-R3	Beyond Category 2	Design and operational requirements ensure that exposure of workers due to inadvertent actuation of shield doors or pit protective covers is not Category 1.	Preventive	Design-Procedural Safety
	4. Inadvertent opening of the WP transporter shielded enclosure doors, leading to a worker exposure (Rooms 1031, 1032, and 1033).	CHF-WPL-R4	Beyond Category 2	Same disposition as Potential Event CHF-WPL-R3.	Preventive	Design-Procedural Safety
Fissile	1. Criticality associated with a trolley holding a WP derailment followed by a load tipover or fall and rearrangement of the WP internals (Room 1033).	CHF-WPL-F1	Beyond Category 2	A design requirement ensures that loaded transfer trolleys do not derail or drop their loads. Design requirements apply to trolleys for casks, waste packages, site-specific casks, and dual-purpose canisters.	Preventive	Design
	2. Criticality associated with a WP transporter derailment followed by a load tipover or fall and rearrangement of the WP internals (Rooms 1031, 1032, and 1033).	CHF-WPL-F2	Beyond Category 2	Same disposition as Potential Events CHF-WPL-CC18 and CHF-WPL-F3.	Preventive	Design

Table III-8. Disposition of Internal Events That Occur Inside the Canister Handling Facility (Waste Package Loadout): Canister Transfer Cell. (Room 1033), Waste Package Tool Storage Room. (Room 1032), Exit Vestibule. (Room 1031) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	3. Criticality associated with a drop, slapdown, or collision of a WP and a rearrangement of the container internals (Rooms 1031, 1032, and 1033).	CHF-WPL-F3	Beyond Category 2	A design requirement ensures that sealed waste packages are designed such that drops, collisions, and other handling impacts within their design bases, allowing for rearrangement of the waste package internals and without credit for burnup, cannot lead to a nuclear criticality.	Preventive	Design

NOTES: CC = collision-crushing; CCF = chemical-contamination flooding; CHF = Canister Handling Facility; EI = explosion-implosion; F = fissile; FT = fire-thermal; GET = generalized event tree; NA = not applicable; R = radiation; SNF = spent nuclear fuel; WPL = waste package loadout.

The Event Sequence Designator is a unique event sequence index for each event in this table. The prefix identifies the building or facility, for example "CHF," the middle identifies an activity, room, or area, for example "WPL," and the suffix identifies the hazard category and event number, for example "CC1." When an event sequence has been evaluated in a GET, the GET number is identified in the Disposition of Event column; the GET sequence alpha character is shown at the end of the Event Sequence Designator, for example "A."

GETs are discussed in Sections 6.3.1.1 to 6.3.1.24.

Table III-9. Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Cask and Site-specific Cask Entrance Vestibule (Room 1079), Cask and Site-specific Cask SRTC Receipt Area (Room 1077), Cask and Site-specific Cask to Trolley Transfer Room (Room 1076)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Collision-Crushing	1. SRTC derailment involving a loaded cask (with impact limiters installed) followed by a load tipover or fall (Room 1079).	DTF-CMSCEV-CC1	Beyond Category 2	Transportation casks with impact limiters are designed to withstand, without breaching, the bounding drops that could occur during cask handling at the repository. Consequently, a derailment, overturning or collision would not breach a transportation cask.	Preventive	Design
	2. Collision of an SRTC carrying a loaded cask (with impact limiters installed) with the cask and MSC entrance vestibule doors or the cask and MSC SRTC receipt area doors (Rooms 1077 and 1079).	DTF-CMSCEV-CC2	Beyond Category 2	Same disposition as Potential Event DTF-CMSCEV-CC1.	Preventive	Design
	3. The cask and MSC entrance vestibule doors or the cask and MSC SRTC receipt area doors close on an SRTC carrying a loaded cask (with impact limiters installed) (Rooms 1077 and 1079).	DTF-CMSCEV-CC3	Beyond Category 2	A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transfer trolley, site-rail transfer cart (SRTC), MSC transporter, WP transporter, would not cause a tipover of the conveyance or cause the conveyance to drop its load. A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transportation cask, transfer cask, or MSC suspended from an overhead crane would not cause the crane to drop its load.	Preventive	Design
	4. MSC transporter collision or overturning involving a loaded MSC followed by a load tipover or fall (Rooms 1077 and 1079).	DTF-CMSCEV-CC4	Beyond Category 2	Design and operational requirements establish speed limits such that a collision with shield or airlock doors or other heavy objects would not overturn an SRTC, or site-specific cask transporter or cause it to lose its load.	Preventive	Design-Procedural Safety
	5. Collision of an MSC transporter carrying a loaded MSC with the cask and MSC entrance vestibule doors or the cask and MSC SRTC receipt area shield doors (Rooms 1077 and 1079).	DTF-CMSCEV-CC5	Beyond Category 2	Same disposition as Potential Event DTF-CMSCEV-CC4.	Preventive	Design-Procedural Safety
	6. The cask and MSC entrance vestibule doors or the cask and MSC SRTC receipt area shield doors close on an MSC transporter carrying a loaded MSC (Rooms 1077 and 1079).	DTF-CMSCEV-CC6	Beyond Category 2	Same disposition as Potential Event DTF-CMSCEV-CC3.	Preventive	Design
	7. Collision of a mobile elevated platform with a loaded cask during removal of the personnel barriers and impact limiters or during survey activities (Room 1077).	DTF-CMSCEV-CC7	Beyond Category 2	Operational requirements ensure that the portable platforms, access platforms, mobile elevated platforms, and forklifts operated in the facility are not operated in a manner that could breach or overturn a loaded transportation cask or site-specific cask.	Preventive	Procedural Safety
	8. Forklift collision with a cask on an SRTC (with or without impact limiters installed on the cask) or the SRTC holding the cask (Room 1077).	DTF-CMSCEV-CC8	Beyond Category 2	Same disposition as Potential Event DTF-CMSCEV-CC7.	Preventive	Procedural Safety
	9. Collision between a forklift and an MSC positioned on the floor, an MSC on a pedestal on a trolley, or the MSC transporter holding the MSC (Room 1077).	DTF-CMSCEV-CC9	Beyond Category 2	Same disposition as Potential Event DTF-CMSCEV-CC7.	Preventive	Procedural Safety
	10. Collision between a mobile elevated platform and an MSC positioned on the floor, an MSC on a pedestal on a trolley, or the MSC transporter holding the MSC (Room 1077).	DTF-CMSCEV-CC10	Beyond Category 2	Same disposition as Potential Event DTF-CMSCEV-CC7.	Preventive	Procedural Safety
	11. Drop or collision of personnel barriers or impact limiters from the receipt area crane onto or against a loaded cask (Room 1077).	DTF-CMSCEV-CC11	Beyond Category 2	Operational requirements for cask preparation and handling ensure that a drop of or collision involving equipment would not breach a transportation cask, transfer cask, or an MSC.	Preventive	Procedural Safety

Table III-9. Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Cask and Site-specific Cask Entrance Vestibule (Room 1079), Cask and Site-specific Cask SRTC Receipt Area (Room 1077), Cask and Site-specific Cask to Trolley Transfer Room (Room 1076) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	12. Slapdown of a loaded cask onto an SRTC during the upending of the loaded cask to the vertical orientation by the overhead crane (Room 1076).	DTF-CMSCEV-CC12A DTF-CMSCEV-CC12B DTF-CMSCEV-CC12C DTF-CMSCEV-CC12D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-01) Design and operational requirements reduce the drop probability. Design requirements limit the lift height for transportation and transfer casks without impact limiters and site-specific casks. Design and operational requirements limit the probability of exceeding the lift height. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multiccanister overpack is defective.	Preventive	Design- Procedural Safety
	13. Drop of a loaded cask from an overhead crane onto the floor during the transfer from an SRTC to a pedestal previously staged on a trolley (Room 1076).	DTF-CMSCEV-CC13A DTF-CMSCEV-CC13B DTF-CMSCEV-CC13C DTF-CMSCEV-CC13D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-01) Same disposition as Potential Event DTF-CMSCEV-CC12.	Preventive	Design- Procedural Safety
	14. Drop of a loaded cask from an overhead crane onto the pedestal on a trolley during the transfer from an SRTC to a pedestal previously staged on a trolley (Room 1076).	DTF-CMSCEV-CC14A DTF-CMSCEV-CC14B DTF-CMSCEV-CC14C DTF-CMSCEV-CC14D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-01) Same disposition as Potential Event DTF-CMSCEV-CC12.	Preventive	Design- Procedural Safety
	15. Drop or collision of a loaded cask from an overhead crane onto or against a sharp object during the transfer from an SRTC to a pedestal previously positioned on the trolley (Room 1076).	DTF-CMSCEV-CC15	Beyond Category 2	Design and operational requirements ensure that surfaces in the load paths through which WPs, DOE SNF canisters, naval canisters, DPCs, transportation casks, transfer casks, or MSCs are transferred by crane are kept free of structures, such as posts and curbs, that could puncture a container in case of a drop. An operational requirement ensures that the load paths are kept free of movable puncture hazards. A design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design- Procedural Safety
	16. Slapdown of a loaded cask following a drop from an overhead crane onto the edge of the trolley or pedestal during transfer of the cask from the SRTC to the pedestal on a trolley (Room 1076).	DTF-CMSCEV-CC16A DTF-CMSCEV-CC16B DTF-CMSCEV-CC16C DTF-CMSCEV-CC16D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-01) Same disposition as Potential Event DTF-CMSCEV-CC12.	Preventive	Design- Procedural Safety
	17. Collision of a loaded cask suspended from an overhead crane with the shield doors separating the cask and MSC SRTC receipt area and the cask and MSC to trolley transfer room during the transfer of the cask from the SRTC to the trolley (Rooms 1076 and 1077).	DTF-CMSCEV-CC17	Beyond Category 2	A design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design
	18. Closing of the shield doors separating the cask and MSC SRTC receipt area and the cask and MSC to trolley transfer room (striking a loaded cask while it is suspended from the overhead crane) during the transfer of the cask from the SRTC to the pedestal on a trolley (Room 1076).	DTF-CMSCEV-CC18	Beyond Category 2	Same disposition as Potential Event DTF-CMSCEV-CC3.	Preventive	Design
	19. Drop of a loaded MSC from an overhead crane onto the floor during the transfer from an SRTC to a pedestal previously positioned on a trolley (Room 1076).	DTF-CMSCEV-CC19A DTF-CMSCEV-CC19B DTF-CMSCEV-CC19C DTF-CMSCEV-CC19D	Category 2 No breach Beyond Category 2 Beyond Category 2	(Bounded by GET-01) Same disposition as Potential Event DTF-CMSCEV-CC12	Preventive	Design- Procedural Safety

Table III-9. Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Cask and Site-specific Cask Entrance Vestibule (Room 1079), Cask and Site-specific Cask SRTC Receipt Area (Room 1077), Cask and Site-specific Cask to Trolley Transfer Room (Room 1076) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Mitigative Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Chemical Contamination-Flooding	20. Drop of a loaded MSC from an overhead crane onto the pedestal on a trolley during the transfer from an SRTC to a pedestal previously positioned on a trolley (Room 1076).	DTF-CMMSCEV-CC20A DTF-CMMSCEV-CC20B DTF-CMMSCEV-CC20C DTF-CMMSCEV-CC20D	Category 2 No breach Beyond Category 2	(Bounded by GET-01) Same disposition as Potential Event DTF-CMMSCEV-CC12.	Preventive	Design- Procedural Safety
	21. Drop or collision of a loaded MSC from an overhead crane onto or against a sharp object during the transfer from the floor (after delivery by the MSC transporter) to a pedestal previously staged on trolley (Room 1076).	DTF-CMMSCEV-CC21	Beyond Category 2	Same disposition as Potential Event DTF-CMMSCEV-CC15.	Preventive	Design- Procedural Safety
	22. Collision of a loaded MSC suspended from an overhead crane with the shield doors separating the cask and MSC SRTC receipt area and the cask and MSC to trolley transfer room during transfer of the MSC from the floor (after delivery by the MSC transporter) to the pedestal on a trolley (Room 1076).	DTF-CMMSCEV-CC22	Beyond Category 2	Same disposition as Potential Event DTF-CMMSCEV-CC17.	Preventive	Design
	23. Closing of the shield doors separating the cask and MSC SRTC receipt area and the cask and MSC to trolley transfer room (striking a loaded MSC while it is suspended from the overhead crane) during the transfer of the MSC from the floor (after delivery by the MSC transporter) to the pedestal on a trolley (Room 1076).	DTF-CMMSCEV-CC23	Beyond Category 2	Same disposition as Potential Event DTF-CMMSCEV-CC3.	Preventive	Design
	24. Shipdown of a loaded MSC following a drop from an overhead crane onto the edge of the trolley or pedestal during transfer of the MSC from the floor (after delivery by the MSC transporter) to the pedestal on a trolley (Room 1076).	DTF-CMMSCEV-CC24A DTF-CMMSCEV-CC24B DTF-CMMSCEV-CC24C DTF-CMMSCEV-CC24D	Category 2 No breach Beyond Category 2	(Bounded by GET-01) Same disposition as Potential Event DTF-CMMSCEV-CC12.	Preventive	Design- Procedural Safety
	25. Drop or collision of handling equipment from an overhead bridge crane onto or against a loaded cask or MSC (Room 1076).	DTF-CMMSCEV-CC25	Beyond Category 2	Same disposition as Potential Event DTF-CMMSCEV-CC11.	Preventive	Procedural Safety
	26. Drop or collision of equipment from the maintenance crane onto or against a loaded cask or MSC (Room 1076).	DTF-CMMSCEV-CC26	Beyond Category 2	Same disposition as Potential Event DTF-CMMSCEV-CC11.	Preventive	Procedural Safety
	27. Collision of a trolley holding a cask or MSC on a pedestal with the shield doors separating the cask and MSC to trolley transfer room and the cask and MSC turntable room (Room 1076).	DTF-CMMSCEV-CC27	Beyond Category 2	(See GET-22) A design requirement limits the speed of trolley movements such that a collision at the speed limit would not cause the trolley to drop its load.	Preventive	Design
	28. The shield doors separating the cask and MSC to trolley transfer room and the cask and MSC turntable room close on a trolley holding a loaded cask or MSC on a pedestal (Room 1076).	DTF-CMMSCEV-CC28	Beyond Category 2	Same disposition as Potential Event DTF-CMMSCEV-CC3.	Preventive	Design
	29. Derailment of a trolley holding a cask or MSC on a pedestal followed by a load tipover or fall (Room 1076).	DTF-CMMSCEV-CC29	Beyond Category 2	A design requirement ensures that loaded transfer trolleys do not derail or drop their loads. Design requirements apply to trolleys for casks, waste packages, site-specific casks, and dual-purpose canisters.	Preventive	Design
	1. Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures (Rooms 1076, 1077, and 1079).	DTF-CMMSCEV-CCF1	NA—Accounted for in consequence analyses, if applicable	NA—SNF is contained inside a sealed cask, therefore this event does not occur unless an event sequence leads to exposure of SNF to air. Oxidation of the fuel matrix is a possible possibility of oxidation, as applicable.	NA	NA

Table III-9. Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Cask and Site-specific Cask Entrance Vestibule (Room 1079), Cask and Site-specific Cask SRTC Receipt Area (Room 1077), Cask and Site-specific Cask to Trolley Transfer Room (Room 1076) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Explosion-Implosion	1. Hydrogen explosion involving batteries on a cask trolley (Room 1076).	DTF-CMSCEV-EI1	Beyond Category 2	Operational controls pertaining to batteries for powering heavy equipment ensure the generation or accumulation of enough hydrogen gas to cause an explosion that could breach a transportation cask, site-specific cask, or waste package is prevented.	Preventive	Procedural Safety
	2. Hydrogen explosion involving batteries on a forklift (Room 1077).	DTF-CMSCEV-EI2	Beyond Category 2	Same disposition as Potential Event DTF-CMSCEV-EI1.	Preventive	Procedural Safety
	3. Hydrogen explosion involving batteries on a mobile elevated platform (Room 1077).	DTF-CMSCEV-EI3	Beyond Category 2	Same disposition as Potential Event DTF-CMSCEV-EI1.	Preventive	Procedural Safety
Fire-Thermal	1. Electrical fire associated with the cask and MSC SRTC receipt area overhead cranes (Rooms 1076 and 1077).	DTF-CMSCEV-FT1	Beyond Category 2	Design and operational requirements ensure control of the presence and amount of combustibles in the different areas of the repository to preclude any Category 1 or Category 2 event sequences potentially initiated by a fire.	Preventive	Design-Procedural Safety
	2. Electrical fire associated with handling equipment or other electrical equipment in the cask and MSC entrance vestibule, cask and MSC SRTC receipt area, or the cask and MSC to trolley transfer room (Rooms 1076, 1077, and 1079).	DTF-CMSCEV-FT2	Beyond Category 2	Same disposition as Potential Event DTF-CMSCEV-FT1.	Preventive	Design-Procedural Safety
	3. Diesel fuel fire/explosion involving an SRTC tractor pulling or pushing an SRTC holding a loaded cask (Rooms 1077 and 1079).	DTF-CMSCEV-FT3	Beyond Category 2	Same disposition as Potential Event DTF-CMSCEV-FT1.	Preventive	Design-Procedural Safety
	4. Diesel fuel fire/explosion involving an MSC transporter holding a loaded MSC (Rooms 1077 and 1079).	DTF-CMSCEV-FT4	Beyond Category 2	Same disposition as Potential Event DTF-CMSCEV-FT1.	Preventive	Design-Procedural Safety
	5. Fire/explosion (battery/electrical fire) associated with the cask trolley (Room 1076).	DTF-CMSCEV-FT5	Beyond Category 2	Same disposition as Potential Event DTF-CMSCEV-FT1.	Preventive	Design-Procedural Safety
	6. Fire/explosion (battery/electrical fire) associated with a forklift (Room 1077).	DTF-CMSCEV-FT6	Beyond Category 2	Same disposition as Potential Event DTF-CMSCEV-FT1.	Preventive	Design-Procedural Safety
	7. Fire/explosion (battery/electrical fire) associated with a mobile elevated platform (Room 1077).	DTF-CMSCEV-FT7	Beyond Category 2	Same disposition as Potential Event DTF-CMSCEV-FT1.	Preventive	Design-Procedural Safety
	8. Transient combustible fire in the cask and MSC SRTC receipt area, the cask and MSC entrance vestibule, or the cask and MSC to trolley transfer room (Rooms 1076, 1077, and 1079).	DTF-CMSCEV-FT8	Beyond Category 2	Same disposition as Potential Event DTF-CMSCEV-FT1.	Preventive	Design-Procedural Safety
	9. Thermal hazard (from decay heat) associated with a vertical orientation of a loaded cask (Rooms 1076, 1077, and 1079).	DTF-CMSCEV-FT9	Beyond Category 2	Transportation casks are designed to withstand normal conditions of transport (including high ambient temperatures and insolation) and hypothetical accident conditions (including fire). These conditions bound the thermal effect of orienting the cask vertically rather than horizontally. This potential event would not cause oxidation of SNF leading to exposure of individuals to radiation because the waste is contained in a sealed cask.	Preventive	Design

Table III-9. Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Cask and Site-specific Cask Entrance Vestibule (Room 1079), Cask and Site-specific Cask SRTC Receipt Area (Room 1077), Cask and Site-specific Cask to Trolley Transfer Room (Room 1076) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Radiation	1. Radiation exposure of a facility worker and/or the offsite public (Rooms 1076, 1077, and 1079).	DTF-CMSCEV-R1	NA—Accounted for in consequence analyses, if applicable	NA—Potential exposure of workers or the public to radiation is a hazard for the event sequences considered in this analysis. Consequence analyses evaluate this hazard for Category 1 and Category 2 event sequences, as applicable.	NA	NA
			Normal Operations	Some exposure to radiation is expected as a part of normal facility operations. Exposures are managed by design features and procedures that ensure that workers or the public do not receive excessive radiation doses.	Mitigative	Design-Procedural Safety
	2. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation (Rooms 1076, 1077, and 1079).	DTF-CMSCEV-R2	NA (no significant exposure)	Operating procedures ensure that a loss of confinement during otherwise normal operations does not cause individuals to be exposed to significant amounts of radioactivity.	Mitigative	Procedural Safety
	3. Radiation-induced damage to a facility SSC (Rooms 1076, 1077, and 1079).	DTF-CMSCEV-R3	NA	Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization.	NA	NA
Fissile	1. Criticality associated with an SRTC derailment or collision followed by a load tipover or fall and a rearrangement of cask internals (Rooms 1077 and 1079).	DTF-CMSCEV-F1	Beyond Category 2	Design requirements and waste acceptance criteria ensure that transportation casks, transfer casks, MSCs, and dual-purpose canisters (DPCs) are designed to ensure nuclear criticality safety with optimum moderation and most-reactive waste forms. Criticality safety will be maintained despite geometric rearrangements due to a drop or other handling incident.	Preventive	Design
	2. Criticality associated with a cask drop, slapdown, or collision and rearrangement of cask internals (Rooms 1076, 1077, and 1079).	DTF-CMSCEV-F2	Beyond Category 2	Same disposition as Potential Event DTF-CMSCEV-F1.	Preventive	Design
	3. Criticality associated with an MSC drop, slapdown, or collision and rearrangement of cask internals (Rooms 1076, 1077, and 1079).	DTF-CMSCEV-F3	Beyond Category 2	Same disposition as Potential Event DTF-CMSCEV-F1.	Preventive	Design
	4. Criticality associated with an MSC transporter (holding a loaded MSC) collision followed by a load tipover or fall and rearrangement of the MSC internals (Rooms 1077 and 1079).	DTF-CMSCEV-F4	Beyond Category 2	Same disposition as Potential Event DTF-CMSCEV-F1.	Preventive	Design

NOTES: CC = collision-crushing; CCF = chemical contamination flooding; CMSCEV = cask and site-specific cask entrance vestibule; DTF = dry transfer facility (DTF 1 and DTF 2); EI = explosion-implosion; F = fissile; FT = fire-thermal; GET = generalized event tree; HLW = high-level radioactive waste; NA = not applicable; R = radiation; SNF = spent nuclear fuel; SRTC = site rail transfer cart.

The Event Sequence Designator is a unique event sequence index for each event in this table. The prefix identifies the building or facility, for example "DTF," the middle identifies an activity, room, or area, for example "CMSCEV," and the suffix identifies the hazard category and event number, for example "CC1." When an event sequence has been evaluated in a GET, the GET number is identified in the Disposition of Event column; the GET sequence alpha character is shown at the end of the Event Sequence Designator, for example "A."

GETs are discussed in Sections 6.3.1.1 to 6.3.1.24.

Table III-10. Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Cask/Site-specific Cask Turntable Room (Room 1073), Cask Preparation Room (Room 1074), Cask Docking Ring Installation Room (Room 2051)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Collision-Crushing	1. Derailment of a trolley holding a cask or MSC on a pedestal (with outer and/or inner lid bolted in place, if applicable) followed by a load tipover or fall (Rooms 1073 and 1074).	DTF-CTRPR-CC1	Beyond Category 2	A design requirement ensures that loaded-transfer trolleys do not derail or drop their loads during normal operation or as a result of a turntable malfunction. Design requirements apply to trolleys for transportation casks, site-specific casks, and dual-purpose canisters.	Preventive	Design
	2. Derailment of a trolley holding a cask or MSC on a pedestal (with outer and/or inner lid bolted in place, if applicable) due to a turntable malfunction followed by a load tipover or fall (Rooms 1073 and 1074).	DTF-CTRPR-CC2	Beyond Category 2	Same disposition as Potential Event DTF-CTRPR-CC1.	Preventive	Design
	3. Collision of a trolley holding a cask or MSC on a pedestal (with outer and/or inner lid bolted in place, if applicable) with shield doors separating the cask/MSR turntable room and the cask preparation room (Rooms 1073 and 1074).	DTF-CTRPR-CC3	Beyond Category 2	(See GET-22) A design requirement limits the speed of trolley movements such that a collision at the speed limit would not cause the trolley to drop its load.	Preventive	Design
	4. Closure of the shield doors separating the cask/MSR turntable room and the cask preparation room onto the trolley holding a cask or MSC on a pedestal (with outer and/or inner lid bolted in place, if applicable) (Rooms 1073 and 1074).	DTF-CTRPR-CC4	Beyond Category 2	A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transfer trolley, site-rail transfer cart (SRTC), MSC transporter, WP transporter, would not cause a tipover of the conveyance or cause the conveyance to drop its load. A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transportation cask, transfer cask, or MSC suspended from an overhead crane would not cause the crane to drop its load.	Preventive	Design
	5. Collision involving two trolleys with at least one holding a cask or MSC on a pedestal (with outer and/or inner lid bolted in place, if applicable) (Rooms 1073 and 1074).	DTF-CTRPR-CC5	Beyond Category 2	(See GET-22) Same disposition as Potential Event DTF-CTRPR-CC3.	Preventive	Design
	6. Drop or collision of tools or equipment (including a lid-lifting fixture, lid bolts, etc.) onto or against a cask or MSC outer lid (if applicable) or a cask or MSC inner lid in the cask preparation room (Room 1074).	DTF-CTRPR-CC6	Beyond Category 2	An operational requirement limits lift heights for tools and equipment associated with transportation cask, transfer cask, MSC, and DPC handling and preparation to the minimum necessary for operational purposes. The operational requirement ensures that tools and equipment, including handling equipment, if dropped from the height limit, do not initiate an event sequence if dropped onto or collided against (1) a transportation cask or site-specific cask with its outer lid removed and its inner lid in place but unbolted, (2) an exposed sealed dual-purpose canister, or (3) a dual-purpose canister with its severed lid in place.	Preventive	Procedural Safety
	7. Drop of a cask or MSC outer lid from the overhead crane onto the cask or MSC (if applicable) in the cask preparation room (Room 1074).	DTF-CTRPR-CC7A DTF-CTRPR-CC7B DTF-CTRPR-CC7C DTF-CTRPR-CC7D DTF-CTRPR-CC7E DTF-CTRPR-CC7F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-02) Design and operational requirements reduce the drop probability. Operational requirements limit the lift height of the inner lid of a transportation cask, transfer cask, site-specific cask, or waste package to ensure that a lid drop onto a DOE canister within that breaches the canister is a beyond Category 2 event sequence. Design and operational requirements limit the probability of exceeding the lift height. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multicask overpack is defective.	Preventive	Design - Procedural Safety
	8. Drop or collision of a docking ring onto or against a cask or MSC in the cask preparation room (Room 1074).	DTF-CTRPR-CC8	Beyond Category 2	Same DTF-CTRPR-CC6.	Preventive	Procedural Safety

Table III-10. Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Cask/Site-specific Cask Turntable Room (Room 1073), Cask Preparation Room (Room 1074), Cask Docking Ring Installation Room (Room 2051) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Event Sequence Category	Disposition of Event	
				Preventive or Mitigative Requirement	Design or Procedural Safety Control
Chemical Contamination-Flooding	1. Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures (Rooms 1073 and 1074).	DTF-CTRPR-CCF1	Normal Operations	Oxidation of failed commercial SNF, not contained inside a sealed canister, is expected as a part of normal operations whenever commercial SNF is exposed to air. Any resulting potential exposure of workers to radiation is managed as a normal-operations dose by procedures that ensure that workers do not receive excessive radiation doses.	Procedural Safety
				Design, Procedural Safety, or Operational Requirement	
Explosion-Imposition	1. Cask purging or sampling system (or other pneumatic or pressurized system) missile due to a fractured nozzle/valve stem/pneumatic device (Rooms 1073 and 1074).	DTF-CTRPR-EH	Beyond Category 2	An operational requirement ensures that pressurized systems that could generate missiles, energetic enough to penetrate a transportation cask, with or without impact limiters, a transfer cask, a DOE SNF canister, a naval SNF canister, a waste package, or the inner lid of a site-specific cask, are not present in areas where vulnerable items may be exposed.	Procedural Safety
				Precautions taken during the cask sampling and purging process provide reasonable assurance that such hydrogen explosions would not occur.	Procedural Safety
	2. Explosion hazard associated with the cask sampling and purging system and the ignition of hydrogen that may have accumulated in the cask (Rooms 1073 and 1074).	DTF-CTRPR-EI2	Beyond Category 2	Operational controls pertaining to batteries for powering heavy equipment ensure the generation or accumulation of enough hydrogen gas to cause an explosion that could breach a transportation cask, site-specific cask, or waste package is prevented.	Procedural Safety
				Design and operational requirements ensure control of the presence and amount of combustibles in the different areas of the repository to preclude any Category 1 or Category 2 event sequences potentially initiated by a fire.	Design-Precedural Safety
Fire-Thermal	1. Electrical fire associated with the cask preparation area 20-ton overhead crane (Room 2051).	DTF-CTRPR-FT1	Beyond Category 2	Same disposition as Potential Event DTF-CTRPR-FT1.	Design-Precedural Safety
				Same disposition as Potential Event DTF-CTRPR-FT1.	Design-Precedural Safety
	2. Electrical fire associated with handling equipment or other cask preparation area equipment, including the turntable (Rooms 1073 and 1074).	DTF-CTRPR-FT2	Beyond Category 2	Same disposition as Potential Event DTF-CTRPR-FT1.	Design-Precedural Safety
	3. Fire/explosion (battery/electrical fire) associated with the trolley (Rooms 1073 and 1074).	DTF-CTRPR-FT3	Beyond Category 2	Same disposition as Potential Event DTF-CTRPR-FT1.	Design-Precedural Safety
	4. Transient combustible fire in the cask preparation room or the cask/MSC turntable room (Rooms 1073 and 1074).	DTF-CTRPR-FT4	Beyond Category 2	Same disposition as Potential Event DTF-CTRPR-FT1.	Design-Precedural Safety
	5. Thermal hazard (from decay heat) associated with vertical orientation of the loaded cask (Rooms 1073 and 1074).	DTF-CTRPR-FT5	Normal Operations	Same disposition as Potential Event DTF-CTRPR-CCF1.	Procedural Safety
	6. Intact or non-intact SNF overheating or damage to cask or MSC contents due to a loss of cooling resulting in excessive temperature and possible zircaloy cladding (or other cladding) unzipping or cladding failure due to excessive hoop stresses (Rooms 1073 and 1074).	DTF-CTRPR-FT6	Beyond Category 2	If ventilation is lost in areas where DOE or naval canisters are handled, no radiological release occurs from the canisters because containment within the canisters is maintained. Design and operational requirements ensure that the thermal response of areas where releases in excess of those considered in the consequence analysis for normal operations.	Design-Precedural Safety
Radiation	1. Radiation exposure of a facility worker and/or the offsite public (Rooms 1073 and 1074).	DTF-CTRPR-R1	Normal Operations	NA-Accounted for in consequence analyses, if applicable	Design-Precedural Safety
				NA-Potential exposure of workers or the public to radiation is a hazard for the event sequences considered in this analysis. Consequence analyses evaluate this hazard for Category 1 and Category 2 event sequences, as applicable.	NA
				Some exposure to radiation is expected as a part of normal facility operations. Exposures are managed by design features and procedures that ensure that workers or the public do not receive excessive radiation doses.	Mitigative

Table III-10. Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Cask/Site-specific Cask Turntable Room (Room 1073), Cask Preparation Room (Room 1074), Cask Docking Ring Installation Room (Room 2051) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	2. Damage or rupture of cask sampling and purging system, leading to a release of cask or MSC internal gases and radioactive material (Rooms 1073 and 1074).	DTF-CTRPR-R2	Normal Operations	The sampling operation is conducted so that exposure of workers to radiation is managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. Although a rupture leading to a radiological release would be an off-normal occurrence, any release and related dose would be managed as part of routine radiation protection operations.	Mitigative	Procedural Safety
	3. Thermal expansion of gases or other loss of confinement in an unsealed cask or MSC, leading to radiological release (Rooms 1073 and 1074).	DTF-CTRPR-R3	Normal Operations	An exposure of workers to radiation due to this potential event is managed as a normal-operations dose by procedures that ensure workers do not receive excessive radiation doses.	Mitigative	Procedural Safety
	4. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation (Rooms 1073 and 1074).	DTF-CTRPR-R4	NA (no significant exposure)	Operating procedures ensure that a loss of confinement during otherwise normal operations does not cause individuals to be exposed to significant amounts of radioactivity.	Mitigative	Procedural Safety
	5. Radiation-induced damage to a facility SSC (Rooms 1073 and 1074).	DTF-CTRPR-R5	NA	Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization.	NA	NA
Fissile	1. Criticality associated with a cask or MSC collision followed by a load tipover or fall and a rearrangement of the cask or MSC internals (Rooms 1073 and 1074).	DTF-CTRPR-F1	Beyond Category 2	Design requirements and waste acceptance criteria ensure that transportation casks, transfer casks, MSCs, and dual-purpose canisters (DPCs) are designed to ensure nuclear criticality safety with optimum moderation and most-reactive waste forms. Criticality safety will be maintained despite geometric rearrangements due to a drop or other handling incident.	Preventive	Design
	2. Criticality associated with a cask or MSC trolley derailment followed by a load tipover or fall and a rearrangement of the cask or MSC internals (Rooms 1073 and 1074).	DTF-CTRPR-F2	Beyond Category 2	Same disposition as Potential Event DTF-CTRPR-F1.	Preventive	Design

NOTES: CC = collision-crushing; CCF = chemical contamination flooding; CTRPR = cask turntable room preparation room; DTF = dry transfer facility (DTF 1 and DTF 2); EI = explosion-implosion; F = fissile; FT = fire-thermal; GET = generalized event tree; HLW = high-level radioactive waste; NA = not applicable; R = radiation; SNF = spent nuclear fuel.

The Event Sequence Designator is a unique event sequence index for each event in this table. The prefix identifies the building or facility, for example "DTF," the middle identifies an activity, room, or area, for example "CTRPR," and the suffix identifies the hazard category and event number, for example "CC1." When an event sequence has been evaluated in a GET, the GET number is identified in the Disposition of Event column; the GET sequence alpha character is shown at the end of the Event Sequence Designator, for example "A."

GETs are discussed in Sections 6.3.1.1 to 6.3.1.24.

Table III-11. Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Cask and Site-specific Cask Docking Room. (Room 1069)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Collision-Crushing	1. Derailment of a trolley holding a cask or MSC on a pedestal (with outer lid removed [if applicable] and inner lid unbolted but in place) followed by a load tipover or fall. (Room 1069).	DTF-CSKDR-CC1	Beyond Category 2	A design requirement ensures that loaded transfer trolleys do not derail or drop their loads. Design requirements apply to trolleys for casks, waste packages, site-specific casks, and dual-purpose canisters.	Preventive	Design
	2. Derailment of a trolley holding a cask or MSC on a pedestal (with outer lid removed [if applicable] and inner lid unbolted but in place) due to a turntable malfunction followed by a load tipover or fall (Room 1069).	DTF-CSKDR-CC2	Beyond Category 2	Same disposition as Potential Event DTF-CSKDR-CC1.	Preventive	Design
	3. Collision of a trolley holding a cask or MSC on a pedestal (with outer lid removed [if applicable] and inner lid unbolted but in place) with shield doors separating the cask preparation room and the cask/MSD turntable room or the shield doors separating the cask/MSD turntable room and the cask and MSC docking room (Room 1069).	DTF-CSKDR-CC3	Beyond Category 2	(See GET-22) A design requirement limits the speed of trolley movements such that a collision at the speed limit would not cause the trolley to drop its load.	Preventive	Design
	4. Closure of the shield doors separating the cask preparation room and the cask/MSD turntable room or the shield doors separating the cask/MSD turntable room and the cask and MSC docking room onto the trolley holding a cask or MSC on a pedestal (with outer lid removed [if applicable] and inner lid unbolted but in place) (Room 1069).	DTF-CSKDR-CC4	Beyond Category 2	A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transfer trolley, site-rail transfer cart (SRTC), MSC transporter, WP transporter, would not cause a tipover of the conveyance or cause the conveyance to drop its load. A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transportation cask, transfer cask, or MSC suspended from an overhead crane would not cause the crane to drop its load.	Preventive	Design
	5. Collision involving two trolleys with at least one holding a cask or MSC on a pedestal (with outer lid removed [if applicable] and inner lid unbolted but in place) (Room 1069).	DTF-CSKDR-CC5	Beyond Category 2	(See GET-22) Same disposition as Potential Event DTF-CSKDR-CC3.	Preventive	Design
	6. Drop or collision of a docking port (mobile slab) onto or against a cask or MSC (Room 1069).	DTF-CSKDR-CC6	Beyond Category 2	A design requirement ensures that a drop of or collision involving components associated with a docking port will not breach the lid of a cask or MSC situated at the docking port.	Preventive	Design
	7. Drop or collision of a docking port plug onto or against a cask lid or MSC lid (with outer lid removed [if applicable] and inner lid unbolted but in place) (Room 1069).	DTF-CSKDR-CC7	Beyond Category 2	Design requirements ensure that portions of a non-ITS SSC which, upon failure, could adversely interact with an ITS SSC and prevent its safety function from being performed are classified as ITS, redesigned to eliminate the potential unacceptable interaction with the identified ITS SSC, or, for seismic interactions, designed to the same seismic DBGM as the ITS SSCs subjected to the potential unacceptable interaction.	Preventive	Design
	8. Drop of an inner lid into a cask or MSC (with outer lid removed [if applicable]) (Room 1069).	DTF-CSKDR-CC8A DTF-CSKDR-CC8B DTF-CSKDR-CC8C DTF-CSKDR-CC8D DTF-CSKDR-CC8E DTF-CSKDR-CC8F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-02) Design and operational requirements reduce the drop probability. Operational requirements limit the lift height of the inner lid of a transportation cask, transfer cask, site-specific cask, or waste package to ensure that a lid drop onto a DOE canister within that breaches the canister is a beyond Category 2 event sequence. Design and operational requirements limit the probability of exceeding the lift height. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multicarrier overpack is defective.	Preventive	Design- Procedural Safety

Table III-11. Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Cask and Site-specific Cask Docking Room. (Room 1069) (Continued)

Generic Event Category	Potential Event (Room or Area)	Disposition of Event			Preventive or Mitigative Requirement	Design or Procedural Safety Control
		Event Sequence Designator	Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Chemical Contamination-Flooding	1. Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures (Room 1069).	DTF-CSKDR-CCF1	Normal Operations	Oxidation of failed commercial SNF, not contained inside a sealed canister, is expected as a part of normal operations whenever commercial SNF is exposed to air. Any resulting potential exposure of workers to radiation is managed as a normal-operations dose by procedures that ensure that workers do not receive excessive radiation doses.	Mitigative	Procedural Safety
Explosion-Impllosion	1. Hydrogen explosion involving batteries on a cask trolley (Room 1069).	DTF-CSKDR-EI1	Beyond Category 2	Operational controls pertaining to batteries for powering heavy equipment ensure the generation or accumulation of enough hydrogen gas to cause an explosion that could breach a transportation cask, site-specific cask, or waste package is prevented.	Preventive	Procedural Safety
Fire-Thermal	1. Electrical fire associated with handling equipment or other cask and MSC docking room equipment (including the turntable). (Room 1069).	DTF-CSKDR-FT1	Beyond Category 2	Design and operational requirements ensure control of the presence and amount of combustibles in the different areas of the repository to preclude any Category 1 or Category 2 event sequences potentially initiated by a fire.	Preventive	Design-Procedural Safety
	2. Fire/explosion (battery/electrical fire) associated with the cask trolley (Room 1069).	DTF-CSKDR-FT2	Beyond Category 2	Same disposition as Potential Event DTF-CSKDR-FT1.	Preventive	Design-Procedural Safety
	3. Transient combustible fire in the cask and MSC docking room (Room 1069).	DTF-CSKDR-FT3	Beyond Category 2	Same disposition as Potential Event DTF-CSKDR-FT1.	Preventive	Design-Procedural Safety
	4. Thermal hazard (from decay heat) associated with vertical orientation of the loaded cask (Room 1069).	DTF-CSKDR-FT4	Normal Operations	Same disposition as Potential Event DTF-CSKDR-CCF1.	Mitigative	Procedural Safety
	5. Intact or non-intact SNF overheating or damage to cask contents due to a loss of cooling resulting in excessive temperature and possible zircaloy cladding (or other cladding) unzipping or cladding failure due to excessive hoop stresses (Room 1069).	DTF-CSKDR-FT5	Beyond Category 2	If ventilation is lost in areas where DOE or naval canisters are handled, no radiological release occurs from the canisters because containment within the canisters is maintained. Design and operational requirements ensure that the thermal response of areas where CSNF assemblies are handled or staged to a loss of HVAC would not cause radiological releases in excess of those considered in the consequence analysis for normal operations.	Preventive	Design-Procedural Safety
Radiation	1. Radiation exposure of a facility worker and/or the offsite public (Room 1069).	DTF-CSKDR-R1	NA—Accounted for in consequence analyses, if applicable Normal Operations	NA—Potential exposure of workers or the public to radiation is a hazard for the event sequences considered in this analysis. Consequence analyses evaluate this hazard for Category 1 and Category 2 event sequences, as applicable. Some exposure to radiation is expected as a part of normal facility operations. Exposures are managed by design features and procedures that ensure that workers or the public do not receive excessive radiation doses.	NA Mitigative	NA Design-Procedural Safety
	2. Docking ring failure leads to a radiological release (Room 1069).	DTF-CSKDR-R2	NA (no significant exposure)	Same disposition as Potential Event DTF-CSKDR-R5.	Mitigative	Procedural Safety
	3. Radiological release due to installation of incorrect docking ring (Room 1069).	DTF-CSKDR-R3	NA (no significant exposure)	Same disposition as Potential Event DTF-CSKDR-R5.	Mitigative	Procedural Safety
	4. Thermal expansion of gases or other loss of confinement in an unsealed cask or MSC, leading to radiological release (Room 1069).	DTF-CSKDR-R4	Normal Operations	Thermal expansion of gases is expected as a part of normal operations. Any resulting potential exposure of workers to radiation is managed as a normal operations dose by procedures that ensure workers do not receive excessive radiation doses.	Mitigative	Procedural Safety
	5. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation (Room 1069).	DTF-CSKDR-R5	NA (no significant exposure)	Operating procedures ensure that a loss of confinement during otherwise normal operations does not cause individuals to be exposed to significant amounts of radioactivity.	Mitigative	Procedural Safety
	6. Radiation-induced damage to a facility SSC (Room 1069).	DTF-CSKDR-R6	NA	Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization.	NA	NA

Table III-11. Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Cask and Site-specific Cask Docking Room. (Room 1069) (Continued)

Generic Event Category	Potential Event (Room or Area)	Disposition of Event			Preventive or Mitigative Requirement	Design or Procedural Safety Control
		Event Sequence Designator	Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Fissile	1. Criticality associated with cask or MSC collisions or a trolley derailment followed by a load tipover or fall and a rearrangement of cask or MSC internals (Room 1069).	DTF-CSKDR-F1	Beyond Category 2	Design requirements and waste acceptance criteria ensure that transportation casks, transfer casks, MSCs, and dual-purpose canisters (DPCs) are designed to ensure nuclear criticality safety with optimum moderation and most-reactive waste forms. Criticality safety will be maintained despite geometric rearrangements due to a drop or other handling incident.	Preventive	Design

NOTES: CC = collision-crushing; CCF = chemical contamination flooding; CSKDR = cask docking room; DTF = dry transfer facility (DTF 1 and DTF 2); EI = explosion-implosion; F = fissile; FT = fire-thermal; GET = generalized event tree; HLW = high-level radioactive waste; NA = not applicable; R = radiation; SNF = spent nuclear fuel; SRTC = site rail transfer cart.

The Event Sequence Designator is a unique event sequence index for each event in this table. The prefix identifies the building or facility, for example "DTF," the middle identifies an activity, room, or area, for example "CSKDR," and the suffix identifies the hazard category and event number, for example "CC1." When an event sequence has been evaluated in a GET, the GET number is identified in the Disposition of Event column; the GET sequence alpha character is shown at the end of the Event Sequence Designator, for example "A."

GETs are discussed in Sections 6.3.1.1 to 6.3.1.24.

Table III-12. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Naval Spent Nuclear Fuel Receipt): Waste Package and Navy Cask Entrance Vestibule. (Room 1060), Waste Package/Naval Cask SRTC Receipt Area. (Room 1058), Waste Package/Naval to Trolley Transfer Room (Room 1057), Waste Package/Naval Cask Preparation Room (Room 1053).

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Collision-Crushing	1. SRTC derailment involving a loaded naval SNF cask followed by a load tipover or fall (Rooms 1058 and 1060).	DTF-NSNFR-CC1	Beyond Category 2	Transportation casks with impact limiters are designed to withstand, without breaching, the bounding drops that could occur during cask handling at the repository. A derailment, overturning, or collision does not breach a transportation cask with impact limiters. A design requirement ensures that an SRTC carrying a cask without impact limiters (typically only within structures) or site-specific cask does not derail and the cask or site-specific cask does not fall from the SRTC under normal operating conditions or as the result of a collision.	Preventive	Design
	2. Collision of an SRTC carrying a loaded naval SNF cask with the WP and navy cask entrance vestibule doors or the WP/navy cask SRTC receipt area shield doors (Rooms 1058 and 1060).	DTF-NSNFR-CC2	Beyond Category 2	Same disposition as Potential Event DTF-NSNFR-CC1.	Preventive	Design
	3. The WP and navy cask entrance vestibule doors or the WP/navy cask SRTC receipt area shield doors close on an SRTC carrying a loaded cask (Rooms 1058 and 1060).	DTF-NSNFR-CC3	Beyond Category 2	A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transfer trolley, site-rail transfer cart (SRTC), MSC transporter, WP transporter, would not cause a tipover of the conveyance or cause the conveyance to drop its load. A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transportation cask, transfer cask, or MSC suspended from an overhead crane would not cause the crane to drop its load.	Preventive	Design
	4. Collision of mobile elevated platforms with a loaded naval SNF cask during removal of personnel barriers and impact limiters or during survey activities (Room 1058).	DTF-NSNFR-CC4	Beyond Category 2	Operational requirements ensure that the portable platforms, access platforms, mobile elevated platforms, and forklifts operated in the facility are not operated in a manner that could breach or overturn a loaded transportation cask or site-specific cask.	Preventive	Procedural Safety
	5. Forklift collision with a naval SNF cask on an SRTC (with or without impact limiters installed on the cask) or the SRTC holding the cask (Room 1058).	DTF-NSNFR-CC5	Beyond Category 2	Same disposition as Potential Event DTF-NSNFR-CC4.	Preventive	Procedural Safety
	6. Drop or collision of personnel barriers or impact limiters from the receipt area crane onto or against a loaded naval SNF cask (Room 1058).	DTF-NSNFR-CC6	Beyond Category 2	Operational requirements for cask preparation and handling ensure that a drop of or collision involving equipment would not breach a transportation cask, transfer cask, or an MSC.	Preventive	Procedural Safety
	7. Slapdown of a loaded naval SNF cask onto an SRTC during upending of the loaded cask to the vertical orientation (Room 1058).	DTF-NSNFR-CC7A	Category 2	(See GET-01 Sequence A) Design and operational requirements reduce the drop probability.	Preventive	Design-Procedural Safety
	8. Drop of a loaded naval SNF cask from the overhead crane onto the floor during the transfer from an SRTC to a pedestal previously positioned on a trolley (Room 1058).	DTF-NSNFR-CC8A	Category 2	(See GET-01 Sequence A) Same disposition as Potential Event DTF-NSNFR-CC7.	Preventive	Design-Procedural Safety

Table III-12. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Naval SNF Receipt): Waste Package and Navy Cask Entrance Vestibule. (Room 1060), Waste Package/Navy Cask SRTC Receipt Area. (Room 1058), Waste Package/Navy to Trolley Transfer Room. (Room 1057), Waste Package/Navy Cask Preparation Room (Room 1053) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	9. Drop of a loaded naval SNF cask from the overhead crane onto a pedestal on a trolley during the transfer from an SRTC to a pedestal previously positioned on a trolley (Room 1058).	DTF-NSNFR-CC9A	Category 2	(See GET-01 Sequence A) Same disposition as Potential Event DTF-NSNFR-CC7.	Preventive	Design-Procedural Safety
	10. Drop or collision of a loaded cask from the overhead crane onto or against a sharp object during the transfer from an SRTC to a pedestal previously positioned on trolley (Room 1058).	DTF-NSNFR-CC10	Beyond Category 2	Design and operational requirements ensure that surfaces in the load paths through which WPs, DOE SNF canisters, naval canisters, DPCs, transportation casks, transfer casks, or MSCs are transferred by crane are kept free of structures, such as posts and curbs, that could puncture a container in case of a drop. An operational requirement ensures that the load paths are kept free of movable puncture hazards. A design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design-Procedural Safety
	11. Collision of a loaded naval SNF cask suspended from the overhead crane with the shield doors separating the WP/navy cask SRTC receipt area and the WP/navy to trolley transfer room during transfer of the naval SNF cask from the SRTC to the trolley (Room 1058).	DTF-NSNFR-CC11	Beyond Category 2	A design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design
	12. Closing of the shield doors separating the WP/navy cask SRTC receipt area and the WP/navy to trolley transfer room (striking the cask while the loaded cask is suspended from the overhead crane) during the transfer of the cask from the SRTC to the trolley (Rooms 1057 and 1058).	DTF-NSNFR-CC12	Beyond Category 2	Same disposition as Potential Event DTF-NSNFR-CC3.	Preventive	Design
	13. Slapdown of a loaded naval SNF cask following a drop from the overhead crane onto the edge of the trolley or pedestal during transfer of the cask from the SRTC to the trolley (Room 1057).	DTF-NSNFR-CC13A	Category 2	(See GET-01 Sequence A) Same disposition as Potential Event DTF-NSNFR-CC7.	Preventive	Design-Procedural Safety
	14. Drop or collision of handling equipment from the overhead bridge crane onto or against a loaded naval SNF cask (Rooms 1057 and 1058).	DTF-NSNFR-CC14	Beyond Category 2	Same disposition as Potential Event DTF-NSNFR-CC6	Preventive	Procedural Safety
	15. Drop or collision of other miscellaneous (non-handling) equipment (gas-sampling, lid-bolt removal, etc.) from the overhead bridge crane onto or against a loaded naval SNF cask (Rooms 1057 and 1058).	DTF-NSNFR-CC15	Beyond Category 2	Same disposition as Potential Event DTF-NSNFR-CC6.	Preventive	Procedural Safety
	16. Collision of a trolley holding a naval SNF cask on a pedestal with shield doors separating the WP/navy to trolley transfer room and the WP/navy cask preparation room (Room 1057).	DTF-NSNFR-CC16	Beyond Category 2	(See GET-22) A design requirement limits the speed of trolley movements such that a collision at the speed limit would not cause the trolley to drop its load.	Preventive	Design
	17. Closing of the shield doors separating the WP/navy to trolley transfer room and the WP/navy cask preparation room on a trolley holding a naval SNF cask on a pedestal (Room 1057).	DTF-NSNFR-CC17	Beyond Category 2	Same disposition as Potential Event DTF-NSNFR-CC3.	Preventive	Design
	18. Deraiment of a trolley holding a naval SNF cask on a pedestal followed by a load tipover or fall (Room 1057).	DTF-NSNFR-CC18	Beyond Category 2	A design requirement ensures that loaded transfer trolleys do not derail or drop their loads. Design requirements apply to trolleys for casks, waste packages, site-specific casks, and dual-purpose canisters.	Preventive	Design
Explosion-Implosion	1. Hydrogen explosion involving batteries on a forklift (Room 1058).	DTF-NSNFR-EI1	Beyond Category 2	Operational controls pertaining to batteries for powering heavy equipment ensure the generation or accumulation of enough hydrogen gas to cause an explosion that could breach a transportation cask, site-specific cask, or waste package is prevented.	Preventive	Procedural Safety

Table III-12. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Naval SNF Receipt): Waste Package and Navy Cask Entrance Vestibule. (Room 1060), Waste Package/Naval Cask SRTC Receipt Area. (Room 1058), Waste Package/Naval Cask Preparation Room. (Room 1057), Waste Package/Naval Cask Preparation Room (Room 1053) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Fire-Thermal	2. Hydrogen explosion involving batteries on a mobile elevated platform (Room 1058).	DTF-NSNFR-EI2	Beyond Category 2	Same disposition as Potential Event DTF-NSNFR-EI1.	Preventive	Procedural Safety
	1. Electrical fire associated with the WP/naval cask SRTC receipt area overhead cranes (Rooms 1057 and 1058).	DTF-NSNFR-FT1	Beyond Category 2	Design and operational requirements ensure control of the presence and amount of combustibles in the different areas of the repository to preclude any Category 1 or Category 2 event sequences potentially initiated by a fire.	Preventive	Design-Procedural Safety
	2. Electrical fire associated with handling equipment or other electrical equipment in the WP/naval cask SRTC receipt area, WP and naval cask entrance vestibule, the WP/naval cask preparation room, or the WP/naval cask preparation room (Rooms 1057 and 1058).	DTF-NSNFR-FT2	Beyond Category 2	Same disposition as Potential Event DTF-NSNFR-FT1.	Preventive	Design-Procedural Safety
	3. Diesel fuel fire/explosion involving an SRTC tractor pulling or pushing an SRTC holding a naval SNF cask containing a naval SNF canister (Rooms 1058 and 1060).	DTF-NSNFR-FT3	Beyond Category 2	Same disposition as Potential Event DTF-NSNFR-FT1.	Preventive	Design-Procedural Safety
	4. Electrical fire associated with a trolley holding a naval SNF cask containing a naval SNF canister (Room 1057).	DTF-NSNFR-FT4	Beyond Category 2	Same disposition as Potential Event DTF-NSNFR-FT1.	Preventive	Design-Procedural Safety
	5. Fire/explosion (battery/electrical fire) associated with a forklift (Room 1058).	DTF-NSNFR-FT5	Beyond Category 2	Same disposition as Potential Event DTF-NSNFR-FT1.	Preventive	Design-Procedural Safety
	6. Fire/explosion (battery/electrical fire) associated with a mobile elevated platform (Room 1058).	DTF-NSNFR-FT6	Beyond Category 2	Same disposition as Potential Event DTF-NSNFR-FT1.	Preventive	Design-Procedural Safety
	7. Transient combustible fire in the WP and naval cask entrance vestibule, the WP/naval cask SRTC receipt area, the WP/naval cask preparation room, or the WP/naval cask preparation room (Rooms 1057, 1058, and 1060).	DTF-NSNFR-FT7	Beyond Category 2	Same disposition as Potential Event DTF-NSNFR-FT1.	Preventive	Design-Procedural Safety
Radiation	8. Thermal hazard (from decay heat) associated with a vertical orientation of a loaded naval SNF cask (Rooms 1057, 1058, and 1060).	DTF-NSNFR-FT8	Beyond Category 2	This potential event does not lead to exposure of individuals to radiation because the naval SNF is contained in a sealed canister.	Preventive	Design
	1. Radiation exposure of a facility worker and/or the offsite public (Rooms 1057, 1058, and 1060).	DTF-NSNFR-R1	NA—Accounted for in consequence analyses, if applicable Normal Operations	NA—Potential exposure of workers or the public to radiation is a hazard for the event sequences considered in this analysis. Consequence analyses evaluate this hazard for Category 1 and Category 2 event sequences, as applicable. Some exposure to radiation is expected as a part of normal facility operations. Exposures are managed by design features and procedures that ensure that workers or the public do not receive excessive radiation doses.	NA Mitigative	NA Design-Procedural Safety
	2. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation (Rooms 1057, 1058, and 1060).	DTF-NSNFR-R2	NA (no significant exposure)	Operating procedures ensure that a loss of confinement during otherwise normal operations does not cause individuals to be exposed to significant amounts of radioactivity.	Mitigative	Procedural Safety
	3. Radiation-induced damage to a facility SSC (Rooms 1057, 1058, and 1060).	DTF-NSNFR-R3	NA	Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization.	NA	NA

Table III-12. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Naval SNF Receipt): Waste Package and Navy Cask Entrance Vestibule. (Room 1060), Waste Package/Navy Cask SRTC Receipt Area. (Room 1058), Waste Package/Navy to Trolley Transfer Room. (Room 1057), Waste Package/Navy Cask Preparation Room (Room 1053) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Fissile	1. Criticality associated with an SRTC derailment or collision followed by a load tipover or fall and a rearrangement of the naval SNF cask internals (Rooms 1058 and 1060).	DTF-NSNFR-F1	Beyond Category 2	Design requirements and waste acceptance criteria ensure that transportation casks, transfer casks, MSCs, and dual-purpose canisters (DPCs) are designed to ensure nuclear criticality safety with optimum moderation and most-reactive waste forms. Criticality safety will be maintained despite geometric rearrangements due to a drop or other handling incident.	Preventive	Design
	2. Criticality associated with a naval SNF cask drop, slapdown, or collision and rearrangement of cask internals (Rooms 1057, 1058, and 1060).	DTF-NSNFR-F2	Beyond Category 2	Same disposition as Potential Event DTF-NSNFR-F1.	Preventive	Design
	3. Criticality associated with naval SNF cask trolley derailment followed by a load tipover or fall and a rearrangement of the cask internals (Room 1057).	DTF-NSNFR-F3	Beyond Category 2	Same disposition as Potential Event DTF-NSNFR-CC18.	Preventive	Design

NOTES: CC = collision-crushing; CCF = chemical contamination flooding; DTF = dry transfer facility (DTF 1 and DTF 2); Et = explosion-implosion; F = fissile; FT = fire-thermal; GET = generalized event tree; NA = not applicable; NSNFR = naval SNF cask receipt; R = radiation; SNF = spent nuclear fuel; SRTC = site rail transfer cart.

The Event Sequence Designator is a unique event sequence index for each event in this table. The prefix identifies the building or facility, for example "DTF," the middle identifies an activity, room, or area, for example "NSNFR," and the suffix identifies the hazard category and event number, for example "CC1." When an event sequence has been evaluated in a GET, the GET number is identified in the Disposition of Event column; the GET sequence alpha character is shown at the end of the Event Sequence Designator, for example "A."

GETs are discussed in Sections 6.3.1.1 to 6.3.1.24.

Table III-13. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Naval Spent Nuclear Fuel Processing): Waste Package Docking Cell (Rooms 1052 and 1055), Waste Package Loading (Navy Canister)/Docking Ring Removal Cell (Room 1051)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Collision-Crushing	1. Derailment of a trolley holding a loaded naval SNF cask on a pedestal followed by a load tipover or fall (Rooms 1051, 1052, 1053, and 1055).	DTF-NSNFP-CC1	Beyond Category 2	A design requirement ensures that loaded transfer trolleys do not derail or drop their loads. Design requirements apply to trolleys for casks, waste packages, site-specific casks, and dual-purpose canisters.	Preventive	Design
	2. Drop or collision of handling equipment (such as the lid grapple) onto or against a naval SNF cask outer lid (if applicable) or inner lid (Rooms 1051, 1052, 1053, and 1055).	DTF-NSNFP-CC2	Beyond Category 2	An operational requirement limits lift heights for tools and equipment associated with transportation cask, transfer cask, MSC, and DPC handling and preparation to the minimum necessary for operational purposes. The operational requirement ensures that tools and equipment, including handling equipment, if dropped from the height limit, do not initiate an event sequence if dropped onto or collided against (1) a transportation cask or site-specific cask with its outer lid removed and its inner lid in place but unbolted, (2) an exposed sealed dual-purpose canister, or (3) a dual-purpose canister with its severed lid in place.	Preventive	Procedural Safety
	3. Drop of a naval SNF cask inner lid (if applicable) from the 70-ton navy canister handling crane onto a naval SNF canister (Room 1051).	DTF-NSNFP-CC3A DTF-NSNFP-CC3B	No drop Category 2	(See GET-02 Sequences A and B only) Design and operational requirements reduce the drop probability.	Preventive	Design- Procedural Safety
	4. Drop or collision of handling equipment (such as a canister grapple) into or against an open naval SNF cask loaded with a naval SNF canister (Rooms 1051, 1052, 1053, and 1055).	DTF-NSNFP-CC4A DTF-NSNFP-CC4B	No drop Category 2	(See GET-06 Sequences A and B only) In this potential event, a drop has to occur to cause a collision because the equipment would be suspended above the canister. Design and operational requirements reduce the drop probability.	Preventive	Design- Procedural Safety
	5. Drop or collision of a naval SNF canister from the WP docking cell crane back into or against the naval SNF cask being unloaded (Rooms 1052 and 1055).	DTF-NSNFP-CC5A DTF-NSNFP-CC5B	No drop Category 2	(See GET-05 Sequences A and B only) Design and operational requirements reduce the drop probability. For collisions, a design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design- Procedural Safety
	6. Fall of a naval SNF canister from the WP docking crane onto the edge of the cask, the edge of the WP, or the edge of the transfer floor, followed by a slapdown of the canister (Rooms 1052 and 1055).	DTF-NSNFP-CC6A DTF-NSNFP-CC6B	No drop Category 2	(See GET-05 Sequences A and B only) Same disposition as Potential Event DTF-NSNFP-CC5.	Preventive	Design- Procedural Safety
	7. Drop or collision of a naval SNF canister from the 70-ton navy canister handling crane onto or against a sharp object (Room 1051).	DTF-NSNFP-CC7	Beyond Category 2	Design and operational requirements ensure that surfaces in the load paths through which WPs, DOE SNF canisters, naval canisters, DPCs, transportation casks, transfer casks, or MSCs are transferred by crane are kept free of structures, such as posts and curbs, that could puncture a container in case of a drop. An operational requirement ensures that the load paths are kept free of movable puncture hazards. A design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design- Procedural Safety

Table III-13. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Naval SNF Processing): Waste Package Docking Cell (Rooms 1052 and 1055), Waste Package Loading (Navy Canister)/Docking Ring Removal Cell (Room 1051) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence ^a Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	8. Collision involving a naval SNF canister suspended from the 70-ton navy canister handling crane with equipment located in the WP docking cell or the WP loading (navy canister)/docking ring removal cell, such as lid lifting equipment (Rooms 1051, 1052, and 1055).	DTF-NSNFP-CC8	Beyond Category 2	A design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design
	9. Drop of a naval SNF canister from the 70-ton navy canister handling crane onto the navy transfer/docking ring removal cell floor (Room 1051).	DTF-NSNFP-CC9A DTF-NSNFP-CC9B	No drop Category 2	(See GET-05 Sequences A and B only) Same disposition as Potential Event DTF-NSNFP-CC5.	Preventive	Design- Procedural Safety
	10. Impact due to horizontal movement of the naval SNF canister before it is completely removed from the naval transportation cask (Rooms 1051, 1052, 1053, and 1055).	DTF-NSNFP-CC10A	Beyond Category 2	A design requirement ensures that cranes are not capable of exerting sufficient force to breach a transportation cask, MSC, waste package, or canister as the result of attempts to overcome mechanical constraints.	Preventive	Design
	11. Drop or collision of a naval SNF canister from the 70-ton navy canister handling crane into or against the WP (Room 1051).	DTF-NSNFP-CC11A DTF-NSNFP-CC11B	No drop Category 2	(See GET-05 Sequences A and B only) Same disposition as Potential Event DTF-NSNFP-CC5.	Preventive	Design- Procedural Safety
	12. Drop or collision of handling equipment into or against an open WP loaded with a naval SNF canister (Room 1051).	DTF-NSNFP-CC12A DTF-NSNFP-CC12B	No drop Category 2	(See GET-06 Sequences A and B only) Same disposition as Potential Event DTF-NSNFP-CC4.	Preventive	Design- Procedural Safety
	13. Drop of a WP inner lid from the WP docking cell crane into a loaded naval WP (Rooms 1052 and 1055).	DTF-NSNFP-CC13A DTF-NSNFP-CC13B	No drop Category 2	(See GET-02 Sequences A and B only) Same disposition as Potential Event DTF-NSNFP-CC3.	Preventive	Design- Procedural Safety
Explosion-Implosion	No events.					
Fire-Thermal	1. Electrical fire associated with SNF handling equipment in the WP docking cell and the WP loading (naval SNF canister)/docking ring removal cell (including the overhead crane, etc.) (Rooms 1051, 1052, 1053, and 1055).	DTF-NSNFP-FT1	Beyond Category 2	Design and operational requirements ensure control of the presence and amount of combustibles in the different areas of the repository to preclude any Category 1 or Category 2 event sequences potentially initiated by a fire.	Preventive	Design- Procedural Safety
	2. Electrical fire associated with the trolley holding either a loaded, unsealed WP or a loaded naval SNF cask holding a naval SNF canister (Rooms 1051, 1052, 1053, and 1055).	DTF-NSNFP-FT2	Beyond Category 2	Same disposition as Potential Event DTF-NSNFP-FT1.	Preventive	Design- Procedural Safety
	3. Thermal hazard (from decay heat) associated with a vertical orientation of the naval SNF cask (Rooms 1051, 1052, 1053, and 1055).	DTF-NSNFP-FT3	Beyond Category 2	This potential event will not cause oxidation of SNF leading to exposure of individuals to radiation because naval SNF is handled in sealed canisters.	Preventive	Design
	4. Overheating of a loaded, unsealed (and uninerted) cask or WP due to a loss of cooling resulting in excessive temperature and possible damage to canister contents (Rooms 1051, 1052, 1053, and 1055).	DTF-NSNFP-FT4	Beyond Category 2	If ventilation is lost in areas where DOE or naval canisters are handled, no radiological release occurs from the canisters because containment within the canisters is maintained. Design and operational requirements ensure that the thermal response of areas where CSNF assemblies are handled or staged to a loss of HVAC would not cause radiological releases in excess of those considered in the consequence analysis for normal operations.	Preventive	Design- Procedural Safety
	5. Transient combustible fire in the WP docking cell or the WP loading (naval SNF canister)/docking ring removal cell (Rooms 1051, 1052, 1053, and 1055).	DTF-NSNFP-FT5	Beyond Category 2	Same disposition as Potential Event DTF-NSNFP-FT1.	Preventive	Design- Procedural Safety

Table III-13. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Naval SNF Processing): Waste Package Docking Cell (Rooms 1052 and 1055), Waste Package Loading (Navy Canister)/Docking Ring Removal Cell (Room 1051) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Radiation	1. Radiation exposure of a facility worker and/or the offsite public (Rooms 1051, 1052, 1053, and 1055).	DTF-NSNFP-R1	NA--Accounted for in consequence analyses, if applicable	NA--Potential exposure of workers or the public to radiation is a hazard for the event sequences considered in this analysis. Consequence analyses evaluate this hazard for Category 1 and Category 2 event sequences, as applicable.	NA	NA
			Normal Operations	Some exposure to radiation is expected as a part of normal facility operations. Exposures are managed by design features and procedures that ensure that workers or the public do not receive excessive radiation doses.	Mitigative	Design-Procedural Safety
	2. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation (Rooms 1051, 1052, 1053, and 1055).	DTF-NSNFP-R2	NA (no significant exposure)	Operating procedures ensure that a loss of confinement during otherwise normal operations does not cause individuals to be exposed to significant amounts of radioactivity.	Mitigative	Procedural Safety
	3. Inadvertent opening of a shield door, leading to a worker exposure (Rooms 1051, 1052, and 1053).	DTF-NSNFP-R3	Beyond Category 2	Design and operational requirements ensure that exposure of workers due to inadvertent actuation of shield doors or pit protective covers is not Category 1.	Preventive	Design-Procedural Safety
	4. Radiation-induced damage to a facility SSC (Rooms 1051, 1052, 1053, and 1055).	DTF-NSNFP-R4	NA	Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization.	NA	NA
Fissile	1. Criticality associated with a naval SNF cask drop, slapdown, or collision and rearrangement of cask internals (Rooms 1051, 1052, 1053, and 1055).	DTF-NSNFP-F1	Beyond Category 2	Criticality of a naval canister following a drop, or other impact event, has been evaluated to be Beyond Category 2 based upon probabilities of independent events required for criticality..	Preventive	Design

NOTES: CC = collision-crushing; CCF = chemical contamination flooding; DTF = dry transfer facility (DTF 1 and DTF 2); DBGM = design basis ground motion; F = fissile; FT = fire-thermal; GET = generalized event tree; HLW = high-level radioactive waste; NA = not applicable; NSNFP = naval spent nuclear fuel preparation; R = radiation; SNF = spent nuclear fuel.

The Event Sequence Designator is a unique event sequence index for each event in this table. The prefix identifies the building or facility, for example "DTF," the middle identifies an activity, room, or area, for example "NSNFP," and the suffix identifies the hazard category and event number, for example "CC1." When an event sequence has been evaluated in a GET, the GET number is identified in the Disposition of Event column; the GET sequence alpha character is shown at the end of the Event Sequence Designator, for example "A."

GETs are discussed in Sections 6.3.1.1 to 6.3.1.24.

Table III-14. Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Cask and MSC Docking Room (Room 1069), Waste Transfer Cell (Room 2048), Waste Package Docking Cells (Rooms 1052 and 1055), Waste Package Loading/Docking Ring Removal Cell (Room 1054)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Collision-Crushing	1. Drop or collision of handling equipment into or against an open cask or open MSC loaded with commercial SNF assemblies, a DOE HLW canister, a DOE SNF MCO, or a [standardized] DOE SNF canister (Room 2048).	DTF-WPTDRC-CC1aA DTF-WPTDRC-CC1aB DTF-WPTDRC-CC1aC DTF-WPTDRC-CC1aD DTF-WPTDRC-CC1aE DTF-WPTDRC-CC1aF DTF-WPTDRC-CC1bA DTF-WPTDRC-CC1bB	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2 No drop or collision Category 2	CC1a. (See GET-06 for non-commercial SNF canisters) In this potential event, a drop has to occur to cause a collision because the equipment would be suspended above the canister. Design and operational requirements reduce the drop probability. An operational requirement ensures the establishment of a maximum lift height limit for handling equipment suspended above DOE SNF canisters. A design requirement ensures that the handling equipment is not capable of causing an event sequence due to a breach of a DOE SNF canister if dropped from within the lift-height limit. Design and operational requirements limit the probability of exceeding the lift height. CC1b. (See GET-04 for commercial SNF) An operational requirement prohibits carrying DOE HLW canisters or DOE SNF canisters over or near the staging racks for commercial SNF. Design and operational requirements reduce the probability of dropping handling equipment onto or against a SNF assembly energetically enough to breach the assembly.	Preventive	Design-Procedural Safety
	2. Drop or collision of an SNF assembly from the spent fuel transfer machine back into or against a cask or MSC being unloaded (Room 2048).	DTF-WPTDRC-CC2A DTF-WPTDRC-CC2B DTF-WPTDRC-CC2C DTF-WPTDRC-CC2D DTF-WPTDRC-CC2E	No collision Category 1 Category 2 Category 1 Category 2	(See GET-03) Design and operational requirements for the spent fuel transfer machine (in the dry transfer areas) and fuel handling machine (in the pool) reduce the drop rate and collision probabilities for commercial SNF assembly transfers, including those in single-assembly canisters. Assemblies are assumed to breach when they are dropped or involved in a collision. HVAC system reliability requirements ensure availability of high-efficiency particulate air filtration in the primary confinement areas of the DTF and FHF during a 4-h mission time without credit for backup electrical power. An operational requirement ensures that HVAC system is working properly before normal operations begin, that the HVAC system is monitored for proper operation during normal operations; and that normal operations are suspended if the HVAC system or offsite power becomes unavailable.	Preventive-Mitigative	Design-Procedural Safety
	3. Drop or collision of an SNF assembly from the spent fuel transfer machine back onto or against one or more SNF assembly(ies) in a cask or MSC (Room 2048).	DTF-WPTDRC-CC3A DTF-WPTDRC-CC3B DTF-WPTDRC-CC3C DTF-WPTDRC-CC3D DTF-WPTDRC-CC3E	No collision Category 1 Category 2 Category 1 Category 2	(See GET-03) Same disposition as Potential Event DTF-WPTDRC-CC2.	Preventive-Mitigative	Design-Procedural Safety
	4. Impact due to horizontal movement of an SNF assembly by the spent fuel transfer machine before the assembly is completely removed from the cask or MSC (Room 2048).	DTF-WPTDRC-CC4A DTF-WPTDRC-CC4B DTF-WPTDRC-CC4C DTF-WPTDRC-CC4D DTF-WPTDRC-CC4E	No collision Category 1 Category 2 Category 1 Category 2	(See GET-03) Same disposition as Potential Event DTF-WPTDRC-CC2.	Preventive-Mitigative	Design-Procedural Safety
	5. Drop of an SNF assembly from the spent fuel transfer machine onto the waste transfer cell floor (Room 2048).	DTF-WPTDRC-CC5A DTF-WPTDRC-CC5B DTF-WPTDRC-CC5C DTF-WPTDRC-CC5D DTF-WPTDRC-CC5E	No collision Category 1 Category 2 Category 1 Category 2	(See GET-03) Same disposition as Potential Event DTF-WPTDRC-CC2.	Preventive-Mitigative	Design-Procedural Safety

Table III-14. Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Cask and MSC Docking Room (Room 1069), Waste Transfer Cell (Room 2048), Waste Package Docking Cells (Rooms 1052 and 1055), Waste Package Loading/Docking Ring Removal Cell (Room 1054) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	6. Collision involving an SNF assembly suspended from the spent fuel transfer machine with equipment located in the waste transfer cell or on the cell floor (such as lid lifting equipment) (Room 2048).	DTF-WPTDRC-CC6A DTF-WPTDRC-CC6B DTF-WPTDRC-CC6C DTF-WPTDRC-CC6D DTF-WPTDRC-CC6E	No collision Category 1 Category 2 Category 1 Category 2	(See GET-03) Same disposition as Potential Event DFT-WPTDRC-CC2.	Preventive-Mitigative	Design-Procedural Safety
	7. Drop or collision of an SNF assembly from the spent fuel transfer machine onto or against a sharp object (Room 2048).	DTF-WPTDRC-CC7A DTF-WPTDRC-CC7B DTF-WPTDRC-CC7C DTF-WPTDRC-CC7D DTF-WPTDRC-CC7E	No collision Category 1 Category 2 Category 1 Category 2	(See GET-03) Same disposition as Potential Event DFT-WPTDRC-CC2.	Preventive-Mitigative	Design-Procedural Safety
	8. Drop or collision of an SNF assembly from the spent fuel transfer machine into or against an empty WP or MSC being loaded (Room 2048).	DTF-WPTDRC-CC8A DTF-WPTDRC-CC8B DTF-WPTDRC-CC8C DTF-WPTDRC-CC8D DTF-WPTDRC-CC8E	No collision Category 1 Category 2 Category 1 Category 2	(See GET-03) Same disposition as Potential Event DFT-WPTDRC-CC2.	Preventive-Mitigative	Design-Procedural Safety
	9. Drop and slapdown of an SNF assembly from the spent fuel transfer machine (due to impact with an edge of the cask, MSC, WP, floor edge, WP internal baffle, staging rack, etc.) during the transfer from the cask or MSC to a WP or staging rack (Room 2048).	DTF-WPTDRC-CC9A DTF-WPTDRC-CC9B DTF-WPTDRC-CC9C DTF-WPTDRC-CC9D DTF-WPTDRC-CC9E	No collision Category 1 Category 2 Category 1 Category 2	(See GET-03) Same disposition as Potential Event DFT-WPTDRC-CC2.	Preventive-Mitigative	Design-Procedural Safety
	10. Drop or collision of an SNF assembly from the spent fuel transfer machine onto or against another SNF assembly in a WP or MSC (Room 2048).	DTF-WPTDRC-CC10A DTF-WPTDRC-CC10B DTF-WPTDRC-CC10C DTF-WPTDRC-CC10D DTF-WPTDRC-CC10E	No collision Category 1 Category 2 Category 1 Category 2	(See GET-03) Same disposition as Potential Event DFT-WPTDRC-CC2.	Preventive-Mitigative	Design-Procedural Safety
	11. Drop or collision of a SNF assembly from the spent fuel transfer machine into or against an empty staging rack in the waste transfer cell. (Room 2048).	DTF-WPTDRC-CC11A DTF-WPTDRC-CC11B DTF-WPTDRC-CC11C DTF-WPTDRC-CC11D DTF-WPTDRC-CC11E	No collision Category 1 Category 2 Category 1 Category 2	(See GET-03) Same disposition as Potential Event DFT-WPTDRC-CC2.	Preventive-Mitigative	Design-Procedural Safety
	12. Drop or collision of a SNF assembly from the spent fuel transfer machine onto or against one or more SNF assemblies in a staging rack (Room 2048).	DTF-WPTDRC-CC12A DTF-WPTDRC-CC12B DTF-WPTDRC-CC12C DTF-WPTDRC-CC12D DTF-WPTDRC-CC12E	No collision Category 1 Category 2 Category 1 Category 2	(See GET-03) Same disposition as Potential Event DFT-WPTDRC-CC2.	Preventive-Mitigative	Design-Procedural Safety

Table III-14. Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Cask and MSC Docking Room (Room 1069), Waste Transfer Cell (Room 2048), Waste Package Docking Cells (Rooms 1052 and 1055), Waste Package Loading/Docking Ring Removal Cell (Room 1054) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	13. Drop or collision of a SNF assembly from the spent fuel transfer machine onto or against a DOE HLW canister or [standardized] DOE SNF canister in a staging rack (Room 2048).	DTF-WPTDRC-CC13	Beyond Category 2	An operational requirement precludes contact between a commercial SNF assembly and a staged canister	Preventive	Procedural Safety
	14. Drop or collision of a DOE HLW canister or a [standardized] DOE SNF canister from the waste transfer cell overhead crane back into or against the cask or MSC being unloaded (Room 2048).	DTF-WPTDRC-CC14A DTF-WPTDRC-CC14B DTF-WPTDRC-CC14C DTF-WPTDRC-CC14D DTF-WPTDRC-CC14E DTF-WPTDRC-CC14F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-05) Design and operational requirements reduce the drop probability. A design requirement limits lift heights for DOE SNF canister, DOE HLW canister, naval canisters, and DOE SNF multicarrier overpacks. Design and operational requirements limit the probability of exceeding the lift height. Design requirements ensure that standardized DOE SNF canisters would withstand without breach a drop of another standardized DOE SNF canister and that MCOs would withstand without breach a drop of another MCO dropped from within its lift-height limits. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multicarrier overpack is defective. Operational controls render dropping a DOE SNF canister on a DOE HLW canister Beyond Category 2. A design requirement ensures that a DOE SNF canister in a cask, WP, staging rack, or staging pit would withstand without breach the drop of a DOE HLW canister on top of the DOE SNF canister from within their lift height limits. Neither naval canisters nor MCOs are staged in staging racks. For collisions, a design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design Procedural Safety
	15. Drop or collision of a DOE SNF MCO from the waste transfer cell overhead crane back into or against the cask being unloaded (Room 2048).	DTF-WPTDRC-CC15C DTF-WPTDRC-CC15D DTF-WPTDRC-CC15E DTF-WPTDRC-CC15F	No drop No breach Beyond Category 2 Beyond Category 2	(See GET-05 Sequences C to F only) Same disposition as Potential Event DTF-WPTDRC-CC14.	Preventive	Design-Procedural Safety
	16. Impact due to horizontal movement of a DOE HLW canister or a [standardized] DOE SNF canister with the waste transfer cell overhead crane before the canister is completely removed from the cask or MSC (Room 2048).	DTF-WPTDRC-CC16	Beyond Category 2	A design requirement ensures that cranes are not capable of exerting sufficient force during a transfer to breach a transportation cask, MSC, WP, or canister as the result of attempts to overcome mechanical constraints.	Preventive	Design
	17. Impact due to horizontal movement of a DOE SNF MCO with the waste transfer cell overhead crane before the canister is completely removed from the cask (Room 2048).	DTF-WPTDRC-CC17	Beyond Category 2	Same disposition as Potential Event DTF-WPTDRC-CC16.	Preventive	Design
	18. Drop and slapdown of a DOE HLW canister or a [standardized] DOE SNF canister from the waste transfer cell overhead crane (due to impact with an edge of the cask, MSC, WP, floor edge, WP internal baffle, staging rack, etc.) during the transfer from the cask or MSC to a WP, or staging rack (Room 2048).	DTF-WPTDRC-CC18A DTF-WPTDRC-CC18B DTF-WPTDRC-CC18C DTF-WPTDRC-CC18D DTF-WPTDRC-CC18E DTF-WPTDRC-CC18F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-05) Same disposition as Potential Event DTF-WPTDRC-CC14.	Preventive	Design-Procedural Safety
	19. Drop and slapdown of a DOE SNF MCO from the waste transfer cell overhead crane (due to impact with an edge of the cask, WP, floor edge, WP internal baffle, etc.) during the transfer from the cask to a WP (Room 2048).	DTF-WPTDRC-CC19C DTF-WPTDRC-CC19D DTF-WPTDRC-CC19E DTF-WPTDRC-CC19F	No drop No breach Beyond Category 2 Beyond Category 2	(See GET-05 Sequences C to F only) Same disposition as Potential Event DTF-WPTDRC-CC14.	Preventive	Design-Procedural Safety

Table III-14. Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Cask and MSC Docking Room (Room 1069), Waste Transfer Cell (Room 2048), Waste Package Docking Cells (Rooms 1052 and 1055), Waste Package Loading/Docking Ring Removal Cell (Room 1054) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	20. Drop or collision of a DOE HLW canister, a [standardized] DOE SNF canister, or a DOE SNF MCO from the waste transfer cell overhead crane onto or against a sharp object (Room 2048).	DTF-WPTDRC-CC20	Beyond category 2	Design and operational requirements ensure that surfaces in the load paths through which WPs, DOE SNF canisters, naval canisters, DPCs, transportation casks, transfer casks, or MSCs are transferred by crane are kept free of structures, such as posts and curbs, that could puncture a container in case of a drop. An operational requirement ensures that the load paths are kept free of movable puncture hazards. A design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design-Procedural Safety
	21. Collision involving a DOE HLW canister, a [standardized] DOE SNF canister, or a DOE SNF MCO suspended from the waste transfer cell overhead crane with equipment located in the waste transfer cell or on the cell floor, such as lid lifting equipment (Room 2048).	DTF-WPTDRC-CC21	Beyond Category 2	A design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design
	22. Drop of a DOE HLW canister, a [standardized] DOE SNF canister, or a DOE SNF MCO from the waste transfer cell overhead crane onto the waste transfer cell floor (Room 2048).	DTF-WPTDRC-CC22A DTF-WPTDRC-CC22B DTF-WPTDRC-CC22C DTF-WPTDRC-CC22D DTF-WPTDRC-CC22E DTF-WPTDRC-CC22F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-05) Same disposition as Potential Event DTF-WPTDRC-CC14.	Preventive	Design-Procedural Safety
	23. Drop or collision of a DOE HLW canister or a [standardized] DOE SNF canister from the waste transfer cell crane into or against an empty canister staging rack (Room 2048).	DTF-WPTDRC-CC23A DTF-WPTDRC-CC23B DTF-WPTDRC-CC23C DTF-WPTDRC-CC23D DTF-WPTDRC-CC23E DTF-WPTDRC-CC23F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-05) Same disposition as Potential Event DTF-WPTDRC-CC14.	Preventive	Design-Procedural Safety
	24. Drop or collision of a DOE HLW canister or a [standardized] DOE SNF canister from the waste transfer cell crane into or against an SNF assembly staging rack loaded with SNF assemblies (Room 2048).	DTF-WPTDRC-CC24	Beyond category 2	An operational requirement prohibits carrying DOE HLW canisters or DOE SNF canisters over or near the staging racks for commercial SNF.	Preventive	Procedural Safety
	25. Drop or collision of a DOE HLW canister or a [standardized] DOE SNF canister from the waste transfer cell crane onto or against another DOE HLW canister or DOE SNF canister in a staging rack (Room 2048).	DTF-WPTDRC-CC25A DTF-WPTDRC-CC25B DTF-WPTDRC-CC25C DTF-WPTDRC-CC25D DTF-WPTDRC-CC25E DTF-WPTDRC-CC25F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-05) Same disposition as Potential Event DTF-WPTDRC-CC14.	Preventive	Design-Procedural Safety
	26. Drop or collision of a DOE HLW canister or a [standardized] DOE SNF canister from the waste transfer cell crane into or against an empty WP or into or against an empty MSC being loaded (Room 2048).	DTF-WPTDRC-CC26A DTF-WPTDRC-CC26B DTF-WPTDRC-CC26C DTF-WPTDRC-CC26D DTF-WPTDRC-CC26E DTF-WPTDRC-CC26F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-05) Same disposition as Potential Event DTF-WPTDRC-CC14.	Preventive	Design-Procedural Safety

Table III-14. Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Cask and MSC Docking Room (Room 1069), Waste Transfer Cell (Room 2048), Waste Package Docking Cells (Rooms 1052 and 1055), Waste Package Loading/Docking Ring Removal Cell (Room 1054) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	27. Drop or collision of a DOE SNF MCO from the waste transfer cell crane into or against an empty WP being loaded (Room 2048).	DTF-WPTDRC-CC27C DTF-WPTDRC-CC27D DTF-WPTDRC-CC27E DTF-WPTDRC-CC27F	No drop No breach Beyond Category 2 Beyond Category 2	(See GET-05 Sequences C to F only) Same disposition as Potential Event DTF-WPTDRC-CC14.	Preventive	Design-Procedural Safety
	28. Drop or collision of a DOE HLW canister from the waste transfer cell crane onto or against another DOE HLW canister, a [standardized] DOE SNF canister, or a DOE SNF MCO in a WP being loaded (Room 2048).	DTF-WPTDRC-CC28A DTF-WPTDRC-CC28B	No drop Category 2	(See GET-05 Sequences A and B only) Design and operational requirements reduce the drop probability. For collisions, a design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design-Procedural Safety
	29. Drop or collision of a DOE HLW canister from the waste transfer cell crane onto or against another DOE HLW canister or a [standardized] DOE SNF canister in a WP or in an MSC being loaded (Room 2048).	DTF-WPTDRC-CC29A DTF-WPTDRC-CC29B	No drop Category 2	(See GET-05 Sequences A and B only) Same disposition as Potential Event DTF-WPTDRC-CC28.	Preventive	Design-Procedural Safety
	30. Drop or collision of a DOE SNF canister from the waste transfer cell crane onto or against a DOE HLW canister in a WP or in an MSC (Room 2048).	DTF-WPTDRC-CC30	Beyond Category 2	Dropping a DOE SNF canister on a DOE HLW canister is rendered beyond Category 2 by an operational requirement to not transfer or remove the DOE SNF canister into or from the waste package or site-specific cask if there are one or more DOE HLW canisters present in the waste package or site-specific cask. For collisions, a design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design-Procedural Safety
	31. Drop or collision of a DOE SNF MCO from the waste transfer cell crane onto or against another DOE SNF MCO or a DOE HLW canister in a WP being loaded (Room 2048).	DTF-WPTDRC-CC31	Beyond Category 2	Same disposition as Potential Event DTF-WPTDRC-CC30. Additionally, a design requirement ensures that MCOs would withstand without breach a drop of another MCO dropped from within its lift height limit.	Preventive	Design-Procedural Safety
	32. Drop or collision of a DOE SNF canister from the waste transfer cell crane onto or against another [standardized] DOE SNF canister in a WP or in an MSC in a misload situation (Room 2048).	DTF-WPTDRC-CC32C DTF-WPTDRC-CC32D DTF-WPTDRC-CC32E DTF-WPTDRC-CC32F	No drop No breach Beyond Category 2 Beyond Category	(See GET-05 Sequences C to F only) Same disposition as Potential Event DTF-WPTDRC-CC14.	Preventive	Design-Procedural Safety
	33. Drop or collision of a DOE SNF MCO from the waste transfer cell crane onto or against a [standardized] DOE SNF canister in a WP in a misload situation (Room 2048).	DTF-WPTDRC-CC33C DTF-WPTDRC-CC33D DTF-WPTDRC-CC33E DTF-WPTDRC-CC33F	No drop No breach Beyond Category 2 Beyond Category	(See GET-05 Sequences C to F only) Same disposition as Potential Event DTF-WPTDRC-CC14.	Preventive	Design-Procedural Safety
	34. Drop or collision of a DOE HLW canister, a [standardized] DOE SNF canister, or a DOE SNF MCO from the waste transfer cell crane onto or against SNF assemblies in a WP or in an MSC in a misload situation (Room 2048).	DTF-WPTDRC-CC34	Beyond Category 2	This potential event requires, in addition to a dropped canister, an attempt to load a canister into a waste package or site-specific cask designed for bare SNF assemblies. An operational requirement ensures that drops of a DOE canister into a waste package or site-specific cask loaded with SNF assemblies are rendered Beyond Category 2. For collisions, a design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Procedural Safety
	35. Drop or collision of a SNF assembly from the spent fuel transfer machine onto or against a DOE HLW canister or a [standardized] DOE SNF canister in a WP or in an MSC in a misload situation (Room 2048).	DTF-WPTDRC-CC35	Beyond Category 2	This potential event requires, in addition to a dropped assembly, an attempt to load an SNF assembly into a waste package or site-specific cask designed for canisters. An operational requirement ensures that drops of a commercial SNF assembly into a waste package or site-specific cask loaded with DOE canisters are rendered Beyond Category 2.	Preventive	Procedural Safety
	36. Drop or collision of a SNF assembly from the spent fuel transfer machine onto or against a DOE HLW canister or a DOE SNF MCO in a WP in a misload situation (Room 2048).	DTF-WPTDRC-CC36	Beyond Category 2	Same disposition as Potential Event DTF-WPTDRC-CC35.	Preventive	Procedural Safety

Table III-14. Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Cask and MSC Docking Room (Room 1069), Waste Transfer Cell (Room 2048), Waste Package Docking Cells (Rooms 1052 and 1055), Waste Package Loading/Docking Ring Removal Cell (Room 1054) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	37. Drop or collision of handling equipment onto or against SNF assemblies in the SNF staging rack (Room 2048).	DTF-WPTDRC-CC37A DTF-WPTDRC-CC37B	No drop or collision Category 2	(See GET-04) An operational requirement prohibits carrying DOE HLW canisters or DOE SNF canisters over or near the staging racks for commercial SNF. Design and operational requirements reduce the probability of dropping handling equipment onto or against a SNF assembly energetically enough to breach the assembly.	Preventive	Design- Procedural Safety
	38. Drop or collision of handling equipment onto or against a DOE HLW canister or a [standardized] DOE SNF canister in a canister staging rack (Room 2048).	DTF-WPTDRC-CC38A DTF-WPTDRC-CC38B DTF-WPTDRC-CC38C DTF-WPTDRC-CC38D DTF-WPTDRC-CC38E DTF-WPTDRC-CC38F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-06) Same disposition as Potential Event DTF-WPTDRC-CC1a.	Preventive	Design- Procedural Safety
	39. Drop or collision of handling equipment into or against an open MSC or an open WP filled with SNF assemblies (Room 2048).	DTF-WPTDRC-CC39A DTF-WPTDRC-CC39B	No drop or collision Category 2	(See GET-04) Same disposition as Potential Event DTF-WPTDRC-CC37.	Preventive	Design- Procedural Safety
	40. Drop or collision of handling equipment into or against an open WP loaded with SNF assemblies, DOE HLW canisters, and/or a [standardized] DOE SNF canister, and/or DOE SNF MCOs (Room 2048).	DTF-WPTDRC-CC40A DTF-WPTDRC-CC40B DTF-WPTDRC-CC40C DTF-WPTDRC-CC40D DTF-WPTDRC-CC40E DTF-WPTDRC-CC40F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-06) Same disposition as Potential Event DTF-WPTDRC-CC1a.	Preventive	Design- Procedural Safety
	41. Drop or collision of a WP inner lid or MSC cask inner lid from the docking station crane onto or against a loaded WP or loaded MSC (Room 2048).	DTF-WPTDRC-CC41A DTF-WPTDRC-CC41B DTF-WPTDRC-CC41C DTF-WPTDRC-CC41D DTF-WPTDRC-CC41E DTF-WPTDRC-CC41F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-02) Design and operational requirements reduce the drop probability. Operational requirements limit the lift height of the inner lid of a transportation cask, transfer cask, site-specific cask, or waste package to ensure that a lid drop onto a DOE canister within that breaches the canister is a beyond Category 2 event sequence. Design and operational requirements limit the probability of exceeding the lift height. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multiccanister overpack is defective.	Preventive	Design- Procedural Safety
	42. Drop or collision of a WP docking port plug from the waste transfer cell crane onto or against the inner lid of a loaded WP or loaded MSC (with lid in place but not sealed). (Room 2048).	DTF-WPTDRC-CC42	Beyond Category 2	Design requirements ensure that portions of a non-ITS SSC which, upon failure, could adversely interact with an ITS SSC and prevent its safety function from being performed are classified as ITS, redesigned to eliminate the potential unacceptable interaction with the identified ITS SSC, or, for seismic interactions, designed to the same seismic DBGM as the ITS SSCs subjected to the potential unacceptable interaction.	Preventive	Design
	43. Drop or collision of a WP docking ring onto or against a loaded WP (with lid in place but not sealed) during docking ring removal in the WP loading/docking ring removal cell (Room 1054).	DTF-WPTDRC-CC43	Beyond Category 2	Operational requirements establish lift-height limits for handling equipment and other equipment associated with the WP, including lifting collars (or trunnion collars), yokes, docking rings, and WP-closure equipment. The lift-height limits ensure that the handling equipment can not breach a sealed WP if dropped onto or collided into the WP from within the lift-height limit. Furthermore, the lift-height limits ensure that a drop of equipment from within the lift-height limit can not initiate an event sequence if the WP inner lid is in place, but unsealed. An operational requirement ensures that the inner lid, once set in place, is not removed from the WP except in a remediation situation.	Preventive	Procedural Safety
	44. Drop or collision of a handling or other miscellaneous equipment onto or against a loaded WP (with lid in place but not sealed) during docking ring removal in the WP loading/docking ring removal cell (Room 1054).	DTF-WPTDRC-CC44	Beyond Category 2	The inner lid is in place for this potential event. Same disposition as Potential Event DTF-WPTDRC-CC43.	Preventive	Procedural Safety
	45. Deraiment of a trolley holding a loaded, unsealed WP (with lid in place but not sealed) followed by a load lipover or fall (Rooms 1052, 1054, and 1055).	DTF-WPTDRC-CC45	Beyond Category 2	A design requirement ensures that loaded transfer trolleys do not derail or drop their loads. Design requirements apply to trolleys for casks, waste packages, site-specific casks, and dual-purpose canisters.	Preventive	Design

Table III-14. Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Cask and MSC Docking Room (Room 1069), Waste Transfer Cell (Room 2048), Waste Package Docking Cells (Rooms 1052 and 1055), Waste Package Loading/Docking Ring Removal Cell (Room 1054) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Chemical Contamination-Flooding	1. Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures (Rooms 1052, 1054, 1055, 1069, and 2048).	DTF-WPTDRC-CCF1	Normal Operations	Oxidation of failed SNF is to be expected as a part of normal operations. Any resulting potential exposure of workers to radiation is managed as a normal-operations dose by procedures that ensure that workers do not receive excessive radiation doses.	Mitigative	Procedural Safety
Explosion-Implosion	1. Hydrogen explosion involving batteries on a cask trolley (Rooms 1052, 1054, 1055, and 1069).	DTF-WPTDRC-EI1	Beyond Category 2	Operational controls pertaining to batteries for powering heavy equipment ensure the generation or accumulation of enough hydrogen gas to cause an explosion that could breach a transportation cask, site-specific cask, or waste package is prevented.	Preventive	Procedural Safety
Fire-Thermal	1. HEPA filter fire due to excessive radioactive decay within the filter bed (Room 1012).	DTF-WPTDRC-FT1	Beyond Category 2	Operation requirements ensure that the operating surface temperatures of high-efficiency particulate air (HEPA) filters is maintained such that they can not catch on fire under normal operation or in the event of a shutdown of the HVAC system.	Preventive	Procedural Safety
	2. Electrical fire associated with SNF and HLW handling equipment or other electrically powered equipment in the waste transfer cell, the WP docking cell, or the WP loading/docking ring removal cell (including the overhead cranes and the spent fuel transfer machine). (Rooms 1052, 1054, 1055, 1069, and 2048).	DTF-WPTDRC-FT2	Beyond Category 2	Design and operational requirements ensure control of the presence and amount of combustibles in the different areas of the repository to preclude any Category 1 or Category 2 event sequences potentially initiated by a fire.	Preventive	Design-Procedural Safety
	3. Fire/explosion (battery/electrical fire) associated with a cask trolley holding an unsealed, partially-filled or filled cask or MSC (Rooms 1052, 1054, 1055, and 1069).	DTF-WPTDRC-FT3	Beyond Category 2	Same disposition as Potential Event DTF-WPTDRC-FT2.	Preventive	Design-Procedural Safety
	4. Electrical fire associated with a WP trolley holding an unsealed, partially-filled or filled WP (Rooms 1052, 1054, and 1055).	DTF-WPTDRC-FT4	Beyond Category 2	Same disposition as Potential Event DTF-WPTDRC-FT2.	Preventive	Design-Procedural Safety
	5. Intact or non-intact SNF overheating or damage to canister contents due to a loss of cooling resulting in excessive temperature and possible zircaloy cladding (or other cladding) unzipping or cladding failure due to excessive hoop stresses (Rooms 1052, 1054, 1055, 1069, and 2048).	DTF-WPTDRC-FT5	Beyond Category 2	If ventilation is lost in areas where DOE or naval canisters are handled, no radiological release occurs from the canisters because containment within the canisters is maintained. Design and operational requirements ensure that the thermal response of areas where CSNF assemblies are handled or staged to a loss of HVAC would not cause radiological releases in excess of those considered in the consequence analysis for normal operations.	Preventive	Design-Procedural Safety
	6. Transient combustible fire in the cask and MSC docking room, waste transfer cell, the WP docking cell, or the WP loading/docking ring removal cell (Rooms 1052, 1054, 1055, 1069, and 2048).	DTF-WPTDRC-FT6	Beyond Category 2	Same disposition as Potential Event DTF-WPTDRC-FT2.	Preventive	Design-Procedural Safety
Radiation	1. Radiation exposure of a facility worker and/or the offsite public (Rooms 1052, 1054, 1055, 1069, and 2048).	DTF-WPTDRC-R1	NA—Accounted for in consequence analyses, if applicable	NA—Potential exposure of workers or the public to radiation is a hazard for the event sequences considered in this analysis. Consequence analyses evaluate this hazard for Category 1 and Category 2 event sequences, as applicable.	NA	NA
			Normal Operations	Some exposure to radiation is expected as a part of normal facility operations. Exposures are managed by design features and procedures that ensure that workers or the public do not receive excessive radiation doses.	Mitigative	Design-Procedural Safety
	2. Docking ring failure leads to a radiological release (Room 2048).	DTF-WPTDRC-R2	NA (no significant exposure)	Same disposition as Potential Event DTF-WPTDRC-R4.	Mitigative	Procedural Safety
	3. Radiological release due to installation of incorrect docking ring (Room 2048).	DTF-WPTDRC-R3	NA (no significant exposure)	Same disposition as Potential Event DTF-WPTDRC-R4.	Mitigative	Procedural Safety

Table III-14. Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Cask and MSC Docking Room (Room 1069), Waste Transfer Cell (Room 2048), Waste Package Docking Cells (Rooms 1052 and 1055), Waste Package Loading/Docking Ring Removal Cell (Room 1054) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	4. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne contamination (Rooms 1052, 1054, 1055, 1069, and 2048).	DTF-WPTDRC-R4	NA (no significant exposure)	Operating procedures ensure that a loss of confinement during otherwise normal operations does not cause individuals to be exposed to significant amounts of radioactivity.	Mitigative	Procedural Safety
	5. Thermal expansion of gases or other loss of confinement in an unsealed cask or MSC, leading to radiological release (Rooms 1052, 1054, 1055, and 1069).	DTF-WPTDRC-R5	Normal Operations	Thermal expansion of gases is to be expected as a part of normal operations. Any resulting potential exposure of workers to radiation is managed as a normal-operations dose by procedures that ensure that workers do not receive excessive radiation doses.	Mitigative	Procedural Safety
	6. Inadvertent opening of a shield door, leading to a worker exposure (Room 1052, 1054, 1055, and 1069).	DTF-WPTDRC-R6	Beyond Category 2	Design and operational requirements ensure that exposure of workers due to inadvertent actuation of shield doors or pit protective covers is not Category 1.	Preventive	Design-Procedural Safety
	7. Radiation-induced damage to a facility SSC (Rooms 1052, 1054, 1055, 1069, and 2048).	DTF-WPTDRC-R7	NA	Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization.	NA	NA
Fissile	1. Criticality associated with a drop of an SNF assembly from the spent fuel transfer machine into a cask, MSC, or WP and a rearrangement of the cask, MSC, or WP internals (Room 2048).	DTF-WPTDRC-F1	Beyond Category 2	Design requirements and waste acceptance criteria ensure that transportation casks, transfer casks, MSCs, and dual-purpose canisters (DPCs) are designed to ensure nuclear criticality safety with optimum moderation and most-reactive waste forms. Criticality safety will be maintained despite geometric rearrangements due to a drop or other handling incident. A design requirement ensures that sealed WPs are designed such that drops, collisions, and other handling impacts within their design bases (allowing for rearrangement of container internals, proximity of other sealed waste packages, and without credit for burnup) cannot lead to a nuclear criticality. An unsealed waste package remains subcritical with credit for moderator control and without credit for burnup. Design and operational requirements ensure that moderator control is in effect.	Preventive	Design-Procedural Safety
	2. Criticality associated with a drop of an SNF assembly from the spent fuel transfer machine and a rearrangement of the fuel rods that comprise the assembly due to impact (Room 2048).	DTF-WPTDRC-F2	NA	Results of criticality analyses ensure that drops, collisions, and other handling impacts of a commercial SNF assembly (allowing for rearrangement of fuel rods and without credit for burnup or moderator control) do not pose a criticality safety concern.	NA	NA
	3. Criticality associated with a drop of an SNF assembly from the spent fuel transfer machine onto the storage racks and a rearrangement of the orientation of the SNF assemblies in the storage racks (Room 2048).	DTF-WPTDRC-F3	Beyond Category 2	A design requirement ensures criticality safety for commercial SNF assemblies dropped into or onto an SNF assembly staging rack with moderator control in effect.	Preventive	Design
	4. Criticality associated with a drop or slapdown of a [standardized] DOE SNF canister, a DOE SNF MCO, or a DOE HLW canister (Room 2048).	DTF-WPTDRC-F4	Beyond Category 2	Same disposition as Potential Event DTF-WPTDRC-F1. Additionally, an operational requirement prohibits carrying DOE HLW canisters or DOE SNF canisters over or near the staging racks for commercial SNF. There is no potential for criticality of HLW canisters.	Preventive	Design-Procedural Safety
	5. Criticality associated with the drop of heavy equipment onto a loaded, unsealed cask, MSC, or WP and a rearrangement of the container internals (Rooms 1052, 1054, 1055, 1069, and 2048).	DTF-WPTDRC-F5	Beyond Category 2	Same disposition as Potential Event DTF-WPTDRC-F1.	Preventive	Design-Procedural Safety
	6. Criticality associated with a misload of a WP or an MSC (Room 2048).	DTF-WPTDRC-F6	Beyond Category 2	Same disposition as Potential Event DTF-WPTDRC-F1.	Preventive	Design-Procedural Safety
	7. Criticality associated with a misload of a commercial SNF staging rack (Room 2048).	DTF-WPTDRC-F7	Beyond Category 2	A design requirement ensures criticality safety for commercial SNF assembly staging racks loaded to capacity with the most reactive commercial SNF assembly accepted at the repository and not cause a nuclear criticality with moderator control in effect.	Preventive	Design

Table III-14. Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Cask and MSC Docking Room (Room 1069), Waste Transfer Cell (Room 2048), Waste Package Docking Cells (Rooms 1052 and 1055), Waste Package Loading/Docking Ring Removal Cell (Room 1054) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	8. Criticality associated with a misload of a canister staging rack. (Room 2048).	DTF-WPTDRC-F8	Beyond Category 2	A design requirement ensures that the most reactive configuration of standardized DOE SNF canisters can be loaded into DOE SNF staging racks (with credit for moderator control) without causing a nuclear criticality. An operational requirement ensures that commercial SNF assemblies are not loaded into the canister staging rack. Neither MCOs nor naval canisters are staged. There is no potential for criticality of HLW canisters.	Preventive	Design-Procedural Safety

NOTES: CC = collision-crushing; CCF = chemical contamination flooding; DBGm = design basis ground motion; DOE = U.S. Department of Energy; DTF = dry transfer facility (DTF 1 and DTF 2); EI = explosion-implosion; F = fissile; FT = fire-thermal; GET = generalized event tree; HLW = high-level radioactive waste; NA = not applicable; R = radiation; SNF = spent nuclear fuel; WPTDRC = waste package transfer docking ring cell.

The Event Sequence Designator is a unique event sequence index for each event in this table. The prefix identifies the building or facility, for example "DTF," the middle identifies an activity, room, or area, for example "WPTDRC," and the suffix identifies the hazard category and event number, for example "CC1." When an event sequence has been evaluated in a GET, the GET number is identified in the Disposition of Event column; the GET sequence alpha character is shown at the end of the Event Sequence Designator, for example "A."

Additional room(s) with potential events in this table: Room 1012 – HEPA filter room.

GETs are discussed in Sections 6.3.1.1 to 6.3.1.24.

Table III-15. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Empty Transportation Cask/Site-specific Cask/Dual-purpose Canister Removal): Cask and Site-specific Cask Docking Room (Room 1069), Cask/Site-specific Cask Turntable Room (Room 1073), Cask Restoration Room (Room 1072), Cask and Site-specific Cask to Trolley Transfer Room (Room 1076), Cask and Site-specific Cask SRTC Receipt Area (Room 1077), Cask and Site-specific Cask Entrance Vestibule (Room 1079)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Collision-Crushing	No events					
Chemical Contamination-Flooding	No events					
Explosion-Implosion	No events					
Fire-Thermal	No events					
Radiation	1. Radiation exposure of a facility worker (Rooms 1069, 1072, 1073, 1076, 1077, and 1079).	DTF-ETCMDR-R1	NA—Accounted for in consequence analyses, if applicable	NA—Potential exposure of workers or the public to radiation is a hazard for the event sequences considered in this analysis. Consequence analyses evaluate this hazard for Category 1 and Category 2 event sequences, as applicable.	NA	NA
			Normal Operations	Some exposure to radiation is expected as a part of normal facility operations. Exposures are managed by design features and procedures that ensure that workers or the public do not receive excessive radiation doses.	Mitigative	Design-Procedural Safety
	2. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation (Rooms 1069, 1072, 1073, 1076, 1077, and 1079).	DTF-ETCMDR-R2	NA (no significant exposure)	Operating procedures ensure that a loss of confinement during otherwise normal operations does not cause individuals to be exposed to significant amounts of radioactivity.	Mitigative	Procedural Safety
Fissile	1. Criticality associated with the collection and concentration of fissile material collected from casks during cask restoration activities (Rooms 1069, 1072, 1073, 1076, 1077, and 1079).	DTF-ETCMDR-F1	Beyond Category 2	An operational requirement ensures that radioactive contamination that is collected during cleanup activities in transfer cells is handled in a manner that precludes nuclear criticality.	Preventive	Procedural Safety

NOTES: DTF = dry transfer facility (DTF 1 and DTF 2); ETCMDR = empty transportation cask site-specific cask/dual-purpose canister removal; F = fissile; NA = not applicable; R = radiation.

Additional room(s) with potential events in this table: Room 1079 – Cask and MSC Entrance Vestibule.

Table III-16. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Loaded Site-specific Cask Removal): Cask and Site-specific Cask Docking Room (Room 1069), Cask/Site-specific Cask Turntable Room (Room 1073), Cask Preparation Room (Room 1074), Cask and Site-specific Cask to Trolley Transfer Room (Room 1076), Cask and Site-specific Cask Site Rail Transfer Cart Receipt Area (Room 1077), Cask and Site-specific Cask Entrance Vestibule (Room 1079)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Collision-Crushing	1. Deraiment of a trolley holding a loaded MSC on a pedestal followed by a load tipover or fall (before or after the outer lid [as applicable] is fastened) (Rooms 1069, 1072, 1073, and 1076).	DTF-LSSCR-CC1	Beyond Category 2	A design requirement ensures that loaded transfer trolleys do not derail or drop their loads. Design requirements apply to trolleys for casks, waste packages, site-specific casks, and dual-purpose canisters.	Preventive	Design
	2. Deraiment of a trolley holding a loaded MSC on a pedestal due to a turntable malfunction followed by a load tipover or fall (before or after the outer lid [as applicable] is fastened). (Room 1069).	DTF-LSSCR-CC2	Beyond Category 2	Same disposition as Potential Event DTF-LSSCR-CC1.	Preventive	Design
	3. Collision of a trolley holding a loaded MSC on a pedestal with the shield doors separating the cask and MSC docking room and the cask/MSR turntable room or the cask/MSR turntable room and the cask preparation room (before or after the outer lid [as applicable] is fastened). (Rooms 1069, 1072, and 1073).	DTF-LSSCR-CC3	Beyond Category 2	(See GET-22) A design requirement limits the speed of trolley movements such that a collision at the speed limit would not cause the trolley to drop its load.	Preventive	Design
	4. Closure of the shield doors separating the cask and MSC docking room and the cask/MSR turntable room or the cask/MSR turntable room and the cask preparation room onto the trolley holding a loaded MSC on a pedestal (before or after the outer lid [as applicable] is fastened). (Rooms 1069, 1072, and 1073).	DTF-LSSCR-CC4	Beyond Category 2	A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transfer trolley, site-rail transfer cart (SRTC), MSC transporter, WP transporter, would not cause a tipover of the conveyance or cause the conveyance to drop its load. A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transportation cask, transfer cask, or MSC suspended from an overhead crane would not cause the crane to drop its load.	Preventive	Design
	5. Collision involving two trolleys holding casks on pedestals (including a loaded MSC) (before or after the outer lid [as applicable] is fastened) (Rooms 1069, 1072, 1073, and 1076).	DTF-LSSCR-CC5	Beyond Category 2	(See GET-22) Same disposition as Potential Event DTF-LSSCR-CC3.	Preventive	Design
	6. Drop or collision of tools or equipment (including the outer lid-lifting fixture, inner lid-lifting fixture, lid bolts, etc.) onto or against an MSC inner lid or outer lid, as applicable, during the MSC lid fastening process. (Room 1069).	DTF-LSSCR-CC6	Beyond Category 2	An operational requirement limits lift heights for tools and equipment associated with transportation cask, transfer cask, MSC, and DPC handling and preparation to the minimum necessary for operational purposes. The operational requirement ensures that tools and equipment, including handling equipment, if dropped from the height limit, can not initiate an event sequence if dropped onto or collided against (1) a transportation cask or site-specific cask with its outer lid removed and its inner lid in place but unbolted, (2) an exposed sealed dual-purpose canister, or (3) a dual-purpose canister with its severed lid in place.	Preventive	Procedural Safety
	7. Drop of an MSC outer lid from the overhead crane onto the loaded MSC inner lid, as applicable (Room 1069).	DTF-LSSCR-CC7A DTF-LSSCR-CC7B DTF-LSSCR-CC7C DTF-LSSCR-CC7D DTF-LSSCR-CC7E DTF-LSSCR-CC7F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(Bounded by GET-02) Design and operational requirements reduce the drop probability. Operational requirements limit the lift height of the inner lid of a transportation cask, transfer cask, site-specific cask, or waste package to ensure that a lid drop onto a DOE canister within that breaches the canister is a beyond Category 2 event sequence. Design and operational requirements limit the probability of exceeding the lift height. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multicarrier overpack is defective. Operational requirements will establish permissible lift heights to ensure that a drop of a cask outer lid onto the inner lid of a loaded DOE SNF transportation cask or MSC will not breach a DOE SNF canister inside.	Preventive	Design-Procedural Safety
	8. Drop or collision of a docking ring onto or against a loaded MSC (Room 1069).	DTF-LSSCR-CC8	Beyond Category 2	Same disposition as Potential Event DTF-LSSCR-CC6.	Preventive	Procedural Safety

Table III-16. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Loaded Site-specific Cask Removal): Cask and Site-specific Cask Docking Room (Room 1069), Cask/Site-specific Cask Turntable Room (Room 1073), Cask Preparation Room (Room 1074), Cask and Site-specific Cask to Trolley Transfer Room (Room 1076), Cask and Site-specific Cask Site Rail Transfer Cart Receipt Area (Room 1077), Cask and Site-specific Cask Entrance Vestibule (Room 1079) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	9. Collision of a trolley holding a loaded, sealed MSC on a pedestal with shield doors separating cask/MSR turntable room and the cask and MSC to trolley transfer room (Rooms 1073, 1076, and 1077).	DTF-LSSCR-CC9	Beyond Category 2	(See GET-22) Same disposition as Potential Event DTF-LSSCR-CC3.	Preventive	Design
	10. Closure of the shield doors separating cask/MSR turntable room and the cask and MSC to trolley transfer room onto the trolley holding a loaded, sealed MSC on a pedestal (Rooms 1073, 1076, and 1077).	DTF-LSSCR-CC10	Beyond Category 2	Same disposition as Potential Event DTF-LSSCR-CC4.	Preventive	Design
	11. Drop of a loaded, sealed MSC from the overhead crane onto the floor during the transfer of the MSC from a pedestal staged on a trolley to the floor in the lay-down area in the cask and MSC SRTC receipt area (Room 1077).	DTF-LSSCR-CC11A DTF-LSSCR-CC11B DTF-LSSCR-CC11C DTF-LSSCR-CC11D	Category 2 No breach Beyond Category 2 Beyond Category 2	(Bounded by GET-01) Design and operational requirements reduce the drop probability. Design requirements limit the lift height for transportation and transfer casks without impact limiters and site-specific casks. Design and operational requirements limit the probability of exceeding the lift height. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multiccanister overpack is defective.	Preventive	Design-Procedural Safety
	12. Drop or collision of a loaded MSC from the overhead crane onto or against a sharp object during the transfer of the MSC from a pedestal staged on a trolley to the floor in the lay-down area in the cask and MSC SRTC receipt area (Room 1077).	DTF-LSSCR-CC12	Beyond Category 2	Design and operational requirements ensure that surfaces in the load paths through which WPs, DOE SNF canisters, naval canisters, DPCs, transportation casks, transfer casks, or MSCs are transferred by crane are kept free of structures, such as posts and curbs, that could puncture a container in case of a drop. An operational requirement ensures that the load paths are kept free of movable puncture hazards. A design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design-Procedural Safety
	13. Slapdown of a loaded, sealed MSC following a drop onto the edge of the pedestal, trolley, railcar or other object during the transfer of the MSC from a pedestal staged on a trolley to the floor in the lay-down area in the cask and MSC SRTC receipt area (Room 1077).	DTF-LSSCR-CC13A DTF-LSSCR-CC13B DTF-LSSCR-CC13C DTF-LSSCR-CC13D	Category 2 No breach Beyond Category 2 Beyond Category 2	(Bounded by GET-01) Same disposition as Potential Event DTF-LSSCR-CC11.	Preventive	Design-Procedural Safety
	14. Drop or collision of handling equipment from the overhead bridge crane onto or against a loaded MSC (Rooms 1076 and 1077).	DTF-LSSCR-CC14	Beyond Category 2	Operational requirements for cask preparation and handling ensure that a drop of or collision involving equipment would not breach a transportation cask, transfer cask, or an MSC.	Preventive	Procedural Safety
	15. Drop or collision of equipment from the 25-ton material handling crane onto or against a loaded, sealed MSC (Rooms 1076 and 1077).	DTF-LSSCR-CC15	Beyond Category 2	Same disposition as Potential Event DTF-LSSCR-CC14.	Preventive	Procedural Safety
	16. Forklift collision with a loaded, sealed MSC on a pedestal on a trolley, an MSC positioned on the floor in the lay-down area in the cask and MSC SRTC receipt area, or with the MSC transporter holding the MSC (Rooms 1077 and 1079).	DTF-LSSCR-CC16	Beyond Category 2	Operational requirements ensure that the portable platforms, access platforms, mobile elevated platforms, and forklifts operated in the facility are not operated in a manner that could breach or overturn a loaded transportation cask or site-specific cask.	Preventive	Procedural Safety
	17. Mobile elevated platform collision with a loaded, sealed MSC on a pedestal on a trolley, an MSC positioned on the floor in the lay-down area in the cask and MSC SRTC receipt area, or with the MSC transporter holding the MSC (Rooms 1077 and 1079).	DTF-LSSCR-CC17	Beyond Category 2	Same disposition as Potential Event DTF-LSSCR-CC16.	Preventive	Procedural Safety

Table III-16. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Loaded Site-specific Cask Removal): Cask and Site-specific Cask Docking Room (Room 1069), Cask/Site-specific Cask Turntable Room (Room 1073), Cask Preparation Room (Room 1074), Cask and Site-specific Cask to Trolley Transfer Room (Room 1076), Cask and Site-specific Cask Site Rail Transfer Cart Receipt Area (Room 1077), Cask and Site-specific Cask Entrance Vestibule (Room 1079) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	18. Drop of a loaded MSC from the MSC transporter onto the floor inside the DTF while in-transit to the SNF Aging System (Rooms 1077 and 1079).	DTF-LSSCR-CC18	Beyond Category 2	A design requirement ensures that site-specific casks can withstand a drop from the maximum handling height of a site-specific cask transporter/horizontal transfer cask trailer or a collision involving the MSC transporter or HTC trailer without loss of function.	Preventive	Design
	19. Drop or collision of a loaded MSC from the MSC transporter onto or against a sharp object inside the DTF while in-transit to the SNF Aging System (Rooms 1077 and 1079).	DTF-LSSCR-CC19	Beyond Category 2	Same disposition as Potential Event DTF-LSSCR-CC18. Additionally, design requirements limit potential damage caused by collisions involving a MSC Transporter and HTC Trailer/Tractor. Design requirements ensure that the SNF aging system provides a reliable means to stop the site-specific cask transporter-horizontal transfer cask trailer and maintain its stability.	Preventive	Design
	20. MSC transporter collision while carrying a loaded, sealed MSC followed by an MSC tipover or fall (Rooms 1077 and 1079).	DTF-LSSCR-CC20	Beyond Category 2	Same disposition as Potential Event DTF-LSSCR-CC19. Additionally, design requirements preclude tip-over of the MSC transporter and HTC trailer/tractor during transfer by ensuring that designs preclude failure modes that could result in tip-over under design basis load handling conditions. Design requirements preclude tip-over during transfer by ensuring minimum tip-over resistance/stability standards are maintained consistent with roadway design.	Preventive	Design
	21. MSC transporter collision into a loaded, sealed MSC followed by an MSC tipover or fall (Rooms 1077 and 1079).	DTF-LSSCR-CC21	Beyond Category 2	Same disposition as Potential Event DTF-LSSCR-CC20.	Preventive	Design
	22. Collision of the MSC transporter (holding a loaded, sealed MSC) with the cask and MSC SRTC receipt area shield doors or the cask and MSC entrance vestibule doors (Rooms 1077 and 1079).	DTF-LSSCR-CC22	Beyond Category 2	Design and operational requirements establish speed limits such that a collision with shield or airlock doors or other heavy objects would not overturn an SRTC, or site-specific cask... transporter or cause it to lose its load.	Preventive	Design- Procedural Safety
	23. The cask and MSC SRTC receipt area shield doors or the cask and MSC entrance vestibule doors close on the MSC transporter holding a loaded, sealed MSC (Rooms 1077 and 1079).	DTF-LSSCR-CC23	Beyond Category 2	Same disposition as Potential Event DTF-LSSCR-CC4.	Preventive	Design
Chemical Contamination-Flooding	1. Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures (Rooms 1069, 1072, 1073, 1076, 1077, and 1079).	DTF-LSSCR-CCF1	Normal Operations	Oxidation of failed commercial SNF, not contained inside a sealed cask or canister, is expected as a part of normal operations whenever commercial SNF is exposed to air. Any resulting potential exposure of workers to radiation is managed as a normal-operations dose by procedures that ensure that workers do not receive excessive radiation doses.	Mitigative	Procedural Safety
Explosion-Implosion	1. MSC inerting system (or other pneumatic or pressurized system) missile due to a fractured nozzle/valve stem/pneumatic device (Rooms 1069, 1072, 1073, 1076, 1077, and 1079).	DTF-LSSCR-EI1	Beyond Category 2	An operational requirement ensures that pressurized systems that could generate missiles, energetic enough to penetrate a transportation cask with or without impact limiters, a transfer cask, a DOE canister, a naval SNF canister, a dual-purpose canister, the inner lid of a transportation cask, a site-specific cask, a waste package, or the inner lid of a site-specific cask or waste package are not present in areas where potentially vulnerable items may be exposed.	Preventive	Procedural Safety
	2. Hydrogen explosion involving batteries on a cask trolley (Rooms 1069, 1072, 1073, and 1076).	DTF-LSSCR-EI2	Beyond Category 2	Operational controls pertaining to batteries for powering heavy equipment ensure the generation or accumulation of enough hydrogen gas to cause an explosion that could breach a transportation cask, site-specific cask, or waste package is prevented.	Preventive	Procedural Safety
	3. Hydrogen explosion involving batteries on a mobile elevated platform (Rooms 1076 and 1077).	DTF-LSSCR-EI3	Beyond Category 2	Same disposition as Potential Event DTF-LSSCR-EI2.	Preventive	Procedural Safety
	4. Hydrogen explosion involving batteries on a forklift (Rooms 1077 and 1079).	DTF-LSSCR-EI4	Beyond Category 2	Same disposition as Potential Event DTF-LSSCR-EI2.	Preventive	Procedural Safety
	5. Explosion hazard associated with the cask purging system and the ignition of hydrogen that may have accumulated in the cask prior to MSC purging and inerting (Rooms 1069 and 1072).	DTF-LSSCR-EI5	Beyond Category 2	Operational requirements ensure that precautions taken during the cask sampling and purging process provide reasonable assurance that such hydrogen explosions would not occur.	Preventative	Procedural Safety

Table III-16. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Loaded Site-specific Cask Removal): Cask and Site-specific Cask Docking Room (Room 1069), Cask/Site-specific Cask Turntable Room (Room 1073), Cask Preparation Room (Room 1074), Cask and Site-specific Cask to Trolley Transfer Room (Room 1076), Cask and Site-specific Cask Site Rail Transfer Cart Receipt Area (Room 1077), Cask and Site-specific Cask Entrance Vestibule (Room 1079) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Fire-Thermal	1. Electrical fire associated with the overhead cranes, including those located in the cask and MSC docking room and the cask and MSC SRTC receipt area (Rooms 1069, 1072, 1073, 1076, and 1077).	DTF-LSSCR-FT1	Beyond Category 2	Design and operational requirements ensure control of the presence and amount of combustibles in the different areas of the repository to preclude any Category 1 or Category 2 event sequences potentially initiated by a fire.	Preventive	Design-Procedural Safety
	2. Electrical fire associated with handling equipment or other equipment located in the cask and MSC docking room, cask/MSR turntable room, cask and MSC to trolley transfer room, cask preparation room, cask and MSC SRTC receipt area, or the cask and MSC entrance vestibule (including the turntables) (Rooms 1069, 1072, 1073, 1076, 1077, and 1079).	DTF-LSSCR-FT2	Beyond Category 2	Same disposition as Potential Event DTF-LSSCR-FT1.	Preventive	Design-Procedural Safety
	3. Transient combustible fire in the cask and MSC docking room, cask/MSR turntable room, cask preparation room, cask and MSC to trolley transfer room, cask and MSC SRTC receipt area, or the cask and MSC entrance vestibule (Rooms 1069, 1072, 1073, 1076, 1077, and 1079).	DTF-LSSCR-FT3	Beyond Category 2	Same disposition as Potential Event DTF-LSSCR-FT1.	Preventive	Design-Procedural Safety
	4. Fire/explosion (battery/electrical fire) associated with the cask trolley (Rooms 1069, 1072, 1073, and 1076).	DTF-LSSCR-FT4	Beyond Category 2	Same disposition as Potential Event DTF-LSSCR-FT1.	Preventive	Design-Procedural Safety
	5. Fire/explosion (battery/electrical fire) associated with a forklift (Rooms 1077 and 1079).	DTF-LSSCR-FT5	Beyond Category 2	Same disposition as Potential Event DTF-LSSCR-FT1.	Preventive	Design-Procedural Safety
	6. Fire/explosion (battery/electrical fire) associated with a mobile elevated platform (Rooms 1076 and 1077).	DTF-LSSCR-FT6	Beyond Category 2	Same disposition as Potential Event DTF-LSSCR-FT1.	Preventive	Design-Procedural Safety
	7. Diesel fuel fire/explosion involving an MSC transporter holding a loaded MSC (Rooms 1077 and 1079).	DTF-LSSCR-FT7	Beyond Category 2	Same disposition as Potential Event DTF-LSSCR-FT1.	Preventive	Design-Procedural Safety
Radiation	1. Radiation exposure of a facility worker and/or the offsite public (Rooms 1069, 1072, 1073, 1076, 1077, and 1079).	DTF-LSSCR-R1	NA—Accounted for in consequence analyses, if applicable Normal Operations	NA—Potential exposure of workers or the public to radiation is a hazard for the event sequences considered in this analysis. Consequence analyses evaluate this hazard for Category 1 and Category 2 event sequences, as applicable. Some exposure to radiation is expected as a part of normal facility operations. Exposures are managed by design features and procedures that ensure that workers or the public do not receive excessive radiation doses.	NA Mitigative	NA Design-Procedural Safety
	2. Damage or rupture of cask inerting system leading to a release of MSC internal gases (Rooms 1069 and 1072).	DTF-LSSCR-R2	Normal Operations	Although a rupture leading to a radiological release would be an off-normal occurrence, any release and related dose would be managed as part of routine radiation protection operations. Potential exposure of workers to radiation as a result of this event is managed as a normal-operations dose by procedures that ensure that workers do not receive excessive radiation doses.	Mitigative	Procedural Safety
	3. Expansion of gases in the loaded, unsealed MSC, leading to radiological release (Rooms 1069 and 1072).	DTF-LSSCR-R3	Normal Operations	Thermal expansion of gases is to be expected as a part of normal operations. Any resulting potential exposure of workers to radiation is managed as a normal-operations dose by procedures that ensure that workers do not receive excessive radiation doses.	Mitigative	Procedural Safety

Table III-16. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Loaded Site-specific Cask Removal): Cask and Site-specific Cask Docking Room (Room 1069), Cask/Site-specific Cask Turntable Room (Room 1073), Cask Preparation Room (Room 1074), Cask and Site-specific Cask to Trolley Transfer Room (Room 1076), Cask and Site-specific Cask Site Rail Transfer Cart Receipt Area (Room 1077), Cask and Site-specific Cask Entrance Vestibule (Room 1079) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	4. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation (Rooms 1069, 1072, 1073, 1076, 1077, and 1079).	DTF-LSSCR-R4	NA (no significant exposure)	Operating procedures ensure that a loss of confinement during otherwise normal operations does not cause individuals to be exposed to significant amounts of radioactivity.	Mitigative	Procedural Safety
	5. Radiation-induced damage to a facility SSC (Rooms 1069, 1072, 1073, 1076, 1077, and 1079).	DTF-LSSCR-R5	NA	Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization.	NA	NA
Fissile	1. Criticality associated with an MSC collision or trolley derailment followed by a load tipover or fall and a rearrangement of the MSC internals (before or after the outer lid [as applicable] is fastened) (Rooms 1069, 1072, 1073, and 1076).	DTF-LSSCR-F1	Beyond Category 2	Design requirements and waste acceptance criteria ensure that transportation casks, transfer casks, MSCs, and dual-purpose canisters (DPCs) are designed to ensure nuclear criticality safety with optimum moderation and most-reactive waste forms. Criticality safety will be maintained despite geometric rearrangements due to a drop or other handling incident.	Preventive	Design
	2. Criticality associated with a drop or slapdown of a loaded, sealed MSC from an overhead crane and a rearrangement of cask internals (Rooms 1076 and 1077).	DTF-LSSCR-F2	Beyond Category 2	Same disposition as Potential Event DTF-LSSCR-F1.	Preventive	Design
	3. Criticality associated with an MSC transporter collision while holding a loaded, sealed MSC followed by a load tipover or fall and rearrangement of the cask internals (Rooms 1077 and 1079).	DTF-LSSCR-F3	Beyond Category 2	Same disposition as Potential Event DTF-LSSCR-CC1.	Preventive	Design

NOTES: CC = collision-crushing; CCF = chemical contamination flooding; DOE = U.S. Department of Energy; DTF = dry transfer facility (DTF 1 and DTF 2); EI = explosion-implosion; F = fissile; FT = fire-thermal; GET = generalized event tree; HLW = high-level radioactive waste; LSSCR = loaded site-specific cask removal; NA = not applicable; R = radiation; SNF = spent nuclear fuel; SRTC = site rail transfer cart.

The Event Sequence Designator is a unique event sequence index for each event in this table. The prefix identifies the building or facility, for example "DTF," the middle identifies an activity, room, or area, for example "LSSCR," and the suffix identifies the hazard category and event number, for example "CC1." When an event sequence has been evaluated in a GET, the GET number is identified in the Disposition of Event column; the GET sequence alpha character is shown at the end of the Event Sequence Designator, for example "A."

Additional room(s) with potential events in this table: Room 1072 – Cask Restoration Room.

GETs are discussed in Sections 6.3.1.1 to 6.3.1.24.

Table III-17. Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Waste Package Handling and Staging Cell (Room 1044), Waste Package Positioning Cells (Rooms 1039, 1040 and 1041), Waste Package Closure Cells (Rooms 2032, 2033, and 2035), and the Waste Package/Trolley Decontamination Room (Room 1094)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Collision-Crushing	1. Collision involving the trolley holding the loaded, unsealed WP and the shield doors between the WP loading/docking ring removal cell and the WP handling and staging cell (Room 1044).	DTF-WPHSPCD-CC1	Beyond Category 2	(See GET-22) A design requirement limits the speed of trolley movements such that a collision at the speed limit would not cause the trolley to drop its load.	Preventive	Design
	2. Shield doors between the WP loading/docking ring removal cell and the WP handling and staging cell close on the trolley holding the loaded, unsealed WP (Room 1044).	DTF-WPHSPCD-CC2	Beyond Category 2	A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transfer trolley, site-rail transfer cart (SRTC), MSC transporter, WP transporter, would not cause a tipover of the conveyance or cause the conveyance to drop its load. A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transportation cask, transfer cask, or MSC suspended from an overhead crane would not cause the crane to drop its load.	Preventive	Design
	3. Derailment of a trolley holding a loaded, unsealed WP followed by a load tipover or fall (Rooms 1039, 1040, 1041, 1044, and 1094).	DTF-WPHSPCD-CC3	Beyond Category 2	A design requirement ensures that loaded transfer trolleys do not derail or drop their loads. Design requirements apply to trolleys for casks, waste packages, site-specific casks, and dual-purpose canisters.	Preventive	Design
	4. Drop of a loaded, unsealed WP from the WP handling and staging cell overhead crane onto the floor during the transfer from the waste transfer area pedestal and trolley to a WP positioning cell pedestal and trolley (Room 1044).	DTF-WPHSPCD-CC4A DTF-WPHSPCD-CC4B DTF-WPHSPCD-CC4C DTF-WPHSPCD-CC4D DTF-WPHSPCD-CC4E	No drop Category 2 No Breach Beyond Category 2 Beyond Category 2	(See GET-07) Design and operational requirements reduce the drop probability. Design and operational requirements specify lift-height limits for unsealed waste packages whenever waste packages are transferred. If the limit can not be met, impact absorbers are provided. Design and operational requirements limit the probability of exceeding the lift-height limit. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multicarrier overpack is defective.	Preventive	Design- Procedural Safety
	5. Drop of a loaded, unsealed WP from the WP handling and staging cell overhead crane onto a pedestal on a trolley during the transfer from the waste transfer area pedestal and trolley to a WP positioning cell pedestal and trolley (Room 1044).	DTF-WPHSPCD-CC5A DTF-WPHSPCD-CC5B DTF-WPHSPCD-CC5C DTF-WPHSPCD-CC5D DTF-WPHSPCD-CC5E	No Drop Category 2 No Breach Beyond Category 2 Beyond Category 2	(See GET-07) Same disposition as Potential Event DTF-WPHSPCD-CC4.	Preventive	Design- Procedural Safety
	6. Drop or collision of a loaded, unsealed WP from the WP handling and staging cell overhead crane onto or against a sharp object during the transfer from the waste transfer area pedestal and trolley to a WP positioning cell pedestal and trolley (Room 1044).	DTF-WPHSPCD-CC6	Beyond Category 2	Design and operational requirements ensure that surfaces in the load paths through which WPs, DOE SNF canisters, naval canisters, DPCs, transportation casks, transfer casks, or MSCs are transferred by crane are kept free of structures, such as posts and curbs, that could puncture a container in case of a drop. An operational requirement ensures that the load paths are kept free of movable puncture hazards. A design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design- Procedural Safety
	7. Slapdown of a loaded, unsealed WP from the WP handling and staging cell overhead crane (due to impact with a curb/berm/impact limiter used to maintain drop height limits) or pedestal edge during the transfer from the waste transfer area pedestal and trolley to a WP positioning cell pedestal and trolley (Room 1044).	DTF-WPHSPCD-CC7A DTF-WPHSPCD-CC7B DTF-WPHSPCD-CC7C DTF-WPHSPCD-CC7D DTF-WPHSPCD-CC7E	No Drop Category 2 No Breach Beyond Category 2 Beyond Category 2	(See GET-07) Same disposition as Potential Event DTF-WPHSPCD-CC4.	Preventive	Design- Procedural Safety

Table III-17. Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Waste Package Handling and Staging Cell (Room 1044), Waste Package Positioning Cells (Rooms 1039, 1040 and 1041), Waste Package Closure Cells (Rooms 2032, 2033 and 2035), and the Waste Package/Trolley Decontamination Room (Room 1094) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	8. Drop or collision of equipment (handling equipment, etc.) from the WP handling and staging cell overhead crane onto or against a loaded, unsealed WP positioned on a pedestal on a trolley (Room 1044).	DTF-WPHSPCD-CC8	Beyond Category 2	Operational requirements establish lift-height limits for handling equipment and other equipment associated with the WP, including lifting collars (or trunnion collars), yokes, docking rings, and WP-closure equipment. The lift-height limits ensure that the handling equipment can not breach a sealed WP if dropped onto or collided into the WP from within the lift-height limit. Furthermore, the lift-height limits ensure that a drop of equipment from within the lift-height limit can not initiate an event sequence if the WP inner lid is in place, but unsealed. An operational requirement ensures that the inner lid, once set in place, is not removed from the WP except in a remediation situation.	Preventive	Procedural Safety
	9. Collision involving the trolley holding the loaded, unsealed WP and the shield doors between WP handling and staging cell and the WP positioning cell (Rooms 1039, 1040, 1041, and 1044).	DTF-WPHSPCD-CC9	Beyond Category 2	(See GET-22) Same disposition as Potential Event DTF-WPHSPCD-CC1.	Preventive	Design
	10. Shield doors between the WP handling and staging cell and the WP positioning cell close on the trolley holding the loaded, unsealed WP (Rooms 1039, 1040, 1041, and 1044).	DTF-WPHSPCD-CC10	Beyond Category 2	Same disposition as Potential Event DTF-WPHSPCD-CC2.	Preventive	Design
	11. Lid drop onto a WP from the lid placement fixture equipment during the welding process (Rooms 1039, 1040, 1041, 2032, 2033, and 2035).	DTF-WPHSPCD-CC11A DTF-WPHSPCD-CC11B DTF-WPHSPCD-CC11C DTF-WPHSPCD-CC11D DTF-WPHSPCD-CC11E DTF-WPHSPCD-CC11F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-02) Design and operational requirements reduce the drop probability. Operational requirements limit the lift height of the inner lid of a transportation cask, transfer cask, site-specific cask, or waste package to ensure that a lid drop onto a DOE canister within that breaches the canister is a beyond Category 2 event sequence. Design and operational requirements limit the probability of exceeding the lift height. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multicarrier overpack is defective.	Preventive	Design- Procedural Safety
	12. Equipment drop onto a WP during the welding process (Rooms 1039, 1040, 1041, 2032, 2033, and 2035).	DTF-WPHSPCD-CC12	Beyond Category 2	Same disposition as Potential Event DTF-WPHSPCD-CC8.	Preventive	Procedural Safety
	13. Drop or collision of equipment (handling equipment, etc.) from the WP handling and staging cell overhead crane onto or against a loaded, sealed WP positioned on a pedestal on a trolley (Room 1044).	DTF-WPHSPCD-CC13	Beyond Category 2	Same disposition as Potential Event DTF-WPHSPCD-CC8.	Preventive	Procedural Safety
	14. Collision involving the trolley holding the loaded, sealed WP and the shield doors between the WP positioning cell and the WP handling and staging cell (Rooms 1039, 1040, 1041, and 1044).	DTF-WPHSPCD-CC14	Beyond Category 2	(See GET-22) Same disposition as Potential Event DTF-WPHSPCD-CC1.	Preventive	Design
	15. Shield doors between the WP positioning cell and the WP handling and staging cell close on the trolley holding the loaded, sealed WP (Rooms 1039, 1040, 1041, and 1044).	DTF-WPHSPCD-CC15	Beyond Category 2	Same disposition as Potential Event DTF-WPHSPCD-CC2.	Preventive	Design
	16. Derailment of a trolley holding a loaded, sealed WP on the rails leading from the WP positioning cell, followed by a load tipover or fall (Rooms 1039, 1040, 1041, and 1044).	DTF-WPHSPCD-CC16	Beyond Category 2	Same disposition as Potential Event DTF-WPHSPCD-CC3.	Preventive	Design
	17. Drop of a loaded, sealed WP from the WP handling and staging cell overhead crane onto the floor during transfer from the WP positioning cell pedestal and trolley to the WP survey station (Room 1044).	DTF-WPHSPCD-CC17A DTF-WPHSPCD-CC17B DTF-WPHSPCD-CC17C	No drop No breach Beyond Category 2	(See GET-08) Design and operational requirements reduce the drop probability. Design and operational requirements limit the lift height of waste packages in horizontal and vertical orientations. Design requirements ensure that waste packages withstand without breaching drops and tipovers within their lift height limits. Design and operational requirements limit the probability of exceeding the lift height.	Preventive	Design- Procedural Safety

Table III-17. Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Waste Package Handling and Staging Cell (Room 1044), Waste Package Positioning Cells (Rooms 1039, 1040 and 1041), Waste Package Closure Cells (Rooms 2032, 2033 and 2035), and the Waste Package/Trolley Decontamination Room (Room 1094) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	18. Drop or collision of a loaded, sealed WP from the WP handling and staging cell overhead crane onto or against a sharp object during transfer from the WP positioning cell pedestal and trolley to the WP survey station (Room 1044).	DTF-WPHSPCD-CC18	Beyond Category 2	Same disposition as Potential Event DTF-WPHSPCD-CC6.	Preventive	Design-Procedural Safety
	19. Drop of a loaded, sealed WP from the WP handling and staging cell overhead crane onto the floor during the transfer from the WP survey station to a trolley for transfer to the WP loadout cell or during transfer to a position in a vertical orientation in a staging area location in the WP handling and staging cell (Room 1044).	DTF-WPHSPCD-CC19A DTF-WPHSPCD-CC19B DTF-WPHSPCD-CC19C	No drop No breach Beyond Category 2	(See GET-08) Same disposition as Potential Event DTF-WPHSPCD-CC17.	Preventive	Design-Procedural Safety
	20. Drop of a loaded, sealed WP from the WP handling and staging cell overhead crane onto a trolley during the transfer from the WP survey station to a trolley for transfer to the WP loadout cell (Room 1044).	DTF-WPHSPCD-CC20A DTF-WPHSPCD-CC20B DTF-WPHSPCD-CC20C	No drop No breach Beyond Category 2	(See GET-08) Same disposition as Potential Event DTF-WPHSPCD-CC17.	Preventive	Design-Procedural Safety
	21. Drop or collision of a loaded, sealed WP from the WP handling and staging cell overhead crane onto or against a sharp object during transfer from the WP survey station to a trolley for transfer to the WP loadout cell or during transfer to a position in a vertical orientation in a staging area location in the WP handling and staging cell (Room 1044).	DTF-WPHSPCD-CC21	Beyond Category 2	Same disposition as Potential Event DTF-WPHSPCD-CC6.	Preventive	Design-Procedural Safety
	22. Slapdown of a loaded, sealed WP from the WP handling and staging cell overhead crane (due to impact with a curb/barricade/impact limiter used to maintain drop height limits) or trolley edge during transfer from the WP survey station to a trolley for transfer to the WP loadout cell or during transfer to a position in a vertical orientation in a staging area location in the WP handling and staging cell (Room 1044).	DTF-WPHSPCD-CC22A DTF-WPHSPCD-CC22B DTF-WPHSPCD-CC22C	No drop No breach Beyond Category 2	(See GET-08) Same disposition as Potential Event DTF-WPHSPCD-CC17. Additionally, a design requirement ensures that waste packages can withstand a tipover during placement onto the tilting machine, including contact with trunnion cradles or the floor and a design requirement prevents backward slapdowns associated with the tilting machine for waste packages.	Preventive	Design-Procedural Safety
	23. Drop or collision of equipment (handling equipment, etc.) from the WP handling and staging cell overhead crane onto or against a loaded, sealed WP positioned in a vertical position in a staging area location in the WP handling and staging cell (Room 1044).	DTF-WPHSPCD-CC23	Beyond Category 2	Same disposition as Potential Event DTF-WPHSPCD-CC8.	Preventive	Procedural Safety
	24. Drop of a loaded, partially sealed WP (WP with a known weld defect) from the WP handling and staging cell overhead crane onto the floor during the transfer from the WP positioning cell pedestal and trolley to a trolley for transfer to the DPC cutting/WP dry remediation cell (Room 1044).	DTF-WPHSPCD-CC24A DTF-WPHSPCD-CC24B DTF-WPHSPCD-CC24C DTF-WPHSPCD-CC24D DTF-WPHSPCD-CC24E DTF-WPHSPCD-CC24F	No defect No drop Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-09) Design and operational requirements reduce the drop probability. Design and operational requirements specify lift-height limits for unsealed waste packages whenever waste packages are transferred. If the limit can not be met, impact absorbers are provided. Design and operational requirements limit the probability of exceeding the lift height. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multiccanister overpack is defective.	Preventive	Design-Procedural Safety
	25. Drop of a loaded, partially sealed WP (WP with a known weld defect) from the WP handling and staging cell overhead crane onto a trolley during the transfer from the WP positioning cell pedestal and trolley to a trolley for transfer to the DPC cutting/WP dry remediation cell (Room 1044).	DTF-WPHSPCD-CC25A DTF-WPHSPCD-CC25B DTF-WPHSPCD-CC25C DTF-WPHSPCD-CC25D DTF-WPHSPCD-CC25E DTF-WPHSPCD-CC25F	No defect No drop Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-09) Same disposition as Potential Event DTF-WPHSPCD-CC24.	Preventive	Design-Procedural Safety

Table III-17. Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Waste Package Handling and Staging Cell (Room 1044), Waste Package Positioning Cells (Rooms 1039, 1040 and 1041), Waste Package Closure Cells (Rooms 2032, 2033 and 2035), and the Waste Package/Trolley Decontamination Room (Room 1094) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	26. Drop or collision of a loaded, partially sealed WP (WP with a known weld defect) from the WP handling and staging cell overhead crane onto or against a sharp object during transfer from the WP positioning cell pedestal and trolley to a trolley for transfer to the DPC cutting/WP dry remediation cell (Room 1044).	DTF-WPHSPCD-CC26	Beyond Category 2	Same disposition as Potential Event DTF-WPHSPCD-CC6.	Preventive	Design-Procedural Safety
	27. Slapdown of a loaded, partially sealed WP (WP with a known weld defect) from the WP handling and staging cell overhead crane (due to impact with a curb/berm/impact limiter used to maintain drop height limits) or trolley edge during the transfer from the WP positioning cell pedestal and trolley to a trolley for transfer to the DPC cutting/WP dry remediation cell (Room 1044).	DTF-WPHSPCD-CC27A DTF-WPHSPCD-CC27B DTF-WPHSPCD-CC27C DTF-WPHSPCD-CC27D DTF-WPHSPCD-CC27E DTF-WPHSPCD-CC27F	No defect No drop Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-09) Same disposition as Potential Event DTF-WPHSPCD-CC24.	Preventive	Design-Procedural Safety
	28. Drop of a loaded, sealed WP (WP needing decontamination) from the WP handling and staging cell overhead crane onto the floor during transfer from the WP survey station to a trolley for transfer to the WP/trolley decontamination room (Rooms 1044 and 1094).	DTF-WPHSPCD-CC28A DTF-WPHSPCD-CC28B DTF-WPHSPCD-CC28C	No drop No breach Beyond Category 2	(See GET-08) Same disposition as Potential Event DTF-WPHSPCD-CC17.	Preventive	Design-Procedural Safety
	29. Drop of a loaded, sealed WP (WP needing decontamination) from the WP handling and staging cell overhead crane onto a trolley during transfer from the WP survey station to a trolley for transfer to the WP/trolley decontamination room (Room 1044).	DTF-WPHSPCD-CC29A DTF-WPHSPCD-CC29B DTF-WPHSPCD-CC29C	No drop No breach Beyond Category 2	(See GET-08) Same disposition as Potential Event DTF-WPHSPCD-CC17.	Preventive	Design-Procedural Safety
	30. Drop or collision of a loaded, sealed WP (WP needing decontamination) from the WP handling and staging cell overhead crane onto or against a sharp object during transfer from the WP survey station to a trolley for transfer to the WP/trolley decontamination room (Rooms 1044 and 1094).	DTF-WPHSPCD-CC30	Beyond Category 2	Same disposition as Potential Event DTF-WPHSPCD-CC6.	Preventive	Design-Procedural Safety
	31. Slapdown of a loaded, sealed WP (WP needing decontamination) from the WP handling and staging cell overhead crane (due to impact with a curb/berm/impact limiter used to maintain drop height limits) or trolley edge during the transfer from the WP survey station to a trolley for transfer to the WP/trolley decontamination room (Rooms 1044 and 1094).	DTF-WPHSPCD-CC31A DTF-WPHSPCD-CC31B DTF-WPHSPCD-CC31C	No drop No breach Beyond Category 2	(See GET-08) Same disposition as Potential Event DTF-WPHSPCD-CC17. Additionally, a design requirement ensures that waste packages can withstand a tipover during placement onto the tilting machine, including contact with trunnion cradles or the floor.	Preventive-Mitigative	Design-Procedural Safety
	32. Collision involving the trolley holding the loaded, sealed, contaminated or decontaminated WP and the shield doors between the WP handling and staging cell and the WP/trolley decontamination room (Rooms 1044 and 1094).	DTF-WPHSPCD-CC32	Beyond Category 2	(See GET-22) Same disposition as Potential Event DTF-WPHSPCD-CC1.	Preventive	Design
	33. Shield doors between the WP handling and staging cell and the WP/trolley decontamination room close on the trolley holding the loaded, sealed, contaminated or decontaminated WP (Rooms 1044 and 1094).	DTF-WPHSPCD-CC33	Beyond Category 2	Same disposition as Potential Event DTF-WPHSPCD-CC2.	Preventive	Design
	34. Derailment of a trolley holding the loaded, sealed, contaminated or decontaminated WP in the WP/trolley decontamination room (or on the rails leading to/from this room) followed by a load tipover or fall (Room 1094).	DTF-WPHSPCD-CC34	Beyond Category 2	Same disposition as Potential Event DTF-WPHSPCD-CC3.	Preventive	Design

Table III-17. Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Waste Package Handling and Staging Cell (Room 1044), Waste Package Positioning Cells (Rooms 1039, 1040 and 1041), Waste Package Closure Cells (Rooms 2032, 2033 and 2035), and the Waste Package/Trolley Decontamination Room (Room 1094) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	35. Drop or collision of equipment (handling equipment, decontamination equipment etc.) onto or against a loaded, sealed contaminated or decontaminated WP positioned on a trolley in the WP/trolley decontamination room (Room 1094).	DTF-WPHSPCD-CC35	Beyond Category 2	Same disposition as Potential Event DTF-WPHSPCD-CC8.	Preventive	Procedural Safety
	36. Drop of a loaded, sealed, decontaminated WP from the WP handling and staging cell overhead crane onto the floor during transfer from the trolley serving the WP/trolley decontamination room to the trolley to the WP loadout cell (Rooms 1044 and 1094).	DTF-WPHSPCD-CC36aA DTF-WPHSPCD-CC36aB DTF-WPHSPCD-CC36aC DTF-WPHSPCD-CC36b	No drop No breach Beyond Category 2 Beyond Category 2	CC36a (See GET-08 for drop event) Same disposition as Potential Event DTF-WPHSPCD-CC17. CC36b (See GET-22 for trolley collision) Same disposition as Potential Event DTF-WPHSPCD-CC1.	Preventive	Design-Procedural Safety
	37. Drop of a loaded, sealed, decontaminated WP from the WP handling and staging cell overhead crane onto a trolley during transfer from the trolley serving the WP/trolley decontamination room to the trolley to the WP loadout cell. (Rooms 1044 and 1094).	DTF-WPHSPCD-CC37A DTF-WPHSPCD-CC37B DTF-WPHSPCD-CC37C	No drop No breach Beyond Category 2	(See GET-08) Same disposition as Potential Event DTF-WPHSPCD-CC17.	Preventive	Design-Procedural Safety
	38. Drop or collision of a loaded, sealed, decontaminated WP from the WP handling and staging cell overhead crane onto or against a sharp object during transfer from the trolley serving the WP/trolley decontamination room to the trolley to the WP loadout cell (Rooms 1044 and 1094).	DTF-WPHSPCD-CC38	Beyond Category 2	Same disposition as Potential Event DTF-WPHSPCD-CC6.	Preventive	Design-Procedural Safety
	39. Slapdown (tip-over from an elevated surface) of a loaded, sealed, decontaminated WP from the WP handling and staging cell overhead crane (due to impact with a curb/berm/impact limiter used to maintain drop height limits) or trolley edge during the transfer from the trolley serving the WP/trolley decontamination room to the trolley to the WP loadout cell (Rooms 1044 and 1094).	DTF-WPHSPCD-CC39A DTF-WPHSPCD-CC39B DTF-WPHSPCD-CC39C	No drop No breach Beyond Category 2	(See GET-08) Same disposition as Potential Event DTF-WPHSPCD-CC31.	Preventive	Design-Procedural Safety
	40. Drop or collision of equipment (handling equipment, etc.) from the WP handling and staging cell overhead crane onto or against a loaded, sealed or partially sealed (with a known weld defect), contaminated or decontaminated WP positioned on a pedestal on a trolley, on a trolley without a pedestal, or the WP survey station (Room 1044).	DTF-WPHSPCD-CC40	Beyond Category 2	Same disposition as Potential Event DTF-WPHSPCD-CC8.	Preventive	Procedural Safety
	41. Derailement of a trolley holding a loaded, sealed WP on the rails leading from the WP handling and staging cell to the WP loadout cell, followed by a load tipover or fall (Room 1044).	DTF-WPHSPCD-CC41	Beyond Category 2	Same disposition as Potential Event DTF-WPHSPCD-CC3.	Preventive	Design
Chemical Contamination-Flooding	1. Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures (Rooms 1039, 1040, 1041, 1044, 2032, 2033, and 2035).	DTF-WPHSPCD-CCF1	Normal Operations	Oxidation of failed commercial SNF is expected as a part of normal operations whenever commercial SNF is exposed to air. Any resulting potential exposure of workers to radiation is managed as a normal-operations dose by procedures that ensure that workers do not receive excessive radiation doses.	Mitigative	Procedural Safety
	2. Flooding due to rupture of water line or clogging of drain associated with the high pressure water system used for decontamination activities in the WP/trolley decontamination room. (Rooms 1039, 1040, 1041, and 1094).	DTF-WPHSPCD-CCF2	Normal Operations	Minor increases in potential worker doses that might be caused by the spread of contamination because of flooding would be managed as a normal-operations dose by procedures that ensure that workers do not receive excessive radiation doses.	Mitigative	Procedural Safety

Table III-17. Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Waste Package Handling and Staging Cell (Room 1044), Waste Package Positioning Cells (Rooms 1039, 1040 and 1041), Waste Package Closure Cells (Rooms 2032, 2033 and 2035), and the Waste Package/Trolley Decontamination Room (Room 1094) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Explosion-Implosion	1. Explosion hazard associated with the WP purging and inerting system and the ignition of hydrogen that may have accumulated in the WP (Rooms 1039, 1040, 1041, 2032, 2033, and 2035).	DTF-WPHSPCD-EI1	Beyond Category 2	Operational requirements ensure that precautions taken during the cask sampling and purging process provide reasonable assurance that such hydrogen explosions would not occur.	Preventative	Procedural Safety
	2. WP decontamination system missile due to a fractured nozzle/valve stem/pneumatic device (Room 1094).	DTF-WPHSPCD-EI2	Beyond Category 2	An operational requirement ensures that pressurized systems that could generate missiles energetic enough to penetrate a transportation cask with or without impact limiters, a transfer cask, a DOE canister, a naval SNF canister, a dual-purpose canister, the inner lid of a transportation cask, a site-specific cask, a waste package, or the inner lid of a site-specific cask or waste package are not present in areas where the potentially vulnerable items may be exposed.	Preventive	Procedural Safety
	3. WP inerting system (or other pneumatic or pressurized system) missile due to a fractured nozzle/valve stem/pneumatic device (Rooms 1039, 1040, 1041, 2032, 2033, and 2035).	DTF-WPHSPCD-EI3	Beyond Category 2	Same disposition as Potential Event DTF-WPHSPCD-EI2.	Preventive	Procedural Safety
Fire-Thermal	1. Electrical fire associated with handling and other electrically powered equipment in the WP handling and staging cell, the WP positioning cells, and the WP closure cells, including the cranes and the welding subsystem in the WP closure cells (Rooms 1039, 1040, 1041, 2032, 2033, and 2035).	DTF-WPHSPCD-FT1	Beyond Category 2	Design and operational requirements ensure control of the presence and amount of combustibles in the different areas of the repository to preclude any Category 1 or Category 2 event sequences potentially initiated by a fire.	Preventive	Design-Procedural Safety
	2. Electrical fire associated with a trolley holding a loaded WP (unsealed or sealed). (Rooms 1039, 1040, 1041, 1044, 1094, 2032, 2033, and 2035).	DTF-WPHSPCD-FT2	Beyond Category 2	Same disposition as Potential Event DTF-WPHSPCD-FT1.	Preventive	Design-Procedural Safety
	3. Fuel damage by burn-through during welding process/heat damage (Rooms 1039, 1040, 1041, 2032, 2033, and 2035).	DTF-WPHSPCD-FT3	NA	Burn-through of the inner lid is not possible with the gas tungsten arc welding process used for the closure welds.	NA	NA
	4. Thermal hazard/SNF overheating in a WP during the welding process resulting in excessive cladding temperature and possible zircaloy cladding (or other cladding) unzipping (Rooms 1039, 1040, 1041, 2032, 2033, and 2035).	DTF-WPHSPCD-FT4	NA	Overheating of the WP contents due to welding is not possible using the gas tungsten arc welding process, which is used for the closure welds.	NA	NA
	5. Thermal hazard/SNF overheating in a partially sealed WP (WP with weld defects) in the WP handling and staging cell, prior to entering WP remediation (Room 1044).	DTF-WPHSPCD-FT5	Beyond Category 2	If ventilation is lost in areas where DOE or naval canisters are handled, no radiological release occurs from the canisters because containment within the canisters is maintained. Design and operational requirements ensure that the thermal response of areas where CSNF assemblies are handled or staged to a loss of HVAC would not cause radiological releases in excess of those considered in the consequence analysis for normal operations.	Preventive	Design-Procedural Safety
	6. Intact or non-intact SNF overheating or damage to canister contents due to a loss of cooling resulting in excessive temperature and possible zircaloy cladding (or other cladding) unzipping or cladding failure due to excessive hoop stresses. (Rooms 1039, 1040, 1041, 1044, 1094, 2032, 2033, and 2035).	DTF-WPHSPCD-FT6	Beyond Category 2	Same disposition as Potential Event DTF-WPHSPCD-FT5.	Preventive	Design
	7. Transient combustible fire in the WP handling and staging cell, WP positioning cells, WP closure cells, and the WP/trolley decontamination room (Rooms 1039, 1040, 1041, 1044, 1094, 2032, 2033, and 2035).	DTF-WPHSPCD-FT7	Beyond Category 2	Same disposition as Potential Event DTF-WPHSPCD-FT1.	Preventive	Design-Procedural Safety

Table III-17. Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Waste Package Handling and Staging Cell (Room 1044), Waste Package Positioning Cells (Rooms 1039, 1040 and 1041), Waste Package Closure Cells (Rooms 2032, 2033 and 2035), and the Waste Package/Trolley Decontamination Room (Room 1094) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Radiation	1. Radiation exposure of a facility worker and/or the offsite public (Rooms 1039, 1040, 1041, 1044, 1094, 2032, 2033, and 2035).	DTF-WPHSPCD-R1	NA—Accounted for in consequence analyses, if applicable Normal Operations	NA—Potential exposure of workers or the public to radiation is a hazard for the event sequences considered in this analysis. Consequence analyses evaluate this hazard for Category 1 and Category 2 event sequences, as applicable. Some exposure to radiation is expected as a part of normal facility operations. Exposures are managed by design features and procedures that ensure that workers or the public do not receive excessive radiation doses.	NA Mitigative	NA Design- Procedural Safety
	2. Glovebox leak leads radiological release of airborne contamination (Room 2024).	DTF-WPHSPCD-R2	Normal Operations	Potential exposure of workers to radiation from a glovebox leak is managed as a normal-operations dose by routine procedures that ensure that workers do not receive excessive radiation doses.	Mitigative	Procedural Safety
	3. Thermal expansion of gases within WP (prior to seal of inner lid) leads to radiological release (Rooms 1039, 1040, 1041, 2032, 2033, and 2035).	DTF-WPHSPCD-R3	Normal Operations	Thermal expansion of gases is to be expected as a part of normal operations. Any resulting potential exposure of workers to radiation is managed as a normal-operations dose by procedures that ensure that workers do not receive excessive radiation doses.	Mitigative	Procedural Safety
	4. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation (Rooms 1039, 1040, 1041, 1044, 1094, 2032, 2033, and 2035).	DTF-WPHSPCD-R4	NA (no significant exposure)	Operating procedures ensure that a loss of confinement during otherwise normal operations would not cause individuals to be exposed to significant amounts of radioactivity.	Mitigative	Procedural Safety
	5. Inadvertent opening of a shield door, leading to a worker exposure (Rooms 1039, 1040, 1041, 1044, and 1094).	DTF-WPHSPCD-R5	Beyond Category 2	Design and operational requirements ensure that exposure of workers due to inadvertent actuation of shield doors or pit protective covers is not Category 1.	Preventive	Design- Procedural Safety
	6. Radiation-induced damage to a facility SSC (Rooms 1039, 1040, 1041, 1044, 1094, 2032, 2033, and 2035).	DTF-WPHSPCD-R6	NA	Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization.	NA	NA
Fissile	1. Criticality associated with a trolley holding a loaded, sealed or unsealed WP derailment followed by a load tipover or fall and a rearrangement of the container internals (Rooms 1039, 1040, 1041, 1044, 1094, 2032, 2033, and 2035).	DTF-WPHSPCD-F1	Beyond Category 2	Same disposition as Potential Event DTF-WPHSPCD-CC3.	Preventive	Design
	2. Criticality associated with a drop or slapdown of an loaded, unsealed WP and a rearrangement of the container contents (including SNF assemblies that may move out of the WP) (Rooms 1039, 1040, 1041, 1044, 1094, 2032, 2033, and 2035).	DTF-WPHSPCD-F2	Beyond Category 2	A design requirement ensures that an unsealed WP that is dropped onto an essentially unyielding surface from within its lift-height limits would not spill its contents. A design requirement ensures that waste packages are designed to preclude criticality with credit for moderator control and without credit for burnup. Demonstration of compliance must account for the bowing of fuel rods or other rearrangement of fissile material that may occur due to a drop or other handling incident. Design and operational requirements ensure that moderator control is in effect.	Preventive	Design- Procedural Safety
	3. Criticality associated with the drop of heavy equipment onto a loaded, unsealed WP and a rearrangement of the container internals (Rooms 1039, 1040, 1041, 1044, 1094, 2032, 2033, and 2035).	DTF-WPHSPCD-F3	Beyond Category 2	Same disposition as Potential Event DTF-WPHSPCD-F2.	Preventive	Design- Procedural Safety

Table III-17. Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Waste Package Handling and Staging Cell (Room 1044), Waste Package Positioning Cells (Rooms 1039, 1040 and 1041), Waste Package Closure Cells (Rooms 2032, 2033 and 2035), and the Waste Package/Trolley Decontamination Room (Room 1094) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	4. Criticality associated with a drop or slapdown of a loaded, sealed WP and a rearrangement of the container internals (Rooms 1039, 1040, 1041, 1044, 1094, 2032, 2033, and 2035).	DTF-WPHSPCD-F4	Beyond Category 2	A design requirement ensures that sealed waste packages are designed such that drops, collisions, and other handling impacts within their design bases, allowing for rearrangement of the waste package internals and without credit for burnup cannot lead to a nuclear criticality.	Preventive	Design

NOTES: CC = collision-crushing; CCF = chemical contamination flooding; CHF = Canister Handling Facility; DTF = dry transfer facility (DTF 1 and DTF 2); EI = explosion-implosion; F = fissile; FT = fire-thermal; GET = generalized event tree; HLW = high-level radioactive waste; NA = not applicable; R = radiation; SNF = spent nuclear fuel; SRTC = site rail transfer cart; WPHSPCD = waste package handling and staging, positioning, closure and decontamination.

The Event Sequence Designator is a unique event sequence index for each event in this table. The prefix identifies the building or facility, for example "DTF," the middle identifies an activity, room, or area, for example "WPHSPCD," and the suffix identifies the hazard category and event number, for example "CC1." When an event sequence has been evaluated in a GET, the GET number is identified in the Disposition of Event column; the GET sequence alpha character is shown at the end of the Event Sequence Designator, for example "A."

Additional room(s) with potential events in this table: Room 1036 – Entrance Vestibule.

GETs are discussed in Sections 6.3.1.1 to 6.3.1.24.

Table III-18. Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Waste Package Loadout Cell (Room 1088), Waste Package Transporter Vestibule (Room 1087), and Exit Vestibule (Room 1086)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Collision-Crushing	1. Collision involving the trolley holding the loaded, sealed WP and the shield doors between the WP handling and staging cell and the WP loadout cell (Room 1088).	DTF-WPLCTEV-CC1	Beyond Category 2	(See GET-22) A design requirement limits the speed of trolley movements such that a collision at the speed limit would not cause the trolley to drop its load.	Preventive	Design
	2. Shield doors between the WP handling and staging cell and the WP loadout cell close on the trolley holding the loaded, sealed WP (Room 1088).	DTF-WPLCTEV-CC2	Beyond Category 2	A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transfer trolley, site-rail transfer cart (SRTC), MSC transporter, WP transporter, would not cause a tipover of the conveyance or cause the conveyance to drop its load. A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transportation cask, transfer cask, or MSC suspended from an overhead crane would not cause the crane to drop its load.	Preventive	Design
	3. Deraillment of a trolley in the WP loadout cell holding a loaded, sealed WP followed by a load tipover or fall (Room 1088).	DTF-WPLCTEV-CC3	Beyond Category 2	A design requirement ensures that loaded transfer trolleys do not derail or drop their loads. Design requirements apply to trolleys for casks, waste packages, site-specific casks, and dual-purpose canisters.	Preventive	Design
	4. Drop of a loaded, sealed WP from the WP loadout cell overhead crane onto the floor during the transfer from the trolley to the tilting machine (Room 1088).	DTF-WPLCTEV-CC4A DTF-WPLCTEV-CC4B DTF-WPLCTEV-CC4C	No Drop No Breach Beyond Category 2	(See GET-08) Design and operational requirements reduce the drop probability. Design and operational requirements limit the lift height of waste packages in horizontal and vertical orientations. Design requirements ensure that waste packages withstand without breaching drops and tipovers within their lift height limits. Design and operational requirement limits the probability of exceeding the lift height.	Preventive	Design- Procedural Safety
	5. Drop of a loaded, sealed WP from the WP loadout cell overhead crane back onto the trolley during the transfer from the trolley to the tilting machine (Room 1088).	DTF-WPLCTEV-CC5A DTF-WPLCTEV-CC5B DTF-WPLCTEV-CC5C	No Drop No Breach Beyond Category 2	(See GET-08) Same disposition as Potential Event DTF-WPLCTEV-CC4.	Preventive	Design- Procedural Safety
	6. Drop or collision of a loaded, sealed WP from the WP loadout cell overhead crane onto or against a sharp object (including the tilting machine) during transfer from the trolley to the tilting machine (Room 1088).	DTF-WPLCTEV-CC6	Beyond Category 2	Design and operational requirements ensure that surfaces in the load paths through which WPs, DOE SNF canisters, naval canisters, DPCs, transportation casks, transfer casks, or MSCs are transferred by crane are kept free of structures, such as posts and curbs, that could puncture a container in case of a drop. An operational requirement ensures that the load paths are kept free of movable puncture hazards. A design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design- Procedural Safety
	7. Slapdown (either forward into the WP turntable or backward onto the floor) of a loaded, sealed WP engaged in the tilting machine from the WP loadout cell overhead crane during the lowering of the WP to the horizontal position on the WP pallet previously placed on the WP turntable (Room 1088).	DTF-WPLCTEV-CC7A DTF-WPLCTEV-CC7B DTF-WPLCTEV-CC7C	No drop No breach Beyond Category 2	(See GET-08) Same disposition as Potential Event DTF-WPLCTEV-CC4. Additionally, a design requirement ensures that waste packages can withstand a tipover during placement onto the tilting machine, including contact with trunnion cradles or the floor and a design requirement prevents backward slapdowns associated with the tilting machine for waste packages.	Preventive	Design- Procedural Safety
	8. Collision of the tilting machine against a loaded, sealed WP on a pallet on the WP turntable (Room 1088).	DTF-WPLCTEV-CC8	Beyond Category 2	A design or operational requirement ensures that an impact or collision between the trunnion collar removal machine, WP turntable, or WP tilting machine and a WP will not breach the WP or cause it to fall off the emplacement pallet.	Preventive	Design- Procedural Safety

Table III-18. Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Waste Package Loadout Cell (Room 1088), Waste Package Transporter Vestibule (Room 1087), Exit Vestibule (Room 1086) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	9. Equipment drop or collision (including lifting yokes) onto or against a loaded, sealed WP during the process to move the WP from the trolley to the tilting machine (Room 1088).	DTF-WPLCTEV-CC9	Beyond Category 2	Operational requirements establish lift-height limits for handling equipment and other equipment associated with the WP, including lifting collars (or trunnion collars), yokes, docking rings, and WP-closure equipment. The lift-height limits ensure that the handling equipment can not breach a sealed WP if dropped onto or collided into the WP from within the lift-height limit. Furthermore, the lift-height limits ensure that a drop of equipment from within the lift-height limit can not initiate an event sequence if the WP inner lid is in place, but unsealed. An operational requirement ensures that the inner lid, once set in place, is not removed from the WP except in a remediation situation.	Preventive	Procedural Safety
	10. Collision of the WP trunnion collar removal machine and the WP during trunnion collar removal (Room 1088).	DTF-WPLCTEV-CC10	Beyond Category 2	Same disposition as Potential Event DTF-WPLCTEV-CC8.	Preventive	Design-Procedural Safety
	11. Drop of trunnion collar from the 100-ton overhead bridge crane in the WP loadout cell onto a WP during trunnion collar removal (Room 1088).	DTF-WPLCTEV-CC11	Beyond Category 2	Same disposition as Potential Event DTF-WPLCTEV-CC9.	Preventive	Procedural Safety
	12. Movement of the WP turntable holding the loaded, sealed WP (positioned on the WP pallet) prior to disengagement/removal of the WP trunnion collar removal machine (Room 1088).	DTF-WPLCTEV-CC12	Beyond Category 2	A design requirement precludes premature actuation of the turntable, holding the waste package on an emplacement pallet, before the disengagement of the trunnion collar removal machine.	Preventive	Design
	13. Collision of the WP transporter or transporter bedplate with the loaded, sealed WP positioned on a pallet on the WP turntable during movement of the bedplate under the WP turntable (Room 1088).	DTF-WPLCTEV-CC13	Beyond Category 2	Design and operational requirements ensure that the waste package transporter and its bedplate do not collide with a waste package on the turntable and cause a waste package breach.	Preventive	Design-Procedural Safety
	14. Drop of the loaded, sealed WP (positioned on a pallet) onto the transporter bedplate during the lowering of the WP and emplacement pallet from the WP turntable to the transporter bedplate positioned under the WP turntable (Room 1088).	DTF-WPLCTEV-CC14A DTF-WPLCTEV-CC14B DTF-WPLCTEV-CC14C	No drop No breach Beyond Category 2	(See GET-08) Same disposition as Potential Event DTF-WPLCTEV-CC4.	Preventive	Design-Procedural Safety
	15. Collision involving a WP transporter (holding the sealed WP on a pallet) and the shield doors between the WP loadout cell and the WP transporter vestibule (Rooms 1087 and 1088).	DTF-WPLCTEV-CC15	Beyond Category 2	A design requirement ensures that the WP transporter transports the WP in a manner such that if a collision or derailment (excluding tipover) occurs, the WP impact energy would be low enough to preclude a WP breach. A design requirement ensures that the WP transporter transports the WP in a manner such that if a collision or derailment leading to a transporter tipover occurs, the WP impact energy would be low enough to preclude a WP breach.	Preventive	Design
	16. Shield doors between the WP loadout cell and the WP transporter vestibule close on the WP transporter (holding the loaded, sealed WP on a pallet) (Rooms 1087 and 1088).	DTF-WPLCTEV-CC16	Beyond Category 2	Same disposition as Potential Event DTF-WPLCTEV-CC2.	Preventive	Design
	17. Collision involving WP transporter (holding the loaded, sealed WP on a pallet) and the shield doors between the WP transporter vestibule and the exit vestibule (Rooms 1086 and 1087).	DTF-WPLCTEV-CC17	Beyond Category 2	Same disposition as Potential Event DTF-WPLCTEV-CC15.	Preventive	Design
	18. Shield doors between the WP transporter vestibule and the exit vestibule close on the WP transporter (holding the loaded, sealed WP on a pallet) (Rooms 1086 and 1087).	DTF-WPLCTEV-CC18	Beyond Category 2	Same disposition as Potential Event DTF-WPLCTEV-CC2.	Preventive	Design
	19. Collision involving the WP transporter (holding the loaded, sealed WP on a pallet) and the doors between the exit vestibule and the ambient air (outside) (Room 1086).	DTF-WPLCTEV-CC19	Beyond Category 2	Same disposition as Potential Event DTF-WPLCTEV-CC15.	Preventive	Design

Table III-18. Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Waste Package Loadout Cell (Room 1088), Waste Package Transporter Vestibule (Room 1087), Exit Vestibule (Room 1086) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	20. Doors between the exit vestibule and the ambient air (outside) close on the WP transporter (holding the loaded, sealed WP on a pallet). (Room 1086).	DTF-WPLCTEV-CC20	Beyond Category 2	Same disposition as Potential Event DTF-WPLCTEV-CC2.	Preventive	Design
	21. Deraillment of a WP transporter in the exit vestibule, WP transporter vestibule, or WP loadout cell followed by a load tipover or fall (Rooms 1086, 1087, and 1088).	DTF-WPLCTEV-CC21	Beyond Category 2	Same disposition as Potential Event DTF-WPLCTEV-CC15.	Preventive	Design
	22. Drop of a heavy load from the waste package loadout crane auxiliary trolley hoist in the WP loadout crane park cell onto a loaded, sealed WP (Room 1088).	DTF-WPLCTEV-CC22	Beyond Category 2	An operational requirement ensures that heavy loads that could potentially initiate an event sequence if dropped on a transportation cask, transfer cask or waste package can not be lifted over or near a transportation cask, transfer cask, or waste package, except as needed for transfer and closure operations.	Preventive	Procedural Safety
Chemical Contamination-Flooding	1. Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures (Rooms 1086, 1087, and 1088).	DTF-WPLCTEV-FCC1	NA-Accounted for in consequence analyses, if applicable	NA-SNF is contained inside a sealed waste package, therefore this event does not occur unless an event sequence leads to exposure of SNF to air. Oxidation of the fuel matrix is a possible outcome of any event that exposes SNF to air. Consequence analyses account for the possibility of oxidation, as applicable.	NA	NA
Explosion-Implosion	1. Hydraulic system or other pneumatic or pressurized system missile due to a fractured nozzle/valve stem/pneumatic device (Rooms 1086, 1087, and 1088).	DTF-WPLCTEV-EI1	Beyond Category 2	An operational requirement ensures that pressurized systems that could generate missiles, energetic enough to penetrate a transportation cask with or without impact limiters, a transfer cask, a DOE canister, a naval SNF canister, a dual-purpose canister, the inner lid of a transportation cask, a site-specific cask, a waste package, or the inner lid of a site-specific cask or waste package are not present in areas where potentially vulnerable items may be exposed.	Preventive	Procedural Safety
Fire-Thermal	1. Electrical fire associated with the WP loadout cell, the WP transporter vestibule, or the exit vestibule (including the WP trunnion collar removal machine, the tilting machine, and the WP turntable). (Rooms 1086, 1087, and 1088).	DTF-WPLCTEV-FT1	Beyond Category 2	Design and operational requirements ensure control of the presence and amount of combustibles in the different areas of the repository to preclude any Category 1 or Category 2 event sequences potentially initiated by a fire.	Preventive	Design-Procedural Safety
	2. Electrical fire associated with a trolley holding a sealed WP (Rooms 1087 and 1088).	DTF-WPLCTEV-FT2	Beyond Category 2	Same disposition as Potential Event DTF-WPLCTEV-FT1.	Preventive	Design-Procedural Safety
	3. Electrical fire associated with the WP loadout cell overhead bridge crane (Room 1088).	DTF-WPLCTEV-FT3	Beyond Category 2	Same disposition as Potential Event DTF-WPLCTEV-FT1.	Preventive	Design-Procedural Safety
	4. Electrical fire associated with equipment on the WP transporter, including motors to extend the WP transporter bedplate (Rooms 1086 and 1087).	DTF-WPLCTEV-FT4	Beyond Category 2	Same disposition as Potential Event DTF-WPLCTEV-FT1.	Preventive	Design-Procedural Safety
	5. Electrical fire associated with the WP transport locomotive (Rooms 1086 and 1087).	DTF-WPLCTEV-FT5	Beyond Category 2	Same disposition as Potential Event DTF-WPLCTEV-FT1.	Preventive	Design-Procedural Safety

Table III-18. Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Waste Package Loadout Cell (Room 1088), Waste Package Transporter Vestibule (Room 1087), Exit Vestibule (Room 1086) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	6. Intact or non-intact SNF overheating or damage to canister contents due to a loss of cooling resulting in excessive temperature and possible zircaloy cladding (or other cladding) unzipping or cladding failure due to excessive hoop stresses (Rooms 1086, 1087, and 1088).	DTF-WPLCTEV-FT6	Beyond Category 2	If ventilation is lost in areas where DOE or naval canisters are handled, no radiological release occurs from the canisters because containment within the canisters is maintained. Design and operational requirements ensure that the thermal response of areas where CSNF assemblies are handled or staged to a loss of HVAC would not cause radiological releases in excess of those considered in the consequence analysis for normal operations.	Preventive	Design-Procedural Safety
	7. Transient combustible fire in the WP loadout cell, the WP transporter vestibule, or the exit vestibule (Rooms 1086, 1087, and 1088).	DTF-WPLCTEV-FT7	Beyond Category 2	Same disposition as Potential Event DTF-WPLCTEV-FT1.	Preventive	Design-Procedural Safety
Radiation	1. Radiation exposure of a facility worker and/or the offsite public (Rooms 1086, 1087, and 1088).	DTF-WPLCTEV-R1	NA—Accounted for in consequence analyses, if applicable	NA—Potential exposure of workers or the public to radiation is a hazard for the event sequences considered in this analysis. Consequence analyses evaluate this hazard for Category 1 and Category 2 event sequences, as applicable.	NA	NA
			Normal Operations	Some exposure to radiation is expected as a part of normal facility operations. Exposures are managed by design features and procedures that ensure that workers or the public do not receive excessive radiation doses.	Mitigative	Design-Procedural Safety
	2. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation (Rooms 1086, 1087, and 1088).	DTF-WPLCTEV-R2	NA (no significant exposure)	Operating procedures ensure that a loss of confinement during otherwise normal operations does not cause individuals to be exposed to significant amounts of radioactivity.	Mitigative	Procedural Safety
	3. Inadvertent opening of a shield door, leading to a worker exposure (Rooms 1086, 1087, and 1088).	DTF-WPLCTEV-R3	Beyond Category 2	Design and operational requirements ensure that exposure of workers due to inadvertent actuation of shield doors or pit protective covers is not Category 1.	Preventive	Design-Procedural Safety
	4. Inadvertent opening of the WP transporter shielded enclosure doors, leading to a worker exposure (Rooms 1086, 1087, and 1088).	DTF-WPLCTEV-R4	Beyond Category 2	Same disposition as Potential Event CHF-WPL-R3.	Preventive	Design-Procedural Safety
	5. Radiation-induced damage to a facility SSC (Rooms 1086, 1087, and 1088).	DTF-WPLCTEV-R5	NA	Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization.	NA	NA
Fissile	1. Criticality associated with a trolley holding a loaded, sealed WP derailment followed by a load tipover or fall and a rearrangement of the container internals (Room 1088).	DTF-WPLCTEV-F1	Beyond Category 2	Same disposition as Potential Event CHF-WPL-F2. Additionally, a design requirement ensures that loaded transfer trolleys do not derail or drop their loads. Design requirements apply to trolleys for casks, waste packages, site-specific casks, and dual-purpose canisters.	Preventive	Design
	2. Criticality associated with a drop, slapdown, or collision of a loaded, sealed WP and a rearrangement of the container internals (Rooms 1086, 1087, and 1088).	DTF-WPLCTEV-F2	Beyond Category 2	A design requirement ensures that sealed waste packages are designed such that drops, collisions, and other handling impacts within their design bases (allowing for rearrangement of the waste package internals and without credit for burnup) cannot lead to a nuclear criticality.	Preventive	Design

Table III-18. Disposition of Internal Events That Occur Inside the Dry Transfer Facility: Waste Package Loadout Cell (Room 1088), Waste Package Transporter Vestibule (Room 1087), Exit Vestibule (Room 1086) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	3. Criticality associated with a WP transporter derailment followed by a load tipover or fall and rearrangement of the WP internals (Rooms 1086, 1087, and 1088).	DTF-WPLCTEV-F3	Beyond Category 2	Same disposition as Potential Events DTF-WPLCTEV-CC15 and DTF-WPLCTEV-F2.	Preventive	Design

NOTES: CC = collision-crushing; CCF = chemical contamination flooding; CHF = Canister Handling Facility; DTF = dry transfer facility (DTF 1 and DTF 2); EI = explosion-implosion; F = fissile; FT = fire-thermal; GET = generalized event tree; HLW = high-level radioactive waste; NA = not applicable; R = radiation; SNF = spent nuclear fuel; SRTC = site rail transfer cart; WPLCTEV = waste package loadout cell transport exit vestibule.

The Event Sequence Designator is a unique event sequence index for each event in this table. The prefix identifies the building or facility, for example "DTF," the middle identifies an activity, room, or area, for example "WPLCTEV," and the suffix identifies the hazard category and event number, for example "CC1." When an event sequence has been evaluated in a GET, the GET number is identified in the Disposition of Event column; the GET sequence alpha character is shown at the end of the Event Sequence Designator, for example "A."

GETs are discussed in Sections 6.3.1.1 to 6.3.1.24.

Table III-19. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Waste Package Remediation): Dual-purpose Canister Cutting/Waste Package Dry Remediation Cell (Room 1097)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Collision-Crushing	1. Collision involving the trolley holding a loaded, partially sealed WP (WP with a known weld defect) and the shield doors between the WP handling and staging cell and the WP/trolley decontamination room or the doors between the WP/trolley decontamination room and the DPC cutting/WP dry remediation cell. (Room 1097).	DTF-DPCWPDRM-CC1	Beyond Category 2	(See GET-22) A design requirement limits the speed of trolley movements such that a collision at the speed limit could not cause the trolley to drop its load.	Preventive	Design
	2. Shield doors between the WP handling and staging cell and the WP/trolley decontamination room or the doors between the WP/trolley decontamination room and the DPC cutting/WP dry remediation cell close on the trolley holding a loaded, partially sealed WP (WP with a known weld defect) (Room 1097).	DTF-DPCWPDRM-CC2	Beyond Category 2	A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transfer trolley, site-rail transfer cart (SRTC), MSC transporter, WP transporter, would not cause a tipover of the conveyance or cause the conveyance to drop its load. A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transportation cask, transfer cask, or MSC suspended from an overhead crane would not cause the crane to drop its load.	Preventive	Design
	3. Derailment of a trolley holding a loaded, partially sealed WP (WP with a known weld defect) followed by a load tipover or fall in the DPC cutting/WP dry remediation cell (Room 1097).	DTF-DPCWPDRM-CC3	Beyond Category 2	A design requirement ensures that loaded transfer trolleys do not derail or drop their loads. Design requirements apply to trolleys for casks, waste packages, site-specific casks, and dual-purpose canisters.	Preventive	Design
	4. Drop of a loaded, partially sealed WP (WP with a known weld defect) from the DPC cutting/WP dry remediation cell overhead crane onto the floor during the transfer from the trolley to the cutting machine base (Room 1097).	DTF-DPCWPDRM-CC4A DTF-DPCWPDRM-CC4B DTF-DPCWPDRM-CC4C DTF-DPCWPDRM-CC4D DTF-DPCWPDRM-CC4E DTF-DPCWPDRM-CC4F	No Defect No Drop Category 2 No Breach Beyond Category 2 Beyond Category 2	(See GET-09) Design and operational requirements reduce the drop probability. Design and operational requirements specify lift-height limits for unsealed waste packages whenever waste packages are transferred. If the limit can not be met, impact absorbers are provided. Design and operational requirements limit the probability of exceeding the lift height. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multicarrier overpack is defective.	Preventive	Design- Procedural Safety
	5. Drop of a loaded, partially sealed WP (WP with a known weld defect) from the DPC cutting/WP dry remediation cell overhead crane onto the cutting machine base during the transfer from the trolley to the cutting machine base (Room 1097).	DTF-DPCWPDRM-CC5A DTF-DPCWPDRM-CC5B DTF-DPCWPDRM-CC5C DTF-DPCWPDRM-CC5D DTF-DPCWPDRM-CC5E DTF-DPCWPDRM-CC5F	No Defect No Drop Category 2 No Breach Beyond Category 2 Beyond Category 2	(See GET-09) Same disposition as Potential Event DTF-DPCWPDRM-CC4.	Preventive	Design- Procedural Safety
	6. Drop or collision of a loaded, partially sealed WP (WP with a known weld defect) from the DPC cutting/WP dry remediation cell overhead crane onto or against a sharp object during transfer from the trolley to the cutting machine base. (Room 1097).	DTF-DPCWPDRM-CC6	Beyond Category 2	Design and operational requirements ensure that surfaces in the load paths through which WPs, DOE SNF canisters, naval canisters, DPCs, transportation casks, transfer casks, or MSCs are transferred by crane are kept free of structures, such as posts and curbs, that could puncture a container in case of a drop. An operational requirement ensures that the load paths are kept free of movable puncture hazards. A design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design- Procedural Safety
	7. Drop or collision of equipment (including a lifting yoke) from the DPC cutting/WP dry remediation cell overhead crane onto or against a loaded, partially sealed WP (WP with a known weld defect). (Room 1097).	DTF-DPCWPDRM-CC7	Beyond Category 2	Operational requirements establish lift-height limits for handling equipment and other equipment associated with the WP, including lifting collars (or trunnion collars), yokes, docking rings, and WP-closure equipment. The lift-height limits ensure that the handling equipment can not breach a sealed WP if dropped onto or collided into the WP from within the lift-height limit. Furthermore, the lift-height limits ensure that a drop of equipment from within the lift-height limit can not initiate an event sequence if the WP inner lid is in place, but unsealed. An operational requirement ensures that the inner lid, once set in place, is not removed from the WP except in a remediation situation.	Preventive	Procedural Safety

Table III-19. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Waste Package Remediation): Dual-purpose Canister Cutting/Waste Package Dry Remediation Cell (Room 1097) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	8. Drop or collision of the WP/canister cutting machine onto or against the defective WP during the lowering of the machine for the lid-cutting operation (Room 1097).	DTF-DPCWPDRM-CC8	Beyond Category 2	A design requirement ensures that the lid-cutting machine is designed to preclude a radiological release due to damage inflicted upon the WP contents during the lid-cutting process.	Preventive	Design
	9. Damage to the WP contents (fuel assembly[ies], canisters, etc.) during lid-cutting operations (Room 1097).	DTF-DPCWPDRM-CC9	Beyond Category 2	Same disposition as Potential Event DTF-DPCWPDRM-CC8.	Preventive	Design
	10. Drop or collision of the WP/canister cutting machine onto or against the defective WP during the removal of the machine after the lid-cutting operation (Room 1097).	DTF-DPCWPDRM-CC10	Beyond Category 2	Same disposition as Potential Event DTF-DPCWPDRM-CC8.	Preventive	Design
	11. Drop of a severed lid (outer, middle, or inner) back onto the WP from an overhead crane during, or after, the completion of the WP cutting (Room 1097).	DTF-DPCWPDRM-CC11A DTF-DPCWPDRM-CC11B DTF-DPCWPDRM-CC11C DTF-DPCWPDRM-CC11D DTF-DPCWPDRM-CC11E DTF-DPCWPDRM-CC11F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(Bounded by GET-02) Design and operational requirements reduce the drop probability. Operational requirements limit the lift height of the inner lid of a transportation cask, transfer cask, site-specific cask, or waste package to ensure that a lid drop onto a DOE canister within that breaches the canister is a beyond Category 2 event sequence. Design and operational requirements limit the probability of exceeding the lift height. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multiccanister overpack is defective.	Preventive	Design-Procedural Safety
	12. Drop or collision of handling equipment (lid grapple) onto or against the unsealed (open), loaded WP (Room 1097).	DTF-DPCWPDRM-CC12a DTF-DPCWPDRM-CC12bA DTF-DPCWPDRM-CC12bB DTF-DPCWPDRM-CC12bC DTF-DPCWPDRM-CC12bD DTF-DPCWPDRM-CC12bE DTF-DPCWPDRM-CC12bF	Beyond Category 2 No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	An operational requirement prohibits suspending a lid grapple above the open waste package or DPC unless the lid is in place or is being lifted. CC12a. If the lid is in place, same disposition as Potential Event DTF-DPCWPDRM-CC7. CC12b. If the lid is being lifted, the potential event is analyzed as a lid-drop event (Bounded by GET-02) Same disposition as Potential Event DTF-DPCWPDRM-CC11.	Preventive	Design-Procedural Safety
	13. Drop of an unsealed (open), loaded WP from the overhead crane in the DPC cutting/WP dry remediation cell onto the floor during the transfer of the WP from the cutting machine base to the trolley that travels to the unloading port to the waste transfer cell (Room 1097).	DTF-DPCWPDRM-CC13A DTF-DPCWPDRM-CC13B DTF-DPCWPDRM-CC13C DTF-DPCWPDRM-CC13D DTF-DPCWPDRM-CC13E	No drop Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-07) Design and operational requirements reduce the drop probability. Design and operational requirements specify lift-height limits for unsealed waste packages whenever waste packages are transferred. If the limit can not be met, impact absorbers are provided. Design and operational requirements limit the probability of exceeding the lift-height limit. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multiccanister overpack is defective.	Preventive	Design-Procedural Safety
	14. Drop of an unsealed (open), loaded WP from the overhead crane in the DPC cutting/WP dry remediation cell onto the trolley during the transfer of the WP from the cutting machine base to the trolley that travels to the unloading port to the waste transfer cell (Room 1097).	DTF-DPCWPDRM-CC14A DTF-DPCWPDRM-CC14B DTF-DPCWPDRM-CC14C DTF-DPCWPDRM-CC14D DTF-DPCWPDRM-CC14E	No drop Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-07) Same disposition as Potential Event DTF-DPCWPDRM-CC13.	Preventive	Design-Procedural Safety
	15. Drop or collision of an unsealed (open), loaded WP from the overhead crane in the DPC cutting/WP dry remediation cell onto or against a sharp object during transfer of the WP from the cutting machine base to the trolley that travels to the unloading port to the waste transfer cell (Room 1097).	DTF-DPCWPDRM-CC15	Beyond Category 2	Same disposition as Potential Event DTF-DPCWPDRM-CC6.	Preventive	Design-Procedural Safety
	16. Slapdown of an unsealed (open), loaded WP following a drop from the overhead crane in the DPC cutting/WP dry remediation cell onto the edge of a pedestal or impact limiter on/near the trolley that travels to the unloading port to the waste transfer cell during the lift and transfer to the trolley (Room 1097).	DTF-DPCWPDRM-CC16A DTF-DPCWPDRM-CC16B DTF-DPCWPDRM-CC16C DTF-DPCWPDRM-CC16D DTF-DPCWPDRM-CC16E	No drop Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-07) Same disposition as Potential Event DTF-DPCWPDRM-CC13. Additionally, a design requirement ensures that an unsealed WP that is dropped onto an essentially unyielding surface from within its lift-height limits would not spill its contents.	Preventive	Design-Procedural Safety

Table III-19. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Waste Package Remediation): Dual-purpose Canister Cutting/Waste Package Dry Remediation Cell (Room 1097) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	17. Derailment of a trolley (that travels to the unloading port to the waste transfer cell) holding a loaded WP (in an opened state) in the DPC cutting/WP dry remediation cell followed by a load tipover or fall (Room 1097).	DTF-DPCWPDRM-CC17	Beyond Category 2	Same disposition as Potential Event DTF-DPCWPDRM-CC3.	Preventive	Design
	18. Drop or collision of an SNF assembly from the spent fuel transfer machine into or against the WP (Room 1097).	DTF-DPCWPDRM-CC18A DTF-DPCWPDRM-CC18B DTF-DPCWPDRM-CC18C	No drop Category 2 Category 2	(See GET-10) Design and operational requirements for commercial SNF handling equipment reduce the drop rate and collision probabilities for commercial SNF assembly transfers, including those in single-assembly canisters.	Preventive	Design- Procedural Safety
	19. Drop or collision of an SNF assembly from the spent fuel transfer machine onto or against another SNF assembly or assemblies in the WP (Room 1097).	DTF-DPCWPDRM-CC19A DTF-DPCWPDRM-CC19B DTF-DPCWPDRM-CC19C	No drop Category 2 Category 2	(See GET-10) Same disposition as Potential Event DTF-DPCWPDRM-CC18.	Preventive	Design- Procedural Safety
	20. Impact due to horizontal movement of an SNF assembly by the spent fuel transfer machine before the assembly is fully lifted out of the WP (Room 1097).	DTF-DPCWPDRM-CC20A DTF-DPCWPDRM-CC20B DTF-DPCWPDRM-CC20C	No drop Category 2 Category 2	(See GET-10) Same disposition as Potential Event DTF-DPCWPDRM-CC18.	Preventive	Design- Procedural Safety
	21. Drop and slapdown of an SNF assembly from the spent fuel transfer machine (due to impact with an edge of the WP, floor edge, WP internal baffle, etc.) during the transfer of the SNF assemblies to a WP or staging rack (Room 1097).	DTF-DPCWPDRM-CC21A DTF-DPCWPDRM-CC21B DTF-DPCWPDRM-CC21C	No drop Category 2 Category 2	(See GET-10) Same disposition as Potential Event DTF-DPCWPDRM-CC18.	Preventive	Design- Procedural Safety
	22. Drop or collision of a naval SNF canister, a DOE HLW canister, a [standardized] DOE SNF canister, or a DOE SNF MCO from the waste transfer cell overhead crane back into or against the WP being unloaded (Room 1097).	DTF-DPCWPDRM-CC22A DTF-DPCWPDRM-CC22B DTF-DPCWPDRM-CC22C DTF-DPCWPDRM-CC22D DTF-DPCWPDRM-CC22E DTF-DPCWPDRM-CC22F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-11) Design and operational requirements reduce the drop probability. A design requirement limits lift heights for DOE SNF canisters, DOE HLW canisters, and DOE SNF multicarrier overpacks. Design and operational requirements limit the probability of exceeding the lift height. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multicarrier overpack is defective. Design requirements ensure that standardized DOE SNF canisters would withstand without breach a drop of another standardized DOE SNF canister and that MCOs would withstand without breach a drop of another MCO dropped from within its lift-height limits. Dropping a DOE SNF canister on a DOE HLW canister is rendered beyond Category 2 by an operational requirement to not transfer or remove the DOE SNF canister into or from the waste package or site-specific cask if there are one or more DOE HLW canisters present in the waste package or site-specific cask. For collisions, a design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design- Procedural Safety
	23. Impact due to horizontal movement of a naval SNF canister, a DOE HLW canister, a [standardized] DOE SNF canister, or a DOE SNF MCO with the waste transfer cell overhead crane before the canister is completely removed from the (Room 1097).	DTF-DPCWPDRM-CC23	Beyond Category 2	A design requirement ensures that cranes are not capable of exerting sufficient force to breach a transportation cask, MSC, waste package, or canister as the result of attempts to overcome mechanical constraints.	Preventive	Design
	24. Drop or collision of a DOE HLW canister from the waste transfer cell crane back onto or against, another DOE HLW canister, a [standardized] DOE SNF canister, or a DOE SNF MCO in a WP (Room 1097).	DTF-DPCWPDRM-CC24A DTF-DPCWPDRM-CC24B	No drop Category 2	(See GET-05 Sequences A and B only) Design and operational requirements reduce the drop probability. For collisions, a design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design- Procedural Safety
	25. Drop or collision of a [standardized] DOE SNF canister from the waste transfer cell crane onto or against, a DOE HLW canister in the WP (Room 1097).	DTF-DPCWPDRM-CC25	Beyond Category 2	Dropping a DOE SNF canister on a DOE HLW canister is rendered beyond Category 2 by an operational requirement to not transfer or remove the DOE SNF canister into or from the waste package or site-specific cask if there are one or more DOE HLW canisters present in the waste package or site-specific cask. For collisions, a design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design- Procedural Safety

Table III-19. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Waste Package Remediation): Dual-purpose Canister Cutting/Waste Package Dry Remediation Cell (Room 1097) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	26. Drop or collision of a DOE SNF MCO from the waste transfer cell crane onto or against, another DOE SNF MCO or a DOE HLW canister in the WP (Room 1097).	DTF-DPCWPDRM-CC26	Beyond Category 2	Same disposition as Potential Event DFT-WPTDRM-CC25. Additionally, a design requirement ensures that standardized DOE SNF canisters can withstand without breach a drop of another DOE SNF canister dropped from within their lift-height limits.	Preventive	Design-Procedural Safety
	27. Drop and slapdown of a DOE HLW canister, a DOE SNF MCO, a [standardized] DOE SNF canister, or a naval SNF canister from the waste transfer cell overhead crane (due to impact with an edge of the WP, floor edge, WP internal baffle, etc.) during the transfer from the WP to a new WP, MSC, or staging rack (if applicable) (Room 1097).	DTF-DPCWPDRM-CC27A DTF-DPCWPDRM-CC27B DTF-DPCWPDRM-CC27C DTF-DPCWPDRM-CC27D DTF-DPCWPDRM-CC27E DTF-DPCWPDRM-CC27F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-11, Event B for HLW and naval canisters and Event F for DOE SNF and MCO canisters) Design and operational requirements reduce the drop probability. A design requirement limits lift heights for DOE SNF canisters, DOE HLW canisters, and DOE SNF multicarrier overpacks. Design and operational requirements limit the probability of exceeding the lift height. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multicarrier overpack is defective. Design requirements ensure that standardized DOE SNF canisters would withstand without breach a drop of another standardized DOE SNF canister and that MCOs would withstand without breach a drop of another MCO dropped from within its lift-height limits. Operational requirements to not transfer a DOE SNF canister into or from the waste package if a DOE HLW canister is present in the same waste package precludes dropping a DOE SNF canister on a DOE HLW canister. Additionally, if a DOE SNF or MCO canister, that is not defective, is dropped on an edge of a WP, staging-pit or load-port edge, or WP internal baffle from the height limits, a design requirement ensures that the canister will not breach.	Preventive	Design-Procedural Safety
	28. Drop or collision of handling equipment into or against an opened WP filled with SNF assemblies (Room 1097).	DTF-DPCWPDRM-CC28A DTF-DPCWPDRM-CC28B	No drop Category 2	(See GET-18) Design and operational requirements reduce the probability of dropping handling equipment onto a SNF assembly energetically enough to breach the assembly. A design requirement ensures that the spent fuel transfer machine, fuel handling machine and other equipment designed to handle individual SNF assemblies are not capable of lateral movements of handling equipment at a speed that could initiate an event sequence as a result of collision with a SNF assembly.	Preventive	Design-Procedural Safety
	29. Drop or collision of handling equipment into or against an opened WP loaded with a naval SNF canister, DOE HLW canisters, and/or [standardized] DOE SNF canisters, and/or DOE SNF MCOs (Room 1097).	DTF-DPCWPDRM-CC29A DTF-DPCWPDRM-CC29B DTF-DPCWPDRM-CC29C DTF-DPCWPDRM-CC29D DTF-DPCWPDRM-CC29E DTF-DPCWPDRM-CC29F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-19) Design and operational requirements reduce the drop probability. An operational requirement ensures the establishment of a maximum lift height limit for handling equipment suspended above DOE SNF canisters. A design requirement ensures that the handling equipment is not capable of causing an event sequence due to a breach of a DOE SNF canister if dropped from within the lift-height limit. Design and operational requirements limit the probability of exceeding the lift height. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multicarrier overpack is defective.	Preventive	Design-Procedural Safety
Chemical Contamination-Flooding	1. Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures (Room 1097).	DTF-DPCWPDRM-CCF1	Normal Operations	Oxidation of failed commercial SNF is expected as a part of normal operations whenever commercial SNF is exposed to air. Any resulting potential exposure of workers to radiation is managed as a normal-operations dose by procedures that ensure that workers do not receive excessive radiation doses.	Mitigative	Procedural Safety
Explosion-Implosion	1. Explosion hazard associated with the cutting and removal of the waste package lid system and the ignition of hydrogen that may have accumulated inside the waste package, including hydrogen removed during the purging process (Room 1097).	DTF-DPCWPDRM-EI1	Beyond Category 2	Operational requirements ensure that precautions taken during the cask sampling and purging process provide reasonable assurance that such hydrogen explosions would not occur.	Preventative	Procedural Safety
	2. Cask/waste package purging or sampling system (or other pneumatic or pressurized system) missile due to a fractured nozzle/valve stem/pneumatic device (Room 1097).	DTF-DPCWPDRM-EI2	Beyond Category 2	An operational requirement ensures that pressurized systems that could generate missiles, energetic enough to penetrate a transportation cask with or without impact limiters, a transfer cask, a DOE canister, a naval SNF canister, a dual-purpose canister, the inner lid of a transportation cask, a site-specific cask, a waste package, or the inner lid of a site-specific cask or waste package are not present in areas where potentially vulnerable items may be exposed.	Preventive	Procedural Safety

Table III-19. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Waste Package Remediation): Dual-purpose Canister Cutting/Waste Package Dry Remediation Cell (Room 1097) (Continued)

Generic Event Category	Fire-Thermal	1. Electrical fire associated with SNF and HLW handling equipment in the DPC cutting/WFP dry remediation cell (including the overhead cranes, manipulators, the chipless cutting equipment, etc.). (Room 1097).	DTF-DPCWPPDRM-FT1	Event Sequence Designator	Event Sequence Category	Disposition of Event		Preventive or Mitigative Requirement	Preventive	Design or Safety Control	
				Beyond Category 2	Design and operational requirements ensure control of the presence and amount of combustibles in the different areas of the repository to preclude any Category 1 or Category 2 event sequences potentially initiated by a fire.						
Radiation		1. Electrical fire associated with the trolley (Room 1097).	DTF-DPCWPPDRM-FT2	Beyond Category 2	Same disposition as Potential Event DTF-DPCWPPDRM-FT1.	Preventive					
		2. Electrical fire associated with the trolley (Room 1097).	DTF-DPCWPPDRM-FT2	Beyond Category 2	Same disposition as Potential Event DTF-DPCWPPDRM-FT1.	Preventive					
		3. Intact or non-intact SNF overheating or damage to canister contents due to a loss of cooling resulting in excessive temperature and possible zircaloy cladding (or other cladding) unzipping or cladding failure due to excessive hoop stresses (Room 1097).	DTF-DPCWPPDRM-FT3	Beyond Category 2	If ventilation is lost in areas where DOE or naval canisters are handled, no radiological release occurs from the canisters because containment within the canisters is maintained. Design and operational requirements ensure that the thermal response of areas where GSNF assemblies are handled or staged to a loss of HVAC would not cause radiological releases in excess of those considered in the consequence analysis for normal operations.	Preventive	Design- Procedural Safety				
		4. Thermal hazard (from decay heat) associated with vertical orientation of the non-inerted, opened, loaded waste package (Room 1097).	DTF-DPCWPPDRM-FT4	Normal Operations	Same disposition as Potential Event DTF-DPCWPPDRM-CCF1.	Mitigative	Procedural Safety				
		5. Transient combustible fire in the DPC cutting/WFP dry remediation cell (Room 1097).	DTF-DPCWPPDRM-FT5	Beyond Category 2	Same disposition as Potential Event DTF-DPCWPPDRM-FT1.	Preventive	Design- Procedural Safety				
Radiation		1. Radiation exposure of a facility worker and/or the offsite public (Room 1097).	DTF-DPCWPPDRM-R1	NA-Accounted for in consequence analyses, if applicable	Some exposure to radiation is expected as a part of normal facility operations. Exposures are managed by design features and procedures that ensure that workers or the public do not receive excessive radiation doses.	Mitigative	NA	NA	Design- Procedural Safety		
		2. Damage or rupture of the WFP sampling and purging system, leading to a release of WFP internal gases and radioactive material (Room 1097).	DTF-DPCWPPDRM-R2	Normal Operations	Like the cask-sampling operation, the waste package sampling operation is conducted so that exposure of workers to radiation is managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. Normal operations releases are expected as a result of this potential event. Therefore, no Category 1 or Category 2 event sequences occur as a result of this event.	Mitigative	Procedural Safety				
		3. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation (Room 1097).	DTF-DPCWPPDRM-R3	NA (no significant exposure)	Operating procedures ensure that a loss of confinement during otherwise normal operations does not cause individuals to be exposed to significant amounts of radioactivity.	Mitigative	Procedural Safety				
		4. Thermal expansion of gases or other loss of confinement in an unsealed cask, leading to radiological release (Room 1097).	DTF-DPCWPPDRM-R4	Normal Operations	Thermal expansion of gases is to be expected as a part of normal operations. Any resulting potential exposure of workers to radiation is managed as a normal-operations dose by procedures that ensure that workers do not receive excessive radiation doses.	Mitigative	Procedural Safety				
		5. Radiation-induced damage to a facility SSC (Room 1097).	DTF-DPCWPPDRM-R5	NA	Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization.	NA	NA				
Fissile		1. Critically associated with a trolley (holding a partially sealed WFP requiring remediation) derailment followed by a load tipover or fall and a rearrangement of the container internals (Room 1097).	DTF-DPCWPPDRM-F1	Beyond Category 2	Same disposition as Potential Event DTF-DPCWPPDRM-CC3.	Preventive	Design				

Table III-19. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Waste Package Remediation): Dual-purpose Canister Cutting/Waste Package Dry Remediation Cell (Room 1097) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	2. Criticality associated with a drop of an SNF assembly from the waste transfer cell spent fuel transfer machine back into the WP being unloaded and a rearrangement of the WP internals (Room 1097).	DTF-DPCWPDRM-F2	Beyond Category 2	A design requirement ensures that waste packages are designed to preclude criticality with credit for moderator control and without credit for burnup. Demonstration of compliance must account for the bowing of fuel rods or other rearrangement of fissile material that may occur due to a drop or other handling incident. Design and operational requirements ensure that moderator control is in effect.	Preventive	Design-Procedural Safety
	3. Criticality associated with a drop of an SNF assembly from the spent fuel transfer machine back into a WP being unloaded and a rearrangement of the fuel rods that comprise the assembly due to impact (Room 1097).	DTF-DPCWPDRM-F3	Beyond Category 2	Same disposition as Potential Event DTF-DPCWPDRM-F2.	Preventive	Design-Procedural Safety
	4. Criticality associated with a drop or slapdown of a WP from the DPC cutting/WP dry remediation cell overhead crane and a rearrangement of the container internals (Room 1097).	DTF-DPCWPDRM-F4	Beyond Category 2	A design requirement ensures that sealed waste packages are designed such that drops, collisions, and other handling impacts within their design bases, allowing for rearrangement of the waste package internals and without credit for burnup, cannot lead to a nuclear criticality.	Preventive	Design
	5. Criticality associated with a drop or slapdown of a naval SNF canister, a [standardized] DOE SNF canister, a DOE SNF MCO, or a DOE HLW canister from the waste transfer cell overhead crane during WP unloading (Room 1097).	DTF-DPCWPDRM-F5	Beyond Category 2	Design requirements ensure that a drop of a DOE SNF canister does not lead to a nuclear criticality with the most reactive configuration of DOE SNF canisters and moderator control. Design and operational requirements ensure that moderator control is in effect. There is no potential for criticality of DOE HLW canisters. Criticality of a naval canister following a drop, or other impact event, has been evaluated to be Beyond Category 2 based upon probabilities of independent events required for criticality.	Preventive	Design-Procedural Safety
	6. Criticality associated with a trolley (holding an unsealed, open WP) derailment followed by a load tipover or fall and a rearrangement of the container internals (Room 1097).	DTF-DPCWPDRM-F6	Beyond Category 2	Same disposition as Potential Event DTF-DPCWPDRM-F1.	Preventive	Design
	7. Criticality associated with the drop of heavy equipment onto an unsealed, open WP and a rearrangement of the container internals (Room 1097).	DTF-DPCWPDRM-F7	Beyond Category 2	Same disposition as Potential Event DTF-DPCWPDRM-F4. Additionally, a design requirement ensures that waste packages must demonstrate criticality safety with moderator control and must account for the bowing of fuel rods or other rearrangement of fissile material that may occur due to a drop or other handling incident. Design and operational requirements ensure that moderator control is in effect.	Preventive	Design-Procedural Safety

NOTES: CC = collision-crushing; CCF = chemical contamination flooding; CHF = Canister Handling Facility; DBGm = design basis ground motion; DPCWPDRM = dual-purpose canister waste package dry remediation; DTF = dry transfer facility (DTF 1 and DTF 2); EI = explosion-implosion; F = fissile; FT = fire-thermal; GET = generalized event tree; HLW = high-level radioactive waste; NA = not applicable; R = radiation; SNF = spent nuclear fuel; SRTC = site rail transfer cart.

The Event Sequence Designator is a unique event sequence index for each event in this table. The prefix identifies the building or facility, for example "DTF," the middle identifies an activity, room, or area, for example "DPCWPDRM," and the suffix identifies the hazard category and event number, for example "CC1." When an event sequence has been evaluated in a GET, the GET number is identified in the Disposition of Event column; the GET sequence alpha character is shown at the end of the Event Sequence Designator, for example "A."

GETs are discussed in Sections 6.3.1.1 to 6.3.1.24.

Table III-20. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Dry Remediation): Cask Docking/Dry Remediation Room (Room 1109), Tool Spare Transfer Room (Room 1127), Dual-purpose Canister Cutting/Waste Package Dry Remediation Cell (Room 1097)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Collision-Crushing	1. Collision involving the trolley holding the cask or MSC requiring remediation and the shield doors between the cask and MSC docking room and the cask/MSC turntable room, the cask/MSC turntable room and the cask preparation room, the cask preparation room and the DPC preparation/cask dry remediation room, the DPC preparation/cask dry remediation room and the DPC docking room, the DPC docking room and the cask docking/dry remediation room, or the cask docking/dry remediation room and the tool spare transfer room (Rooms 1069, 1073, 1074, 1100, 1101, 1109, and 1127).	DTF-DRMCDTDPC-CC1DTF-	Beyond Category 2	(See GET-22) A design requirement limits the speed of trolley movements such that a collision at the speed limit would not cause the trolley to drop its load.	Preventive	Design
	2. Shield doors between the cask and MSC docking room and the cask/MSC turntable room, the cask/MSC turntable room and the cask preparation room, the cask preparation room and the DPC preparation/cask dry remediation room, the DPC preparation/cask dry remediation room and the DPC docking room, the DPC docking room and the cask docking/dry remediation room, or the cask docking/dry remediation room and the tool spare transfer room close on the trolley holding the cask or MSC requiring remediation (Rooms 1069, 1073, 1074, 1100, 1101, 1109, and 1127).	DTF-DRMCDTDPC-CC2	Beyond Category 2	A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transfer trolley, site-rail transfer cart (SRTC), MSC transporter, WP transporter, would not cause a tipover of the conveyance or cause the conveyance to drop its load. A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transportation cask, transfer cask, or MSC suspended from an overhead crane would not cause the crane to drop its load.	Preventive	Design
	3. Derailment of a trolley in the cask and MSC docking room, the cask/MSC turntable room, the cask preparation room, the DPC preparation/cask dry remediation room, the DPC docking room, the cask docking/dry remediation room, or the tool spare transfer room while holding a cask or MSC, followed by a load tipover or fall (Rooms 1069, 1073, 1074, 1100, 1101, 1109, and 1127).	DTF-DRMCDTDPC-CC3	Beyond Category 2	A design requirement ensures that loaded transfer trolleys do not derail or drop their loads. Design requirements apply to trolleys for casks, waste packages, site-specific casks, and dual-purpose canisters.	Preventive	Design
	4. Drop or collision of tools or equipment onto or against a cask or MSC requiring remediation (Rooms 1069, 1073, 1074, 1100, 1101, 1109, and 1127).	DTF-DRMCDTDPC-CC4	Beyond Category 2	Operational requirement ensures that the handling equipment associated with cask handling and preparation is not capable of breaching a transportation cask, with or without impact limiters, or a site-specific cask if collided against the cask or dropped onto the cask from within the lift-height limit.	Preventive	Procedural Safety
	5. Collision involving an access platform or a mobile elevated platform (if required) and a cask or MSC requiring remediation (Rooms 1109 and 1127).	DTF-DRMCDTDPC-CC5	Beyond Category 2	Operational requirements ensure that the portable platforms, access platforms, mobile elevated platforms, and forklifts operated in the facility are not operated in a manner that could breach or overturn a loaded transportation cask or site-specific cask.	Preventive	Procedural Safety
	6. Collision of a trolley holding the cask or MSC requiring remediation with another trolley holding a cask or MSC on the turntable in the DPC docking room or on the tracks leading to the cask docking/dry remediation room or tool spare transfer room (Rooms 1101, 1109, and 1127).	DTF-DRMCDTDPC-CC6	Beyond Category 2	(See GET-22) Same disposition as Potential Event DTF-DRMCDTDPC-CC1.	Preventive	Design
	7. Drop or collision of a docking port (mobile slab) onto or against a cask or MSC (Rooms 1069 and 1109).	DTF-DRMCDTDPC-CC7	Beyond Category 2	A design requirement ensures that a drop of or collision involving components associated with a docking port will not breach the lid of a cask or MSC situated at the docking port.	Preventive	Design

Table III-20. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Dry Remediation): Cask Docking/Dry Remediation Room (Room 1109), Tool Spare Transfer Room (Room 1127), Dual-purpose Canister Cutting/Waste Package Dry Remediation Cell (Room 1097) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	8. Drop or collision of a docking port plug onto or against a cask lid or MSC lid (with outer lid removed [if applicable] and inner lid unbolted but in place) (Rooms 1069 and 1109).	DTF-DRMCDTDP-CC8	Beyond Category 2	Design requirements ensure that portions of a non-ITS SSC which, upon failure, could adversely interact with an ITS SSC and prevent its safety function from being performed are classified as ITS, redesigned to eliminate the potential unacceptable interaction with the identified ITS SSC, or, for seismic interactions, designed to the same seismic DBGM as the ITS SSCs subjected to the potential unacceptable interaction.	Preventive	Design
	9. Drop of an inner lid on a cask or MSC (with outer lid removed [if applicable]) (Rooms 1069 and 1109).	DTF-DRMCDTDP-CC9A DTF-DRMCDTDP-CC9B DTF-DRMCDTDP-CC9C DTF-DRMCDTDP-CC9D DTF-DRMCDTDP-CC9E DTF-DRMCDTDP-CC9F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-02) Design and operational requirements reduce the drop probability. Operational requirements limit the lift height of the inner lid of a transportation cask, transfer cask, site-specific cask, or waste package to ensure that a lid drop onto a DOE canister within that breaches the canister is a beyond Category 2 event sequence. Design and operational requirements limit the probability of exceeding the lift height. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multicask overpack is defective.	Preventive	Design- Procedural Safety
	10. Drop or collision of a grapple or other handling equipment into or against an open cask or MSC loaded with commercial SNF assemblies, a DPC, a DOE HLW canister, a DOE SNF MCO, or a [standardized] DOE SNF canister (Rooms 1069 and 1109).	DTF-DRMCDTDP-CC10aA DTF-DRMCDTDP-CC10aB DTF-DRMCDTDP-CC10bA DTF-DRMCDTDP-CC10bB DTF-DRMCDTDP-CC10bC DTF-DRMCDTDP-CC10bD DTF-DRMCDTDP-CC10bE DTF-DRMCDTDP-CC10bF	No drop Category 2 No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	CC10a. (See GET-18 for commercial SNF) Design and operational requirements reduce the probability of dropping handling equipment onto a SNF assembly energetically enough to breach the assembly. A design requirement ensures that the spent fuel transfer machine, fuel handling machine and other equipment designed to handle individual SNF assemblies are not capable of lateral movements of handling equipment at a speed that could initiate an event sequence as a result of collision with a SNF assembly. CC10b. (See GET-19 for non-commercial SNF) Design and operational requirements reduce the drop probability. An operational requirement ensures the establishment of a maximum lift height limit for handling equipment suspended above DOE SNF canisters. A design requirement ensures that the handling equipment is not capable of causing an event sequence due to a breach of a DOE SNF canister if dropped from within the lift-height limit. Design and operational requirements limit the probability of exceeding the lift height. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multicask overpack is defective.	Preventive	Design- Procedural Safety
	11. Drop or collision of an SNF assembly from the DPC cutting/WP dry remediation cell crane back into or against a cask or MSC being unloaded (Room 1109).	DTF-DRMCDTDP-CC11A DTF-DRMCDTDP-CC11B DTF-DRMCDTDP-CC11C	No drop Category 2 Category 2	(See GET-10) Design and operational requirements for commercial SNF handling equipment reduce the drop rate and collision probabilities for commercial SNF assembly transfers, including those in single-assembly canisters.	Preventive	Design- Procedural Safety
	12. Drop or collision of an SNF assembly from the DPC cutting/WP dry remediation cell crane onto or against another SNF assembly in a cask or MSC (Room 1109).	DTF-DRMCDTDP-CC12A DTF-DRMCDTDP-CC12B DTF-DRMCDTDP-CC12C	No drop Category 2 Category 2	(See GET-10) Same disposition as Potential Event DTF-DRMCDTDP-CC11.	Preventive	Design- Procedural Safety
	13. Impact due to horizontal movement of an SNF assembly by the DPC cutting/WP dry remediation cell crane before the assembly is completely removed from the cask or MSC (Room 1109).	DTF-DRMCDTDP-CC13A DTF-DRMCDTDP-CC13B DTF-DRMCDTDP-CC13C	No drop Category 2 Category 2	(See GET-10) Same disposition as Potential Event DTF-DRMCDTDP-CC11.	Preventive	Design- Procedural Safety
	14. Drop of an SNF assembly from the DPC cutting/WP dry remediation cell crane onto the DPC cutting/WP dry remediation cell floor (Rooms 1097, 1101, and 1109).	DTF-DRMCDTDP-CC14A DTF-DRMCDTDP-CC14B DTF-DRMCDTDP-CC14C	No drop Category 2 Category 2	(See GET-10) Same disposition as Potential Event DTF-DRMCDTDP-CC11.	Preventive	Design- Procedural Safety
	15. Collision involving an SNF assembly suspended from the DPC cutting/WP dry remediation cell crane with equipment located in the DPC cutting/WP dry remediation cell or on the cell floor (such as lid lifting equipment) (Rooms 1097, 1101, and 1109).	DTF-DRMCDTDP-CC15A DTF-DRMCDTDP-CC15B DTF-DRMCDTDP-CC15C	No drop Category 2 Category 2	(See GET-10) Same disposition as Potential Event DTF-DRMCDTDP-CC11.	Preventive	Design- Procedural Safety

Table III-20. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Dry Remediation): Cask Docking/Dry Remediation Room (Room 1109), Tool Spare Transfer Room (Room 1127), Dual-purpose Canister Cutting/Waste Package Dry Remediation Cell (Room 1097) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	16. Drop or collision of an SNF assembly from the DPC cutting/WP dry remediation cell crane onto or against a sharp object (Rooms 1097, 1101, and 1109).	DTF-DRMCDTDP-CC16A DTF-DRMCDTDP-CC16B DTF-DRMCDTDP-CC16C	No drop Category 2 Category 2	(See GET-10) Same disposition as Potential Event DTF-DRMCDTDP-CC11.	Preventive	Design- Procedural Safety
	17. Drop or collision of an SNF assembly from the DPC cutting/WP dry remediation cell crane into or against an empty basket located on a trolley in the DPC cutting/WP dry remediation cell (Room 1097).	DTF-DRMCDTDP-CC17A DTF-DRMCDTDP-CC17B DTF-DRMCDTDP-CC17C	No drop Category 2 Category 2	(See GET-10) Same disposition as Potential Event DTF-DRMCDTDP-CC11.	Preventive	Design- Procedural Safety
	18. Drop and slapdown of an SNF assembly from the DPC cutting/WP dry remediation cell crane (due to impact with an edge of the cask, MSC, basket, floor edge, basket internal baffle, etc.) during the transfer from the cask or MSC to a basket on a trolley in the DPC cutting/WP dry remediation cell (Rooms 1097, 1101, and 1109).	DTF-DRMCDTDP-CC18A DTF-DRMCDTDP-CC18B DTF-DRMCDTDP-CC18C	No drop Category 2 Category 2	(See GET-10) Same disposition as Potential Event DTF-DRMCDTDP-CC11.	Preventive	Design- Procedural Safety
	19. Drop or collision of a SNF assembly from the DPC cutting/WP dry remediation cell crane onto or against one or more SNF assemblies in a basket on a trolley in the DPC cutting/WP dry remediation cell (Room 1097).	DTF-DRMCDTDP-CC19A DTF-DRMCDTDP-CC19B DTF-DRMCDTDP-CC19C	No drop Category 2 Category 2	(See GET-10) Same disposition as Potential Event DTF-DRMCDTDP-CC11.	Preventive	Design- Procedural Safety
	20. Drop or collision of a DPC, a DOE HLW canister, a [standardized] DOE SNF canister, or a DOE SNF MCO from the DPC cutting/WP dry remediation cell crane back into or against the cask or MSC being unloaded, as applicable (Room 1109).	DTF-DRMCDTDP-CC20A DTF-DRMCDTDP-CC20B DTF-DRMCDTDP-CC20C DTF-DRMCDTDP-CC20D DTF-DRMCDTDP-CC20E DTF-DRMCDTDP-CC20F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-11) Design and operational requirements reduce the drop probability. A design requirement limits lift heights for DOE SNF canisters, DOE HLW canisters, and DOE SNF multiccanister overpacks. Design and operational requirements limit the probability of exceeding the lift height. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multiccanister overpack is defective. Design requirements ensure that standardized DOE SNF canisters would withstand without breach a drop of another standardized DOE SNF canister and that MCOs would withstand without breach a drop of another MCO dropped from within its lift-height limits. Operational requirements to not transfer a DOE SNF canister into or from the waste package if a DOE HLW canister is present in the same waste package precludes dropping a DOE SNF canister on a DOE HLW canister. For collisions, a design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design- Procedural Safety
	21. Drop or collision of a DPC, a DOE HLW canister, a [standardized] DOE SNF canister, or a DOE SNF MCO from the DPC cutting/WP dry remediation cell crane back onto or against a DPC, a DOE HLW canister, a [standardized] DOE SNF canister, or a DOE SNF MCO in the cask or MSC, as applicable (Room 1109).	DTF-DRMCDTDP-CC21A DTF-DRMCDTDP-CC21B DTF-DRMCDTDP-CC21C DTF-DRMCDTDP-CC21D DTF-DRMCDTDP-CC21E DTF-DRMCDTDP-CC21F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-11) Same disposition as Potential Event DTF-DRMCDTDP-CC20.	Preventive	Design- Procedural Safety
	22. Impact due to horizontal movement of a DPC, a DOE HLW canister, a [standardized] DOE SNF canister, or a DOE SNF MCO with the DPC cutting/WP dry remediation cell crane before the canister is completely removed from the cask or MSC, as applicable (Room 1109).	DTF-DRMCDTDP-CC22	Beyond Category 2	A design requirement ensures that cranes are not capable of exerting sufficient force to breach a transportation cask, MSC, waste package, or canister as the result of attempts to overcome mechanical constraints.	Preventive	Design

Table III-20. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Dry Remediation): Cask Docking/Dry Remediation Room (Room 1109), Tool Spare Transfer Room (Room 1127), Dual-purpose Canister Cutting/Waste Package Dry Remediation Cell (Room 1097) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	23. Drop and slapdown of a DPC, a DOE HLW canister, a DOE SNF MCO, or a [standardized] DOE SNF canister from the DPC cutting/WP dry remediation cell crane (due to impact with an edge of the cask, MSC, floor edge, basket internal baffle, etc.) during the transfer from the cask or MSC (as applicable) to a basket on a trolley in the DPC cutting/WP dry remediation cell (Rooms 1097, 1101, and 1109).	DTF-DRMCDTDP-CC23A DTF-DRMCDTDP-CC23B DTF-DRMCDTDP-CC23C DTF-DRMCDTDP-CC23D DTF-DRMCDTDP-CC23E DTF-DRMCDTDP-CC23F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-11) Same disposition as Potential Event DTF-DRMCDTDP-CC20.	Preventive	Design- Procedural Safety
	24. Drop or collision of a DPC, a DOE HLW canister, a [standardized] DOE SNF canister, or a DOE SNF MCO from the DPC cutting/WP dry remediation cell crane onto or against a sharp object (Rooms 1097, 1101, and 1109).	DTF-DRMCDTDP-CC24	Beyond Category 2	Design and operational requirements ensure that surfaces in the load paths through which WPs, DOE SNF canisters, naval canisters, DPCs, transportation casks, transfer casks, or MSCs are transferred by crane are kept free of structures, such as posts and curbs, that could puncture a container in case of a drop. An operational requirement ensures that the load paths are kept free of movable puncture hazards. A design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design- Procedural Safety
	25. Collision involving a DPC, a DOE HLW canister, a [standardized] DOE SNF canister, or a DOE SNF MCO suspended from the DPC cutting/WP dry remediation cell crane with equipment located in the DPC cutting/WP dry remediation cell or on the cell floor (Rooms 1097, 1101, and 1109).	DTF-DRMCDTDP-CC25	Beyond Category 2	A design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design
	26. Drop of a DPC, a DOE HLW canister, a [standardized] DOE SNF canister, or a DOE SNF MCO from the DPC cutting/WP dry remediation cell crane onto DPC cutting/WP dry remediation cell floor (Rooms 1097, 1101, and 1109).	DTF-DRMCDTDP-CC26A DTF-DRMCDTDP-CC26B DTF-DRMCDTDP-CC26C DTF-DRMCDTDP-CC26D DTF-DRMCDTDP-CC26E DTF-DRMCDTDP-CC26F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-11) Same disposition as Potential Event DTF-DRMCDTDP-CC20.	Preventive	Design- Procedural Safety
	27. Drop or collision of a DPC, a DOE HLW canister, a [standardized] DOE SNF canister, or a DOE SNF MCO from the DPC cutting/WP dry remediation cell crane into or against an empty basket on a trolley in the DPC cutting/WP dry remediation cell (Room 1097).	DTF-DRMCDTDP-CC27A DTF-DRMCDTDP-CC27B DTF-DRMCDTDP-CC27C DTF-DRMCDTDP-CC27D DTF-DRMCDTDP-CC27E DTF-DRMCDTDP-CC27F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-11) Same disposition as Potential Event DTF-DRMCDTDP-CC20.	Preventive	Design- Procedural Safety
	28. Drop or collision of a DOE HLW canister from the DPC cutting/WP dry remediation cell crane onto or against another DOE HLW canister, a [standardized] DOE SNF canister or a DOE SNF MCO in a basket, as applicable, on a trolley in the DPC cutting/WP dry remediation cell (Room 1097).	DTF-DRMCDTDP-CC28A DTF-DRMCDTDP-CC28B	No drop Category 2	(See GET-11 Sequences A and B only) Design and operational requirements reduce the drop probability. For collisions, a design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design- Procedural Safety
	29. Drop or collision of a [standardized] DOE SNF canister from the DPC cutting/WP dry remediation cell crane onto or against a DOE HLW canister, as applicable, in a basket on a trolley in the DPC cutting/WP dry remediation cell (Room 1097).	DTF-DRMCDTDP-CC29C DTF-DRMCDTDP-CC29D DTF-DRMCDTDP-CC29E DTF-DRMCDTDP-CC29F	No drop No breach Beyond Category 2 Beyond Category 2	(See GET-11 Sequences C to F only) Same disposition as Potential Event DTF-DRMCDTDP-CC20.	Preventive	Design- Procedural Safety

Table III-20. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Dry Remediation): Cask Docking/Dry Remediation Room (Room 1109), Tool Spare Transfer Room (Room 1127), Dual-purpose Canister Cutting/Waste Package Dry Remediation Cell (Room 1097) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	30. Drop or collision of a DOE SNF MCO from the DPC cutting/WP dry remediation cell crane onto or against another DOE SNF MCO or a DOE HLW canister, as applicable, in a basket on a trolley in the DPC cutting/WP dry remediation cell (Room 1097).	DTF-DRMCDTDP-CC30C DTF-DRMCDTDP-CC30D DTF-DRMCDTDP-CC30E DTF-DRMCDTDP-CC30F	No drop No breach Beyond Category 2 Beyond Category 2	(See GET-11 Sequences C to F only) Same disposition as Potential Event DTF-DRMCDTDP-CC20.	Preventive	Design- Procedural Safety
	31. Drop or collision of handling equipment from the DPC cutting/WP dry remediation cell crane into or against a basket on a trolley in the DPC cutting/WP dry remediation cell filled with SNF assemblies (Room 1097).	DTF-DRMCDTDP-CC31A DTF-DRMCDTDP-CC31B	No drop Category 2	(See GET-18) Design and operational requirements reduce the probability of dropping handling equipment onto a SNF assembly energetically enough to breach the assembly. A design requirement ensures that the spent fuel transfer machine, fuel handling machine and other equipment designed to handle individual SNF assemblies are not capable of lateral movements of handling equipment at a speed that could initiate an event sequence as a result of collision with a SNF assembly.	Preventive	Design- Procedural Safety
	32. Drop or collision of handling equipment from the DPC cutting/WP dry remediation cell crane into or against a basket on a trolley in the DPC cutting/WP dry remediation cell loaded with DOE HLW canisters, and/or a [standardized] DOE SNF canister, and/or DOE SNF MCOs, as applicable (Room 1097).	DTF-DRMCDTDP-CC32A DTF-DRMCDTDP-CC32B DTF-DRMCDTDP-CC32C DTF-DRMCDTDP-CC32D DTF-DRMCDTDP-CC32E DTF-DRMCDTDP-CC32F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(Bounded by GET-06) In this potential event, a drop has to occur to cause a collision because the equipment would be suspended above the canister. Design and operational requirements reduce the drop probability. An operational requirement ensures the establishment of a maximum lift height limit for handling equipment suspended above DOE SNF canisters. A design requirement ensures that the handling equipment is not capable of causing an event sequence due to a breach of a DOE SNF canister if dropped from within the lift-height limit. Design and operational requirements limit the probability of exceeding the lift height.	Preventive	Design- Procedural Safety
	33. Drop or collision of handling equipment from the DPC cutting/WP dry remediation cell crane into or against a basket on a trolley in the DPC cutting/WP dry remediation cell loaded with a DPC (if not emptied), (Room 1097).	DTF-DRMCDTDP-CC33A DTF-DRMCDTDP-CC33B	No drop Category 2	(See GET-18) Same disposition as Potential Event DTF-DRMCDTDP-CC31.	Preventive	Design- Procedural Safety
	34. Derailment of a trolley (that travels to the unloading port to the waste transfer cell) holding a loaded basket containing SNF assemblies in the DPC cutting/WP dry remediation cell, followed by a load tipover or fall (Room 1097).	DTF-DRMCDTDP-CC34	Beyond category 2	A design requirement ensures that loaded transfer trolleys do not derail or drop their loads. Design requirements apply to trolleys for casks, waste packages, site-specific casks, and dual-purpose canisters.	Preventive	Design
	35. Derailment of a trolley (that travels to the unloading port to the waste transfer cell) holding a loaded basket containing a DPC (if not emptied), or a combination of DOE HLW canisters, [standardized] DOE SNF canisters, or DOE SNF MCOs, as applicable, in the DPC cutting/WP dry remediation cell, followed by a load tipover or fall (Room 1097).	DTF-DRMCDTDP-CC35	Beyond category 2	Same disposition as Potential Event DTF-DRMCDTDP-CC34.	Preventive	Design
	36. Drop or collision of an SNF assembly from the spent fuel transfer machine back into or against the basket on a trolley that is being unloaded. (Room 1097).	DTF-DRMCDTDP-CC36A DTF-DRMCDTDP-CC36B DTF-DRMCDTDP-CC36C	No drop Category 2 Category 2	(See GET-10) Same disposition as Potential Event DTF-DRMCDTDP-CC11.	Preventive	Design- Procedural Safety
	37. Drop or collision of a SNF assembly from the spent fuel transfer machine back onto or against another SNF assembly or assemblies in the basket on a trolley (Room 1097).	DTF-DRMCDTDP-CC37A DTF-DRMCDTDP-CC37B DTF-DRMCDTDP-CC37C	No drop Category 2 Category 2	(See GET-10) Same disposition as Potential Event DTF-DRMCDTDP-CC11.	Preventive	Design- Procedural Safety
	38. Impact due to horizontal movement of a SNF assembly by the spent fuel transfer machine before the assembly is fully lifted out of the basket on a trolley (Room 1097).	DTF-DRMCDTDP-CC38A DTF-DRMCDTDP-CC38B DTF-DRMCDTDP-CC38C	No drop Category 2 Category 2	(See GET-10) Same disposition as Potential Event DTF-DRMCDTDP-CC11.	Preventive	Design- Procedural Safety

Table III-20. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Dry Remediation): Cask Docking/Dry Remediation Room (Room 1109), Tool Spare Transfer Room (Room 1127), Dual-purpose Canister Cutting/Waste Package Dry Remediation Cell (Room 1097) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	39. Drop and slapdown of an SNF assembly from the spent fuel transfer machine (due to impact with an edge of the basket, the floor edge, a basket internal baffle, etc.) during the SNF transfer from the basket on the trolley to a WP or staging rack (Room 2048)	DTF-DRMCDTPC-CC39A DTF-DRMCDTPC-CC39B DTF-DRMCDTPC-CC39C	No drop Category 2 Category 2	(See GET-10) Same disposition as Potential Event DTF-DRMCDTPC-CC11.	Preventive	Design- Procedural Safety
	40. Drop or collision of a DPC (if not emptied), a DOE HLW canister, a [standardized] DOE SNF canister, or a DOE SNF MCO, as applicable, from the waste transfer cell overhead crane back into or against the basket on a trolley being unloaded (Room 2048).	DTF-DRMCDTPC-CC40A DTF-DRMCDTPC-CC40B DTF-DRMCDTPC-CC40C DTF-DRMCDTPC-CC40D DTF-DRMCDTPC-CC40E DTF-DRMCDTPC-CC40F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-11) Same disposition as Potential Event DTF-DRMCDTPC-CC20.	Preventive	Design- Procedural Safety
	41. Impact due to horizontal movement of a DPC (if not emptied), a DOE HLW canister, a [standardized] DOE SNF canister, or DOE SNF MCO, as applicable, with the waste transfer cell overhead crane before the canister is completely removed from the basket on a trolley (Room 2048).	DTF-DRMCDTPC-CC41	Beyond Category 2	A design requirement ensures that cranes are not capable of exerting sufficient force during a transfer to breach a transportation cask, site-specific cask, waste package, or canister as the result of attempts to overcome mechanical constraints.	Preventive	Design
	42. Drop or collision of a DOE HLW canister from the waste transfer cell crane back onto or against another DOE HLW canister, a [standardized] DOE SNF canister, or a DOE SNF MCO, as applicable, in the basket on a trolley (Room 2048).	DTF-DRMCDTPC-CC42A DTF-DRMCDTPC-CC42B	No drop Category 2	(See GET-05 Sequences A and B only) Design and operational requirements reduce the drop probability. For collisions, a design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design- Procedural Safety
	43. Drop or collision of a [standardized] DOE SNF canister from the waste transfer cell crane onto or against a DOE HLW canister in the basket on a trolley (Room 2048).	DTF-DRMCDTPC-CC43C DTF-DRMCDTPC-CC43D DTF-DRMCDTPC-CC43E DTF-DRMCDTPC-CC43F	No drop No breach Beyond Category 2 Beyond Category 2	(See GET-05 Sequences C to F only) Design and operational requirements reduce the drop probability. A design requirement limits lift heights for DOE SNF canisters, DOE HLW canisters, naval canisters, DPCs, and DOE SNF multicaster overpacks. Design and operational requirements limit the probability of exceeding the lift height. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multicaster overpack is defective. Design requirements ensure that standardized DOE SNF canisters, would withstand without breach a drop of another standardized DOE SNF canister and that MCOs would withstand without breach a drop of another MCO dropped from within its lift-height limits. Operational controls render dropping a DOE SNF canister on a DOE HLW canister Beyond Category 2. A design requirement ensures that a DOE SNF canister in a cask, WP, staging rack, or staging pit would withstand without breach the drop of a DOE HLW canister on top of the DOE SNF canister from within their lift height limits. Neither naval canisters nor MCOs are staged in staging racks. For collisions, a design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design- Procedural Safety
	44. Drop or collision of a DOE SNF MCO from the waste transfer cell crane onto or against another DOE SNF MCO or a DOE HLW canister, as applicable, in the basket on a trolley (Room 2048).	DTF-DRMCDTPC-CC44C DTF-DRMCDTPC-CC44D DTF-DRMCDTPC-CC44E DTF-DRMCDTPC-CC44F	No drop No breach Beyond Category 2 Beyond Category 2	(See GET-05 Sequences C to F only) Same disposition as Potential Event DTF-DRMCDTPC-CC43.	Preventive	Design- Procedural Safety
	45. Drop and slapdown of a DOE HLW canister, a DOE SNF MCO, or a [standardized] DOE SNF canister, as applicable, from the waste transfer cell overhead crane (due to impact with an edge of the basket, floor edge, basket internal baffle, etc.) during the transfer from the basket on a trolley to a new WP or staging rack (if applicable) (Room 2048).	DTF-DRMCDTPC-CC45A DTF-DRMCDTPC-CC45B DTF-DRMCDTPC-CC45C DTF-DRMCDTPC-CC45D DTF-DRMCDTPC-CC45E DTF-DRMCDTPC-CC45F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-11) Same disposition as Potential Event DTF-DRMCDTPC-CC20.	Preventive	Design- Procedural Safety

Table III-20. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Dry Remediation): Cask Docking/Dry Remediation Room (Room 1109), Tool Spare Transfer Room (Room 1127), Dual-purpose Canister Cutting/Waste Package Dry Remediation Cell (Room 1097) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	46. Drop or collision of handling equipment from the spent fuel transfer machine into or against a basket on a trolley filled with SNF assemblies (Room 2048).	DTF-DRMCDTDP-CC46A DTF-DRMCDTDP-CC46B	No drop Category 2	(See GET-18) Same disposition as Potential Event DTF-DRMCDTDP-CC31.	Preventive	Design- Procedural Safety
	47. Drop or collision of handling equipment from the waste transfer cell overhead crane into or against a basket on a trolley loaded with DOE HLW canisters, and/or [standardized] DOE SNF canisters, and/or DOE SNF MCOs, as applicable (Room 2048).	DTF-DRMCDTDP-CC47A DTF-DRMCDTDP-CC47B DTF-DRMCDTDP-CC47C DTF-DRMCDTDP-CC47D DTF-DRMCDTDP-CC47E DTF-DRMCDTDP-CC47F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-06) Same disposition as Potential Event DTF-DRMCDTDP-CC32.	Preventive	Design- Procedural Safety
Chemical Contamination-Flooding	1. Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures (Rooms 1097, 1101, 1109, 1127, and 2048).	DTF-DRMCDTDP-CCF1	Normal Operations	Oxidation of failed commercial SNF is expected as a part of normal operations whenever commercial SNF is exposed to air. Any resulting potential exposure of workers to radiation is managed as a normal-operations dose by procedures that ensure that workers do not receive excessive radiation doses.	Mitigative	Procedural Safety
Explosion-Implosion	1. Hydrogen explosion involving batteries on a mobile elevated platform (Rooms 1109 and 1127).	DTF-DRMCDTDP-EI1	Beyond Category 2	Operational controls pertaining to batteries for powering heavy equipment ensure the generation or accumulation of enough hydrogen gas to cause an explosion that could breach a transportation cask, site-specific cask, or waste package is prevented.	Preventive	Procedural Safety
	2. Explosion hazard associated with the cask and MSC sampling and purging system and the ignition of hydrogen that may have accumulated in the cask or MSC (Room 1127).	DTF-DRMCDTDP-EI2	Beyond Category 2	Operational requirements ensure that precautions taken during the cask sampling and purging process provide reasonable assurance that such hydrogen explosions would not occur.	Preventive	Procedural Safety
Fire-Thermal	1. Electrical fire associated with tools or SNF and HLW handling equipment in the cask docking/dry remediation room, the tool spare transfer room, or the DPC cutting/WP dry remediation cell (including the overhead cranes, overhead manipulators, turntable, etc.) (Rooms 1097, 1109, and 1127).	DTF-DRMCDTDP-FT1	Beyond Category 2	Design and operational requirements ensure control of the presence and amount of combustibles in the different areas of the repository to preclude any Category 1 or Category 2 event sequences potentially initiated by a fire.	Preventive	Design- Procedural Safety
	2. Intact or non-intact SNF overheating or damage to canister contents due to a loss of cooling resulting in excessive temperature and possible zircaloy cladding (or other cladding) unzipping or cladding failure due to excessive hoop stresses (Rooms 1097, 1101, 1109, 1127, and 2048).	DTF-DRMCDTDP-FT2	Beyond Category 2	If ventilation is lost in areas where DOE or naval canisters are handled, no radiological release occurs from the canisters because containment within the canisters is maintained. Design and operational requirements ensure that the thermal response of areas where CSNF assemblies are handled or staged to a loss of HVAC would not cause radiological releases in excess of those considered in the consequence analysis for normal operations.	Preventive	Design- Procedural Safety
	3. Thermal hazard (from decay heat) associated with vertical orientation of the cask, MSC, or basket (Rooms 1097, 1109, and 1127)	DTF-DRMCDTDP-FT3	Normal Operations	Same disposition as Potential Event DTF-DRMCDTDP-CCF1.	Mitigative	Procedural Safety
	4. Transient combustible fire in the cask docking/dry remediation room, the tool spare transfer room, or the DPC cutting/WP dry remediation cell (Rooms 1097, 1109, and 1127).	DTF-DRMCDTDP-FT4	Beyond Category 2	Same disposition as Potential Event DTF-DRMCDTDP-FT1.	Preventive	Design- Procedural Safety
	5. Electrical fire associated with the trolley (Rooms 1097, 1101, 1109, and 1127).	DTF-DRMCDTDP-FT5	Beyond Category 2	Same disposition as Potential Event DTF-DRMCDTDP-FT1.	Preventive	Design- Procedural Safety
	6. Fire/explosion (battery/electrical fire) associated with a mobile elevated platform (Rooms 1109 and 1127).	DTF-DRMCDTDP-FT6	Beyond Category 2	Same disposition as Potential Event DTF-DRMCDTDP-FT1.	Preventive	Design- Procedural Safety

Table III-20. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Dry Remediation): Cask Docking/Dry Remediation Room (Room 1109), Tool Spare Transfer Room (Room 1127), Dual-purpose Canister Cutting/Waste Package Dry Remediation Cell (Room 1097) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Radiation	1. Radiation exposure of a facility worker and/or the offsite public (Rooms 1097, 1101, 1109, 1127, and 2048).	DTF-DRMCDTDP-C-R1	NA—Accounted for in consequence analyses, if applicable	NA—Potential exposure of workers or the public to radiation is a hazard for the event sequences considered in this analysis. Consequence analyses evaluate this hazard for Category 1 and Category 2 event sequences, as applicable.	NA	NA
			Normal Operations	Some exposure to radiation is expected as a part of normal facility operations. Exposures are managed by design features and procedures that ensure that workers or the public do not receive excessive radiation doses.	Mitigative	Design-Procedural Safety
	2. Damage or rupture of the cask and MSC sampling and purging system, leading to a release of canister internal gases and radioactive material (Room 1127).	DTF-DRMCDTDP-C-R2	Normal Operations	The sampling operation is conducted so that exposure of workers to radiation is managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. Although a rupture leading to a radiological release would be an off-normal occurrence, any release and related dose would be managed as part of routine radiation protection operations.	Mitigative	Procedural Safety
	3. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation (Rooms 1097, 1101, 1109, 1127, and 2048).	DTF-DRMCDTDP-C-R3	NA (no significant exposure)	Operating procedures ensure that a loss of confinement during otherwise normal operations does not cause individuals to be exposed to significant amounts of radioactivity.	Mitigative	Procedural Safety
	4. Thermal expansion of gases or other loss of confinement in an unsealed cask or MSC, leading to radiological release (Rooms 1097, 1101, 1109, 1127, and 2048).	DTF-DRMCDTDP-C-R4	Normal Operations	Thermal expansion of gases is to be expected as a part of normal operations. Any resulting potential exposure of workers to radiation is managed as a normal-operations dose by procedures that ensure that workers do not receive excessive radiation doses.	Mitigative	Procedural Safety
	5. Radiation-induced damage to a facility SSC (Rooms 1097, 1101, 1109, 1127, and 2048).	DTF-DRMCDTDP-C-R5	NA	Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization.	NA	NA
Fissile	1. Criticality associated with a trolley derailment (holding a cask or MSC requiring remediation) followed by a load tipover or fall and a rearrangement of the container internals (Rooms 1097, 1101, 1109, and 1127).	DTF-DRMCDTDP-C-F1	Beyond Category 2	Same disposition as Potential Event DTF-DRMCDTDP-C-CC3.	Preventive	Design
	2. Criticality associated with a drop of an SNF assembly from the DPC cutting/WP dry remediation cell crane back into the cask or MSC being unloaded or drop into a basket on a trolley being unloaded and a rearrangement of the cask, MSC, or basket internals (Room 1097).	DTF-DRMCDTDP-C-F2	Beyond Category 2	Design requirements and waste acceptance criteria ensure criticality safety in transportation casks, transfer casks, site-specific casks, CSNF baskets in dry processing areas, and dual-purpose canisters even with most reactive credible configuration of fissile material and with optimal moderation. Demonstration of compliance must account for the bowing of fuel rods or other rearrangement of fissile material that may occur due to a drop or other handling incident.	Preventive	Design
	3. Criticality associated with a drop or slapdown of a [standardized] DOE SNF canister, a DOE SNF MCO, or a DOE HLW canister from DPC cutting/WP dry remediation cell crane during cask or MSC unloading or basket on a trolley loading (as applicable) (Room 1097).	DTF-DRMCDTDP-C-F3	Beyond Category 2	A design requirement ensures that dropping a DOE SNF canister within its design basis does not lead to a criticality. Demonstration of compliance for the staging rack must account for the most reactive configuration of DOE SNF canisters with credit for moderator control. Design and operational requirements ensure that moderator control is in effect. There is no potential for criticality of DOE HLW canisters.	Preventive	Design-Procedural Safety
	4. Criticality associated with a trolley (holding a basket containing SNF assemblies, a naval SNF canister, or various combinations of [standardized] DOE SNF canisters, DOE SNF MCOs, or DOE HLW canisters) derailment followed by a load tipover or fall and a rearrangement of the basket contents (Rooms 1097, 1101, 1109, and 1127).	DTF-DRMCDTDP-C-F4	Beyond Category 2	Same disposition as Potential Event DTF-DRMCDTDP-C-F1.	Preventive	Design
	5. Criticality associated with a drop of an SNF assembly from the spent fuel transfer machine back into the basket on a trolley being unloaded and a rearrangement of the basket contents (Room 2048).	DTF-DRMCDTDP-C-F5	Beyond Category 2	Same disposition as Potential Events DTF-DRMCDTDP-C-F2. Additionally, results of criticality analyses ensure that drops, collisions, and other handling impacts of a commercial SNF assembly, allowing for rearrangement of fuel rods and without credit for burnup or moderator control, do not pose a criticality safety concern.	Preventive	Design

Table III-20. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Dry Remediation): Cask Docking/Dry Remediation Room (Room 1109), Tool Spare Transfer Room (Room 1127), Dual-purpose Canister Cutting/Waste Package Dry Remediation Cell (Room 1097) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	6. Criticality associated with a drop of an SNF assembly from the DPC cutting/WP dry remediation cell crane back into the cask or MSC being unloaded or onto the DPC cutting/WP dry remediation cell floor and a rearrangement of the fuel rods that comprise the assembly due to impact (Room 1097).	DTF-DRMCDTDP-C-F6	Beyond Category 2	Same disposition as Potential Events DTF-DRMCDTDP-C-F5.	Preventive	Design
	7. Criticality associated with a drop or slapdown of a [standardized] DOE SNF canister, a DOE SNF MCO, or a DOE HLW canister from waste transfer cell crane during the unloading of the basket on a trolley (as applicable) (Room 2048).	DTF-DRMCDTDP-C-F7	Beyond Category 2	Same disposition as Potential Events DTF-DRMCDTDP-C-F3.	Preventive	Design-Procedural Safety
	8. Criticality associated with the drop of heavy equipment (lifting fixture, etc.) onto a basket on a trolley and a rearrangement of the basket contents (Room 1097).	DTF-DRMCDTDP-C-F8	Beyond Category 2	An operational requirement establishes limited lift heights of heavy equipment above an SNF assembly, a DOE SNF or HLW canister, or a DPC in a fuel basket on a trolley in the dry remediation area such that criticality as the result of equipment drop is precluded with moderator control in effect.	Preventive	Procedural Safety

NOTES: CC = collision-crushing; CCF = chemical contamination flooding; DRMCDTDP-C = dry remediation cask docking tool dual purpose canister; DTF = dry transfer facility (DTF 1 and DTF 2); EI = explosion-implosion; F = fissile; FT = fire-thermal; GET = generalized event tree; HLW = high-level radioactive waste; NA = not applicable; R = radiation; SNF = spent nuclear fuel; SRTC = site rail transfer cart.

The Event Sequence Designator is a unique event sequence index for each event in this table. The prefix identifies the building or facility, for example "DTF," the middle identifies an activity, room, or area, for example "DRMCDTDP-C," and the suffix identifies the hazard category and event number, for example "CC1." When an event sequence has been evaluated in a GET, the GET is identified in the Disposition of Event column; the GET sequence alpha character is shown at the end of the Event Sequence Designator, for example "A."

Additional room(s) with potential events in this table: Room 1069 - Cask and MSC docking room; Room 1073 - Cask/MSR turntable room; Room 1074 - Cask preparation room; Room 1100 - DPC preparation/cask dry remediation; Room 1101 - DPC docking room; Room 2048 - Waste transfer cell.

GETs are discussed in Sections 6.3.1.1 to 6.3.1.24.

Table III-21. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Wet Remediation): Cask Wet Remediation-Laydown Area (Room 1117), Cask Wet Remediation Entrance Vestibule (Room 1120)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Collision-Crushing	1. Collision involving the trolley (holding the cask or MSC to be remediated) and the doors to the cask wet remediation entrance vestibule, the shield doors between the cask wet remediation entrance vestibule and the cask wet remediation-laydown area, or the shield doors between the DPC docking room and the cask wet remediation-laydown area (Rooms 1117 and 1120).	DTF-WREMLDEV-CC1	Beyond Category 2	(See GET-22) A design requirement limits the speed of trolley movements such that a collision at the speed limit would not cause the trolley to drop its load.	Preventive	Design
	2. Doors to the cask wet remediation entrance vestibule, the shield doors between the cask wet remediation entrance vestibule and the cask wet remediation-laydown area, or the shield doors between the DPC docking room and the cask wet remediation-laydown area close on the trolley (holding the cask or MSC to be remediated) (Rooms 1117 and 1120).	DTF-WREMLDEV-CC2	Beyond Category 2	A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transfer trolley, site-rail transfer cart (SRTC), MSC transporter, WP transporter, would not cause a tipover of the conveyance or cause the conveyance to drop its load. A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transportation cask, transfer cask, or MSC suspended from an overhead crane would not cause the crane to drop its load.	Preventive	Design
	3. Derailment of a trolley in the cask wet remediation-laydown area while holding a cask or MSC to be remediated, followed by a load tipover or fall (Rooms 1117 and 1120).	DTF-WREMLDEV-CC3	Beyond Category 2	A design requirement ensures that loaded transfer trolleys do not derail or drop their loads. Design requirements apply to trolleys for casks, waste packages, site-specific casks, and dual-purpose canisters.	Preventive	Design
	4. SRTC derailment involving a loaded cask (with or without impact limiters installed) or MSC (Rooms 1117 and 1120).	DTF-WREMLDEV-CC4	Beyond Category 2	A design requirement ensures that the SRTC carrying a cask without impact limiters (typically only within structures) or a site-specific cask does not derail and the cask or site-specific cask does not fall off the SRTC under normal operating conditions or as the result of a collision.	Preventive	Design
	5. Collision of an SRTC carrying a loaded cask (with or without impact limiters installed) or MSC with the cask wet remediation entrance vestibule doors or the cask wet remediation-laydown area shield doors (Rooms 1117 and 1120).	DTF-WREMLDEV-CC5	Beyond Category 2	Design and operational requirements establish speed limits such that a collision with shield or airlock doors or other heavy objects would not overturn an SRTC, or site-specific cask transporter or cause it to lose its load.	Preventive	Design-Procedural Safety
	6. Cask wet remediation entrance vestibule doors or the cask wet remediation-laydown area shield doors close on an SRTC carrying a loaded cask (with or without impact limiters installed) or MSC (Rooms 1117 and 1120).	DTF-WREMLDEV-CC6	Beyond Category 2	Same disposition as Potential Event DTF-WREMLDEV-CC2.	Preventive	Design
	7. Collision of a mobile elevated platform with a loaded cask or MSC during removal of personnel barriers and impact limiters (if applicable) or during survey activities (Room 1117).	DTF-WREMLDEV-CC7	Beyond Category 2	Operational requirements ensure that the portable platforms, access platforms, mobile elevated platforms, and forklifts operated in the facility are not operated in a manner that could breach or overturn a loaded transportation cask or site-specific cask.	Preventive	Procedural Safety
	8. Drop or collision of personnel barriers or impact limiters from the cask wet remediation-laydown area crane onto or against a loaded cask (if applicable) (Room 1117).	DTF-WREMLDEV-CC8	Beyond Category 2	An operational requirement ensures that the equipment associated with cask handling and preparation is not capable of breaching a transportation cask, with or without impact limiters, or a site-specific cask if collided against the cask or dropped onto the cask from the lift-height limit.	Preventive	Procedural Safety

Table III-21. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Wet Remediation): Cask Wet Remediation-Laydown Area (Room 1117), Cask Wet Remediation Entrance Vestibule (Room 1120) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	9. Slapdown of a loaded cask onto an SRTC during upending of the loaded cask to the vertical orientation (Room 1117).	DTF-WREMLDEV-CC9A DTF-WREMLDEV-CC9B DTF-WREMLDEV-CC9C DTF-WREMLDEV-CC9D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-01) Design and operational requirements reduce the drop probability. Design requirements limit the lift height for transportation and transfer casks without impact limiters and site-specific casks. Design and operational requirements limit the probability of exceeding the lift height. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multicanister overpack is defective.	Preventive	Design-Procedural Safety
	10. Drop and slapdown of a loaded MSC onto an SRTC or the floor during the lift of the loaded MSC off of the SRTC (Room 1117).	DTF-WREMLDEV-CC10A DTF-WREMLDEV-CC10B DTF-WREMLDEV-CC10C DTF-WREMLDEV-CC10D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-01) Same disposition as Potential Event DTF-WREMLDEV-CC9.	Preventive	Design-Procedural Safety
	11. Drop of a loaded cask or MSC from the overhead bridge crane onto the floor during transfer from the trolley or SRTC to the cask decontamination pit/cask prep pit (Room 1117).	DTF-WREMLDEV-CC11A DTF-WREMLDEV-CC11B DTF-WREMLDEV-CC11C DTF-WREMLDEV-CC11D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-13) Design and operational requirements reduce the drop probability. Design requirements limit the lift height for transportation and transfer casks without impact limiters and site-specific casks. Design and operational requirements limit the probability of exceeding the lift height. An operational requirement prohibits carrying a cask or MSC over or near the SNF assembly staging rack in the pool. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multicanister overpack is defective.	Preventive	Design-Procedural Safety
	12. Drop or collision of a loaded cask or MSC from the overhead bridge crane onto or against a sharp object during transfer from the trolley or SRTC to the cask decontamination pit/cask prep pit (Room 1117).	DTF-WREMLDEV-CC12	Beyond Category 2	Design and operational requirements ensure that surfaces in the load paths through which WPs, DOE SNF canisters, naval canisters, DPCs, transportation casks, transfer casks, or MSCs are transferred by crane are kept free of structures; such as posts and curbs, that could puncture a container in case of a drop. An operational requirement ensures that the load paths are kept free of movable puncture hazards. A design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design-Procedural Safety
	13. Drop or collision of a loaded cask or MSC from the overhead bridge crane into or against the cask decontamination pit/cask prep pit during transfer from the trolley or SRTC to the cask decontamination pit/cask prep pit (Room 1117).	DTF-WREMLDEV-CC13A DTF-WREMLDEV-CC13B DTF-WREMLDEV-CC13C DTF-WREMLDEV-CC13D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-13) Same disposition as Potential Event DTF-WREMLDEV-CC11. For collisions, a design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design-Procedural Safety
	14. Tipover or slapdown of a loaded cask or MSC from the overhead bridge crane into the cask decontamination pit/cask prep pit or onto the floor due to contact with the pit ledge or access platform during transfer from the trolley or SRTC to the cask decontamination pit/cask prep pit (Room 1117).	DTF-WREMLDEV-CC14A DTF-WREMLDEV-CC14B DTF-WREMLDEV-CC14C DTF-WREMLDEV-CC14D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-13) Same disposition as Potential Event DTF-WREMLDEV-CC11.	Preventive	Design-Procedural Safety -
	15. Drop or collision of handling equipment (including the cask lifting yoke, cask skirt, cask skirt lifting beam, and cask immersion rod) onto or against the cask or MSC before or after transfer of the cask to the cask decontamination pit/cask prep pit (Room 1117).	DTF-WREMLDEV-CC15	Beyond Category 2	Same disposition as Potential Event DTF-WREMLDEV-CC8.	Preventive	Procedural Safety
	16. Collision involving an access platform and a cask or MSC in the cask decontamination pit/cask prep pit (Room 1117).	DTF-WREMLDEV-CC16	Beyond Category 2	Same disposition as Potential Event DTF-WREMLDEV-CC7.	Preventive	Procedural Safety

Table III-21. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Wet Remediation): Cask Wet Remediation-Laydown Area (Room 1117), Cask Wet Remediation Entrance Vestibule (Room 1120) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	17. Drop or collision of the cask lid bolt detorque machine or other cask prep equipment onto or against a loaded cask or MSC or cask or MSC inner lid (including a lid-lifting fixture, cask gas sample/purge system equipment, cask cool-down equipment, etc.) (Room 1117).	DTF-WREMLDEV-CC17	Beyond Category 2	An operational requirement ensures that the lift height permitted for the lid-bolt detorque machines in the dry-handling cell and the pool area are such that the lid of the transportation cask or site-specific cask, without credit for the bolts, are able to prevent a potential radiological release should the detorque machine fall onto or collide with the transportation cask.	Preventive	Procedural Safety
	18. Drop of a cask or MSC outer lid from the overhead crane onto the cask or MSC (Room 1117).	DTF-WREMLDEV-CC18A DTF-WREMLDEV-CC18B DTF-WREMLDEV-CC18C DTF-WREMLDEV-CC18D DTF-WREMLDEV-CC18E DTF-WREMLDEV-CC18F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(Bounded by GET-02) Design and operational requirements reduce the drop probability. Operational requirements limit the lift height of the inner lid of a transportation cask, transfer cask, site-specific cask, or waste package to ensure that a lid drop onto a DOE canister within that breaches the canister is a beyond Category 2 event sequence. Design and operational requirements limit the probability of exceeding the lift height. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multiccanister overpack is defective.	Preventive	Design-Procedural Safety
	19. Drop or collision of a loaded cask or MSC from the overhead bridge crane back into or against a pit during transfer from the cask decontamination pit/cask prep pit into the pool (Room 1117).	DTF-WREMLDEV-CC19A DTF-WREMLDEV-CC19B DTF-WREMLDEV-CC19C DTF-WREMLDEV-CC19D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-13) Same disposition as Potential Event DTF-WREMLDEV-CC13.	Preventive	Design-Procedural Safety
	20. Drop of a loaded cask or MSC from the overhead bridge crane onto the cell floor during transfer from the cask decontamination pit/cask prep pit into the pool (Room 1117).	DTF-WREMLDEV-CC20A DTF-WREMLDEV-CC20B DTF-WREMLDEV-CC20C DTF-WREMLDEV-CC20D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-13) Same disposition as Potential Event DTF-WREMLDEV-CC11.	Preventive	Design-Procedural Safety
	21. Drop or collision of a loaded cask or MSC from the overhead bridge crane onto or against a sharp object during transfer from the cask decontamination pit/cask prep pit into the pool (Room 1117).	DTF-WREMLDEV-CC21	Beyond Category 2	Same disposition as Potential Event DTF-WREMLDEV-CC12.	Preventive	Design-Procedural Safety
	22. Drop of a loaded cask or MSC from the overhead bridge crane onto the pool floor during transfer from the cask decontamination pit/cask prep pit into the pool (Room 1117).	DTF-WREMLDEV-CC22A DTF-WREMLDEV-CC22B DTF-WREMLDEV-CC22C DTF-WREMLDEV-CC22D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-13) Same disposition as Potential Event DTF-WREMLDEV-CC11.	Preventive	Design-Procedural Safety -
	23. Drop or collision of a loaded cask or MSC from the overhead bridge crane onto or against an empty cask or MSC already in the pool during transfer from the cask decontamination pit/cask prep pit into the pool (Room 1117).	DTF-WREMLDEV-CC23A DTF-WREMLDEV-CC23B DTF-WREMLDEV-CC23C DTF-WREMLDEV-CC23D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-13) Same disposition as Potential Event DTF-WREMLDEV-CC13.	Preventive	Design-Procedural Safety
	24. Tipover or slapdown of a loaded cask or MSC from the overhead bridge crane (due to impact with the pool edge or ledge/wall in the pool) into the pool during transfer from the cask decontamination pit/cask prep pit into the pool (Room 1117).	DTF-WREMLDEV-CC24A DTF-WREMLDEV-CC24B DTF-WREMLDEV-CC24C DTF-WREMLDEV-CC24D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-13) Same disposition as Potential Event DTF-WREMLDEV-CC11.	Preventive	Design-Procedural Safety
	25. Drop or collision of handling equipment (or other equipment, including an immersion rod) onto or against the lid of a loaded cask or MSC positioned in the pool prior to, or after, the cask or MSC lid removal or installation process, respectively (Room 1117).	DTF-WREMLDEV-CC25	Beyond Category 2	Same disposition as Potential Event DTF-WREMLDEV-CC8.	Preventive	Procedural Safety

Table III-21. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Wet Remediation): Cask Wet Remediation-Laydown Area (Room 1117), Cask Wet Remediation Entrance Vestibule (Room 1120) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Design or Preventive Requirement or Mitigative Safety Control
			Event Sequence Category	Design-Precedural Safety	
26. Collision involving a lid suspended in the pool from the fuel transfer machine removing (or installing) the cask or MSC lid during the lid removal (or installation) process in the pool (Room 1117).	DTF-WREMLDEV-CC26A DTF-WREMLDEV-CC26B DTF-WREMLDEV-CC26C DTF-WREMLDEV-CC26D DTF-WREMLDEV-CC26E DTF-WREMLDEV-CC26F	No drop Beyond Category 2	(Bounded by GET-02) Same disposition as Potential Event DTF-WREMLDEV-CC18.	Preventive	Design-Precedural Safety
				Design-Precedural Safety	
27. Drop of a cask or MSC inner lid onto or into a loaded cask or MSC from the fuel handling machine during the lid removal (or installation) process in the pool (Room 1117).	DTF-WREMLDEV-CC27A DTF-WREMLDEV-CC27B DTF-WREMLDEV-CC27C DTF-WREMLDEV-CC27D DTF-WREMLDEV-CC27E DTF-WREMLDEV-CC27F	No drop Beyond Category 2	(Bounded by GET-02) Same disposition as Potential Event DTF-WREMLDEV-CC18.	Preventive	Design-Precedural Safety
				Design-Precedural Safety	
28. Drop or collision of an empty cask or MSC from the overhead bridge crane onto or against the cask or MSC already in the pool (to be unloaded) during the lowering of the empty cask or MSC into the pool (Room 1117).	DTF-WREMLDEV-CC28	Beyond Category 2	For drops, an operational requirement prohibits carrying an empty cask in the DTF remediation pool above a transportation cask, MSC, or basket that contains CSNF. For collisions, a design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design-Precedural Safety
				Design-Precedural Safety	
29. MSC onto or against the unsealed (open) cask to be unloaded (Room 1117).	DTF-WREMLDEV-CC29A DTF-WREMLDEV-CC29B DTF-WREMLDEV-CC29C DTF-WREMLDEV-CC29D DTF-WREMLDEV-CC29E DTF-WREMLDEV-CC29F	No drop Beyond Category 2	(Bounded by GET-02) Same disposition as Potential Event DTF-WREMLDEV-CC18.	Preventive	Design-Precedural Safety
				Design-Precedural Safety	
30. Drop or collision of an empty SNF basket onto or against the cask to be unloaded (Room 1117).	DTF-WREMLDEV-CC30	Beyond Category 2	Operational requirements ensure that an SNF assembly basket or basket grapple dropped or collided against another basket or a cask in the pool does not damage SNF assemblies in the basket or cask already in place.	Preventive	Design-Precedural Safety
				Design-Precedural Safety	
31. Drop or collision of an empty or full canister for damaged SNF onto or against the cask being unloaded (Room 1117).	DTF-WREMLDEV-CC31A DTF-WREMLDEV-CC31B DTF-WREMLDEV-CC31C	No collision Category 2	(See GET-15) Design and operational requirements for commercial SNF handling equipment reduce the drop rate and collision probabilities for commercial SNF assembly transfers, including those in single-assembly canisters. To avoid a drop or collision involving an empty canister that could lead to a radiological release, an operational requirement prohibits suspending an empty canister above an open cask, MSC, or CSNF basket that contains CSNF	Preventive	Design-Precedural Safety
				Design-Precedural Safety	
32. Drop or collision of an empty or full canister for damaged SNF onto or against the empty or full SNF basket being loaded (Room 1117).	DTF-WREMLDEV-CC32A DTF-WREMLDEV-CC32B DTF-WREMLDEV-CC32C	No collision Category 2	(See GET-15) Same disposition as Potential Event DTF-WREMLDEV-CC31.	Preventive	Design-Precedural Safety
				Design-Precedural Safety	
33. Drop of an SNF assembly onto the pool floor while suspended from the fuel handling machine during transfer from the cask to the SNF basket or to the empty cask or MSC in the pool (Room 1117).	DTF-WREMLDEV-CC33A DTF-WREMLDEV-CC33B DTF-WREMLDEV-CC33C	No collision Category 2	(See GET-16) Design and operational requirements for commercial SNF handling equipment reduce the drop rate and collision probabilities for commercial SNF assembly transfers, including those in single-assembly canisters.	Preventive	Design-Precedural Safety
				Design-Precedural Safety	
34. Drop or collision of an SNF assembly onto or against a sharp object while suspended from the fuel handling machine during transfer from the cask to the SNF basket or to the empty cask or MSC in the pool (Room 1117).	DTF-WREMLDEV-CC34A DTF-WREMLDEV-CC34B DTF-WREMLDEV-CC34C	No collision Category 2	(See GET-16) Same disposition as Potential Event DTF-WREMLDEV-CC33.	Preventive	Design-Precedural Safety
				Design-Precedural Safety	

Table III-21. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Wet Remediation): Cask Wet Remediation-Laydown Area (Room 1117), Cask Wet Remediation Entrance Vestibule (Room 1120) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	35. Drop or collision of an SNF assembly back into or against the cask or MSC while suspended from the fuel handling machine during transfer from the cask to the SNF basket or to the empty cask or MSC in the pool (Room 1117).	DTF-WREMLDEV-CC35A DTF-WREMLDEV-CC35B DTF-WREMLDEV-CC35C	No collision Category 2 Category 2	(See GET-16) Same disposition as Potential Event DTF-WREMLDEV-CC33.	Preventive	Design- Procedural Safety
	36. Drop or collision of an SNF assembly onto or against another assembly or assemblies in the cask or MSC while suspended from the fuel handling machine during transfer from the cask to the SNF basket or to the empty cask or MSC in the pool (Room 1117).	DTF-WREMLDEV-CC36A DTF-WREMLDEV-CC36B DTF-WREMLDEV-CC36C	No collision Category 2 Category 2	(See GET-16) Same disposition as Potential Event DTF-WREMLDEV-CC33.	Preventive	Design- Procedural Safety
	37. Impact due to horizontal movement of an SNF assembly by the spent fuel transfer machine before the assembly is fully lifted out of the cask or MSC (Room 1117).	DTF-WREMLDEV-CC37A DTF-WREMLDEV-CC37B DTF-WREMLDEV-CC37C	No collision Category 2 Category 2	(See GET-16) Same disposition as Potential Event DTF-WREMLDEV-CC33.	Preventive	Design- Procedural Safety
	38. Drop or collision of an SNF assembly into or against the empty SNF basket in the pool while suspended from the fuel handling machine during transfer from the cask or MSC to an empty location in the SNF basket (Room 1117).	DTF-WREMLDEV-CC38A DTF-WREMLDEV-CC38B DTF-WREMLDEV-CC38C	No collision Category 2 Category 2	(See GET-16) Same disposition as Potential Event DTF-WREMLDEV-CC33.	Preventive	Design- Procedural Safety
	39. Drop or collision of an SNF assembly onto or against another fuel assembly or assemblies in the SNF basket in the pool while suspended from the fuel handling machine during transfer from the cask or MSC to an empty location in the SNF basket (Room 1117).	DTF-WREMLDEV-CC39A DTF-WREMLDEV-CC39B DTF-WREMLDEV-CC39C	No collision Category 2 Category 2	(See GET-16) Same disposition as Potential Event DTF-WREMLDEV-CC33.	Preventive	Design- Procedural Safety
	40. Collision of the fuel handling machine basket grapple with a filled SNF basket during the closing (or opening) of the SNF basket (Room 1117).	DTF-WREMLDEV-CC40	Beyond Category 2	Same disposition as Potential Event DTF-WREMLDEV-CC30.	Preventive	Procedural Safety
	41. Drop of a filled SNF basket from the fuel handling machine onto the pool floor during transfer of the filled SNF basket to (or from) the pool area basket storage rack (Room 1117).	DTF-WREMLDEV-CC41A DTF-WREMLDEV-CC41B	No drop Category 2	(See GET-17) Design and operational requirements for commercial SNF handling equipment reduce the drop rate for commercial SNF assembly transfers, including those in single-assembly canisters.	Preventive	Design- Procedural Safety
	42. Drop or collision of a filled SNF basket from the fuel handling machine onto or against a sharp object during transfer of the filled SNF basket to (or from) the pool area basket storage rack (Room 1117).	DTF-WREMLDEV-CC42A DTF-WREMLDEV-CC42B	No drop Category 2	(See GET-17) Same disposition as Potential Event DTF-WREMLDEV-CC41.	Preventive	Design- Procedural Safety
	43. Drop or collision of a filled SNF basket from the fuel handling machine onto, into, or against the cask or MSC being unloaded or loaded (containing SNF) during transfer of the filled SNF basket to or from the pool area basket storage rack (Room 1117).	DTF-WREMLDEV-CC43A DTF-WREMLDEV-CC43B	No drop Category 2	(See GET-17) Same disposition as Potential Event DTF-WREMLDEV-CC41.	Preventive	Design- Procedural Safety
	44. Drop or collision of a filled SNF basket from the fuel handling machine onto or against an empty basket storage rack location during transfer of the filled SNF basket to (or from) the pool area basket storage rack (Room 1117).	DTF-WREMLDEV-CC44A DTF-WREMLDEV-CC44B	No drop Category 2	(See GET-17) Same disposition as Potential Event DTF-WREMLDEV-CC41.	Preventive	Design- Procedural Safety
	45. Drop or collision of a filled SNF basket from the fuel handling machine onto or against a filled basket storage rack location (onto another filled SNF basket) during transfer of the filled SNF basket to (or from) the pool area basket storage rack (Room 1117).	DTF-WREMLDEV-CC45A DTF-WREMLDEV-CC45B	No drop Category 2	(See GET-17) Same disposition as Potential Event DTF-WREMLDEV-CC41.	Preventive	Design- Procedural Safety

Table III-21. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Wet Remediation): Cask Wet Remediation-Laydown Area (Room 1117), Cask Wet Remediation Entrance Vestibule (Room 1120) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	46. Drop or collision of handling equipment from the fuel handling machine onto or against an SNF assembly or assemblies in the SNF basket (before or after transfer to pool area basket storage rack) (Room 1117).	DTF-WREMLDEV-CC46A DTF-WREMLDEV-CC46B	No drop Category 2	(See GET-12) Design and operational requirements reduce the probability of dropping handling equipment onto a SNF assembly energetically enough to breach the assembly. For collisions, a design requirement ensures that the spent fuel transfer machine, fuel handling machine and other equipment designed to handle individual SNF assemblies are not capable of lateral movements of handling equipment at a speed that could initiate an event sequence as a result of collision with a SNF assembly.	Preventive	Design-Procedural Safety
	47. Drop of an SNF assembly onto the pool floor while suspended from the fuel handling machine during transfer to an empty cask or MSC from the SNF basket (Room 1117).	DTF-WREMLDEV-CC47A DTF-WREMLDEV-CC47B DTF-WREMLDEV-CC47C	No collision Category 2 Category 2	(See GET-16) Same disposition as Potential Event DTF-WREMLDEV-CC33.	Preventive	Design-Procedural Safety
	48. Drop of an SNF assembly onto or against a sharp object while suspended from the fuel handling machine during transfer to an empty cask or MSC from the SNF basket (Room 1117).	DTF-WREMLDEV-CC48A DTF-WREMLDEV-CC48B DTF-WREMLDEV-CC48C	No collision Category 2 Category 2	(See GET-16) Same disposition as Potential Event DTF-WREMLDEV-CC33.	Preventive	Design-Procedural Safety
	49. Impact due to horizontal movement of an SNF assembly by the fuel handling machine before the assembly is fully lifted out of the SNF basket (Room 1117).	DTF-WREMLDEV-CC49A DTF-WREMLDEV-CC49B DTF-WREMLDEV-CC49C	No collision Category 2 Category 2	(See GET-16) Same disposition as Potential Event DTF-WREMLDEV-CC33.	Preventive	Design-Procedural Safety
	50. Drop or collision of an SNF assembly back into or against the SNF basket being unloaded in the pool while suspended from the fuel handling machine during transfer to an empty cask or MSC (Room 1117).	DTF-WREMLDEV-CC50A DTF-WREMLDEV-CC50B DTF-WREMLDEV-CC50C	No collision Category 2 Category 2	(See GET-16) Same disposition as Potential Event DTF-WREMLDEV-CC33.	Preventive	Design-Procedural Safety
	51. Drop or collision of an SNF assembly onto or against another assembly or assemblies in the SNF basket in the pool while suspended from the fuel handling machine during transfer to an empty cask or MSC (Room 1117).	DTF-WREMLDEV-CC51A DTF-WREMLDEV-CC51B DTF-WREMLDEV-CC51C	No collision Category 2 Category 2	(See GET-16) Same disposition as Potential Event DTF-WREMLDEV-CC33.	Preventive	Design-Procedural Safety
	52. Drop or collision of an SNF assembly into or against an empty MSC in the pool while suspended from the fuel handling machine during transfer to an empty location in a cask or MSC from the SNF basket (Room 1117).	DTF-WREMLDEV-CC52A DTF-WREMLDEV-CC52B DTF-WREMLDEV-CC52C	No collision Category 2 Category 2	(See GET-16) Same disposition as Potential Event DTF-WREMLDEV-CC33.	Preventive	Design-Procedural Safety
	53. Drop or collision of a SNF assembly onto or against another fuel assembly or assemblies inside the MSC in the pool while suspended from the fuel handling machine during transfer to an empty location in a cask or MSC from the SNF basket (Room 1117).	DTF-WREMLDEV-CC53A DTF-WREMLDEV-CC53B DTF-WREMLDEV-CC53C	No collision Category 2 Category 2	(See GET-16) Same disposition as Potential Event DTF-WREMLDEV-CC33.	Preventive	Design-Procedural Safety
	54. Drop or collision of an empty SNF basket onto or against a filled cask or MSC during movement of the empty SNF basket (after closure of the basket) back to the pool area basket storage rack (Room 1117).	DTF-WREMLDEV-CC54	Beyond Category 2	Same disposition as Potential Event DTF-WREMLDEV-CC30.	Preventive	Procedural Safety
	55. Drop or collision of handling equipment or a lid (or other equipment), either from the overhead bridge crane, maintenance crane, or from the fuel handling machine, onto or against an SNF assembly or assemblies in an open unsealed cask or MSC positioned at the bottom of the pool (Room 1117).	DTF-WREMLDEV-CC55aA DTF-WREMLDEV-CC55aB DTF-WREMLDEV-CC55bA DTF-WREMLDEV-CC55bB DTF-WREMLDEV-CC55bC DTF-WREMLDEV-CC55bD DTF-WREMLDEV-CC55bE DTF-WREMLDEV-CC55bF	No drop Category 2 No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	CC55a. (See GET-12 for handling equipment events) Same disposition as Potential Event DTF-WREMLDEV-CC46. CC55b. (Bounded by GET-02 for lid events) Same disposition as Potential Event DTF-WREMLDEV-CC18.	Preventive Preventive	Design-Procedural Safety Design-Procedural Safety

Table III-21. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Wet Remediation): Cask Wet Remediation-Laydown Area (Room 1117), Cask Wet Remediation Entrance Vestibule (Room 1120) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	56. Drop or collision of handling equipment (or other equipment) from the overhead bridge crane onto or against a loaded cask or MSC positioned at the bottom of the pool after the lid has been installed, prior to removal from the pool (Room 1117).	DTF-WREMLDEV-CC56	Beyond Category 2	Same disposition as Potential Event DTF-WREMLDEV-CC8.	Preventive	Procedural Safety
	57. Drop of a loaded cask or MSC from the overhead bridge crane onto the pool floor during transfer from the pool to the cask decontamination pit/cask prep pit (Room 1117).	DTF-WREMLDEV-CC57A DTF-WREMLDEV-CC57B DTF-WREMLDEV-CC57C DTF-WREMLDEV-CC57D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-13) Same disposition as Potential Event DTF-WREMLDEV-CC11.	Preventive	Design-Procedural Safety
	58. Drop or collision of a loaded cask or MSC from the overhead bridge crane onto or against a sharp object in the pool during transfer out of the pool to the cask decontamination pit/cask prep pit (Room 1117).	DTF-WREMLDEV-CC58	Beyond Category 2	Same disposition as Potential Event DTF-WREMLDEV-CC12.	Preventive	Design-Procedural Safety
	59. Tipover or slapdown of a loaded cask or MSC into the cask decontamination pit/cask prep pit from the overhead bridge crane due to impact with the pit edge or access platform in the pit during transfer from the pool to the cask decontamination pit/cask prep pit (Room 1117).	DTF-WREMLDEV-CC59A DTF-WREMLDEV-CC59B DTF-WREMLDEV-CC59C DTF-WREMLDEV-CC59D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-13) Same disposition as Potential Event DTF-WREMLDEV-CC11.	Preventive	Design-Procedural Safety
	60. Tipover or slapdown of a loaded cask or MSC into the pool from the overhead bridge crane due to impact with the pool edge or ledge/wall in the pool during transfer from the pool to the cask decontamination pit/cask prep pit (Room 1117).	DTF-WREMLDEV-CC60A DTF-WREMLDEV-CC60B DTF-WREMLDEV-CC60C DTF-WREMLDEV-CC60D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-13) Same disposition as Potential Event DTF-WREMLDEV-CC11.	Preventive	Design-Procedural Safety
	61. Drop or collision of a loaded cask or MSC from the overhead bridge crane into or against the cask decontamination pit/cask prep pit during transfer from the pool to the cask decontamination pit/cask prep pit (Room 1117).	DTF-WREMLDEV-CC61A DTF-WREMLDEV-CC61B DTF-WREMLDEV-CC61C DTF-WREMLDEV-CC61D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-13) Same disposition as Potential Event DTF-WREMLDEV-CC13.	Preventive	Design-Procedural Safety
	62. Drop of a loaded cask or MSC from the overhead bridge crane onto the wet remediation area floor during transfer from the pool to the cask decontamination pit/cask prep pit or from the cask decontamination pit/cask prep pit to a trolley (Room 1117).	DTF-WREMLDEV-CC62A DTF-WREMLDEV-CC62B DTF-WREMLDEV-CC62C DTF-WREMLDEV-CC62D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-13) Same disposition as Potential Event DTF-WREMLDEV-CC11.	Preventive	Design-Procedural Safety
	63. Drop of a loaded cask or MSC from the overhead bridge crane onto the trolley during the transfer from the cask decontamination pit/cask prep pit to a trolley (Room 1117).	DTF-WREMLDEV-CC63A DTF-WREMLDEV-CC63B DTF-WREMLDEV-CC63C DTF-WREMLDEV-CC63D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-13) Same disposition as Potential Event DTF-WREMLDEV-CC11.	Preventive	Design-Procedural Safety
	64. Drop or collision of a loaded cask or MSC from the overhead bridge crane onto or against a sharp object in the cask wet remediation/laydown area during transfer from the pool to the cask decontamination pit/cask prep pit or from the cask decontamination pit/cask prep pit to a trolley (Room 1117).	DTF-WREMLDEV-CC64	Beyond Category 2	Same disposition as Potential Event DTF-WREMLDEV-CC12.	Preventive	Design-Procedural Safety
	65. Slapdown of a loaded cask or MSC following a drop from the overhead bridge crane (due to contact with the edge of a trolley or trolley pedestal) during the lift from the cask decontamination pit/cask prep pit to the trolley (Room 1117).	DTF-WREMLDEV-CC65A DTF-WREMLDEV-CC65B DTF-WREMLDEV-CC65C DTF-WREMLDEV-CC65D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-13) Same disposition as Potential Event DTF-WREMLDEV-CC11.	Preventive	Design-Procedural Safety
	66. Drop or collision of an unloaded cask from the overhead bridge crane onto or against a loaded cask or MSC in the pool during transfer of the empty cask from the pool (Room 1117).	DTF-WREMLDEV-CC66	Beyond Category 2	Same disposition as Potential Event DTF-WREMLDEV-CC28.	Preventive	Design-Procedural Safety

Table III-21. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Wet Remediation): Cask Wet Remediation-Laydown Area (Room 1117), Cask Wet Remediation Entrance Vestibule (Room 1120) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	67. Collision involving an access platform and a loaded cask or MSC in the cask decontamination pit/cask prep pit (Room 1117).	DTF-WREMLDEV-CC67	Beyond Category 2	Same disposition as Potential Event DTF-WREMLDEV-CC7.	Preventive	Procedural Safety
	68. Drop of a cask or MSC outer lid from the overhead crane onto the loaded cask or MSC (Room 1117).	DTF-WREMLDEV-CC68A DTF-WREMLDEV-CC68B DTF-WREMLDEV-CC68C DTF-WREMLDEV-CC68D DTF-WREMLDEV-CC68E DTF-WREMLDEV-CC68F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(Bounded by GET-02) Same disposition as Potential Event DTF-WREMLDEV-CC18.	Preventive	Design- Procedural Safety
	69. Drop or collision of equipment (including the lifting yoke, cask skirt, cask skirt lifting beam, etc.), the lid bolt torque machine, dry vacuum equipment, leak test equipment, flushing equipment, etc., or other cask preparation or decontamination equipment, onto or against a loaded cask or MSC or cask or MSC inner lid (Room 1117).	DTF-WREMLDEV-CC69	Beyond Category 2	Same disposition as Potential Event DTF-WREMLDEV-CC8.	Preventive	Procedural Safety
	70. Drop or collision of handling equipment (including the cask lifting yoke) onto or against a cask or MSC before or after transfer of the loaded, sealed cask or MSC to the trolley (Room 1117).	DTF-WREMLDEV-CC70	Beyond Category 2	Same disposition as Potential Event DTF-WREMLDEV-CC8.	Preventive	Procedural Safety
	71. Derailement of a trolley holding a loaded, sealed, remediated cask or MSC followed by a load tipover or fall (Room 1117).	DTF-WREMLDEV-CC71	Beyond Category 2	Same disposition as Potential Event DTF-WREMLDEV-CC3.	Preventive	Design
	72. Collision of a trolley holding a loaded, sealed, remediated cask, or MSC with the shield doors separating the cask wet remediation/laydown area and the DPC docking room (Room 1117).	DTF-WREMLDEV-CC72	Beyond Category 2	(See GET-22) A design requirement limits the speed of trolley movements such that a collision at the speed limit would not cause the trolley to drop its load.	Preventive	Design
	73. Shield doors separating the cask wet remediation/laydown area and the DPC docking room close on a trolley holding a loaded, sealed, remediated cask or MSC (Room 1117).	DTF-WREMLDEV-CC73	Beyond Category 2	Same disposition as Potential Event DTF-WREMLDEV-CC2.	Preventive	Design
Chemical Contamination-Flooding	1. Uncontrolled pool water draindown resulting in flooding (including a draindown resulting from a puncture of the pool liner due to a cask drop) (Room 1117).	DTF-WREMLDEV-CCF1	Beyond Category 2	Same disposition as Potential Event DTF-WREMLDEV-CCF2. Additionally, A design requirement ensures that the pool and pool area in the remediation system are designed such that any lost water can be replaced with make-up water until the cause of the loss is corrected or waste forms are removed from the pool. Design and operational requirements ensure that the remediation pool is designed with the appropriate impact-absorbing capability and limitations on heavy load carrying cranes to prevent loss of pool integrity, given a drop of the most challenging cask into the pool.	Preventive	Design- Procedural Safety
	2. Uncontrolled pool water overflow resulting in flooding (including an overflow resulting from cask or MSC placement into an overfilled pool, malfunction of make-up water equipment, etc.) (Room 1117).	DTF-WREMLDEV-CCF2	Beyond Category 2	A design requirement ensures that flooding of areas of the facility where moderators are controlled is precluded by passive design features such as drains, flood control channels, curbs, elevated processing areas, and walls.	Preventive	Design- Procedural Safety
	3. Cask decontamination pit/cask prep pit flooding due to pool overflow, flooding, pool equipment malfunction, cask preparation system (cask cooling) equipment malfunction, etc. (Room 1117).	DTF-WREMLDEV-CCF3	Beyond Category 2	The only hazard due to flooding involves the possibility of criticality due to moderator intrusion. Design requirements and waste acceptance criteria ensure criticality safety in transportation casks, transfer casks, site-specific casks, and dual-purpose canisters with the most reactive credible configuration of fissile material and optimal moderation.	Preventive	Design
	4. Uncontrolled water spill from the cask decontamination system or the cask preparation system (cask cooling) in the cask wet remediation/laydown area (Room 1117).	DTF-WREMLDEV-CCF4	Beyond Category 2	Same disposition as Potential Event WREMLDEV-CCF3.	Preventive	Design

Table III-21. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Wet Remediation): Cask Wet Remediation-Laydown Area (Room 1117), Cask Wet Remediation Entrance Vestibule (Room 1120) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	5. Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures (Room 1117).	DTF-WREMLDEV-CCF5	Normal Operations	Oxidation of failed commercial SNF is expected as a part of normal operations whenever commercial SNF is exposed to air. Any resulting potential exposure of workers to radiation is managed as a normal-operations dose by procedures that ensure that workers do not receive excessive radiation doses.	Mitigative	Procedural Safety
Explosion-Implosion	1. Hydrogen explosion involving batteries on a trolley (Room 1117).	DTF-WREMLDEV-EI1	Beyond Category 2	Operational controls pertaining to batteries for powering heavy equipment ensure the generation or accumulation of enough hydrogen gas to cause an explosion that could breach a transportation cask, site-specific cask, or waste package is prevented.	Preventive	Procedural Safety
	2. Explosion hazard associated with the cask sampling and purging system and the ignition of hydrogen that may have accumulated in the cask or MSC (Room 1117).	DTF-WREMLDEV-EI2	Beyond Category 2	Operational requirements ensure that precautions taken during the cask sampling and purging process provide reasonable assurance that such hydrogen explosions would not occur.	Preventive	Procedural Safety
	3. Cask cooling system (nitrogen, air, etc.) or MSC drying system (or other pneumatic or pressurized system) missile due to fractured nozzle/valve stem/pneumatic device (Room 1117).	DTF-WREMLDEV-EI3	Beyond Category 2	An operational requirement ensures that pressurized systems that could generate missiles, energetic enough to penetrate a transportation cask with or without impact limiters, a transfer cask, a DOE canister, a naval SNF canister, a dual-purpose canister, the inner lid of a transportation cask, a site-specific cask, a waste package, or the inner lid of a site-specific cask or waste package are not present in areas where potentially vulnerable items may be exposed.	Preventive	Procedural Safety
	4. Hydrogen explosion involving batteries on a mobile elevated platform (Room 1117).	DTF-WREMLDEV-EI4	Beyond Category 2	Same disposition as Potential Event DTF-WREMLDEV-EI1.	Preventive	Procedural Safety
	5. Steam explosion or cask overpressurization due to insufficient cooling of a cask or MSC contents prior to insertion of the cask or MSC into the pool (Room 1117).	DTF-WREMLDEV-EI5	Beyond Category 2	An operational requirement ensures that quenching operations involving casks and site-specific casks holding SNF to be unloaded in the remediation pool are conducted to avoid initiation of event sequences due to induced thermal stresses or steam explosion due to insufficient cooling.	Preventive	Procedural Safety
Fire-Thermal	1. Electrical fires associated with the vacuum drier, pool water makeup equipment, or other pool-related equipment (Room 1117).	DTF-WREMLDEV-FT1	Beyond Category 2	Design and operational requirements ensure control of the presence and amount of combustibles in the different areas of the repository to preclude any Category 1 or Category 2 event sequences potentially initiated by a fire.	Preventive	Design-Procedural Safety
	2. Electrical fire associated with SNF and HLW handling equipment or other associated equipment in the cask wet remediation/laydown area and cask wet remediation entrance vestibule (including the cask lid bolt detorque device, the turntable, overhead manipulators, overhead bridge cranes, the fuel handling machine, etc.) (Room 1117).	DTF-WREMLDEV-FT2	Beyond Category 2	Same disposition as Potential Event DTF-WREMLDEV-FT1.	Preventive	Design-Procedural Safety
	3. Fire/explosion (battery/electrical fire) associated with the trolley (Room 1117).	DTF-WREMLDEV-FT3	Beyond Category 2	Same disposition as Potential Event DTF-WREMLDEV-FT1.	Preventive	Design-Procedural Safety
	4. Fire/explosion (battery/electrical fire) associated with the mobile elevated platform (Room 1117).	DTF-WREMLDEV-FT4	Beyond Category 2	Same disposition as Potential Event DTF-WREMLDEV-FT1.	Preventive	Design-Procedural Safety

Table III-21. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Wet Remediation): Cask Wet Remediation-Laydown Area (Room 1117), Cask Wet Remediation Entrance Vestibule (Room 1120) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	5. Diesel fuel fire/explosion involving an SRTC tractor pushing an SRTC holding a transportation cask or MSC into the cask wet remediation entrance vestibule (Rooms 1117 and 1120).	DTF-WREMLDEV-FT5	Beyond Category 2	Same disposition as Potential Event DTF-WREMLDEV-FT1.	Preventive	Design-Procedural Safety
	6. Overheating of SNF due to loss of pool water, including events that could lead to such a loss, including the breakdown of the pool water cooling system, resulting in excessive cladding temperature and possible zircaloy cladding (or other cladding) unzipping (Room 1117).	DTF-WREMLDEV-FT6	Beyond Category 2	Same disposition as Potential Event DTF-WREMLDEV-CCF1.	Preventive	Design-Procedural Safety
	7. Rapid cooling of SNF assemblies, leading to excessive thermal stresses in the SNF cladding (Room 1117).	DTF-WREMLDEV-FT7	Beyond Category 2	Same disposition as Potential Event DTF-WREMLDEV-EI5.	Preventive	Procedural Safety
	8. Damage to SNF due to insufficient cooling of a cask prior to lowering it into the pool, resulting in a thermal shock that damages the SNF cladding (Room 1117).	DTF-WREMLDEV-FT8	Beyond Category 2	Same disposition as Potential Event DTF-WREMLDEV-EI5.	Preventive	Procedural Safety
	9. Intact or non-intact SNF overheating due to a loss of cooling resulting in excessive temperature and possible zircaloy cladding (or other cladding) unzipping or cladding failure due to excessive hoop stresses (Room 1117).	DTF-WREMLDEV-FT9	Beyond Category 2	If ventilation is lost in areas where DOE or naval canisters are handled, no radiological release occurs from the canisters because containment within the canisters is maintained. Design and operational requirements ensure that the thermal response of areas where CSNF assemblies are handled or staged to a loss of HVAC would not cause radiological releases in excess of those considered in the consequence analysis for normal operations.	Preventive	Design-Procedural Safety
	10. Thermal hazard (from decay heat) associated with vertical orientation of a cask or MSC (Room 1117).	DTF-WREMLDEV-FT10	Normal Operations	Same disposition as Potential Event DTF-WREMLDEV-CCF5.	Mitigative	Procedural Safety
	11. Transient combustible fire in the cask wet remediation/laydown area or the cask wet remediation entrance vestibule (Rooms 1117 and 1120).	DTF-WREMLDEV-FT11	Beyond Category 2	Same disposition as Potential Event DTF-WREMLDEV-FT1.	Preventive	Design-Procedural Safety
Radiation	1. Damage or rupture of the cask sampling and purging system, leading to a release of internal gases and radioactive material (Room 1117).	DTF-WREMLDEV-R1	Normal Operations	The sampling operation is conducted so that exposure of workers to radiation is managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. Although a rupture leading to a radiological release would be an off-normal occurrence, any release and related dose would be managed as part of routine radiation protection operations.	Mitigative	Procedural Safety
	2. Uncontrolled pool water draindown/fill or leak of pool cooling or water treatment system resulting in flooding and radioactive contamination of adjoining areas (Room 1117).	DTF-WREMLDEV-R2	Normal Operations	Same disposition as Potential Event DTF-WREMLDEV-CCF1. Additionally, operational requirements maintain water quality within prescribed limits to ensure radiological doses are as low as reasonably achievable in areas around the pools; and the disposition of leaking water is controlled. Pool operations are conducted so that exposure of workers to radiation is managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses.	Preventive	Design-Procedural Safety
	3. Increased radiation levels in the pool cell due to low pool water level uncovering SNF assemblies (either in an opened cask or MSC or in the SNF basket staging rack) (Room 1117).	DTF-WREMLDEV-R3	Beyond Category 2	Same disposition as Potential Event DTF-WREMLDEV-CCF1.	Preventive	Design-Procedural Safety

Table III-21. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Wet Remediation): Cask Wet Remediation-Laydown Area (Room 1117), Cask Wet Remediation Entrance Vestibule (Room 1120) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	4. Radiation exposure of a facility worker and/or the offsite public (Rooms 1117 and 1120).	DTF-WREMLDEV-R4	NA—Accounted for in consequence analyses, if applicable Normal Operations	NA—Potential exposure of workers or the public to radiation is a hazard for all the event sequences considered in this analysis. Consequence analyses evaluate this hazard for Category 1 and Category 2 event sequences, as applicable. Some exposure to radiation is expected as a part of normal facility operations. Exposures are managed by design features and procedures that ensure that workers or the public do not receive excessive radiation doses.	NA Mitigative	NA Design- Procedural Safety
	5. Loss of confinement zone due to a ventilation system malfunction or other breach of a confinement barrier leading to a release of radiation (Room 1117).	DTF-WREMLDEV-R5	NA (no significant exposure)	Operating procedures ensure that a loss of confinement during otherwise normal operations does not cause individuals to be exposed to significant amounts of radioactivity.	Mitigative	Procedural Safety
	6. Insufficient cooling of a cask or loss of the cask cooling system prior to lowering of a cask into the pool, leading to a release of radiologically contaminated steam or gasses (Room 1117).	DTF-WREMLDEV-R6	Normal Operations	Pool operations are conducted so that any potential exposure of workers to radiation is managed as a normal-operations dose by procedures that ensure that workers do not receive excessive radiation doses.	Mitigative	Procedural Safety
	7. Thermal expansion of gases or other loss of confinement in an unsealed cask or MSC, leading to radiological release (Room 1117).	DTF-WREMLDEV-R7	Normal Operations	Thermal expansion of gases is to be expected as a part of normal operations. Any resulting exposure of workers to radiation is managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses.	Mitigative	Procedural Safety
	8. Radiation-induced damage to a facility SSC (Rooms 1117 and 1120).	DTF-WREMLDEV-R8	NA	Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization.	NA	NA
Fissile	1. Criticality associated with a derailment of a trolley moving a loaded cask or MSC followed by a load tipover or fall and a rearrangement of the container internals (Room 1117).	DTF-WREMLDEV-F1	Beyond Category 2	Same disposition as Potential Event DTF-WREMLDEV-CC3.	Preventive	Design.
	2. Criticality associated with a derailment of an SRTC holding a loaded cask or MSC followed by a load tipover or fall and a rearrangement of the container internals (Rooms 1117 and 1120).	DTF-WREMLDEV-F2	Beyond Category 2	Same disposition as Potential Event DTF-WREMLDEV-CC4.	Preventive	Design
	3. Criticality associated with a drop, slapdown, or collision of a cask or a MSC (when handled with an overhead crane) and a rearrangement of the container internals (Room 1117).	DTF-WREMLDEV-F3	Beyond Category 2	Design requirements and waste acceptance criteria ensure that transportation casks, transfer casks, MSCs, CSNF baskets used in dry processing areas, and dual-purpose canisters (DPCs) are designed to ensure nuclear criticality safety with optimum moderation and most-reactive waste forms. Criticality safety will be maintained despite geometric rearrangements due to a drop or other handling incident.	Preventive	Design
	4. Criticality associated with a drop of an SNF assembly while unloading a transportation cask, loading cask or MSC, or filling or emptying an SNF basket in the pool, and a rearrangement of SNF in the cask, MSC, or basket (Room 1117).	DTF-WREMLDEV-F4	Beyond Category 2	Same disposition as Potential Event DTF-WREMLDEV-F3. Additionally, design and operational requirements ensure criticality safety in the baskets and baskets in the storage rack. Fully loaded baskets in staging racks are designed to be subcritical when fully flooded with pure water (i.e., no credit for neutron absorbers dissolved in the water). Baskets are designed to have sufficient nuclear criticality controls to remain subcritical even if a handling incident causes a reconfiguration of the spent fuel. Baskets are closed during handling. A closed basket being transferred in the pool would not spill SNF assemblies into the pool if the basket is dropped.	Preventive	Design
	5. Criticality associated with a drop of an SNF assembly from the fuel handling machine (in the pool) and a rearrangement of the fuel rods that comprise the assembly due to impact (Room 1117).	DTF-WREMLDEV-F5	NA	Results of criticality analyses ensure that drops, collisions, and other handling impacts of a commercial SNF assembly, allowing for rearrangement of fuel rods and without credit for burnup or moderator control, do not pose a criticality safety concern.	NA	NA
	6. Criticality associated with a misload of a cask or MSC in the pool (Room 1117).	DTF-WREMLDEV-F6	Beyond Category 2	Same disposition as Potential Event DTF-WREMLDEV-F3.	Preventive	Design

Table III-21. Disposition of Internal Events That Occur Inside the Dry Transfer Facility (Wet Remediation): Cask Wet Remediation-Laydown Area (Room 1117), Cask Wet Remediation Entrance Vestibule (Room 1120) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	7. Criticality associated with a misload of an SNF basket or SNF baskets in the basket storage rack (Room 1117).	DTF-WREMLDEV-F7	Beyond Category 2	Same disposition as Potential Event DTF-WREMLDEV-F4.	Preventive	Design
	8. Criticality associated with the drop of a spent fuel assembly basket holding several SNF assemblies in the pool (including a drop onto another basket) and a rearrangement of the contents of the basket or baskets (Room 1117).	DTF-WREMLDEV-F8	Beyond Category 2	Same disposition as Potential Event DTF-WREMLDEV-F4.	Preventive	Design
	9. Criticality associated with the drop of heavy equipment onto a loaded fuel basket (either a single basket or several baskets in a basket storage rack) and a rearrangement of the contents of the basket or baskets (Room 1117).	DTF-WREMLDEV-F9	Beyond Category 2	Same disposition as Potential Event DTF-WREMLDEV-F4.	Preventive	Design
	10. Criticality associated with the drop of heavy equipment onto a loaded cask or MSC and a rearrangement of the container internals (either in or out of the pool) (Room 1117).	DTF-WREMLDEV-F10	Beyond Category 2	Same disposition as Potential Event DTF-WREMLDEV-F3.	Preventive	Design

NOTES: CC = collision-crushing; CCF = chemical contamination flooding; EI = explosion-implosion; F = fissile; FT = fire-thermal; GET = generalized event tree; HLW = high-level radioactive waste; NA = not applicable; R = radiation; SNF = spent nuclear fuel; SRTC = site rail transfer cart; WREMLDEV = wet remediation-laydown and entrance vestibule.

The Event Sequence Designator is a unique event sequence index for each event in this table. The prefix identifies the building or facility, for example "DTF," the middle identifies an activity, room, or area, for example "WREMLDEV," and the suffix identifies the hazard category and event number, for example "CC1." When an event sequence has been evaluated in a GET, the GET number is identified in the Disposition of Event column. The GET sequence alpha character is shown at the end of the Event Sequence Designator, for example "A."

GETs are discussed in Sections 6.3.1.1 to 6.3.1.24.

Table III-22. Disposition of Internal Events That Occur Inside the Dry Transfer Facility Dual-purpose Canister Preparation-Cask Dry Remediation Room (Room 1100), Dual-purpose Canister Docking Room (Room 1101), and Dual-purpose Canister Cutting/Waste Package Dry Remediation Cell (Room 1097)

Generic Event Category	Potential Event (Room or Area)	Disposition of Event				Preventive or Mitigative Requirement	Design or Procedural Safety Control
		Event Sequence Designator	Event Sequence Category	Design, Procedural Safety, or Operational Requirement			
Collision-Crushing	1. Collision involving the trolley holding the cask containing the loaded DPC and the shield doors between the cask preparation room and the DPC preparation/cask dry remediation room (Rooms 1074 and 1100).	DTF-DPCPRM-CC1	Beyond Category 2	(See GET-22) A design requirement limits the speed of trolley movements such that a collision at the speed limit would not cause the trolley to drop its load.	Preventive	Design	
	2. Shield doors between the cask preparation room and the DPC preparation/cask dry remediation room close on the trolley holding the cask containing the loaded DPC (Rooms 1074 and 1100).	DTF-DPCPRM-CC2	Beyond Category 2	A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transfer trolley, site-rail transfer cart (SRTC), MSC transporter, WP transporter, would not cause a tipover of the conveyance or cause the conveyance to drop its load. A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transportation cask, transfer cask, or MSC suspended from an overhead crane would not cause the crane to drop its load.	Preventive	Design	
	3. Derailment of a trolley in the DPC preparation/cask dry remediation room or DPC docking room (including derailment due to turntable malfunction or operational error) while holding a cask containing a loaded DPC followed by a load tipover or fall (Rooms 1101 and 1109).	DTF-DPCPRM-CC3	Beyond Category 2	A design requirement ensures that loaded transfer trolleys do not derail or drop their loads. Design requirements apply to trolleys for casks, waste packages, site-specific casks, and dual-purpose canisters.	Preventive	Design	
	4. Drop or collision of a docking ring (or tools, or equipment) onto or against the cask containing the DPC (Room 1101).	DTF-DPCPRM-CC4	Beyond Category 2	An operational requirement limits lift heights for tools and equipment associated with transportation cask, transfer cask, MSC, and DPC handling and preparation to the minimum necessary for operational purposes. The operational requirement ensures that tools and equipment, including handling equipment, if dropped from the height limit, can not initiate an event sequence if dropped onto or collided against (1) a transportation cask or site-specific cask with its outer lid removed and its inner lid in place but unbolted, (2) an exposed sealed dual-purpose canister, or (3) a dual-purpose canister with its severed lid in place.	Preventive	Procedural Safety	
	5. Collision involving the docking ring station or other access platforms and a cask containing a loaded DPC in the DPC preparation/cask dry remediation room (Room 1100).	DTF-DPCPRM-CC5	Beyond Category 2	Operational requirements ensure that the portable platforms, access platforms, mobile elevated platforms, and forklifts operated in the facility are not operated in a manner that could breach or overturn a loaded transportation cask or site-specific cask.	Preventive	Procedural Safety	
	6. Collision involving a trolley holding the cask containing the loaded DPC and the shield doors between DPC preparation/cask dry remediation room and the DPC docking room (Rooms 1100 and 1101).	DTF-DPCPRM-CC6	Beyond Category 2	(See GET-22) Same disposition as Potential Event DTF-DPCPRM-CC1.	Preventive	Design	
	7. Shield doors between the DPC preparation/cask dry remediation room and the DPC docking room close on a trolley holding the cask containing the loaded DPC (Rooms 1100 and 1101).	DTF-DPCPRM-CC7	Beyond Category 2	Same disposition as Potential Event DTF-DPCPRM-CC2.	Preventive	Design	
	8. Derailment of a trolley holding the cask containing the loaded DPC on the turntable in the DPC docking room followed by a load tipover or fall (Room 1101).	DTF-DPCPRM-CC8	Beyond Category 2	Same disposition as Potential Event DTF-DPCPRM-CC3.	Preventive	Design	
	9. Collision of a trolley holding the cask containing the loaded DPC with another trolley holding a cask on the turntable in the DPC docking room (Room 1101).	DTF-DPCPRM-CC9	Beyond Category 2	(See GET-22) Same disposition as Potential Event DTF-DPCPRM-CC1.	Preventive	Design	
	10. Drop or collision of a docking port (mobile slab) onto or against a cask containing the loaded DPC (Room 1101).	DTF-DPCPRM-CC10	Beyond Category 2	A design requirement ensures that a drop of or collision involving components associated with a docking port will not breach the lid of a cask or MSC situated at the docking port.	Preventive	Design	

Table III-22. Disposition of Internal Events That Occur Inside the Dry Transfer Facility Dual-purpose Canister Preparation-Cask Dry Remediation Room (Room 1100), Dual-purpose Canister Docking Room (Room 1101), and Dual-purpose Canister Cutting/Waste Package Dry Remediation Cell (Room 1097) (Continued)

Generic Event Category	Potential Event (Room or Area)	Disposition of Event			Preventive or Mitigative Requirement	Design or Procedural Safety Control
		Event Sequence Designator	Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	11.Drop or collision of a docking port plug onto or against the lid of a cask containing the loaded DPC (with outer lid removed [if applicable] and inner lid unbolted but in place) ((Room 1101).	DTF-DPCPRM-CC11	Beyond Category 2	Design requirements ensure that portions of a non-ITS SSC which, upon failure, could adversely interact with an ITS SSC and prevent its safety function from being performed are classified as ITS, redesigned to eliminate the potential unacceptable interaction with the identified ITS SSC, or, for seismic interactions, designed to the same seismic DBGM as the ITS SSCs subjected to the potential unacceptable interaction.	Preventive	Design
	12. Drop of an inner lid on a cask containing the loaded DPC (with outer lid removed [if applicable]) (Room 1101).	DTF-DPCPRM-CC12A DTF-DPCPRM-CC12B	No drop Category 2	(See GET-02 Sequences A and B only) Design and operational requirements reduce the drop probability.	Preventive	Design- Procedural Safety
	13.Drop or collision of DPC handling device or tools or equipment onto or against the DPC during the drilling/installation of the DPC handling device (Room 1101).	DTF-DPCPRM-CC13	Beyond Category 2	Same disposition as Potential Event DTF-DPCPRM-CC4.	Preventive	Procedural Safety
	14.Drop or collision of a loaded DPC from the DPC Cutting/WP Dry Remediation Cell overhead crane through the unload port back into or against the cask being unloaded during the DPC transfer from the cask to the DPC cutting/WP dry remediation cell cutting machine base (Room 1097).	DTF-DPCPRM-CC14A DTF-DPCPRM-CC14B	No drop Category 2	(See GET-05 Sequences A and B only) Design and operational requirements reduce the drop probability. For collisions, a design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design- Procedural Safety
	15.Drop of a loaded DPC from the DPC Cutting/WP Dry Remediation Cell overhead crane onto the DPC cutting/WP dry remediation cell floor during DPC transfer from the cask to the DPC cutting/WP dry remediation cell cutting machine base (Room 1097).	DTF-DPCPRM-CC15A DTF-DPCPRM-CC15B	No drop Category 2	(See GET-05 Sequences A and B only) Same disposition as Potential Event DTF-DPCPRM-CC14.	Preventive	Design- Procedural Safety
	16.Drop of a loaded DPC from the DPC Cutting/WP Dry Remediation Cell overhead crane onto the cutting machine base during DPC transfer from the cask to the DPC cutting/WP dry remediation cell cutting machine base (Room 1097).	DTF-DPCPRM-CC16A DTF-DPCPRM-CC16B	No drop Category 2	(See GET-05 Sequences A and B only) Same disposition as Potential Event DTF-DPCPRM-CC14.	Preventive	Design- Procedural Safety
	17.Drop or collision of a loaded DPC from the DPC Cutting/WP Dry Remediation Cell overhead crane onto or against a sharp object during DPC transfer from the cask to the DPC cutting/WP dry remediation cell cutting machine base (Room 1097).	DTF-DPCPRM-CC17A DTF-DPCPRM-CC17B	No drop Category 2	(See GET-05 Sequences A and B only) Same disposition as Potential Event DTF-DPCPRM-CC14.	Preventive	Design- Procedural Safety
	18.Drop or collision of the lid-cutting machine onto or against the DPC during the lowering of the machine for the lid-cutting operation (Room 1097).	DTF-DPCPRM-CC18	Beyond Category 2	A design requirement ensure that the mass, potential drop height, and other characteristics of the canister cutting machine are such that the dual-purpose canister lid prevents damage to the commercial SNF resulting in a potential radiological release should the cutting machine fall onto or make contact with the dual-purpose canister.	Preventive	Design
	19.Damage to one or more fuel assembly(ies) during lid-cutting operations or the DPC drainpipe cutting operation (Room 1097).	DTF-DPCPRM-CC19	Beyond Category 2	A design requirement ensures that the canister cutting machine is designed to preclude a radiological release due to damage inflicted upon the DPC contents during the cutting process.	Preventive	Design
	20.Drop or collision of the DPC cutting machine onto or against the open (lidless) DPC during the removal of the machine after the lid-cutting operation (Room 1097).	DTF-DPCPRM-CC20	Beyond Category 2	An operational requirement ensures that the canister cutting machine is not suspended over the open dual-purpose canister after the lid is removed.	Preventive	Procedural Safety
	21.Drop or collision of the severed lid back onto or against the open DPC from the ceiling-mounted manipulator or overhead crane after the completion of the DPC lid-cutting (Room 1097).	DTF-DPCPRM-CC21A DTF-DPCPRM-CC21B	No drop Category 2	(See GET-20) Design and operational requirements reduce the drop probability for cranes involved in handling waste forms and their associated containers..	Preventive	Design- Procedural Safety

Table III-22. Disposition of Internal Events That Occur Inside the Dry Transfer Facility Dual-purpose Canister Preparation-Cask Dry Remediation Room (Room 1100), Dual-purpose Canister Docking Room (Room 1101), and Dual-purpose Canister Cutting/Waste Package Dry Remediation Cell (Room 1097) (Continued)

Generic Event Category	Potential Event (Room or Area)	Disposition of Event			Preventive or Mitigative Requirement	Design or Procedural Safety Control
		Event Sequence Designator	Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	22. Drop or collision of handling equipment (lid grapple, etc.) onto or against the unsealed (open) loaded DPC (Room 1097).	DTF-DPCPRM-CC22A DTF-DPCPRM-CC22B	No drop Category 2	An operational requirement prohibits suspending a lid grapple above an open dual-purpose canister unless the lid is in place or is being lifted. If the lid is in place, then a design requirement ensures that a drop of handling equipment onto a dual-purpose canister with its severed lid in place does not initiate an event sequence. If the lid is being lifted, the potential event is analyzed as a lid-drop event. (see GET-20) Same disposition as Potential Event DTF-DPCPRM-CC21.	Preventive	Design-Procedural Safety
	23. Drop of an unsealed (open), loaded DPC from the overhead crane in the DPC cutting/WP dry remediation cell onto the floor during the transfer of the DPC from the DPC cutting machine base to the trolley that travels to the unloading port to the waste transfer cell (Room 1097).	DTF-DPCPRM-CC23A DTF-DPCPRM-CC23B	No drop Category 2	(See GET-05 Sequences A and B only) Same disposition as Potential Event DTF-DPCPRM-CC14.	Preventive	Design-Procedural Safety
	24. Drop of an unsealed (open), loaded DPC from the overhead crane in the DPC cutting/WP dry remediation cell onto the trolley during the transfer of the DPC from the DPC cutting machine base to the trolley that travels to the unloading port to the waste transfer cell (Room 1097).	DTF-DPCPRM-CC24A DTF-DPCPRM-CC24B	No drop Category 2	(See GET-05 Sequences A and B only) Same disposition as Potential Event DTF-DPCPRM-CC14.	Preventive	Design-Procedural Safety
	25. Drop or collision of an unsealed (open), loaded DPC from the overhead crane in the DPC cutting/WP dry remediation cell onto or against a sharp object during the transfer of the DPC from the DPC cutting machine base to the trolley that travels to the unloading port to the waste transfer cell (Room 1097).	DTF-DPCPRM-CC25	Beyond Category 2	Design and operational requirements ensure that surfaces in the load paths through which WPs, DOE SNF canisters, naval canisters, DPCs, transportation casks, transfer casks, or MSCs are transferred by crane are kept free of structures, such as posts and curbs, that could puncture a container in case of a drop. An operational requirement ensures that the load paths are kept free of movable puncture hazards. A design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design-Procedural Safety
	26. Slapdown of an unsealed (open), loaded DPC following a drop from the overhead crane in the DPC cutting/WP dry remediation cell onto the edge of a trolley that travels to the unloading port to the waste transfer cell during the lift and transfer to the trolley (Room 1097).	DTF-DPCPRM-CC26A DTF-DPCPRM-CC26B	No drop Category 2	(See GET-05 Sequences A and B only) Same disposition as Potential Event DTF-DPCPRM-CC14.	Preventive	Design-Procedural Safety
	27. Derailment of a trolley (that travels to the unloading port to the waste transfer cell) holding a loaded DPC (in an unsealed, opened state) in the DPC cutting/WP dry remediation cell, followed by a load tipover or fall (Room 1097).	DTF-DPCPRM-CC27	Beyond Category 2	Same disposition as Potential Event DTF-DPCPRM-CC3.	Preventive	Design
	28. Drop or collision of a SNF assembly from the spent fuel transfer machine back into or against the DPC being unloaded (Room 1097).	DTF-DPCPRM-CC28A DTF-DPCPRM-CC28B DTF-DPCPRM-CC28C DTF-DPCPRM-CC28D DTF-DPCPRM-CC28E	No collision Category 1 Category 2 Category 1 Category 2	(See GET-03) Design and operational requirements for the spent fuel transfer machine (in the dry transfer areas) and fuel handling machine (in the pool) reduce the drop rate and collision probabilities for commercial SNF assembly transfers, including those in single-assembly canisters. Assemblies are assumed to breach when they are dropped or involved in a collision. HVAC system reliability requirements ensure availability of high-efficiency particulate air filtration in the primary confinement areas of the DTF and FHF during a 4-h mission time without credit for backup electrical power. An operational requirement ensures that HVAC system is working properly before normal operations begin, that the HVAC system is monitored for proper operation during normal operations, and that normal operations are suspended if the HVAC system or offsite power becomes unavailable.	Preventive-Mitigative	Design-Procedural Safety

Table III-22. Disposition of Internal Events That Occur Inside the Dry Transfer Facility Dual-purpose Canister Preparation-Cask Dry Remediation Room (Room 1100), Dual-purpose Canister Docking Room (Room 1101), and Dual-purpose Canister Cutting/Waste Package Dry Remediation Cell (Room 1097) (Continued)

Generic Event Category	Potential Event (Room or Area)	Disposition of Event			Preventive or Mitigative Requirement	Design or Procedural Safety Control
		Event Sequence Designator	Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	29. Drop or collision of a SNF assembly from the spent fuel transfer machine onto or against another SNF assembly or assemblies in the DPC being unloaded (Room 1097).	DTF- DPCPRM-CC29A DTF- DPCPRM-CC29B DTF- DPCPRM-CC29C DTF- DPCPRM-CC29D DTF- DPCPRM-CC29E	No collision Category 1 Category 2 Category 1 Category 2	(See GET-03) Same disposition as Potential Event DTF-DPCPRM-CC28.	Preventive-Mitigative	Design-Procedural Safety
	30. Impact due to horizontal movement of a SNF assembly by the spent fuel transfer machine before the assembly is fully lifted out of the DPC (Room 2048).	DTF- DPCPRM-CC30A DTF- DPCPRM-CC30B DTF- DPCPRM-CC30C DTF- DPCPRM-CC30D DTF- DPCPRM-CC30E	No collision Category 1 Category 2 Category 1 Category 2	(See GET-03) Same disposition as Potential Event DTF-DPCPRM-CC28.	Preventive-Mitigative	Design-Procedural Safety
	31. Drop or collision of a SNF assembly from the spent fuel transfer machine onto or against a sharp object (other than another SNF assembly) (Room 2048).	DTF-DPCPRM-CC31	Beyond Category 2	Same disposition as Potential Event DTF-DPCPRM-CC25.	Preventive	Design-Procedural Safety
	32. Drop and slapdown of an SNF assembly from the spent fuel transfer machine (due to impact with an edge of the DPC, the floor edge, a DPC internal baffle, etc.) during the SNF transfer from the DPC to a WP or staging rack (Room 2048).	DTF- DPCPRM-CC32A DTF- DPCPRM-CC32B DTF- DPCPRM-CC32C DTF- DPCPRM-CC32D DTF- DPCPRM-CC32E	No collision Category 1 Category 2 Category 1 Category 2	(See GET-03) Same disposition as Potential Event DTF-DPCPRM-CC28.	Preventive-Mitigative	Design-Procedural Safety
Chemical Contamination-Flooding	1. Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperature (Rooms 1100, 1101, 1097, and 2048).	DTF-DPCPRM-CCF1	Normal Operations	Oxidation of failed commercial SNF is expected as a part of normal operations whenever commercial SNF is exposed to air. Any resulting potential exposure of workers to radiation is managed as a normal-operations dose by procedures that ensure that workers do not receive excessive radiation doses.	Mitigative	Procedural Safety
Explosion-Implosion	1. Hydrogen explosion involving batteries on a cask-handling trolley (Rooms 1100, 1101, and 1097).	DTF-DPCPRM-EI1	Beyond Category 2	Operational controls pertaining to batteries for powering heavy equipment ensure the generation or accumulation of enough hydrogen gas to cause an explosion that could breach a transportation cask, site-specific cask, or waste package is prevented.	Preventive	Procedural Safety
	2. Explosion hazard associated with the sampling and purging system or the cutting and removal of the DPC enclosure lid system and the ignition of hydrogen that may have accumulated in the canister (Room 1100).	DTF-DPCPRM-EI2	Beyond Category 2	Operational requirements ensure that precautions taken during the cask sampling and purging process provide reasonable assurance that such hydrogen explosions would not occur.	Preventive	Procedural Safety
	3. DPC sampling and purging system (or other pneumatic or pressurized system) missile due to a fractured nozzle/valve stem/pneumatic device (Room 1100).	DTF-DPCPRM-EI3	Beyond Category 2	An operational requirement ensures that pressurized systems that could generate missiles, energetic enough to penetrate a transportation cask with or without impact limiters, a transfer cask, a DOE canister, a naval SNF canister, a dual-purpose canister, the inner lid of a transportation cask, a site-specific cask, a waste package, or the inner lid of a site-specific cask or waste package are not present in areas where potentially vulnerable items may be exposed.	Preventive	Procedural Safety
Fire-Thermal	1. Electrical fire associated with SNF handling equipment in the DPC preparation/dry remediation room, DPC docking room, the waste transfer cell, or the DPC cutting/WP dry remediation cell (including the overhead cranes, manipulators, the chipless cutting equipment, etc.) (Rooms 1100, 1101, 1097, and 2048).	DTF-DPCPRM-FT1	Beyond Category 2	Design and operational requirements ensure control of the presence and amount of combustibles in the different areas of the repository to preclude any Category 1 or Category 2 event sequences potentially initiated by a fire.	Preventive	Design-Procedural Safety
	2. Fire/explosion (battery/electrical fire) associated with the cask-handling trolley (Rooms 1100, 1101, and 1097).	DTF-DPCPRM-FT2	Beyond Category 2	Same disposition as Potential Event DTF-DPCPRM-FT1.	Preventive	Design-Procedural Safety

Table III-22. Disposition of Internal Events That Occur Inside the Dry Transfer Facility Dual-purpose Canister Preparation-Cask Dry Remediation Room (Room 1100), Dual-purpose Canister Docking Room (Room 1101), and Dual-purpose Canister Cutting/Waste Package Dry Remediation Cell (Room 1097) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Event Sequence Category	Disposition of Event	Preventive or Mitigative Requirement	Design or Procedural Safety Control
				Design, Procedural Safety, or Operational Requirement		
	3. Electrical fire associated with the trolley in the DPC cutting/WP dry remediation cell. (Room 1097).	DTF-DPCPRM-FT3	Beyond Category 2	Same disposition as Potential Event DTF-DPCPRM-FT1.	Preventive	Design-Procedural Safety
	4. Intact or non-intact SNF overheating due to a loss of cooling resulting in excessive temperature and possible zircaloy cladding (or other cladding) unzipping or cladding failure due to excessive hoop stresses (Rooms 1100, 1101, 1097, and 2048).	DTF-DPCPRM-FT4	Beyond Category 2	If ventilation is lost in areas where DOE or naval canisters are handled, no radiological release occurs from the canisters because containment within the canisters is maintained. Design and operational requirements ensure that the thermal response of areas where CSNF assemblies are handled or staged to a loss of HVAC would not cause radiological releases in excess of those considered in the consequence analysis for normal operations.	Preventive	Design-Procedural Safety
	5. Thermal hazard (from decay heat) associated with vertical orientation of the cask holding the DPC (Rooms 1100, 1101, and 1097).	DTF-DPCPRM-FT5	Normal Operations	Same disposition as Potential Event DTF-DPCPRM-CCF1	Mitigative	Procedural Safety
	6. Transient combustible fire in the DPC preparation/dry remediation room, DPC docking room, the waste transfer cell, or the DPC cutting/WP dry remediation cell (Rooms 1100, 1101, 1097, and 2048).	DTF-DPCPRM-FT6	Beyond Category 2	Same disposition as Potential Event DTF-DPCPRM-FT1.	Preventive	Design-Procedural Safety
Radiation	1. Radiation exposure of a facility worker and/or the offsite public (Rooms 1100, 1101, 1097, and 2048).	DTF-DPCPRM-R1	NA—Accounted for in consequence analyses, if applicable	NA—Potential exposure of workers or the public to radiation is a hazard for the event sequences considered in this analysis. Consequence analyses evaluate this hazard for Category 1 and Category 2 event sequences, as applicable.	NA	NA
			Normal Operations	Some exposure to radiation is expected as a part of normal facility operations. Exposures are managed by design features and procedures that ensure that workers or the public do not receive excessive radiation doses.	Mitigative	Design-Procedural Safety
	2. Damage or rupture of the DPC sampling and purging system, leading to a release of canister internal gases and radioactive material (Room 1100).	DTF-DPCPRM-R2	Normal Operations	The sampling operation is conducted so that exposure of workers to radiation is managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. Although a rupture leading to a radiological release would be an off-normal occurrence, any release and related dose would be managed as part of routine radiation protection operations.	Mitigative	Procedural Safety
	3. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation (Rooms 1100, 1101, 1097, and 2048).	DTF-DPCPRM-R3	NA (no significant exposure)	Operating procedures ensure that a loss of confinement during otherwise normal operations does not cause individuals to be exposed to significant amounts of radioactivity.	Mitigative	Procedural Safety
	4. Thermal expansion of gases or other loss of confinement in an unsealed cask, leading to radiological release (Rooms 1101, 1097, and 2048).	DTF-DPCPRM-R4	Normal Operations	Thermal expansion of gases is to be expected as a part of normal operations. Any resulting potential exposure of workers to radiation is managed as a normal-operations dose by procedures that ensure that workers do not receive excessive radiation doses.	Mitigative	Procedural Safety
	5. Radiation-induced damage to a facility SSC (Rooms 1100, 1101, 1097, and 2048).	DTF-DPCPRM-R5	NA	Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization.	NA	NA
Fissile	1. Criticality associated with a derailment of a trolley moving a transportation cask holding a sealed, loaded DPC and a rearrangement of the DPC contents followed by a load tipover or fall (Rooms 1100, 1101, and 1097).	DTF-DPCPRM-F1	Beyond Category 2	Design requirements and waste acceptance criteria ensure that transportation casks, transfer casks, MSCs, and dual-purpose canisters (DPCs) are designed to ensure nuclear criticality safety with optimum moderation and most-reactive waste forms. Criticality safety will be maintained despite geometric rearrangements due to a drop or other handling incident.	Preventive	Design

Table III-22. Disposition of Internal Events That Occur Inside the Dry Transfer Facility Dual-purpose Canister Preparation-Cask Dry Remediation Room (Room 1100), Dual-purpose Canister Docking Room (Room 1101), and Dual-purpose Canister Cutting/Waste Package Dry Remediation Cell (Room 1097) (Continued)

Generic Event Category	Potential Event (Room or Area)	Disposition of Event			Preventive or Mitigative Requirement	Design or Procedural Safety Control
		Event Sequence Designator	Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	2. Criticality associated with a drop or slapdown of a sealed, loaded DPC from the DPC Cutting/WP Dry Remediation Cell overhead crane and a rearrangement of the DPC contents (Room 1097).	DTF-DPCPRM-F2	Beyond Category 2	Same disposition as Potential Event DTF- DPCPRM-F1. Additionally, a design requirement ensures that dropping a DOE SNF canister within its design basis does not lead to a criticality. Demonstration of compliance for the staging rack must account for the most reactive configuration of DOE SNF canisters with credit for moderator control. Design and operational requirements ensure that moderator control is in effect. There is no potential for criticality of DOE HLW canisters. Criticality of a naval canister following a drop, or other impact event, has been evaluated to be Beyond Category 2 based upon probabilities of independent events required for criticality.	Preventive	Design
	3. Criticality associated with a drop or slapdown of an unsealed (open) loaded, or sealed (unopened) loaded DPC from DPC cutting area overhead crane and a rearrangement of the DPC contents (Room 1097).	DTF-DPCPRM-F3	Beyond Category 2	Same disposition as Potential Event DTF- DPCPRM-F1.	Preventive	Design
	4. Criticality associated with a derailment of a trolley moving an unsealed (open) loaded DPC followed by a load tipover or fall and a rearrangement of the DPC contents (Rooms 1101 and 1097).	DTF-DPCPRM-F4	Beyond Category 2	Same disposition as Potential Event DTF- DPCPRM-CC3.	Preventive	Design
	5. Criticality associated with a drop of an SNF assembly from the spent fuel transfer machine back into the DPC being unloaded and a rearrangement of the canister internals (Room 2048).	DTF-DPCPRM-F5	Beyond Category 2	Same disposition as Potential Event DTF- DPCPRM-F1.	Preventive	Design
	6. Criticality associated with a drop of an SNF assembly from the spent fuel transfer machine and a rearrangement of the fuel rods that comprise the assembly due to impact (Room 2048).	DTF-DPCPRM-F6	NA	Results of criticality analyses ensure that drops, collisions, and other handling impacts of a commercial SNF assembly (allowing for rearrangement of fuel rods and without credit for burnup or moderator control) do not pose a criticality safety concern.	NA	NA
	7. Criticality associated with the drop of heavy equipment onto an unsealed (open) loaded, or sealed (unopened) loaded DPC and a rearrangement of the container internals (Rooms 1101 and 1097).	DTF-DPCPRM-F7	Beyond Category 2	Same disposition as Potential Event DTF-DPCPRM-F1.	Preventive	Design

NOTES: CC = collision-crushing; CCF = chemical contamination flooding; DBGM = design basis ground motion; DPCPRM= dual purpose canister preparation remediation room; DTF = dry transfer facility (DTF 1 and DTF 2); EI = explosion-implosion; F = fissile; FT = fire-thermal; GET = generalized event tree; HLW = high-level radioactive waste; NA = not applicable; R = radiation; SNF = spent nuclear fuel; SRTC = site rail transfer cart.

The Event Sequence Designator is a unique event sequence index for each event in this table. The prefix identifies the building or facility, for example "DTF," the middle identifies an activity, room, or area, for example "DPCPRM," and the suffix identifies the hazard category and event number, for example "CC1." When an event sequence has been evaluated in a GET, the GET number is identified in the Disposition of Event column; the GET sequence alpha character is shown at the end of the Event Sequence Designator, for example "A."

Additional room(s) with potential events in this table: Room 1074 - Cask preparation room; Room 1109 - cask docking/dry remediation room; Room 2048 - Waste transfer cell.

GETs are discussed in Sections 6.3.1.1 to 6.3.1.24.

Table III-23. Disposition of Internal Events That Occur Inside the Fuel Handling Facility (Cask and Site-specific Cask Receipt): Entrance Vestibule (Room 1001)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Collision-Crushing	1. Railcar derailment, overturning, or collision involving a loaded cask followed by a load tipover or fall (Room 1001).	FHF-EV-CC1	Beyond Category 2	Transportation casks with impact limiters are designed to withstand, without breaching, the bounding drops that could occur during cask handling at the repository. Consequently, a derailment, overturning or collision would not breach a transportation cask.	Preventive	Design
	2. Overturning or collision involving an LWT or an OWT holding a loaded cask (with impact limiters and personnel barrier installed) (Room 1001).	FHF-EV-CC2	Beyond Category 2	Same disposition as Potential Event FHF-EV-CC1.	Preventive	Design
	3. Collision of a railcar, an LWT, or OWT carrying a loaded cask (with impact limiters and personnel barrier installed) with the entrance vestibule doors (Room 1001).	FHF-EV-CC3	Beyond Category 2	Same disposition as Potential Event FHF-EV-CC1.	Preventive	Design
	4. The entrance vestibule doors close on a railcar, an LWT, or an OWT carrying a loaded cask (with impact limiters and personnel barrier installed) (Room 1001).	FHF-EV-CC4	Beyond Category 2	Same disposition as Potential Event FHF-EV-CC1.	Preventive	Design
	5. Collision of the gantry crane carrying a loaded MSC with the entrance vestibule doors (Room 1001).	FHF-EV-CC5	Beyond Category 2	A design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design
	6. The entrance vestibule doors close on the entrance vestibule gantry crane carrying a loaded MSC (Room 1001).	FHF-EV-CC6	Beyond Category 2	A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transfer trolley, site-rail transfer cart (SRTC), MSC transporter, WP transporter, would not cause a tipover of the conveyance or cause the conveyance to drop its load. A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transportation cask, transfer cask, or MSC suspended from an overhead crane would not cause the crane to drop its load.	Preventive	Design
	7. Collision of a mobile elevated platform with a loaded cask or the conveyance holding the cask during removal of personnel barriers and impact limiters or during survey activities (Room 1001).	FHF-EV-CC7	Beyond Category 2	Operational requirements ensure that the portable platforms, access platforms, mobile elevated platforms, and forklifts operated in the facility are not operated in a manner that could breach or overturn a loaded transportation cask or site-specific cask.	Preventive	Procedural Safety
	8. Drop or collision of personnel barriers or impact limiters from the entrance vestibule gantry crane onto or against the loaded cask (Room 1001).	FHF-EV-CC8	Beyond Category 2	Operational requirements for cask preparation and handling ensure that a drop of or collision involving equipment would not breach a transportation cask, transfer cask, or an MSC.	Preventive	Procedural Safety
	9. Collision between a forklift and a loaded cask on a railcar, an LWT, an OWT, or the conveyance holding the cask, prior to or after the removal of impact limiters and personnel barrier (Room 1001).	FHF-EV-CC9	Beyond Category 2	Same disposition as Potential Event FHF-EV-CC7.	Preventive	Procedural Safety
	10. Collision between a mobile elevating platform and a loaded cask on a railcar, an LWT, an OWT, or the conveyance holding the cask (Room 1001).	FHF-EV-CC10	Beyond Category 2	Same disposition as Potential Event FHF-EV-CC1.	Preventive	Design

Table III-23. Disposition of Internal Events That Occur Inside the Fuel Handling Facility (Cask and Site-specific Cask Receipt): Entrance Vestibule (Room 1001) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	11. Collision between the entrance vestibule gantry crane carrying a loaded MSC and a forklift. (Room 1001).	FHF-EV-CC11	Beyond Category 2	Same disposition as Potential Events FHF-EV-CC5 and FHF-EV-CC7.	Preventive	Design-Procedural Safety
	12. Collision between the entrance vestibule gantry crane carrying the loaded MSC and a mobile elevated platform (Room 1001).	FHF-EV-CC12	Beyond Category 2	Same disposition as Potential Event FHF-EV-CC11.	Preventive	Design-Procedural Safety
	13. Drop or collision of equipment from the entrance vestibule gantry crane (including handling equipment for personnel barriers, impact limiters, etc.) onto or against a loaded cask or loaded MSC. (Room 1001).	FHF-EV-CC13	Beyond Category 2	Same disposition as Potential Event FHF-EV-CC8.	Preventive	Procedural Safety
	14. Slapdown of a loaded cask onto a railcar, a truck trailer, or the floor during upending of the cask to the vertical orientation (after removal of the impact limiters and personnel barrier) (Room 1001).	FHF-EV-CC14A FHF-EV-CC14B FHF-EV-CC14C FHF-EV-CC14D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-01) Design and operational requirements reduce the drop probability. Design requirements limit the lift height for transportation and transfer casks without impact limiters and site-specific casks. Design and operational requirements limit the probability of exceeding the lift height. A design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multiccanister overpack is defective.	Preventive	Design-Procedural Safety
	15. Drop of a loaded cask in a horizontal position (such as the Hi Star) from the entrance vestibule gantry crane onto the floor or back onto the railcar or truck trailer during the transfer from a railcar or truck trailer to the tilting frame (Room 1001).	FHF-EV-CC15A FHF-EV-CC15B FHF-EV-CC15C FHF-EV-CC15D	Category 2. No breach Beyond Category 2 Beyond Category 2	(See GET-01) Same disposition as Potential Event FHF-EV-CC14.	Preventive	Design-Procedural Safety
	16. Drop or collision of a loaded cask in a horizontal position (such as the Hi Star) from the entrance vestibule gantry crane onto or against a sharp object or the tilting frame during the transfer from a railcar or truck trailer to the tilting frame (Room 1001).	FHF-EV-CC16	Beyond Category 2	Design and operational requirements ensure that surfaces in the load paths through which WPs, DOE SNF canisters, naval canisters, DPCs, transportation casks, transfer casks, or MSCs are transferred by crane are kept free of structures, such as posts and curbs, that could puncture a container in case of a drop. An operational requirement ensures that the load paths are kept free of movable puncture hazards. A design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventative	Design-Procedural Safety
	17. Drop of a loaded cask from the entrance vestibule gantry crane onto the floor during the transfer from a railcar, truck trailer, or tilting frame to the pedestal on an import-export trolley (Room 1001).	FHF-EV-CC17A FHF-EV-CC17B FHF-EV-CC17C FHF-EV-CC17D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-01) Same disposition as Potential Event FHF-EV-CC14.	Preventive	Design-Procedural Safety
	18. Drop of a loaded cask from the entrance vestibule gantry crane onto the pedestal on an import-export trolley during the transfer from a railcar, truck trailer, or tilting frame to the pedestal on an import-export trolley (Room 1001).	FHF-EV-CC18A FHF-EV-CC18B FHF-EV-CC18C FHF-EV-CC18D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-01) Same disposition as Potential Event FHF-EV-CC14.	Preventive	Design-Procedural Safety
	19. Drop or collision of a loaded cask from the entrance vestibule gantry crane onto or against a sharp object during the transfer from a railcar, truck trailer, or tilting frame to the pedestal on an import-export trolley (Room 1001).	FHF-EV-CC19	Beyond Category 2	Same disposition as Potential Event FHF-EV-CC16.	Preventative	Design-Procedural Safety

Table III-23. Disposition of Internal Events That Occur Inside the Fuel Handling Facility (Cask and Site-specific Cask Receipt): Entrance Vestibule (Room 1001) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	20. Drop of a loaded MSC from the entrance vestibule gantry crane onto the pedestal on an import-export trolley (Room 1001).	FHF-EV-CC20A FHF-EV-CC20B FHF-EV-CC20C FHF-EV-CC20D	Category 2 No breach Beyond Category 2 Beyond Category 2	(Bounded by GET-01) Same disposition as Potential Event FHF-EV-CC14.	Preventive	Design-Procedural Safety
	21. Drop of a loaded MSC from the entrance vestibule gantry crane onto the pedestal on an import-export trolley during the transfer from the FHF pad to the pedestal on an import-export trolley (Room 1001).	FHF-EV-CC21A FHF-EV-CC21B FHF-EV-CC21C FHF-EV-CC21D	Category 2 No breach Beyond Category 2 Beyond Category 2	(Bounded by GET-01) Same disposition as Potential Event FHF-EV-CC14.	Preventive	Design-Procedural Safety
	22. Drop or collision of a loaded MSC from the entrance vestibule gantry crane onto or against a sharp object during the transfer from the FHF pad to the pedestal on an import-export trolley (Room 1001).	FHF-EV-CC22	Beyond Category 2	Same disposition as Potential Event FHF-EV-CC16.	Preventative	Design-Procedural Safety
	23. Slapdown of a loaded cask in the entrance vestibule due to off-center cask lowering or drop onto the pedestal on an import-export trolley (Room 1001).	FHF-EV-CC23A FHF-EV-CC23B FHF-EV-CC23C FHF-EV-CC23D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-01) Same disposition as Potential Event FHF-EV-CC14.	Preventive	Design-Procedural Safety
	24. Slapdown of a loaded MSC in the entrance vestibule due to off-center MSC lowering or drop onto the pedestal or edge of the pedestal on an import-export trolley (Room 1001).	FHF-EV-CC24A FHF-EV-CC24B FHF-EV-CC24C FHF-EV-CC24D	Category 2 No breach Beyond Category 2 Beyond Category 2	(Bounded by GET-01) Same disposition as Potential Event FHF-EV-CC14.	Preventive	Design-Procedural Safety
	25. Handling equipment drop onto a loaded cask or loaded MSC (Room 1001).	FHF-EV-CC25	Beyond Category 2	Same disposition as Potential Event FHF-EV-CC8.	Preventive	Procedural Safety
Chemical Contamination-Flooding	1. Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures or during off-normal temperatures (e.g., during a failure of the cooling system) (Room 1001).	FHF-EV-CCF1	NA—Accounted for in consequence analyses, if applicable	NA—SNF is contained inside a sealed cask, therefore this event does not occur unless an event sequence leads to exposure of SNF to air. Oxidation of the fuel matrix is a possible outcome of any event that exposes SNF to air. Consequence analyses account for the possibility of oxidation, as applicable.	NA	NA
Explosion-Implsion	1. Hydrogen explosion involving batteries on a forklift (Room 1001).	FHF-EV-EI1	Beyond Category 2	Operational controls pertaining to batteries for powering heavy equipment ensure the generation or accumulation of enough hydrogen gas to cause an explosion that could breach a transportation cask, site-specific cask, or waste package is prevented.	Preventive	Procedural Safety

Table III-23. Disposition of Internal Events That Occur Inside the Fuel Handling Facility (Cask and Site-specific Cask Receipt): Entrance Vestibule (Room 1001) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Fire-Thermal	2. Hydrogen explosion involving batteries on a mobile elevated platform (Room 1001).	FHF-EV-EI2	Beyond Category 2	Same disposition as Potential Event FHF-EV-EI1.	Preventive	Procedural Safety
	3. Hydrogen explosion involving batteries on the import-export trolley (Room 1001).	FHF-EV-EI3	Beyond Category 2	Same disposition as Potential Event FHF-EV-EI1.	Preventive	Procedural Safety
	4. Hydrogen explosion involving batteries on a site prime mover (Room 1001).	FHF-EV-EI4	Beyond Category 2	Same disposition as Potential Event FHF-EV-EI1.	Preventive	Procedural Safety
	1. Electrical fire associated with the entrance vestibule gantry crane (Room 1001).	FHF-EV-FT1	Beyond Category 2	Design and operational requirements ensure control of the presence and amount of combustibles in the different areas of the repository to preclude any Category 1 or Category 2 event sequences potentially initiated by a fire.	Preventive	Design-Procedural Safety
	2. Electrical fire associated with handling equipment or other entrance vestibule electrical equipment (Room 1001).	FHF-EV-FT2	Beyond Category 2	Same disposition as Potential Event FHF-EV-FT1.	Preventive	Design-Procedural Safety
	3. Fire/explosion (battery/electrical fire) involving a site prime mover pulling or pushing a conveyance holding a loaded cask (Room 1001).	FHF-EV-FT3	Beyond Category 2	Same disposition as Potential Event FHF-EV-FT1.	Preventive	Design-Procedural Safety
	4. Fire/explosion (battery/electrical fire) associated with the import-export trolley (Room 1001).	FHF-EV-FT4	Beyond Category 2	Same disposition as Potential Event FHF-EV-FT1.	Preventive	Design-Procedural Safety
	5. Fire/explosion (battery/electrical fire) associated with a forklift (Room 1001).	FHF-EV-FT5	Beyond Category 2	Same disposition as Potential Event FHF-EV-FT1.	Preventive	Design-Procedural Safety
	6. Fire/explosion (battery/electrical fire) associated with the mobile elevated platform (Room 1001).	FHF-EV-FT6	Beyond Category 2	Same disposition as Potential Event FHF-EV-FT1.	Preventive	Design-Procedural Safety
	7. Thermal hazard (from decay heat) associated with vertical orientation of a loaded cask (Room 1001).	FHF-EV-FT7	Beyond Category 2	Transportation casks are designed to withstand normal conditions of transport (including high ambient temperatures and insolation) and hypothetical accident conditions (including fire). These conditions bound the thermal effect of orienting the cask vertically rather than horizontally. This potential event would not cause oxidation of SNF leading to exposure of individuals to radiation because the waste is contained in a sealed cask.	Preventive	Design
Radiation	8. Transient combustible fire in the entrance vestibule (Room 1001).	FHF-EV-FT8	Beyond Category 2	Same disposition as Potential Event FHF-EV-FT1.	Preventive	Design-Procedural Safety
	1. Radiation exposure of a facility worker and/or the offsite public (Room 1001).	FHF-EV-R1	NA—Accounted for in consequence analyses, if applicable Normal Operations	NA—Potential exposure of workers or the public to radiation is a hazard for the event sequences considered in this analysis. Consequence analyses evaluate this hazard for Category 1 and Category 2 event sequences, as applicable. Some exposure to radiation is expected as a part of normal facility operations. Exposures are managed by design features and procedures that ensure that workers or the public do not receive excessive radiation doses.	NA Mitigative	NA Design-Procedural Safety
	2. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation (Room 1001).	FHF-EV-R2	NA (no significant exposure)	Operating procedures ensure that a loss of confinement during otherwise normal operations does not cause individuals to be exposed to significant amounts of radioactivity.	Mitigative	Procedural Safety

Table III-23. Disposition of Internal Events That Occur Inside the Fuel Handling Facility (Cask and Site-specific Cask Receipt): Entrance Vestibule (Room 1001) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	3. Radiation-induced damage to a facility SSC (Room 1001).	FHF-EV-R3	NA	Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization.	NA	NA
Fissile	1. Criticality associated with a railcar (holding a loaded cask) derailment or collision followed by a load tipover or fall and rearrangement of the cask internals (Room 1001).	FHF-EV-F1	Beyond Category 2	Design requirements and waste acceptance criteria ensure that transportation casks, transfer casks, MSCs, and dual-purpose canisters (DPCs) are designed to ensure nuclear criticality safety with optimum moderation and most-reactive waste forms. Criticality safety will be maintained despite geometric rearrangements due to a drop or other handling incident.	Preventive	Design
	2. Criticality associated with an overturning or collision involving an LWT or an OWT holding a loaded cask and rearrangement of cask internals (Room 1001).	FHF-EV-F2	Beyond Category 2	Same disposition as Potential Event FHF-EV-F1.	Preventive	Design
	3. Criticality associated with a drop or slapdown of a cask and a rearrangement of the container internals (Room 1001).	FHF-EV-F3	Beyond Category 2	Same disposition as Potential Event FHF-EV-F1.	Preventive	Design
	4. Criticality associated with a drop or slapdown of an MSC and a rearrangement of the container internals (Room 1001).	FHF-EV-F4	Beyond Category 2	Same disposition as Potential Event FHF-EV-F1.	Preventive	Design
	5. Criticality associated with collision of the entrance vestibule gantry crane holding an MSC followed by a load drop or tipover and a rearrangement of the MSC internals (Room 1001).	FHF-EV-F5	Beyond Category 2	Same disposition as Potential Event FHF-EV-F1.	Preventive	Design

NOTES: CC = collision-crushing; CCF = chemical-contamination flooding; EI = explosion-implosion; EV = entrance vestibule; F = fissile; FHF = Fuel Handling Facility; FT = fire-thermal; GET = generalized event tree; LWT = legal-weight truck; NA = not applicable; OWT = overweight truck; R = radiation; SNF = spent nuclear fuel; SRTC = site rail transfer cart.

The Event Sequence Designator is a unique event sequence index for each event in this table. The prefix identifies the building or facility, for example "FHF," the middle identifies an activity, room, or area, for example "EV," and the suffix identifies the hazard category and event number, for example "CC1." When an event sequence has been evaluated in a GET, the GET number is identified in the Disposition of Event column; the GET sequence alpha character is shown at the end of the Event Sequence Designator, for example "A."

GETs are discussed in Sections 6.3.1.1 to 6.3.1.24.

Table III-24. Disposition of Internal Events That Occur Inside the Fuel Handling Facility: Preparation Room (Room 1002)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Collision-Crushing	1. Collision of a loaded cask or loaded MSC on a pedestal on the import-export trolley with the preparation room shield doors separating the FHF entrance vestibule from the preparation room (Room 1002).	FHF-PR-CC1	Beyond Category 2	(See GET-22) A design requirement limits the speed of trolley movements such that a collision at the speed limit would not cause the trolley to drop its load.	Preventive	Design
	2. The preparation room shield doors separating the FHF entrance vestibule from the preparation room close on a loaded cask or loaded MSC on a pedestal on the import-export trolley (Room 1002).	FHF-PR-CC2	Beyond Category 2	A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transfer trolley, site-rail transfer cart (SRTC), MSC transporter, WP transporter, would not cause a tipover of the conveyance or cause the conveyance to drop its load. A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transportation cask, transfer cask, or MSC suspended from an overhead crane would not cause the crane to drop its load.	Preventive	Design
	3. Derailment of an import-export trolley holding a loaded cask or loaded MSC on a pedestal (with outer and/or inner lid bolted in place, if applicable) followed by a load tipover or fall (Room 1002).	FHF-PR-CC3	Beyond Category 2	A design requirement ensures that loaded transfer trolleys do not derail or drop their loads. Design requirements apply to trolleys for casks, waste packages, site-specific casks, and dual-purpose canisters.	Preventive	Design
	4. Drop or collision of tools or equipment (including a lid-lifting fixture, lid bolts, etc.) onto or against a loaded cask or loaded MSC outer lid (if applicable) or a cask or MSC inner lid in the preparation room (Room 1002).	FHF-PR-CC4	Beyond Category 2	An operational requirement limits lift heights for tools and equipment associated with transportation cask, transfer cask, MSC, and DPC handling and preparation to the minimum necessary for operational purposes. The operational requirement ensures that tools and equipment, including handling equipment, if dropped from the height limit, can not initiate an event sequence if dropped onto or collided against (1) a transportation cask or site-specific cask with its outer lid removed and its inner lid in place but unbolted, (2) an exposed sealed dual-purpose canister, or (3) a dual-purpose canister with its severed lid in place.	Preventive	Procedural Safety
	5. Collision of a mobile elevated platform with a loaded cask or loaded MSC during preparation activities on top of the cask or MSC (Room 1002).	FHF-PR-CC5	Beyond Category 2	Operational requirements ensure that the portable platforms, access platforms, mobile elevated platforms, and forklifts operated in the facility are not operated in a manner that could breach or overturn a loaded transportation cask or site-specific cask.	Preventive	Procedural Safety
	6. Drop of a cask or MSC outer lid onto the loaded cask or loaded MSC (if applicable) in the preparation room (Room 1002).	FHF-PR-CC6A FHF-PR-CC6B FHF-PR-CC6C FHF-PR-CC6D FHF-PR-CC6E FHF-PR-CC6F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(Bounded by GET-02) Design and operational requirements reduce the drop probability. Operational requirements limit the lift height of the inner lid of a transportation cask, transfer cask, site-specific cask, or waste package to ensure that a lid drop onto a DOE canister within that breaches the canister is a beyond Category 2 event sequence. Design and operational requirements limit the probability of exceeding the lift height. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multiccanister overpack is defective.	Preventive	Design-Procedural Safety
	7. Derailment of an import-export trolley holding a loaded cask or loaded MSC on a pedestal (with outer lid removed [if applicable] and inner lid unbolted but in place) followed by a load tipover or fall (Room 1002).	FHF-PR-CC7	Beyond Category 2	Same disposition as Potential Event FHF-PR-CC3.	Preventive	Design
	8. Collision of an import-export trolley holding a loaded cask or loaded MSC on a pedestal (with outer lid removed [if applicable] and inner lid unbolted but in place) with shield doors separating the preparation room and the main transfer room (Room 1002).	FHF-PR-CC8	Beyond Category 2	(See GET-22) Same disposition as Potential Event FHF-PR-CC1.	Preventive	Design
	9. Closure of the shield doors separating the preparation room and the main transfer room onto the import-export trolley holding a loaded cask or loaded MSC on a pedestal (with outer lid removed [if applicable] and inner lid unbolted but in place) (Room 1002).	FHF-PR-CC9	Beyond Category 2	Same disposition as Potential Event FHF-PR-CC2.	Preventive	Design

Table III-24. Disposition of Internal Events That Occur Inside the Fuel Handling Facility: Preparation Room (Room 1002) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Chemical Contamination-Flooding	1. Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures (Room 1002).	FHF-PR-CCF1	Normal Operations	Oxidation of failed commercial SNF is expected as a part of normal operations whenever commercial SNF is exposed to air. Any resulting potential exposure of workers to radiation is managed as a normal-operations dose by procedures that ensure that workers do not receive excessive radiation doses.	Mitigative	Procedural Safety
Explosion-Implosion	1. Cask sampling and inerting system (or other pneumatic or pressurized system) missile due to a fractured nozzle/valve stem/pneumatic device (Room 1002).	FHF-PR-EI1	Beyond Category 2	An operational requirement ensures that pressurized systems that could generate missiles, energetic enough to penetrate a transportation cask with or without impact limiters, a transfer cask, a DOE canister, a naval SNF canister, a dual-purpose canister, the inner lid of a transportation cask, a site-specific cask, a waste package, or the inner lid of a site-specific cask or waste package are not present in areas where potentially vulnerable items may be exposed.	Preventive	Procedural Safety
	2. Explosion hazard associated with the cask sampling and inerting system and the ignition of hydrogen that may have accumulated in the cask (Room 1002).	FHF-PR-EI2	Beyond Category 2	Precautions taken during the cask sampling and purging process provide reasonable assurance that such hydrogen explosions would not occur.	Preventive	Procedural Safety
	3. Hydrogen explosion involving batteries on the import-export trolley (Room 1002).	FHF-PR-EI3	Beyond Category 2	Operational controls pertaining to batteries for powering heavy equipment ensure the generation or accumulation of enough hydrogen gas to cause an explosion that could breach a transportation cask, site-specific cask, or waste package is prevented.	Preventive	Procedural Safety
	4. Hydrogen explosion involving batteries on a mobile elevated platform (Room 1002).	FHF-PR-EI4	Beyond Category 2	Same disposition as Potential Event FHF-PR-EI3.	Preventive	Procedural Safety
Fire-Thermal	1. Electrical fire associated with handling equipment or other preparation room equipment, including the main transfer room overhead crane (which can access the preparation room via an overhead hatch) (Room 1002).	FHF-PR-FT1	Beyond Category 2	Design and operational requirements ensure control of the presence and amount of combustibles in the different areas of the repository to preclude any Category 1 or Category 2 event sequences potentially initiated by a fire.	Preventive	Design-Procedural Safety
	2. Fire/explosion (battery/electrical fire) associated with the import-export trolley (Room 1002).	FHF-PR-FT2	Beyond Category 2	Same disposition as Potential Event FHF-PR-FT1.	Preventive	Design-Procedural Safety
	3. Fire/explosion (battery/electrical fire) associated with the mobile elevated platform (Room 1002).	FHF-PR-FT3	Beyond Category 2	Same disposition as Potential Event FHF-PR-FT1.	Preventive	Design-Procedural Safety
	4. Transient combustible fire in the preparation area (Room 1002).	FHF-PR-FT4	Beyond Category 2	Same disposition as Potential Event FHF-PR-FT1	Preventive	Design-Procedural Safety
	5. Thermal hazard (from decay heat) associated with vertical orientation of a loaded cask (Room 1002).	FHF-PR-FT5	Normal Operations	Same disposition as Potential Event FHF-PR-CCF1	Mitigative	Procedural Safety
	6. Intact or non-intact SNF overheating or damage to canister contents due to a loss of cooling resulting in excessive temperature and possible zircaloy cladding (or other cladding) unzipping or cladding failure due to excessive hoop stresses (Room 1002).	FHF-PR-FT6	Beyond Category 2	If ventilation is lost in areas where DOE or naval canisters are handled, no radiological release occurs from the canisters because containment within the canisters is maintained. Design and operational requirements ensure that the thermal response of areas where CSNF assemblies are handled or staged to a loss of HVAC would not cause radiological releases in excess of those considered in the consequence analysis for normal operations.	Preventive	Design-Procedural Safety

Table III-24. Disposition of Internal Events That Occur Inside the Fuel Handling Facility: Preparation Room (Room 1002) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Radiation	1. Radiation exposure of a facility worker and/or the offsite public (Room 1002).	FHF-PR-R1	NA—Accounted for in consequence analyses, if applicable Normal Operations	NA—Potential exposure of workers or the public to radiation is a hazard for the event sequences considered in this analysis. Consequence analyses evaluate this hazard for Category 1 and Category 2 event sequences, as applicable. Some exposure to radiation is expected as a part of normal facility operations. Exposures are managed by design features and procedures that ensure that workers or the public do not receive excessive radiation doses.	NA Mitigative	NA Design-Procedural Safety
	2. Damage or rupture of cask sampling and purging system, leading to a release of cask internal gases and radioactive material (Room 1002).	FHF-PR-R2	Normal Operations	The sampling operation is conducted so that exposure of workers to radiation is managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses. Although a rupture leading to a radiological release would be an off-normal occurrence, any release and related dose would be managed as part of routine radiation protection operations.	Mitigative	Procedural Safety
	3. Thermal expansion of gases or other loss of confinement in an unsealed cask or MSC, leading to radiological release (Room 1002).	FHF-PR-R3	Normal Operations	Any potential exposure of workers to radiation because of this event is managed as a normal-operations dose by procedures that ensure that workers do not receive excessive radiation doses.	Mitigative	Procedural Safety
	4. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation (Room 1002).	FHF-PR-R4	NA (no significant exposure)	Operating procedures ensure that a loss of confinement during otherwise normal operations does not cause individuals to be exposed to significant amounts of radioactivity.	Mitigative	Procedural Safety
	5. Radiation-induced damage to a facility SSC (Room 1002).	FHF-PR-R5	NA	Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization.	NA	NA
Fissile	1. Criticality associated with a loaded cask or loaded MSC collision or trolley derailment followed by a load tipover or fall and a rearrangement of the cask internals (Room 1002).	FHF-PR-F1	Beyond Category 2	Design requirements and waste acceptance criteria ensure that transportation casks, transfer casks, MSCs, and dual-purpose canisters (DPCs) are designed to ensure nuclear criticality safety with optimum moderation and most-reactive waste forms. Criticality safety will be maintained despite geometric rearrangements due to a drop or other handling incident.	Preventive	Design

NOTES: CC = collision-crushing; CCF = chemical-contamination flooding; EI = explosion-implosion; F = fissile; FHF = Fuel Handling Facility; FT = fire-thermal; GET = generalized event tree; HLW = high-level radioactive waste; HVAC = heating, ventilation, and air-conditioning; LWT = legal-weight truck; NA = not applicable; OWT = overweight truck; PR = preparation room; R = radiation; SNF = spent nuclear fuel; SRTC = site rail transfer cart.

The Event Sequence Designator is a unique event sequence index for each event in this table. The prefix identifies the building or facility, for example "FHF," the middle identifies an activity, room, or area, for example "PR," and the suffix identifies the hazard category and event number, for example "CC1." When an event sequence has been evaluated in a GET, the GET number is identified in the Disposition of Event column; the GET sequence alpha character is shown at the end of the Event Sequence Designator, for example "A."

GETs are discussed in Sections 6.3.1.1 to 6.3.1.24.

Table III-25. Disposition of Internal Events That Occur Inside the Fuel Handling Facility (Commercial Spent Nuclear Fuel Assembly Transfer): Main Transfer Room (Room 1003), Fuel Transfer Bay (Rooms 1004, 1005 and 1006), Fuel Transfer Room (Room 2001)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Collision-Crushing	1. Derailment of the import-export trolley holding a loaded cask or loaded MSC on a pedestal (with inner lid in place, unbolted) followed by a load tipover or fall (Room 1003).	FHF-MFTBR-CC1	Beyond Category 2	A design requirement ensures that loaded transfer trolleys do not derail or drop their loads. Design requirements apply to trolleys for casks, waste packages, site-specific casks, and dual-purpose canisters.	Preventive	Design
	2. Drop of a loaded cask or MSC (with inner lid in place, unbolted) onto the floor during the lift using the overhead bridge crane from the import-export trolley to the cask transfer trolley or MSC trolley, respectively (Room 1003).	FHF-MFTBR-CC2A FHF-MFTBR-CC2B FHF-MFTBR-CC2C FHF-MFTBR-CC2D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-01) Design and operational requirements reduce the drop probability. Design requirements limit the lift height for transportation and transfer casks without impact limiters and site-specific casks. Design and operational requirements limit the probability of exceeding the lift height. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multicask overpack is defective.	Preventive	Design- Procedural Safety
	3. Drop of a loaded cask or MSC (with inner lid in place, unbolted) onto the trolley during the lift using the overhead bridge crane from the import-export trolley to the cask transfer trolley or MSC trolley, respectively (Room 1003).	FHF-MFTBR-CC3A FHF-MFTBR-CC3B FHF-MFTBR-CC3C FHF-MFTBR-CC3D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-01) Same disposition as Potential Event FHF-MFTBR-CC2.	Preventive	Design- Procedural Safety
	4. Drop or collision of a loaded cask or MSC (with inner lid in place, unbolted) onto or against a sharp object during the lift using the overhead bridge crane from the import-export trolley to the cask transfer trolley or MSC trolley, respectively (Room 1003).	FHF-MFTBR-CC4	Beyond Category 2	Design and operational requirements ensure that surfaces in the load paths through which WPs, DOE SNF canisters, naval canisters, DPCs, transportation casks, transfer casks, or MSCs are transferred by crane are kept free of structures, such as posts and curbs, that could puncture a container in case of a drop. An operational requirement ensures that the load paths are kept free of movable puncture hazards. A design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventative	Design- Procedural Safety
	5. Slapdown of a loaded cask or MSC (with inner lid in place, unbolted) following a drop from the overhead bridge crane onto the edge of the pedestal, trolley, or other object during the transfer from the import-export trolley to the cask transfer trolley or MSC trolley, respectively (Room 1003).	FHF-MFTBR-CC5A FHF-MFTBR-CC5B FHF-MFTBR-CC5C FHF-MFTBR-CC5D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-01) Same disposition as Potential Event FHF-MFTBR-CC2.	Preventive	Design- Procedural Safety
	6. Drop or collision of a docking ring onto or against a loaded cask or loaded MSC prior to entering the fuel transfer bay for unloading (Room 1003).	FHF-MFTBR-CC6	Beyond Category 2	An operational requirement limits lift heights for tools and equipment associated with transportation cask, transfer cask, MSC, and DPC handling and preparation to the minimum necessary for operational purposes. The operational requirement ensures that tools and equipment, including handling equipment, if dropped from the height limit, do not initiate an event sequence if dropped onto or collided against (1) a transportation cask or site-specific cask with its outer lid removed and its inner lid in place but unbolted, (2) an exposed sealed dual-purpose canister, or (3) a dual-purpose canister with its severed lid in place.	Preventative	Procedural Safety
	7. Collision of a mobile elevated platform with a loaded cask or loaded MSC during docking ring installation activities associated with the cask or MSC prior to entering the fuel transfer bay for unloading (Room 1003).	FHF-MFTBR-CC7	Beyond Category 2	Operational requirements ensure that the portable platforms, access platforms, mobile elevated platforms, and forklifts operated in the facility are not operated in a manner that could breach or overturn a loaded transportation cask or site-specific cask.	Preventive	Procedural Safety
	8. Drop or collision of a manipulator, handling equipment, or other miscellaneous equipment onto or against a loaded cask or loaded MSC prior to entering the fuel transfer bay for unloading (Room 1003).	FHF-MFTBR-CC8	Beyond Category 2	Same disposition as Potential Event FHF-MFTBR-CC6.	Preventative	Procedural Safety

Table III-25. Disposition of Internal Events That Occur Inside the Fuel Handling Facility (commercial SNF Assembly Transfer): Main Transfer Room (Room 1003), Fuel Transfer Bay (Rooms 1004, 1005 and 1006), Fuel Transfer Room (Room 2001) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	9. Derailment of the cask transfer trolley or MSC trolley holding a loaded cask or loaded MSC, respectively, on a pedestal (with inner lid in place, unbolted) followed by a load tipover or fall (Rooms 1003, 1004, 1005, and 1006).	FHF-MFTBR-CC9	Beyond Category 2	Same disposition as Potential Event FHF-MFTBR-CC1.	Preventive	Design
	10. Collision of a trolley holding a loaded cask or loaded MSC on a pedestal (with outer lid removed [if applicable] and inner lid unbolted but in place) with the shield doors separating the main transfer room and the fuel transfer bay (Rooms 1003, 1004, 1005, and 1006).	FHF-MFTBR-CC10	Beyond Category 2	(See GET-22) A design requirement limits the speed of trolley movements such that a collision at the speed limit would not cause the trolley to drop its load.	Preventive	Design
	11. Closure of the shield doors separating the main transfer room and the fuel transfer bay onto the trolley holding a loaded cask or loaded MSC on a pedestal (with outer lid removed [if applicable] and inner lid unbolted but in place) (Rooms 1003, 1004, 1005, and 1006).	FHF-MFTBR-CC11	Beyond Category 2	A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transfer trolley, site-rail transfer cart (SRTC), MSC transporter, WP transporter, would not cause a tipover of the conveyance or cause the conveyance to drop its load. A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transportation cask, transfer cask, or MSC suspended from an overhead crane would not cause the crane to drop its load.	Preventive	Design
	12. Drop or collision of [components associated with] a docking port into or against a cask or MSC (Rooms 1004, 1005, and 1006).	FHF-MFTBR-CC12	Beyond Category 2	A design requirement ensures that a drop of or collision involving components associated with a docking port will not breach the lid of a cask or MSC situated at the docking port.	Preventive	Design
	13. Drop or collision of a docking port plug onto or against a cask lid or MSC lid (with outer lid removed [if applicable] and inner lid unbolted but in place) (Rooms 1004, 1005, and 1006).	FHF-MFTBR-CC13	Beyond Category 2	Design requirements ensure that portions of a non-ITS SSC which, upon failure, could adversely interact with an ITS SSC and prevent its safety function from being performed are classified as ITS, redesigned to eliminate the potential unacceptable interaction with the identified ITS SSC, or, for seismic interactions, designed to the same seismic DBGM as the ITS SSCs subjected to the potential unacceptable interaction.	Preventive	Design
	14. Drop of an inner lid onto a cask or MSC (with outer lid removed [if applicable]) (Rooms 1004, 1005, and 1006).	FHF-MFTBR-CC14A FHF-MFTBR-CC14B FHF-MFTBR-CC14C FHF-MFTBR-CC14D FHF-MFTBR-CC14E FHF-MFTBR-CC14F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-02) Design and operational requirements reduce the drop probability. Operational requirements limit the lift height of the inner lid of a transportation cask, transfer cask, site-specific cask, or waste package to ensure that a lid drop onto a DOE canister within that breaches the canister is a beyond Category 2 event sequence. Design and operational requirements limit the probability of exceeding the lift height. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multicask overpack is defective.	Preventive	Design-Procedural Safety
	15. Drop or collision of an SNF assembly from the spent fuel transfer machine back into or against a cask or MSC being unloaded (Room 2001).	FHF-MFTBR-CC15A FHF-MFTBR-CC15B FHF-MFTBR-CC15C FHF-MFTBR-CC15D FHF-MFTBR-CC15E	No collision Category 1 Category 2 Category 1 Category 2	(See GET-03) Design and operational requirements for the spent fuel transfer machine (in the dry transfer areas) and fuel handling machine (in the pool) reduce the drop rate and collision probabilities for commercial SNF assembly transfers, including those in single-assembly canisters. Assemblies are assumed to breach when they are dropped or involved in a collision. HVAC system reliability requirements ensure availability of high-efficiency particulate air filtration in the primary confinement areas of the DTF and FHF during a 4-h mission time without credit for backup electrical power. An operational requirement ensures that HVAC system is working properly before normal operations begin, that the HVAC system is monitored for proper operation during normal operations, and that normal operations are suspended if the HVAC system or offsite power becomes unavailable.	Preventive-Mitigative	Design-Procedural Safety

Table III-25. Disposition of Internal Events That Occur Inside the Fuel Handling Facility (commercial SNF Assembly Transfer): Main Transfer Room (Room 1003), Fuel Transfer Bay (Rooms 1004, 1005 and 1006), Fuel Transfer Room (Room 2001) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	16. Drop or collision of an SNF assembly from the spent fuel transfer machine onto or against one or more SNF assembly(ies) in the cask or MSC being unloaded or onto one or more SNF assembly(ies) in the WP or MSC being loaded (Room 2001).	FHF-MFTBR-CC16A FHF-MFTBR-CC16B FHF-MFTBR-CC16C FHF-MFTBR-CC16D FHF-MFTBR-CC16E	No collision Category 1 Category 2 Category 1 Category 2	(See GET-03) Same disposition as Potential Event FHF-MFTBR-CC15.	Preventive-Mitigative	Design-Procedural Safety
	17.. Impact due to horizontal movement of an SNF assembly by the spent fuel transfer machine before the assembly is completely removed from the cask or MSC (Room 2001).	FHF-MFTBR-CC17A FHF-MFTBR-CC17B FHF-MFTBR-CC17C FHF-MFTBR-CC17D FHF-MFTBR-CC17E	No collision Category 1 Category 2 Category 1 Category 2	(See GET-03) Same disposition as Potential Event FHF-MFTBR-CC15.	Preventive-Mitigative	Design-Procedural Safety
	18. Drop of an SNF assembly from the spent fuel transfer machine onto the fuel transfer room floor (Room 2001).	FHF-MFTBR-CC18A FHF-MFTBR-CC18B FHF-MFTBR-CC18C FHF-MFTBR-CC18D FHF-MFTBR-CC18E	No collision Category 1 Category 2 Category 1 Category 2	(See GET-03) Same disposition as Potential Event FHF-MFTBR-CC15.	Preventive-Mitigative	Design-Procedural Safety
	19. Collision involving an SNF assembly suspended from the spent fuel transfer machine with wall-mounted equipment located in the fuel transfer room (Room 2001).	FHF-MFTBR-CC19A FHF-MFTBR-CC19B FHF-MFTBR-CC19C FHF-MFTBR-CC19D FHF-MFTBR-CC19E	No collision Category 1 Category 2 Category 1 Category 2	(See GET-03) Same disposition as Potential Event FHF-MFTBR-CC15.	Preventive-Mitigative	Design-Procedural Safety
	20. Drop or collision of an SNF assembly from the spent fuel transfer machine onto or against a sharp object (Room 2001).	FHF-MFTBR-CC20A FHF-MFTBR-CC20B FHF-MFTBR-CC20C FHF-MFTBR-CC20D FHF-MFTBR-CC20E	No collision Category 1 Category 2 Category 1 Category 2	(See GET-03) Same disposition as Potential Event FHF-MFTBR-CC15.	Preventive-Mitigative	Design-Procedural Safety
	21. Drop or collision of an SNF assembly from the spent fuel transfer machine into or against an empty WP or MSC being loaded (Room 2001).	FHF-MFTBR-CC21A FHF-MFTBR-CC21B FHF-MFTBR-CC21C FHF-MFTBR-CC21D FHF-MFTBR-CC21E	No collision Category 1 Category 2 Category 1 Category 2	(See GET-03) Same disposition as Potential Event FHF-MFTBR-CC15.	Preventive-Mitigative	Design-Procedural Safety
	22. Drop and slapdown of an SNF assembly from the spent fuel transfer machine (due to impact with an edge of the cask, MSC, WP, floor edge, WP internal baffle, etc.) during the transfer from the cask or MSC to a WP or MSC (Room 2001).	FHF-MFTBR-CC22A FHF-MFTBR-CC22B FHF-MFTBR-CC22C FHF-MFTBR-CC22D FHF-MFTBR-CC22E	No collision Category 1 Category 2 Category 1 Category 2	(See GET-03) Same disposition as Potential Event FHF-MFTBR-CC15.	Preventive-Mitigative	Design-Procedural Safety
	23. Drop or collision of handling equipment into or against an open MSC or an open WP filled with commercial SNF assemblies (Room 2001).	FHF-MFTBR-CC23A FHF-MFTBR-CC23B	No drop or collision Category 2	(See GET-04) Design and operational requirements reduce the probability of dropping handling equipment onto or against a SNF assembly energetically enough to breach the assembly.	Preventive	Design-Procedural Safety

Table III-25. Disposition of Internal Events That Occur Inside the Fuel Handling Facility (commercial SNF Assembly Transfer): Main Transfer Room (Room 1003), Fuel Transfer Bay (Rooms 1004, 1005 and 1006), Fuel Transfer Room (Room 2001) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	24. Drop of a WP inner lid or MSC cask inner lid (as appropriate) from the fuel transfer room crane onto a loaded WP or loaded MSC (Room 2001).	FHF-MFTBR-CC24A FHF-MFTBR-CC24B FHF-MFTBR-CC24C FHF-MFTBR-CC24D FHF-MFTBR-CC24E FHF-MFTBR-CC24F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(Bounded by GET-02) Same disposition as Potential Event FHF-MFTBR-CC14.	Preventive	Design- Procedural Safety
	25. Drop or collision of a transfer port seal plug from the fuel transfer room crane onto or against the inner lid of a loaded WP or a loaded MSC (Room 2001).	FHF-MFTBR-CC25	Beyond Category 2	Same disposition as Potential Event FHF-MFTBR-CC13.	Preventive	Design
Chemical Contamination-Flooding	1. Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures (Rooms 1003, 1004, 1005, 1006, and 2001).	FHF-MFTBR-CCF1	Normal Operations	Oxidation of failed commercial SNF is expected as a part of normal operations whenever commercial SNF is exposed to air. Any resulting potential exposure of workers to radiation is managed as a normal-operations dose by procedures that ensure that workers do not receive excessive radiation doses.	Mitigative	Procedural Safety
Explosion-Implosion	1. Hydrogen explosion involving batteries on a cask transfer trolley or an MSC trolley (Rooms 1003, 1004, 1005, and 1006).	FHF-MFTBR-EI1	Beyond Category 2	Operational controls pertaining to batteries for powering heavy equipment ensure the generation or accumulation of enough hydrogen gas to cause an explosion that could breach a transportation cask, site-specific cask, or waste package is prevented.	Preventive	Procedural Safety
	2. Hydrogen explosion involving batteries on a mobile elevated platform (Room 1003).	FHF-MFTBR-EI2	Beyond Category 2	Same disposition as Potential Event FHF-MFTBR-EI1.	Preventive	Procedural Safety
Fire-Thermal	1. Electrical fire associated with SNF handling equipment or other electrically powered handling equipment in the main transfer room, the fuel transfer bays, or the fuel transfer room (including the overhead cranes and the spent fuel transfer machine) (Rooms 1003, 1004, 1005, 1006, and 2001).	FHF-MFTBR-FT1	Beyond Category 2	Design and operational requirements ensure control of the presence and amount of combustibles in the different areas of the repository to preclude any Category 1 or Category 2 event sequences potentially initiated by a fire.	Preventive	Design- Procedural Safety
	2. Fire/explosion (battery/electrical fire) associated with an import-export trolley, a cask transfer trolley or an MSC trolley holding a filled or partially filled cask or MSC, respectively, with or without inner lid in place (but not sealed). (Rooms 1003, 1004, 1005, and 1006).	FHF-MFTBR-FT2	Beyond Category 2	Same disposition as Potential Event FHF-MFTBR-FT1.	Preventive	Design- Procedural Safety
	3. Electrical fire associated with a WP trolley holding a partially filled or filled WP, with or without inner lid in place (but not sealed). (Rooms 1003, 1004, and 1006).	FHF-MFTBR-FT3	Beyond Category 2	Same disposition as Potential Event FHF-MFTBR-FT1.	Preventive	Design- Procedural Safety
	4. Fire/explosion (battery/electrical fire) associated with the mobile elevated platform (Room 1003).	FHF-MFTBR-FT4	Beyond Category 2	Same disposition as Potential Event FHF-MFTBR-FT1.	Preventive	Design- Procedural Safety
	5. HEPA filter fire due to excessive radioactive decay within the filter bed (Room 1007)	FHF-MFTBR-FT5	Beyond Category 2	Operation requirements ensure that the operating surface temperatures of high-efficiency particulate air (HEPA) filters is maintained such that they can not catch on fire under normal operation or in the event of a shutdown of the HVAC system.	Preventive	Procedural Safety
	6. Intact or non-intact SNF overheating due to a loss of cooling resulting in excessive temperature and possible zircaloy cladding (or other cladding) unzipping or cladding failure due to excessive hoop stresses (Rooms 1003, 1004, 1005, 1006, and 2001).	FHF-MFTBR-FT6	Beyond Category 2	If ventilation is lost in areas where DOE or naval canisters are handled, no radiological release occurs from the canisters because containment within the canisters is maintained. Design and operational requirements ensure that the thermal response of areas where CSNF assemblies are handled or staged to a loss of HVAC would not cause radiological releases in excess of those considered in the consequence analysis for normal operations.	Preventive	Design- Procedural Safety

Table III-25. Disposition of Internal Events That Occur Inside the Fuel Handling Facility (commercial SNF Assembly Transfer): Main Transfer Room (Room 1003), Fuel Transfer Bay (Rooms 1004, 1005 and 1006), Fuel Transfer Room (Room 2001) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	7. Thermal hazard (from decay heat) associated with a vertical orientation of a loaded cask (sealed/inerted or unsealed/non-inerted) or loaded, unsealed/non-inerted WP (Rooms 1003, 1004, 1005, 1006, and 2001).	FHF-MFTBR-FT7	Normal Operations	Same disposition as Potential Event FHF-MFTBR-CCF1.	Mitigative	Procedural Safety
	8. Transient combustible fire in the main transfer room, the fuel transfer bays, or the fuel transfer room (Rooms 1003, 1004, 1005, 1006, and 2001).	FHF-MFTBR-FT8	Beyond Category 2	Same disposition as Potential Event FHF-MFTBR-FT1.	Preventive	Design-Procedural Safety
Radiation	1. Radiation exposure of a facility worker and/or the offsite public (Rooms 1003, 1004, 1005, 1006, and 2001).	FHF-MFTBR-R1	NA—Accounted for in consequence analyses, if applicable Normal Operations	NA—Potential exposure of workers or the public to radiation is a hazard for the event sequences considered in this analysis. Consequence analyses evaluate this hazard for Category 1 and Category 2 event sequences, as applicable. Some exposure to radiation is expected as a part of normal facility operations. Exposures are managed by design features and procedures that ensure that workers or the public do not receive excessive radiation doses.	NA Mitigative	NA Design-Procedural Safety
	2. Docking ring failure leads to a radiological release (Room 2001).	FHF-MFTBR-R2	NA (no significant exposure)	Same disposition as Potential Event FHF-MFTBR-R5.	Mitigative	Procedural Safety
	3. Radiological release due to installation of incorrect docking ring (Room 2001).	FHF-MFTBR-R3	NA (no significant exposure)	Same disposition as Potential Event FHF-MFTBR-R5.	Mitigative	Procedural Safety
	4. Thermal expansion of gases or other loss of confinement in an unsealed cask or MSC, leading to radiological release (Rooms 1003, 1004, 1005, 1006, and 2001).	FHF-MFTBR-R4	Normal Operations	Thermal expansion of gases is to be expected as a part of normal operations. Any resulting potential exposure of workers to radiation is managed as a normal-operations dose by procedures that ensure that workers do not receive excessive radiation doses.	Mitigative	Design-Procedural Safety
	5. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation (Rooms 1003, 1004, 1005, 1006, and 2001).	FHF-MFTBR-R5	NA (no significant exposure)	Operating procedures ensure that a loss of confinement during otherwise normal operations does not cause individuals to be exposed to significant amounts of radioactivity.	Mitigative	Procedural Safety
	6. Inadvertent opening of a fuel transfer bay door, leading to a worker exposure (Rooms 1003, 1004, and 1005).	FHF-MFTBR-R6	Beyond Category 2	Design requirements and operating procedures ensure that event sequences initiated by actions that accidentally expose workers to radiation are not Category 1.	Preventive	Design-Procedural Safety
	7. Radiation-induced damage to a facility SSC (Rooms 1003, 1004, 1005, 1006, and 2001)	FHF-MFTBR-R7	NA	Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization.	NA	NA
Fissile	1. Criticality associated with a drop or slapdown of a loaded, unsealed cask or MSC from the main transfer room overhead crane and a rearrangement of the container internals (Room 1003).	FHF-MFTBR-F1	Beyond Category 2	Design requirements and waste acceptance criteria ensure that transportation casks, transfer casks, MSCs, and dual-purpose canisters (DPCs) are designed to ensure nuclear criticality safety with optimum moderation and most-reactive waste forms. Criticality safety will be maintained despite geometric rearrangements due to a drop or other handling incident.	Preventive	Design
	2. Criticality associated with an import-export trolley, a cask transfer trolley, or an MSC trolley holding a loaded, unsealed cask or MSC (as applicable) derailment followed by a load tipover or fall and a rearrangement of the container internals (Rooms 1003, 1004, 1005, and 1006).	FHF-MFTBR-F2	Beyond Category 2	Same disposition as Potential Event FHF-MFTBR-F1.	Preventive	Design

Table III-25. Disposition of Internal Events That Occur Inside the Fuel Handling Facility (commercial SNF Assembly Transfer): Main Transfer Room (Room 1003), Fuel Transfer Bay (Rooms 1004, 1005 and 1006), Fuel Transfer Room (Room 2001) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	3. Criticality associated with a drop of an SNF assembly from the spent fuel transfer machine into a cask, MSC, or WP and a rearrangement of the cask, MSC, or WP internals (Room 2001).	FHF-MFTBR-F3	Beyond Category 2	Same disposition as Potential Event FHF-MFTBR-F1. Additionally, a design requirement ensures that waste packages are designed to preclude criticality with credit for moderator control and without credit for burnup. Demonstration of compliance must account for the bowing of fuel rods or other rearrangement of fissile material that may occur due to a drop or other handling incident. Design and operational requirements ensure that moderator control is in effect.	Preventive	Design-Procedural Safety
	4. Criticality associated with a drop of an SNF assembly from the spent fuel transfer machine and a rearrangement of the fuel rods that comprise the assembly due to impact (Room 2001).	FHF-MFTBR-F4	Beyond Category 2	Same disposition as Potential Event FHF-MFTBR-F3.	Preventive	Design-Procedural Safety
	5. Criticality associated with the drop of heavy equipment onto a loaded, open cask, MSC, or WP and a rearrangement of the container internals (Room 2001).	FHF-MFTBR-F5	Beyond Category 2	Same disposition as Potential Event FHF-MFTBR-F3.	Preventive	Design-Procedural Safety
	6. Criticality associated with a misload of a WP or an MSC (Room 2001).	FHF-MFTBR-F6	Beyond Category 2	Same disposition as Potential Event FHF-MFTBR-F3.	Preventive	Design-Procedural Safety

NOTES: CC = collision-crushing; CCF = chemical-contamination flooding; DTF = dry transfer facility (DTF 1 and DTF 2); EI = explosion-implosion; F = fissile; FHF = Fuel Handling Facility; FT = fire-thermal; GET = generalized event tree; HLW = high-level radioactive waste; MFTBR = main fuel transfer bay room; NA = not applicable; R = radiation; SNF = spent nuclear fuel; SRTC = site rail transfer cart.

The Event Sequence Designator is a unique event sequence index for each event in this table. The prefix identifies the building or facility, for example "FHF." If localized, the middle identifies an activity, room, or area, for example "MFTBR," and the suffix identifies the hazard category and event number, for example "CC1." When an event sequence has been evaluated in a GET, the GET number is identified in the Disposition of Event column; the GET sequence-alpha character is shown at the end of the Event Sequence Designator, for example "A."

Additional room(s) with potential events in this table: Room 1007 – Remote HEPA filter room

GETs are discussed in Sections 6.3.1.1 to 6.3.1.24.

Table III-26. Disposition Internal Events That Occur Inside the Fuel Handling Facility (Canister Transfer): Main Transfer Room (Room 1003)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Collision-Crushing	1. Drop of a loaded cask (with inner lid in place, unbolted) from the main transfer room overhead crane onto the floor during the transfer from a pedestal on the import-export trolley to the cask transfer station (Room 1003).	FHF-MTR-CC1A FHF-MTR-CC1B FHF-MTR-CC1C FHF-MTR-CC1D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-01) Design and operational requirements reduce the drop probability. Design requirements limit the lift height for transportation and transfer casks without impact limiters and site-specific casks. Design and operational requirements limit the probability of exceeding the lift height. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multiccanister overpack is defective.	Preventive	Design-Procedural Safety
	2. Drop or collision of a loaded cask (with inner lid in place, unbolted) from the main transfer room overhead crane onto or against a sharp object during the transfer from a pedestal on the import-export trolley to the cask transfer station (Room 1003).	FHF-MTR-CC2	Beyond Category 2	Design and operational requirements ensure that surfaces in the load paths through which WPs, DOE SNF canisters, naval canisters, DPCs, transportation casks, transfer casks, or MSCs are transferred by crane are kept free of structures, such as posts and curbs, that could puncture a container in case of a drop. An operational requirement ensures that the load paths are kept free of movable puncture hazards. A design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventative	Design-Procedural Safety
	3. Drop or collision of a loaded cask (with inner lid in place, unbolted) from the main transfer room overhead crane into or against the canister transfer station (Room 1003).	FHF-MTR-CC3A FHF-MTR-CC3B FHF-MTR-CC3C FHF-MTR-CC3D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-01) Same disposition as Potential Event FHF-MTR-CC1. For collisions, a design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design-Procedural Safety
	4. Slapdown of a loaded cask (with inner lid in place, unbolted) in the main transfer room due to a cask corner drop from the main transfer room overhead crane onto the edge of the pedestal or import-export trolley (Room 1003).	FHF-MTR-CC4A FHF-MTR-CC4B FHF-MTR-CC4C FHF-MTR-CC4D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-01) Same disposition as Potential Event FHF-MTR-CC1.	Preventive	Design-Procedural Safety
	5. Drop or collision of a loaded cask (with inner lid in place, unbolted) from the main transfer room overhead crane into or against the canister transfer station (Room 1003).	FHF-MTR-CC5A FHF-MTR-CC5B FHF-MTR-CC5C FHF-MTR-CC5D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-01) Same disposition as Potential Event FHF-MTR-CC1. For collisions, a design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design-Procedural Safety
	6. Slapdown of a loaded cask (with inner lid in place, unbolted) onto the floor, cask slapdown into the canister transfer station, or cask slapdown into a wall; all due to off-center cask lowering into the canister transfer station (Room 1003).	FHF-MTR-CC6A FHF-MTR-CC6B FHF-MTR-CC6C FHF-MTR-CC6D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-01) Same disposition as Potential Event FHF-MTR-CC1.	Preventive	Design-Procedural Safety
	7. Drop or collision of a manipulator, handling equipment, or other miscellaneous equipment onto or against a loaded cask (with inner lid in place, unbolted) prior to entering the canister transfer station for unloading (Room 1003).	FHF-MTR-CC7	Beyond Category 2	An operational requirement limits lift heights for tools and equipment associated with transportation cask, transfer cask, MSC, and DPC handling and preparation to the minimum necessary for operational purposes. The operational requirement ensures that tools and equipment, including handling equipment, if dropped from the height limit, can not initiate an event sequence if dropped onto or collided against (1) a transportation cask or site-specific cask with its outer lid removed and its inner lid in place but unbolted, (2) an exposed sealed dual-purpose canister, or (3) a dual-purpose canister with its severed lid in place.	Preventive	Procedural Safety

Table III-26. Disposition Internal Events That Occur Inside the Fuel Handling Facility (Canister Transfer): Main Transfer Room (Room 1003) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of a Potential Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	8. Drop of a cask inner lid, as appropriate, from the main transfer room overhead crane into a loaded cask to be unloaded (Room 1003).	FHF-MTR-CC8A FHF-MTR-CC8B FHF-MTR-CC8C FHF-MTR-CC8D FHF-MTR-CC8E FHF-MTR-CC8F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-02) Design and operational requirements reduce the drop probability. Operational requirements limit the lift height of the inner lid of a transportation cask, transfer cask, site-specific cask, or waste package to ensure that a lid drop onto a DOE canister within that breaches the canister is a beyond Category 2 event sequence. Design and operational requirements limit the probability of exceeding the lift height. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multiccanister overpack is defective.	Preventive	Design- Procedural Safety
	9. Drop or collision of handling equipment into or against an open cask loaded with a DPC, a DOE HLW canister, a naval SNF canister, or a [standardized] DOE SNF canister (Room 1003).	FHF-MTR-CC9A FHF-MTR-CC9B FHF-MTR-CC9C FHF-MTR-CC9D FHF-MTR-CC9E FHF-MTR-CC9F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-06) In this potential event, a drop has to occur to cause a collision because the equipment would be suspended above the canister. Design and operational requirements reduce the drop probability. An operational requirement ensures the establishment of a maximum lift height limit for handling equipment suspended above DOE SNF canisters. A design requirement ensures that the handling equipment is not capable of causing an event sequence due to a breach of a DOE SNF canister if dropped from within the lift-height limit. Design and operational requirements limit the probability of exceeding the lift height.	Preventive	Design- Procedural Safety
	10. Drop or collision of a DPC, a DOE HLW canister, a [standardized] DOE SNF canister, or a naval SNF canister from the main transfer room overhead crane back into or against the cask being unloaded (Room 1003).	FHF-MTR-CC10A FHF-MTR-CC10B FHF-MTR-CC10C FHF-MTR-CC10D FHF-MTR-CC10E FHF-MTR-CC10F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-05) Design and operational requirements reduce the drop probability. A design requirement limits lift heights for DOE SNF canisters, DOE HLW canister, naval canisters, and DOE SNF multiccanister overpacks. Design and operational requirements limit the probability of exceeding the lift height. Design requirements ensure that standardized DOE SNF canisters, would withstand without breach a drop of another standardized DOE SNF canister and that MCOs would withstand without breach a drop of another MCO dropped from within its lift-height limits. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multiccanister overpack is defective. A design requirement ensures that a DOE SNF canister in a cask, WP, staging rack, or staging pit would withstand without breach the drop of a DOE HLW canister on top of the DOE SNF canister from within their lift height limits. Neither naval canisters nor MCOs are staged in staging racks. For collisions, a design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design- Procedural Safety
	11. Impact due to horizontal movement of a naval SNF canister, a DPC, a DOE HLW canister, or a [standardized] DOE SNF canister with the main transfer room overhead crane before the canister is completely removed from the cask (Room 1003).	FHF-MTR-CC11	Beyond Category 2	A design requirement ensures that cranes are not capable of exerting sufficient force to breach a transportation cask, MSC, waste package, or canister as the result of attempts to overcome mechanical constraints.	Preventive	Design
	12. Drop and slapdown of a naval SNF canister, a DOE HLW canister or a [standardized] DOE SNF canister from the main transfer room overhead crane into the side of the canister transfer station (due to impact with an edge of the cask, MSC, WP, floor edge, WP or MSC internal baffle, etc.) during the transfer from the cask to a WP or MSC (as appropriate) (Room 1003).	FHF-MTR-CC12A FHF-MTR-CC12B FHF-MTR-CC12C FHF-MTR-CC12D FHF-MTR-CC12E FHF-MTR-CC12F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-05) Same disposition as Potential Event FHF-MTR-CC10.	Preventive	Design- Procedural Safety
	13. Drop and slapdown of a DPC from the main transfer room overhead crane into the side of the canister transfer station (due to impact with an edge of the cask, MSC, floor edge, MSC internal baffle, etc.) during the transfer from the cask to an MSC (Room 1003).	FHF-MTR-CC13A FHF-MTR-CC13B	No drop Category 2	(See GET-05 Sequences A and B only) Design and operational requirements reduce the drop probability.	Preventive	Design- Procedural Safety

Table III-26. Disposition Internal Events That Occur Inside the Fuel Handling Facility (Canister Transfer): Main Transfer Room (Room 1003) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of a Potential Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	14.Drop or collision of a dual-purpose canister, a DOE HLW canister, a [standardized] DOE SNF canister, or a naval SNF canister from the main transfer room overhead crane onto or against a sharp object or edge in the canister transfer station (Room 1003).	FHF-MTR-CC14	Beyond Category 2	Same disposition as Potential Event FHF-MTR-CC2.	Preventive	Design-Procedural Safety
	15.Drop of a DPC, a DOE HLW canister, a [standardized] DOE SNF canister, or a naval SNF canister from the main transfer room overhead crane onto the canister transfer station floor (Room 1003).	FHF-MTR-CC15A FHF-MTR-CC15B FHF-MTR-CC15C FHF-MTR-CC15D FHF-MTR-CC15E FHF-MTR-CC15F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-05) Same disposition as Potential Event FHF-MTR-CC10.	Preventive	Design-Procedural Safety
	16.Drop or collision of a DOE HLW canister, a [standardized] DOE SNF canister, or a naval SNF canister from the main transfer room crane into or against an empty WP or empty MSC (Room 1003).	FHF-MTR-CC16A FHF-MTR-CC16B FHF-MTR-CC16C FHF-MTR-CC16D FHF-MTR-CC16E FHF-MTR-CC16F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-05) Same disposition as Potential Event FHF-MTR-CC10.	Preventive	Design-Procedural Safety
	17.Drop or collision of a naval SNF canister from the main transfer room crane into or against an empty WP (Room 1003).	FHF-MTR-CC17A FHF-MTR-CC17B	No drop Category 2	(See GET-05 Sequences A and B only) Same disposition as Potential Event FHF-MTR-CC13. For collisions, a design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design-Procedural Safety
	18.Drop or collision of a DPC from the main transfer room crane into or against an empty MSC (Room 1003).	FHF-MTR-CC18A FHF-MTR-CC18B	No drop Category 2	(See GET-05 Sequences A and B only) Same disposition as Potential Event FHF-MTR-CC17.	Preventive	Design-Procedural Safety
	19.Collision involving a DPC, a DOE HLW canister, a [standardized] DOE SNF canister, or a naval SNF canister and the canister transfer station (Room 1003).	FHF-MTR-CC19	Beyond Category 2	A design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design
	20.Drop or collision of a DOE HLW canister from the main transfer room overhead crane onto or against another DOE HLW canister or a [standardized] DOE SNF canister in a WP or in an MSC (Room 1003).	FHF-MTR-CC20A FHF-MTR-CC20B	No drop Category 2	(See GET-05 Sequences A and B only) Same disposition as Potential Event FHF-MTR-CC17.	Preventive	Design-Procedural Safety
	21.Drop or collision of a [standardized] DOE SNF canister from the main transfer room overhead crane onto or against a DOE HLW canister in a WP or in an MSC (Room 1003).	FHF-MTR-CC21C FHF-MTR-CC21D FHF-MTR-CC21E FHF-MTR-CC21F	No drop No breach Beyond Category 2 Beyond Category 2	(See GET-05 Sequences C to F only) Same disposition as Potential Event FHF-MTR-CC10.	Preventive	Design-Procedural Safety
	22.Drop or collision of handling equipment into or against an open WP or MSC loaded with a DPC, DOE HLW canisters, and/or [standardized] DOE SNF canisters, and/or a naval SNF canister, as appropriate (Room 1003).	FHF-MTR-CC22A FHF-MTR-CC22B FHF-MTR-CC22C FHF-MTR-CC22D FHF-MTR-CC22E FHF-MTR-CC22F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-06) Same disposition as Potential Event FHF-MTR-CC9.	Preventive	Design-Procedural Safety

Table III-26. Disposition Internal Events That Occur Inside the Fuel Handling Facility (Canister Transfer): Main Transfer Room (Room 1003) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of a Potential Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	23. Drop of a WP inner lid or MSC cask inner lid, as appropriate, from the main transfer room overhead crane onto a filled (loaded) WP or loaded MSC (Room 1003).	FHF-MTR-CC23A FHF-MTR-CC23B FHF-MTR-CC23C FHF-MTR-CC23D FHF-MTR-CC23E FHF-MTR-CC23F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-02) Same disposition as Potential Event FHF-MTR-CC8.	Preventive	Design- Procedural Safety
Chemical Contamination-Flooding	1. Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures (Room 1003).	FHF-MTR-CCF1	NA—Accounted for in consequence analyses, if applicable	NA—SNF is inside sealed canisters, therefore this event does not occur unless an event sequence leads to exposure of SNF to air. Oxidation of the fuel matrix is a possible outcome of any event that exposes SNF to air. Consequence analyses account for the possibility of oxidation, as applicable.	NA	NA
Explosion-Implosion	1. Hydrogen explosion involving batteries on the import-export trolley (Room 1003).	FHF-MTR-EI1	Beyond Category 2	Operational controls pertaining to batteries for powering heavy equipment ensure the generation or accumulation of enough hydrogen gas to cause an explosion that could breach a transportation cask, site-specific cask, or waste package is prevented.	Preventive	Procedural Safety
	2. Hydrogen explosion involving batteries on a mobile elevated platform (Room 1003).	FHF-MTR-EI2	Beyond Category 2	Same disposition as Potential Event FHF-MTR-EI1.	Preventive	Procedural Safety
Fire-Thermal	1. Electrical fire associated with SNF and HLW handling equipment in the main transfer room (including the overhead crane, manipulators, the movable platform/sleeve assembly, etc.) (Room 1003).	FHF-MTR-FT1	Beyond Category 2	Design and operational requirements ensure control of the presence and amount of combustibles in the different areas of the repository to preclude any Category 1 or Category 2 event sequences potentially initiated by a fire.	Preventive	Design- Procedural Safety
	2. Fire/explosion (battery/electrical fire) associated with the import-export trolley (Room 1003).	FHF-MTR-FT2	Beyond Category 2	Same disposition as Potential Event FHF-MTR-FT1.	Preventive	Design- Procedural Safety
	3. Fire/explosion (battery/electrical fire) associated with the mobile elevated platform (Room 1003).	FHF-MTR-FT3	Beyond Category 2	Same disposition as Potential Event FHF-MTR-FT1.	Preventive	Design- Procedural Safety
	4. Thermal hazard (from decay heat) associated with vertical orientation of a loaded cask (with inner lid in place, unbolted) (Room 1003).	FHF-MTR-FT4	NA—Accounted for in consequence analyses, if applicable	Same disposition as Potential Event FHF-MTR-CCF1.	NA	NA
	5. Overheating of a loaded cask, WP, or MSC due to a loss of cooling resulting in excessive temperature and possible damage to canister contents (Room 1003).	FHF-MTR-FT5	Beyond Category 2	If ventilation is lost in areas where DOE or naval canisters are handled, no radiological release occurs from the canisters because containment within the canisters is maintained. Design and operational requirements ensure that the thermal response of areas where CSNF assemblies are handled or staged to a loss of HVAC would not cause radiological releases in excess of those considered in the consequence analysis for normal operations.	Preventive	Design- Procedural Safety
	6. Transient combustible fire in the main transfer room (Room 1003).	FHF-MTR-FT6	Beyond Category 2	Same disposition as Potential Event FHF-MTR-FT2.	Preventive	Design- Procedural Safety
Radiation	1. Radiation exposure of a facility worker and/or the offsite public (Room 1003).	FHF-MTR-R1	NA—Accounted for in consequence analyses, if applicable Normal Operations	NA—Potential exposure of workers or the public to radiation is a hazard for the event sequences considered in this analysis. Consequence analyses evaluate this hazard for Category 1 and Category 2 event sequences, as applicable. Some exposure to radiation is expected as a part of normal facility operations. Exposures are managed by design features and procedures that ensure that workers or the public do not receive excessive radiation doses.	NA Mitigative	NA Design- Procedural Safety

Table III-26. Disposition Internal Events That Occur Inside the Fuel Handling Facility (Canister Transfer): Main Transfer Room (Room 1003) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of a Potential Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	2. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation (Room 1003).	FHF-MTR-R2	NA (no significant exposure)	Operating procedures ensure that a loss of confinement during otherwise normal operations does not cause individuals to be exposed to significant amounts of radioactivity.	Mitigative	Procedural Safety
	3. Thermal expansion of gases or other loss of confinement in an unsealed cask, leading to radiological release (Room 1003).	FHF-MTR-R3	Normal Operations	Thermal expansion of gases is to be expected as a part of normal operations. Any resulting potential exposure of workers to radiation is managed as a normal-operations dose by procedures that ensure that workers do not receive excessive radiation doses.	Mitigative	Procedural Safety
	4. Inadvertent opening of the main transfer room shield door, leading to a worker exposure (Room 1003).	FHF-MTR-R4	Beyond Category 2	Design requirements and operating procedures ensure that event sequences initiated by actions that accidentally expose workers to radiation are not Category 1.	Preventive	Design-Procedural Safety
	5. Radiation-induced damage to a facility SSC (Room 1003).	FHF-MTR-R5	NA	Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization.	NA	NA
Fissile	1. Criticality associated with a drop or slapdown of a loaded cask or MSC from the main transfer room overhead crane and a rearrangement of the cask or MSC internals (Room 1003).	FHF-MTR-F1	Beyond Category 2	Design requirements and waste acceptance criteria ensure that transportation casks, transfer casks, MSCs, and dual-purpose canisters (DPCs) are designed to ensure nuclear criticality safety with optimum moderation and most-reactive waste forms. Criticality safety will be maintained despite geometric rearrangements due to a drop or other handling incident.	Preventive	Design
	2. Criticality associated with a drop or slapdown of a DPC, a [standardized] DOE SNF canister, a naval SNF canister, or a DOE HLW canister and a rearrangement of canister internals (Room 1003).	FHF-MTR-F2	Beyond Category 2	Same disposition as Potential Event FHF-MTR-F1. Additionally, a design requirement ensures that dropping a DOE SNF canister within its design basis does not lead to a criticality. Demonstration of compliance for the staging rack must account for the most reactive configuration of DOE SNF canisters with credit for moderator control. Design and operational requirements ensure that moderator control is in effect. There is no potential for criticality of DOE HLW canisters. Criticality of a naval canister following a drop, or other impact event, has been evaluated to be Beyond Category 2 based upon probabilities of independent events required for criticality.	Preventive	Design-Procedural Safety
	3. Criticality associated with the drop of heavy equipment onto a loaded, open cask, MSC, or WP and a rearrangement of the container internals (Room 1003).	FHF-MTR-F3	Beyond Category 2	Same disposition as Potential Event FHF-MTR-F1. Additionally, an unsealed waste package remains subcritical with credit for moderator control and without credit for burnup. Design and operational requirements ensure that moderator control is in effect. A design requirement ensures that sealed waste packages are designed such that drops, collisions, and other handling impacts within their design bases, allowing for rearrangement of the waste package internals and without credit for burnup, cannot lead to a nuclear criticality.	Preventive	Design-Procedural Safety
	4. Criticality associated with a misload of a WP or an MSC (Room 1003).	FHF-MTR-F4	Beyond Category 2	Same disposition as Potential Event FHF-MTR-F3.	Preventive	Design-Procedural Safety

NOTES: BWR = boiling water reactor; CC = collision-crushing; CCF = chemical-contamination flooding; DBGW = design basis ground motion; DOE = U.S. Department of Energy; EI = explosion-implosion; F = fissile; FHF = Fuel Handling Facility; FT = fire-thermal; GET = generalized event tree; HLW = high-level radioactive waste; MTR = main transfer room; NA = not applicable; PWR = pressurized water reactor; R = radiation; SNF = spent nuclear fuel.

The Event Sequence Designator is a unique event sequence index for each event in this table. The prefix identifies the building or facility, for example "FHF," the middle identifies an activity, room, or area, for example "MTR," and the suffix identifies the hazard category and event number, for example "CC1." When an event sequence has been evaluated in a GET, the GET number is identified in the Disposition of Event column; the GET sequence alpha character is shown at the end of the Event Sequence Designator, for example "A."

Additional room(s) with potential events in this table: Room 1007 – Remote HEPA filter room

GETs are discussed in Sections 6.3.1.1 to 6.3.1.24.

Table III-27. Disposition of Internal Events That Occur Inside the Fuel Handling Facility (Waste Package Closure): Main Transfer Room (Room 1003), Waste Package Positioning Cell (Room 1013), Waste Package Closure Cell (Room 2006)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Collision-Crushing	1. Collision involving the trolley holding the loaded, unsealed WP, and the shield doors between the main transfer room and the WP positioning cell (Rooms 1003 and 1013).	FHF-MTRWPCC-CC1	Beyond Category 2	(See GET-22) A design requirement limits the speed of trolley movements such that a collision at the speed limit would not cause the trolley to drop its load.	Preventive	Design
	2. Shield doors between the main transfer room and the WP positioning cell close on the trolley holding the loaded, unsealed WP (Rooms 1003 and 1013).	FHF-MTRWPCC-CC2	Beyond Category 2	A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transfer trolley, site-rail transfer cart (SRTC), MSC transporter, WP transporter, would not cause a tipover of the conveyance or cause the conveyance to drop its load. A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transportation cask, transfer cask, or MSC suspended from an overhead crane would not cause the crane to drop its load.	Preventative	Design
	3. Derailment of a trolley holding a loaded, unsealed WP followed by a load tipover or fall (Rooms 1003 and 1013).	FHF-MTRWPCC-CC3	Beyond Category 2	A design requirement ensures that loaded transfer trolleys do not derail or drop their loads. Design requirements apply to trolleys for casks, waste packages, site-specific casks, and dual-purpose canisters.	Preventative	Design
	4. Drop or collision of equipment from the main transfer room overhead crane, including a docking ring, lifting equipment, or a lifting fixture, onto or against a loaded, unsealed WP or WP inner lid (Room 1003).	FHF-MTRWPCC-CC4	Beyond Category 2	Operational requirements establish lift-height limits for handling equipment and other equipment associated with the WP, including lifting collars (or trunnion collars), yokes, docking rings, and WP-closure equipment. The lift-height limits ensure that the handling equipment can not breach a sealed WP if dropped onto or collided into the WP from within the lift-height limit. Furthermore, the lift-height limits ensure that a drop of equipment from within the lift-height limit can not initiate an event sequence if the WP inner lid is in place, but unsealed. An operational requirement ensures that the inner lid, once set in place, is not removed from the WP except in a remediation situation.	Preventative	Procedural Safety
	5. Drop or collision of an unsealed, loaded WP from the main transfer room overhead crane back into or against the canister transfer station (Room 1003).	FHF-MTRWPCC-CC5A FHF-MTRWPCC-CC5B FHF-MTRWPCC-CC5C FHF-MTRWPCC-CC5D FHF-MTRWPCC-CC5E	No drop Category 2 No waste form breach Beyond Category 2 Beyond Category 2	(See GET-07) Design and operational requirements reduce the drop probability. Design and operational requirements specify lift-height limits for unsealed waste packages whenever waste packages are transferred. If the limit can not be met, impact absorbers are provided. Design and operational requirements limit the probability of exceeding the lift-height limit. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multiccanister overpack is defective. For collisions, a design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design-Procedural Safety
	6. Drop of an unsealed, loaded WP from the main transfer room overhead crane onto the main transfer room floor during the lift and transfer to the WP positioning cell pedestal and trolley (Room 1003).	FHF-MTRWPCC-CC6A FHF-MTRWPCC-CC6B FHF-MTRWPCC-CC6C FHF-MTRWPCC-CC6D FHF-MTRWPCC-CC6E	No drop Category 2 No waste form breach Beyond Category 2 Beyond Category 2	(See GET-07) Same disposition as Potential Event FHF-MTRWPCC-CC5.	Preventive	Design-Procedural Safety
	7. Drop of an unsealed, loaded WP from the main transfer room overhead crane onto the pedestal on the WP positioning cell trolley during the lift and transfer to the WP positioning cell pedestal and trolley (Room 1003).	FHF-MTRWPCC-CC7A FHF-MTRWPCC-CC7B FHF-MTRWPCC-CC7C FHF-MTRWPCC-CC7D FHF-MTRWPCC-CC7E	No drop Category 2 No waste form breach Beyond Category 2 Beyond Category 2	(See GET-07) Same disposition as Potential Event FHF-MTRWPCC-CC5.	Preventive	Design-Procedural Safety

Table III-27. Disposition of Internal Events That Occur Inside the Fuel Handling Facility (Waste Package Closure): Main Transfer Room (Room 1003), Waste Package Positioning Cell (Room 1013), Waste Package Closure Cell (Room 2006) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	8. Drop or collision of an unsealed, loaded WP from the main transfer room overhead crane onto or against a sharp object during the lift and transfer to the WP positioning cell pedestal and trolley (Room 1003).	FHF-MTRWPCC-CC8	Beyond Category 2	Design and operational requirements ensure that surfaces in the load paths through which WPs, DOE SNF canisters, naval canisters, DPCs, transportation casks, transfer casks, or MSCs are transferred by crane are kept free of structures, such as posts and curbs, that could puncture a container in case of a drop. An operational requirement ensures that the load paths are kept free of movable puncture hazards. A design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design-Procedural Safety
	9. Slapdown of a loaded, unsealed WP onto the floor, into a wall, or into nearby equipment following a drop from the main transfer room overhead crane onto the edge of the trolley, pedestal, or other equipment during the lift and transfer to the WP positioning cell pedestal and trolley (Room 1003).	FHF-MTRWPCC-CC9A FHF-MTRWPCC-CC9B FHF-MTRWPCC-CC9C FHF-MTRWPCC-CC9D FHF-MTRWPCC-CC9E	No drop Category 2 No waste form breach Beyond Category 2 Beyond Category 2	(See GET-07) Same disposition as Potential Event FHF-MTRWPCC-CC5.	Preventive	Design-Procedural Safety
	10. Lid drop onto a WP from the lid placement fixture equipment during the welding process (Room 1013).	FHF-MTRWPCC-CC10A FHF-MTRWPCC-CC10B FHF-MTRWPCC-CC10C FHF-MTRWPCC-CC10D FHF-MTRWPCC-CC10E FHF-MTRWPCC-CC10F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(Bounded by GET-02) Design and operational requirements reduce the drop probability. Operational requirements limit the lift height of the inner lid of a transportation cask, transfer cask, site-specific cask, or waste package to ensure that a lid drop onto a DOE canister within that breaches the canister is a beyond Category 2 event sequence. Design and operational requirements limit the probability of exceeding the lift height. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multiccanister overpack is defective.	Preventive	Design-Procedural Safety
	11. Equipment drop onto a WP during the welding process (Room 1013).	FHF-MTRWPCC-CC11	Beyond Category 2	Same disposition as Potential Event FHF-MTRWPCC-CC4.	Preventative	Procedural Safety
	12. Drop or collision of equipment from the main transfer room overhead crane onto or against a loaded, sealed WP positioned on a pedestal on a trolley (Room 1003).	FHF-MTRWPCC-CC12	Beyond Category 2	Same disposition as Potential Event FHF-MTRWPCC-CC4.	Preventative	Procedural Safety
	13. Collision involving a trolley holding the loaded, sealed WP and the shield doors between the WP positioning cell and the main transfer room (Rooms 1003 and 1013).	FHF-MTRWPCC-CC13	Beyond Category 2	(See GET-22) Same disposition as Potential Event FHF-MTRWPCC-CC1.	Preventative	Design
	14. Shield doors between the WP positioning cell and the main transfer room close on the trolley holding the loaded, sealed WP (Rooms 1003 and 1013).	FHF-MTRWPCC-CC14	Beyond Category 2	Same disposition as Potential Event FHF-MTRWPCC-CC2.	Preventative	Design
Chemical Contamination-Flooding	1. Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures (Rooms 1003, 1013, and 2006).	FHF-MTRWPCC-CCF1	NA-Accounted for in consequence analyses, if applicable	NA-Oxidation of the fuel matrix is a possible outcome of any event that exposes SNF to air. Consequence analyses account for the possibility of oxidation, as applicable.	NA	NA
			Normal Operations	Oxidation of failed commercial SNF is expected as a part of normal operations whenever commercial SNF is exposed to air. Any resulting potential exposure of workers to radiation is managed as a normal-operations dose by procedures that ensure that workers do not receive excessive radiation doses.	Mitigative	Procedural Safety
Explosion-Implosion	1. Explosion hazard associated with the WP purging and inerting system and the ignition of hydrogen that may have accumulated in the WP (Room 1013).	FHF-MTRWPCC-EI1	Beyond Category 2	Operational requirements ensure that precautions taken during the cask sampling and purging process provide reasonable assurance that such hydrogen explosions would not occur.	Preventative	Procedural Safety

Table III-27. Disposition of Internal Events That Occur Inside the Fuel Handling Facility (Waste Package Closure): Main Transfer Room (Room 1003), Waste Package Positioning Cell (Room 1013), Waste Package Closure Cell (Room 2006) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	2. WP inerting system (or other pneumatic or pressurized system) missile due to a fractured nozzle/valve stem/pneumatic device (Room 1013).	FHF-MTRWPCC-EI2	Beyond Category 2	An operational requirement ensures that pressurized systems that could generate missiles, energetic enough to penetrate a transportation cask with or without impact limiters, a transfer cask, a DOE canister, a naval SNF canister, a dual-purpose canister, the inner lid of a transportation cask, a site-specific cask, a waste package, or the inner lid of a site-specific cask or waste package are not present in areas where potentially vulnerable items may be exposed.	Preventive	Procedural Safety
	3. Hydrogen explosion involving batteries on the WP closure transfer trolley. (Rooms 1003 and 1013).	FHF-MTRWPCC-EI3	Beyond Category 2	Operational controls pertaining to batteries for powering heavy equipment ensure the generation or accumulation of enough hydrogen gas to cause an explosion that could breach a transportation cask, site-specific cask, or waste package is prevented.	Preventive	Procedural Safety
Fire-Thermal	1. Electrical fire associated with handling equipment or other electrically powered equipment in the WP closure cell and the WP positioning cell, including the overhead cranes and welding subsystem in the WP closure cell (Rooms 1003, 1013, and 2006).	FHF-MTRWPCC-FT1	Beyond Category 2	Design and operational requirements ensure control of the presence and amount of combustibles in the different areas of the repository to preclude any Category 1 or Category 2 event sequences potentially initiated by a fire.	Preventive	Design-Procedural Safety
	2. Electrical fire hazard associated with the WP transfer trolley holding a loaded, unsealed WP or a WP closure transfer trolley holding a loaded, unsealed or sealed WP (Rooms 1003 and 1013).	FHF-MTRWPCC-FT2	Beyond Category 2	Same disposition as Potential Event FHF-MTRWPCC-FT1.	Preventive	Design-Procedural Safety
	3. Intact or non-intact SNF overheating or damage to canister contents due to a loss of cooling resulting in excessive temperature and possible zircaloy cladding (or other cladding) unzipping or cladding failure due to excessive hoop stresses (Rooms 1003, 1013, and 2006).	FHF-MTRWPCC-FT3	Beyond Category 2	If ventilation is lost in areas where DOE or naval canisters are handled, no radiological release occurs from the canisters because containment within the canisters is maintained. Design and operational requirements ensure that the thermal response of areas where CSNF assemblies are handled or staged to a loss of HVAC would not cause radiological releases in excess of those considered in the consequence analysis for normal operations.	Preventive	Design-Procedural Safety
	4. Canister/fuel damage by burn-through during welding process/heat damage (Room 1013).	FHF-MTRWPCC-FT4	NA	Burn-through of the inner lid is not possible with the gas tungsten arc welding process used for the closure welds.	NA	NA
	5. Thermal hazard/canister contents overheating/SNF assemblies overheating in a WP during the welding process resulting in excessive cladding temperature and possible zircaloy cladding (or other cladding) unzipping (Room 1013).	FHF-MTRWPCC-FT5	NA	Overheating of the waste package contents due to welding is not possible using the gas tungsten arc welding process which used for the closure welds.	NA	NA
	6. Transient combustible fire in the WP closure cell and the WP positioning cell (Room 1013).	FHF-MTRWPCC-FT6	Beyond Category 2	Same disposition as Potential Event FHF-MTRWPCC-FT1.	Preventive	Design-Procedural Safety
Radiation	1. Radiation exposure of a facility worker and/or the offsite public (Rooms 1003, 1013, and 2006).	FHF-MTRWPCC-R1	NA—Accounted for in consequence analyses, if applicable Normal Operations	NA—Potential exposure of workers or the public to radiation is a hazard for the event sequences considered in this analysis. Consequence analyses evaluate this hazard for Category 1 and Category 2 event sequences, as applicable. Some exposure to radiation is expected as a part of normal facility operations. Exposures are managed by design features and procedures that ensure that workers or the public do not receive excessive radiation doses.	NA Mitigative	NA Design-Procedural Safety
	2. Glovebox leak leads to a radiological release (Room 2008).	FHF-MTRWPCC-R2	Normal Operations	Potential exposure of workers to radiation from a glovebox leak is managed as a normal-operations dose by routine procedures that ensure that workers do not receive excessive radiation doses.	Mitigative	Procedural Safety
	3. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation (Rooms 1003, 1013, and 2006).	FHF-MTRWPCC-R3	NA (no significant exposure)	Operating procedures ensure that a loss of confinement during otherwise normal operations does not cause individuals to be exposed to significant amounts of radioactivity.	Mitigative	Procedural Safety

Table III-27. Disposition of Internal Events That Occur Inside the Fuel Handling Facility (Waste Package Closure): Main Transfer Room (Room 1003), Waste Package Positioning Cell (Room 1013), Waste Package Closure Cell (Room 2006) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	4. Inadvertent opening of a transfer bay shield door or the WP positioning cell shield door, leading to a worker exposure (Rooms 1003 and 1013).	FHF-MTRWPCC-R4	Beyond Category 2	Design requirements and operating procedures ensure that event sequences initiated by actions that accidentally expose workers to radiation are not Category 1.	Preventive	Design-Procedural Safety
	5. Radiation-induced damage to a facility SSC (Rooms 1003, 1013, and 2006).	FHF-MTRWPCC-R5	NA	Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization.	NA	NA
Fissile	1. Criticality associated with a trolley holding a sealed or unsealed WP derailment followed by a load tipover or fall and rearrangement of the container internals (Rooms 1003 and 1013).	FHF-MTRWPCC-F1	Beyond Category 2	Same disposition as Potential Event FHF-MTRWPCC-CC3.	Preventive	Design
	2. Criticality associated with a drop or slapdown of a loaded, unsealed WP from the main transfer room overhead crane and a rearrangement of the container internals (Room 1003).	FHF-MTRWPCC-F2	Beyond Category 2	A design requirement ensures that an unsealed WP that is dropped onto an essentially unyielding surface from within its lift-height limits would not spill its contents. A design requirement ensures that waste packages are designed to preclude criticality with credit for moderator control and without credit for burnup. Demonstration of compliance must account for the bowing of fuel rods or other rearrangement of fissile material that may occur due to a drop or other handling incident. Design and operational requirements ensure that moderator control is in effect.	Preventive	Design-Procedural Safety
	3. Criticality associated with the drop of heavy equipment onto a loaded, unsealed WP and a rearrangement of the container internals (Rooms 1003 and 1013).	FHF-MTRWPCC-F3	Beyond Category 2	Same disposition as Potential Event FHF-MTRWPCC-F2.	Preventive	Design-Procedural Safety

NOTES: CC = collision-crushing; CCF = chemical-contamination flooding; CHF = Canister Handling Facility; DTF = dry transfer facility (DTF 1 and DTF 2); DOE = U.S. Department of Energy; EI = explosion-implosion; F = fissile; FHF = Fuel Handling Facility; FT = fire-thermal; GET = generalized event tree; HLW = high-level radioactive waste; MTRWPCC = main transfer room waste package closure cell; NA = not applicable; R = radiation; SNF = spent nuclear fuel; SRTC = site rail transfer cart.

The Event Sequence Designator is a unique event sequence index for each event in this table. The prefix identifies the building or facility, for example "FHF," the middle identifies an activity, room, or area, for example "MTRWPCC," and the suffix identifies the hazard category and event number, for example "CC1." When an event sequence has been evaluated in a GET, the GET number is identified in the Disposition of Event column; the GET sequence alpha character is shown at the end of the Event Sequence Designator, for example "A."

GETs are discussed in Sections 6.3.1.1 to 6.3.1.24.

Table III-28. Disposition of Internal Events That Occur Inside the Fuel Handling Facility (Waste Package Loadout): Main Transfer Room (Room 1003), Preparation Room (Room 1002), Entrance Vestibule (Room 1001)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Collision-Crushing	1. Derailment of a trolley holding a loaded, sealed WP followed by a load tipover or fall (Room 1003).	FHF-MTRWPLO-CC1	Beyond Category 2	A design requirement ensures that loaded transfer trolleys do not derail or drop their loads. Design requirements apply to trolleys for casks, waste packages, site-specific casks, and dual-purpose canisters.	Preventative	Design
	2. Drop of a loaded, sealed WP from a main transfer room overhead crane onto the floor during transfer from the trolley to the survey area or from the survey area to the tilting machine (Room 1003).	FHF-MTRWPLO-CC2A FHF-MTRWPLO-CC2B FHF-MTRWPLO-CC2C	No drop No breach Beyond Category 2	(See GET-08) Design and operational requirements reduce the drop probability. Design and operational requirements limit the lift height of waste packages in horizontal and vertical orientations. Design requirements ensure that waste packages withstand without breaching drops and tipovers within their lift height limits. Design and operational requirements limit the probability of exceeding the lift height.	Preventive	Design-Procedural Safety
	3. Drop or collision of a loaded, sealed WP from a main transfer room overhead crane onto or against a sharp object (including the tilting machine) during transfer from the trolley to the survey area or from the survey area to the tilting machine (Room 1003).	FHF-MTRWPLO-CC3	Beyond Category 2	Design and operational requirements ensure that surfaces in the load paths through which WPs, DOE SNF canisters, naval canisters, DPCs, transportation casks, transfer casks, or MSCs are transferred by crane are kept free of structures, such as posts and curbs, that could puncture a container in case of a drop. An operational requirement ensures that the load paths are kept free of movable puncture hazards. A design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventative	Design-Procedural Safety
	4. Slapdown of a loaded, sealed WP from a main transfer room overhead crane to the cell floor during transfer from the trolley to the survey area due to drop from the overhead crane onto the edge of the pedestal on the trolley, the edge of the trolley, or another object on the floor (Room 1003).	FHF-MTRWPLO-CC4	No drop No breach Beyond Category 2	(See GET-08) Same disposition as Potential Event FHF-MTRWPLO-CC2.	Preventive	Design-Procedural Safety
	5. Slapdown (either forward into the WP turntable or backward onto the floor) of a loaded, sealed waste package in the tilting machine from a main transfer room overhead crane during the lowering of the WP to the horizontal position on the pallet previously placed on the WP turntable (Room 1003).	FHF-MTRWPLO-CC5	No drop No breach Beyond Category 2	(See GET-08) Same disposition as Potential Event FHF-MTRWPLO-CC2. Additionally, a design requirement prevents backward slapdowns associated with the tilting machine for waste packages.	Preventive	Design-Procedural Safety
	6. Collision of the tilting machine against a loaded, sealed WP on a pallet on the WP turntable (Room 1003).	FHF-MTRWPLO-CC6	Beyond Category 2	Design and operational requirements ensure that an impact or collision between the trunnion collar removal machine, WP turntable, or WP tilting machine and a WP will not breach the WP or cause it to fall off the emplacement pallet.	Preventative	Design-Procedural Safety
	7. Drop or collision of a lifting collar from a main transfer room overhead crane onto or against a loaded, sealed waste package after removal of the collar from the WP collar removal machine (Room 1003).	FHF-MTRWPLO-CC7	Beyond Category 2	Operational requirements establish lift-height limits for handling equipment and other equipment associated with the WP, including lifting collars (or trunnion collars), yokes, docking rings, and WP-closure equipment. The lift-height limits ensure that the handling equipment can not breach a sealed WP if dropped onto or collided into the WP from within the lift-height limit. Furthermore, the lift-height limits ensure that a drop of equipment from within the lift-height limit can not initiate an event sequence if the WP inner lid is in place, but unsealed. An operational requirement ensures that the inner lid, once set in place, is not removed from the WP except in a remediation situation.	Preventative	Procedural Safety

Table III-28. Disposition of Internal Events That Occur Inside the Fuel Handling Facility (Waste Package Loadout): Main Transfer Room (Room 1003), Preparation Room (Room 1002), Entrance Vestibule (Room 1001) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	8. Collision or impact of the lifting collar removal machine and a loaded, sealed WP placed on a pallet positioned on the WP turntable (Room 1003).	FHF-MTRWPLO-CC8	Beyond Category 2	Same disposition as Potential Event FHF-MTRWPLO-CC6.	Preventive	Design-Procedural Safety
	9. Drop of a loaded, sealed WP and pallet from a main transfer room overhead crane onto the floor during transfer of the WP and pallet from the WP turntable to the WP transporter bedplate (Room 1003).	FHF-MTRWPLO-CC9A FHF-MTRWPLO-CC9B FHF-MTRWPLO-CC9C	No drop No breach Beyond Category 2	(See GET-08) Same disposition as Potential Event FHF-MTRWPLO-CC2.	Preventive	Design-Procedural Safety
	10. Drop of a loaded, sealed WP and pallet from a main transfer room overhead crane onto the WP transporter bedplate during transfer of the WP and pallet from the WP turntable to the WP transporter bedplate (Room 1003).	FHF-MTRWPLO-CC10A FHF-MTRWPLO-CC10B FHF-MTRWPLO-CC10C	No drop No breach Beyond Category 2	(See GET-08) Same disposition as Potential Event FHF-MTRWPLO-CC2.	Preventive	Design-Procedural Safety
	11. Drop or collision of a loaded, sealed WP on a pallet from a main transfer room overhead crane onto or against a sharp object during transfer of the WP and pallet from the WP turntable to the WP transporter bedplate (Room 1003).	FHF-MTRWPLO-CC11A FHF-MTRWPLO-CC11B FHF-MTRWPLO-CC11C	No drop No breach Beyond Category 2	(See GET-08) Same disposition as Potential Event FHF-MTRWPLO-CC2. For collisions, a design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventive	Design-Procedural Safety
	12. Equipment drop or collision (including lifting yokes) onto or against a loaded, sealed WP in the WP transporter load area (including the process to move the WP from the trolley to the WP transporter) (Room 1003).	FHF-MTRWPLO-CC12	Beyond Category 2	Same disposition as Potential Event FHF-MTRWPLO-CC7.	Preventative	Procedural Safety
	13. Collision involving a WP transporter (holding the sealed WP on a pallet) and the doors between the main transfer room and the preparation room (Rooms 1002 and 1003).	FHF-MTRWPLO-CC13	Beyond Category 2	A design requirement ensures that the WP transporter transports the WP in a manner such that if a collision or derailment (excluding tipover) occurs, the WP impact energy would be low enough to preclude a WP breach. A design requirement ensures that the WP transporter transports the WP in a manner such that if a collision or derailment leading to a transporter tipover occurs, the WP impact energy would be low enough to preclude a WP breach.	Preventive	Design
	14. The doors between the main transfer room and the preparation room close on the WP transporter (holding the sealed WP on a pallet) (Rooms 1002 and 1003).	FHF-MTRWPLO-CC14	Beyond Category 2	A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transfer trolley, site-rail transfer cart (SRTC), MSC transporter, WP transporter, would not cause a tipover of the conveyance or cause the conveyance to drop its load. A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transportation cask, transfer cask, or MSC suspended from an overhead crane would not cause the crane to drop its load.	Preventative	Design
	15. Collision involving a WP transporter (holding a sealed WP on a pallet) and the shield doors between the preparation room and the entrance vestibule (Rooms 1001 and 1002).	FHF-MTRWPLO-CC15	Beyond Category 2	Same disposition as Potential Event FHF-MTRWPLO-CC13.	Preventative	Design
	16. Shield doors between the preparation room and the entrance vestibule close on the WP transporter (holding the sealed WP on a pallet) (Rooms 1001 and 1002).	FHF-MTRWPLO-CC16	Beyond Category 2	Same disposition as Potential Event FHF-MTRWPLO-CC14.	Preventative	Design
	17. Collision involving a WP transporter (holding a sealed WP on a pallet) and the doors between the entrance vestibule and the ambient air (outside) (Room 1001).	FHF-MTRWPLO-CC17	Beyond Category 2	Same disposition as Potential Event FHF-MTRWPLO-CC13.	Preventative	Design
	18. Doors between the entrance vestibule and the ambient air (outside) close on the WP transporter (holding the sealed WP on a pallet) (Room 1001).	FHF-MTRWPLO-CC18	Beyond Category 2	Same disposition as Potential Event FHF-MTRWPLO-CC14.	Preventative	Design

Table III-28. Disposition of Internal Events That Occur Inside the Fuel Handling Facility (Waste Package Loadout): Main Transfer Room (Room 1003), Preparation Room (Room 1002), Entrance Vestibule (Room 1001) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	19. Derailment or collision of a WP transporter (holding the sealed WP on a pallet) in the main transfer room, preparation room, or entrance vestibule followed by a load tipover or fall (Rooms 1001, 1002, and 1003).	FHF-MTRWPLO-CC19	Beyond Category 2	Same disposition as Potential Event FHF-MTRWPLO-CC13.	Preventative	Design
Chemical Contamination-Flooding	1. Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures (Rooms 1001, 1002, and 1003).	FHF-MTRWPLO-CCF1	NA—Accounted for in consequence analyses, if applicable	NA—SNF is contained inside a sealed waste package, therefore this event does not occur unless an event sequence leads to exposure of SNF to air. Oxidation of the fuel matrix is a possible outcome of any event that exposes SNF to air. Consequence analyses account for the possibility of oxidation, as applicable.	NA	NA
Explosion-Implosion	1. Hydraulic system (or other pneumatic or pressurized system) missile due to a fractured nozzle/valve stem/pneumatic device (Room 1003).	FHF-MTRWPLO-EI1	Beyond Category 2	An operational requirement ensures that pressurized systems that could generate missiles, energetic enough to penetrate a transportation cask with or without impact limiters, a transfer cask, a DOE canister, a naval SNF canister, a dual-purpose canister, the inner lid of a transportation cask, a site-specific cask, a waste package, or the inner lid of a site-specific cask or waste package are not present in areas where potentially vulnerable items may be exposed.	Preventive	Procedural Safety
	2. Hydrogen explosion involving batteries on a trolley (Room 1003).	FHF-MTRWPLO-EI2	Beyond Category 2	Operational controls pertaining to batteries for powering heavy equipment ensure the generation or accumulation of enough hydrogen gas to cause an explosion that could breach a transportation cask, site-specific cask, or waste package is prevented.	Preventive	Procedural Safety
Fire-Thermal	1. Electrical fire associated with the equipment in the WP transporter load area of the main transfer room, including the WP collar removal machine, the tilting machine, and the WP turntable (Rooms 1001, 1002, and 1003).	FHF-MTRWPLO-FT1	Beyond Category 2	Design and operational requirements ensure control of the presence and amount of combustibles in the different areas of the repository to preclude any Category 1 or Category 2 event sequences potentially initiated by a fire.	Preventive	Design-Procedural Safety
	2. Electrical fire associated with the main transfer room overhead crane (Room 1003).	FHF-MTRWPLO-FT2	Beyond Category 2	Same disposition as Potential Event FHF-MTRWPLO-FT1.	Preventive	Design-Procedural Safety
	3. Electrical fire associated with equipment on the WP transporter, including motors to extend the WP transporter bedplate (Rooms 1001, 1002, and 1003).	FHF-MTRWPLO-FT3	Beyond Category 2	Same disposition as Potential Event FHF-MTRWPLO-FT1.	Preventive	Design-Procedural Safety
	4. Electrical fire associated with the WP transporter locomotive (Rooms 1001 and 1002).	FHF-MTRWPLO-FT4	Beyond Category 2	Same disposition as Potential Event FHF-MTRWPLO-FT1.	Preventive	Design-Procedural Safety
	5. Fire/explosion (battery/electrical fire) associated with the WP closure transfer trolley (Room 1003).	FHF-MTRWPLO-FT5	Beyond Category 2	Same disposition as Potential Event FHF-MTRWPLO-FT1.	Preventive	Design-Procedural Safety
	6. Transient combustible fire in the main transfer room, preparation room, or the entrance vestibule (Rooms 1001, 1002, and 1003).	FHF-MTRWPLO-FT6	Beyond Category 2	Same disposition as Potential Event FHF-MTRWPLO-FT1.	Preventive	Design-Procedural Safety
Radiation	1. Radiation exposure of a facility worker and/or the offsite public (Rooms 1001, 1002, and 1003).	FHF-MTRWPLO-R1	NA—Accounted for in consequence analyses, if applicable Normal Operations	NA—Potential exposure of workers or the public to radiation is a hazard for the event sequences considered in this analysis. Consequence analyses evaluate this hazard for Category 1 and Category 2 event sequences, as applicable. Some exposure to radiation is expected as a part of normal facility operations. Exposures are managed by design features and procedures that ensure that workers or the public do not receive excessive radiation doses.	NA Mitigative	NA Design-Procedural Safety

Table III-28. Disposition of Internal Events That Occur Inside the Fuel Handling Facility (Waste Package Loadout): Main Transfer Room (Room 1003), Preparation Room (Room 1002), Entrance Vestibule (Room 1001) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	2. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation (Rooms 1001, 1002, and 1003).	FHF-MTRWPLO-R2	NA (no significant exposure)	Operating procedures ensure that a loss of confinement during otherwise normal operations does not cause individuals to be exposed to significant amounts of radioactivity.	Mitigative	Procedural Safety
	3. Inadvertent opening of the main transfer room shield door, leading to a worker exposure (Rooms 1002 and 1003).	FHF-MTRWPLO-R3	Beyond Category 2	Design requirements and operating procedures ensure that event sequences initiated by actions that accidentally expose workers to radiation are not Category 1.	Preventive	Design-Procedural Safety
	4. Inadvertent opening of the WP transporter shielded enclosure doors, leading to a worker exposure (Room 1001).	FHF-MTRWPLO-R4	Beyond Category 2	Same disposition as Potential Event FHF-MTRWPLO-R3.	Preventive	Design-Procedural Safety
	5. Radiation-induced damage to a facility SSC (Rooms 1001, 1002, and 1003).	FHF-MTRWPLO-R5	NA	Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization.	NA	NA
Fissile	1. Criticality associated with a trolley holding a sealed WP derailment followed by a load tipover or fall and rearrangement of the WP internals (Room 1003).	FHF-MTRWPLO-F1	Beyond Category 2	Same disposition as Potential Event FHF-MTRWPLO-CC1.	Preventive	Design
	2. Criticality associated with a drop, slapdown, or collision of a sealed WP and a rearrangement of the container internals (Room 1003).	FHF-MTRWPLO-F2	Beyond Category 2	A design requirement ensures that sealed waste packages are designed such that drops, collisions, and other handling impacts within their design bases, allowing for rearrangement of waste package internals and without credit for burnup, cannot lead to a nuclear criticality.	Preventive	Design
	3. Criticality associated with a WP transporter derailment followed by a load tipover or fall and rearrangement of the WP internals (Room 1003).	FHF-MTRWPLO-F3	Beyond Category 2	Same disposition as Potential Events FHF-MTRWPLO-F2 and FHF-MTRWPLO-CC13.	Preventive	Design

NOTES: CC = collision-crushing; CCF = chemical-contamination flooding; EI = explosion-implosion; F = fissile; FHF = Fuel Handling Facility; FT = fire-thermal; GET = generalized event tree; HLW = high-level radioactive waste; MTRWPLO = main transfer room waste package loadout; NA = not applicable; R = radiation; SNF = spent nuclear fuel; SRTC = site rail transfer cart.

The Event Sequence Designator is a unique event sequence index for each event in this table. The prefix identifies the building or facility, for example "FHF." If localized, the middle identifies an activity, room, or area, for example "MTRWPLO," and the suffix identifies the hazard category and event number, for example "CC1." When an event sequence has been evaluated in a GET, that tree is identified in the Disposition of Event column. The specific event tree sequence is noted by the last letter in the Event Sequence Designator, for example "A."

GETs are discussed in Sections 6.3.1.1 to 6.3.1.24.

Table III-29. Disposition of Internal Events That Occur Inside the FHF (Loaded Site-specific Cask Removal): Main Transfer Room (Room 1003), Preparation Room (Room 1002), Entrance Vestibule (Room 1001)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Collision-Crushing	1. Impact due to horizontal movement of a loaded MSC by the main transfer room overhead crane before it is fully removed from the canister transfer station (Room 1003).	FHF-MTRWLOM-CC1	Beyond Category 2	A design requirement ensures that cranes are not capable of exerting sufficient force to breach a transportation cask, MSC, waste package, or canister as the result of attempts to overcome mechanical constraints.	Preventative	Design
	2. Collision of a loaded MSC from the main transfer room overhead crane with the canister transfer station (Room 1003).	FHF-MTRWLOM-CC2	Beyond Category 2	A design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventative	Design
	3. Drop of an MSC inner or outer lid (as applicable) from the fuel transfer room overhead crane onto the loaded MSC in the fuel transfer bay or main transfer room (as applicable) (Room 1003).	FHF-MTRWLOM-CC3A FHF-MTRWLOM-CC3B FHF-MTRWLOM-CC3C FHF-MTRWLOM-CC3D FHF-MTRWLOM-CC3E FHF-MTRWLOM-CC3F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(Bounded by GET-02) Design and operational requirements reduce the drop probability. Operational requirements limit the lift height of the inner lid of a transportation cask, site-specific cask, or waste package to ensure that a lid drop onto a DOE SNF canister or DOE SNF multicask overpack in a waste package, transportation cask, or site-specific cask that breaches the canister is a beyond Category 2 event sequence. Design and operational requirements limit the probability of exceeding the lift height. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multicask overpack is defective. Operational requirements will establish permissible lift heights to ensure that a drop of a cask outer lid onto the inner lid of a loaded DOE SNF transportation cask or MSC will not breach a DOE SNF canister inside.	Preventative	Design-Procedural Safety
	4. Drop or collision of the transfer port plug from the fuel transfer room overhead crane onto or against the inner lid or outer lid of a loaded MSC (as applicable) in the fuel transfer bay (Room 1003).	FHF-MTRWLOM-CC4	Beyond Category 2	Design requirements ensure that portions of a non-ITS SSC which, upon failure, could adversely interact with an ITS SSC and prevent its safety function from being performed are classified as ITS, redesigned to eliminate the potential unacceptable interaction with the identified ITS SSC, or, for seismic interactions, designed to the same seismic DBGM as the ITS SSCs subjected to the potential unacceptable interaction.	Preventative	Design
	5. Drop of an MSC inner or outer lid (as applicable) from the main transfer room overhead crane onto the loaded MSC in the canister transfer station (Room 1003).	FHF-MTRWLOM-CC5A FHF-MTRWLOM-CC5B FHF-MTRWLOM-CC5C FHF-MTRWLOM-CC5D FHF-MTRWLOM-CC5E FHF-MTRWLOM-CC5F	No drop Category 2 No drop No breach Beyond Category 2 Beyond Category 2	(See GET-02) Same disposition as Potential Event FHF-MTRWLOM-CC3.	Preventative	Design-Procedural Safety
	6. Collision of a mobile elevated platform with a loaded MSC during docking ring removal activities associated with the MSC (Room 1003).	FHF-MTRWLOM-CC6	Beyond Category 2	Operational requirements ensure that the portable platforms, access platforms, mobile elevated platforms, and forklifts operated in the facility are not operated in a manner that could breach or overturn a loaded transportation cask or site-specific cask.	Preventative	Procedural Safety
	7. Collision of a trolley holding a loaded MSC on a pedestal with the shield doors separating the fuel transfer bay and the main transfer room (Room 1003).	FHF-MTRWLOM-CC7	Beyond Category 2	(See GET-22) A design requirement limits the speed of trolley movements such that a collision at the speed limit would not cause the trolley to drop its load.	Preventative	Design

Table III-29. Disposition of Internal Events That Occur Inside the FHF (Loaded Site-specific Cask Removal): Main Transfer Room (Room 1003), Preparation Room (Room 1002), Entrance Vestibule (Room 1001) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	8. Closure of the shield doors separating the fuel transfer bay and the main transfer room onto the trolley holding a loaded MSC on a pedestal (Room 1003).	FHF-MTRWLOM-CC8	Beyond Category 2	A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transfer trolley, site-rail transfer cart (SRTC), MSC transporter, WP transporter, would not cause a tipover of the conveyance or cause the conveyance to drop its load. A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transportation cask, transfer cask, or MSC suspended from an overhead crane would not cause the crane to drop its load.	Preventative	Design
	9. Drop or collision of tools or equipment (including the outer lid-lifting fixture, inner lid-lifting fixture (as applicable), lid bolts, etc.) onto or against a MSC inner lid or outer lid (as applicable) during the MSC sealing process (Room 1003).	FHF-MTRWLOM-CC9	Beyond Category 2	An operational requirement limits lift heights for tools and equipment associated with transportation cask, transfer cask, MSC, and DPC handling and preparation to the minimum necessary for operational purposes. The operational requirement ensures that tools and equipment, including handling equipment, if dropped from the height limit, can not initiate an event sequence if dropped onto or collided against (1) a transportation cask or site-specific cask with its outer lid removed and its inner lid in place but unbolted, (2) an exposed sealed dual-purpose canister, or (3) a dual-purpose canister with its severed lid in place.	Preventive	Procedural Safety
	10. Derailment of a trolley serving a fuel transfer bay or the import-export trolley holding a loaded MSC on a pedestal followed by a load tipover or fall (Room 1003).	FHF-MTRWLOM-CC10	Beyond Category 2	A design requirement ensures that loaded transfer trolleys do not derail or drop their loads. Design requirements apply to trolleys for casks, waste packages, site-specific casks, and dual-purpose canisters.	Preventive	Design
	11. Drop of a loaded MSC from the main transfer room overhead crane onto the floor during the MSC transfer from a pedestal staged on a trolley serving the fuel transfer bay or from the canister transfer station to the import-export trolley and pedestal (Room 1003).	FHF-MTRWLOM-CC11A FHF-MTRWLOM-CC11B FHF-MTRWLOM-CC11C FHF-MTRWLOM-CC11D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-01) Design and operational requirements reduce the drop probability. Design requirements limit the lift height for transportation and transfer casks without impact limiters and site-specific casks. Design and operational requirements limit the probability of exceeding the lift height. Canister design requirements and the reliability of fabrication processes limit the probability that a DOE SNF canister or DOE multiccanister overpack is defective.	Preventive	Design-Procedural Safety
	12. Drop of a loaded MSC from the main transfer room overhead crane onto the pedestal on a trolley during the MSC transfer from a pedestal staged on a transfer trolley serving the fuel transfer bay or from the canister transfer station to the import-export trolley and pedestal (Room 1003).	FHF-MTRWLOM-CC12A FHF-MTRWLOM-CC12B FHF-MTRWLOM-CC12C FHF-MTRWLOM-CC12D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-01) Same disposition as Potential Event FHF-MTRWLOM-CC11.	Preventive	Design-Procedural Safety
	13. Drop or collision of a loaded MSC from the main transfer room overhead crane onto or against a sharp object during the transfer from a pedestal staged on a transfer trolley serving the fuel transfer bay or from the canister transfer station to the import-export trolley and pedestal (Room 1003).	FHF-MTRWLOM-CC13	Beyond Category 2	Design and operational requirements ensure that surfaces in the load paths through which WPs, DOE SNF canisters, naval canisters, DPCs, transportation casks, transfer casks, or MSCs are transferred by crane are kept free of structures, such as posts and curbs, that could puncture a container in case of a drop. An operational requirement ensures that the load paths are kept free of movable puncture hazards. A design requirement limits speed for crane transfers such that a collision at the maximum speed could not breach an MSC, transportation cask, transfer cask, DPC, DOE or naval canister, or waste package involved in the transfer.	Preventative	Design-Procedural Safety
	14. Stakedown of a loaded MSC following a drop from onto the edge of the pedestal or trolley or other object during the transfer from a pedestal staged on a transfer trolley serving the fuel transfer bay or from the canister transfer station to the import-export trolley and pedestal (Room 1003).	FHF-MTRWLOM-CC14A FHF-MTRWLOM-CC14B FHF-MTRWLOM-CC14C FHF-MTRWLOM-CC14D	Category 2 No breach Beyond Category 2 Beyond Category 2	(See GET-01) Same disposition as Potential Event FHF-MTRWLOM-CC11.	Preventive	Design-Procedural Safety

Table III-29. Disposition of Internal Events That Occur Inside the FHF (Loaded Site-specific Cask Removal): Main Transfer Room (Room 1003), Preparation Room (Room 1002), Entrance Vestibule (Room 1001) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement	
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement	
Chemical Contamination-Flooding	15. Slidown of a loaded MSC onto the floor, into a wall, or into nearby equipment following a drop from the main transfer room overhead crane onto the edge of the import-export trolley, pedestal, or other equipment during the lift and transfer of the MSC from the canister transfer station to the import-export trolley (Room 1002).	FHF-MTRWLOM-CC15A FHF-MTRWLOM-CC15B FHF-MTRWLOM-CC15C FHF-MTRWLOM-CC15D	Category 2 Beyond Category 2	(See GET-01) Same disposition as Potential Event FHF-MTRWLOM-CC11.	Preventive Design- Procedural Safety
	16. Collision of the import-export trolley holding a loaded MSC on a pedestal with the shield doors separating the main transfer room and the preparation room or the preparation room and the entrance vestibule (Rooms 1002 and 1003).	FHF-MTRWLOM-CC16	Beyond Category 2	(See GET-22) Same disposition as Potential Event FHF-MTRWLOM-CC7.	Preventative Design
	17. Closure of the shield doors separating main transfer room and the preparation room or the preparation room and the entrance vestibule onto the import-export trolley holding a loaded MSC on a pedestal (Rooms 1002 and 1003).	FHF-MTRWLOM-CC17	Beyond Category 2	Same disposition as Potential Event FHF-MTRWLOM-CC8.	Preventative Design
	18. Drop or collision of equipment in the preparation room onto or against a loaded MSC on a pedestal on an import-export trolley (Room 1002).	FHF-MTRWLOM-CC18	Beyond Category 2	Same disposition as Potential Event FHF-MTRWLOM-CC9.	Preventative Procedural Safety
	19. Drop of a loaded MSC from the entrance vestibule gantry crane onto the floor during the lifting of the loaded MSC off of the pedestal on the import-export trolley (Room 1001).	FHF-MTRWLOM-CC19A FHF-MTRWLOM-CC19B FHF-MTRWLOM-CC19C FHF-MTRWLOM-CC19D	Category 2 No breach Beyond Category 2	(See GET-01) Same disposition as Potential Event FHF-MTRWLOM-CC11.	Preventive Design- Procedural Safety
	20. Drop or collision of a loaded MSC from the entrance vestibule gantry crane onto or against a sharp object during the lifting of the loaded MSC off of the pedestal on the import-export trolley. (Room 1001).	FHF-MTRWLOM-CC20	Beyond Category 2	Same disposition as Potential Event FHF-MTRWLOM-CC13.	Preventative Design- Procedural Safety
	21. Slidown of a loaded, sealed MSC following a drop from the entrance vestibule gantry crane onto the edge of the pedestal, edge of the import-export trolley, or other equipment during the lifting of the loaded MSC off of the pedestal on the import-export trolley (Room 1001).	FHF-MTRWLOM-CC21A FHF-MTRWLOM-CC21B FHF-MTRWLOM-CC21C FHF-MTRWLOM-CC21D	Category 2 No breach Beyond Category 2	(See GET-01) Same disposition as Potential Event FHF-MTRWLOM-CC11.	Preventive Design- Procedural Safety
	22. Collision of the entrance vestibule gantry crane, holding a loaded MSC, with a forklift, mobile elevated platform, or other object in the entrance vestibule (Room 1001).	FHF-MTRWLOM-CC22	Beyond Category 2	Same disposition as Potential Events FHF-MTRWLOM-CC2 and FHF-MTRWLOM-CC6.	Preventative Design- Procedural Safety
	23. Collision of the entrance vestibule gantry crane holding a loaded MSC with the entrance vestibule doors (Room 1001).	FHF-MTRWLOM-CC23	Beyond Category 2	Same disposition as Potential Event FHF-MTRWLOM-CC2.	Preventative Design
	24. The entrance vestibule doors close on the entrance vestibule gantry crane holding a loaded MSC (Room 1001).	FHF-MTRWLOM-CC24	Beyond Category 2	Same disposition as Potential Event FHF-MTRWLOM-CC8.	Preventative Design
	1 Non-inert SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inert environment at normal operating temperatures (Rooms 1001, 1002, and 1003).	FHF-MTRWLOM-CCF1	NA—Accounted for in consequence analyses, if applicable	NA—SNF is contained inside a sealed cask, therefore this event does not occur unless an event sequence leads to exposure of SNF to air. Oxidation of the fuel matrix is a possible possibility of oxidation, as applicable.	NA
					NA

Table III-29. Disposition of Internal Events That Occur Inside the FHF (Loaded Site-specific Cask Removal): Main Transfer Room (Room 1003), Preparation Room (Room 1002), Entrance Vestibule (Room 1001) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Explosion-Implosion	1. MSC inerting system (or other pneumatic or pressurized system) missile due to a fractured nozzle/valve stem/pneumatic device (Room 1003).	FHF-MTRWLOM-EI1	Beyond Category 2	An operational requirement ensures that pressurized systems that could generate missiles, energetic enough to penetrate a transportation cask with or without impact limiters, a transfer cask, a DOE canister, a naval SNF canister, a dual-purpose canister, the inner lid of a transportation cask, a site-specific cask, a waste package, or the inner lid of a site-specific cask or waste package are not present in areas where potentially vulnerable items may be exposed.	Preventive	Procedural Safety
	2. Hydrogen explosion involving batteries on the import-export trolley (Rooms 1001, 1002, and 1003).	FHF-MTRWLOM-EI2	Beyond Category 2	Operational controls pertaining to batteries for powering heavy equipment ensure the generation or accumulation of enough hydrogen gas to cause an explosion that could breach a transportation cask, site-specific cask, or waste package is prevented.	Preventive	Procedural Safety
	3. Hydrogen explosion involving batteries on a mobile elevated platform (Room 1003).	FHF-MTRWLOM-EI3	Beyond Category 2	Same disposition as Potential Event FHF-MTRWLOM-EI2.	Preventive	Procedural Safety
	4. Explosion hazard associated with the cask purging system and the ignition of hydrogen that may have accumulated in the cask prior to MSC purging and inerting (Room 1003).	FHF-MTRWLOM-EI4	Beyond Category 2	Operational requirements ensure that precautions taken during the cask sampling and purging process provide reasonable assurance that such hydrogen explosions would not occur.	Preventative	Procedural Safety
Fire-Thermal	1. Electrical fire associated with the main transfer room overhead cranes and the entrance vestibule gantry crane (Rooms 1001, 1002, and 1003).	FHF-MTRWLOM-FT1	Beyond Category 2	Design and operational requirements ensure control of the presence and amount of combustibles in the different areas of the repository to preclude any Category 1 or Category 2 event sequences potentially initiated by a fire.	Preventive	Design-Procedural Safety
	2. Electrical fire associated with handling equipment or other equipment located in the main transfer room, the preparation room, or the entrance vestibule (Rooms 1001, 1002, and 1003).	FHF-MTRWLOM-FT2	Beyond Category 2	Same disposition as Potential Event FHF-MTRWLOM-FT1.	Preventive	Design-Procedural Safety
	3. Transient combustible fire in the main transfer room, preparation room, or the entrance vestibule (Rooms 1001, 1002, and 1003).	FHF-MTRWLOM-FT3	Beyond Category 2	Same disposition as Potential Event FHF-MTRWLOM-FT1.	Preventive	Design-Procedural Safety
	4. Intact or non-intact SNF overheating due to a loss of cooling resulting in excessive temperature and possible zircaloy cladding (or other cladding) unzipping or cladding failure due to excessive hoop stresses (Rooms 1001, 1002, and 1003).	FHF-MTRWLOM-FT4	Beyond Category 2	If ventilation is lost in areas where DOE or naval canisters are handled, no radiological release occurs from the canisters because containment within the canisters is maintained. Design and operational requirements ensure that the thermal response of areas where CSNF assemblies are handled or staged to a loss of HVAC would not cause radiological releases in excess of those considered in the consequence analysis for normal operations.	Preventive	Design-Procedural Safety
	5. Fire/explosion (battery/electrical fire) associated with the import-export trolley or MSC trolley (Rooms 1001, 1002, and 1003).	FHF-MTRWLOM-FT5	Beyond Category 2	Same disposition as Potential Event FHF-MTRWLOM-FT1.	Preventive	Design-Procedural Safety
	6. Fire/explosion (battery/electrical fire) associated with the mobile elevated platform (Room 1003).	FHF-MTRWLOM-FT6	Beyond Category 2	Same disposition as Potential Event FHF-MTRWLOM-FT1.	Preventive	Design-Procedural Safety
Radiation	1. Radiation exposure of a facility worker and/or the offsite public (Rooms 1001, 1002, and 1003).	FHF-MTRWLOM-R1	NA—Accounted for in consequence analyses, if applicable	NA—Potential exposure of workers or the public to radiation is a hazard for the event sequences considered in this analysis. Consequence analyses evaluate this hazard for Category 1 and Category 2 event sequences, as applicable.	NA	NA
			Normal Operations	Some exposure to radiation is expected as a part of normal facility operations. Exposures are managed by design features and procedures that ensure that workers or the public do not receive excessive radiation doses.	Mitigative	Design-Procedural Safety

Table III-29. Disposition of Internal Events That Occur Inside the FHF (Loaded Site-specific Cask Removal): Main Transfer Room (Room 1003), Preparation Room (Room 1002), Entrance Vestibule (Room 1001) (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	2. Damage or rupture of cask inerting system leading to a release of cask internal gases (Room 1003).	FHF-MTRWLOM-R2	Normal Operations	Although a rupture leading to a radiological release would be an off-normal occurrence, any release and related dose would be managed as part of routine radiation protection operations. Potential exposure of workers to radiation as a result of this event is managed as a normal-operations dose by procedures that ensure that workers do not receive excessive radiation doses.	Mitigative	Procedural Safety
	3. Expansion of gasses in the MSC, leading to radiological release (Rooms 1001, 1002, and 1003).	FHF-MTRWLOM-R3	Normal Operations	Thermal expansion of gases is to be expected as a part of normal operations. Any resulting potential exposure of workers to radiation is managed as a normal-operations dose by procedures that ensure that workers do not receive excessive radiation doses.	Mitigative	Procedural Safety
	4. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation (Rooms 1001, 1002, and 1003).	FHF-MTRWLOM-R4	NA (no significant exposure)	Operating procedures ensure that a loss of confinement during otherwise normal operations does not cause individuals to be exposed to significant amounts of radioactivity.	Mitigative	Procedural Safety
	5. Radiation-induced damage to a facility SSC (Rooms 1001, 1002, and 1003).	FHF-MTRWLOM-R5	NA	Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization.	NA	NA
Fissile	1. Criticality associated with a MSC trolley collision or trolley derailment followed by a load tipover or fall and a rearrangement of the MSC internals (Rooms 1001, 1002, and 1003).	FHF-MTRWLOM-F1	Beyond Category 2	Design requirements and waste acceptance criteria ensure that transportation casks, transfer casks, MSCs, and dual-purpose canisters (DPCs) are designed to ensure nuclear criticality safety with optimum moderation and most-reactive waste forms. Criticality safety will be maintained despite geometric rearrangements due to a drop or other handling incident.	Preventive	Design
	2. Criticality associated with a drop or slapping of a loaded MSC from an overhead crane and a rearrangement of cask internals (Room 1003).	FHF-MTRWLOM-F2	Beyond Category 2	Same disposition as Potential Event FHF-MTRWLOM-F1.	Preventive	Design
	3. Criticality associated with the drop of heavy equipment onto an unsealed MSC and a rearrangement of the container internals (Room 1003).	FHF-MTRWLOM-F3	Beyond Category 2	Same disposition as Potential Event FHF-MTRWLOM-F1.	Preventive	Design

NOTES: CC = collision-crushing; CCF = chemical-contamination flooding; EI = explosion-implosion; F = fissile; FHF = Fuel Handling Facility; FT = fire-thermal; GET = generalized event tree; HLW = high-level radioactive waste; MTRWLOM = main transfer room waste loadout site-specific cask; NA = not applicable; R = radiation; SNF = spent nuclear fuel; SRTC = site rail transfer cart.

The Event Sequence Designator is a unique event sequence index for each event in this table. The prefix identifies the building or facility, for example "FHF," the middle identifies an activity, room, or area, for example "MTRWLOM," and the suffix identifies the hazard category and event number, for example "CC1." When an event sequence has been evaluated in a GET, the GET number is identified in the Disposition of Event column; the GET sequence alpha character is shown at the end of the Event Sequence Designator, for example "A."

GETs are discussed in Sections 6.3.1.1 to 6.3.1.24.

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Table III-30. Disposition Internal Events That Occur Inside the Fuel Handling Facility (Empty Site-specific Cask Removal): Main Transfer Room (Room 1003), Preparation Room (Room 1002), Entrance Vestibule (Room 1001)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Collision-Crushing	No potential events identified.					
Chemical Contamination-Flooding	No potential events identified.					
Explosion-Implosion	No potential events identified.					
Fire-Thermal	No potential events identified.					
Radiation	1. Radiation exposure of a facility worker and/or the offsite public (Rooms 1001, 1002, and 1003).	FHF-EMR-R1	NA—Accounted for in consequence analyses, if applicable	NA—Potential exposure of workers or the public to radiation is a hazard for the event sequences considered in this analysis. Consequence analyses evaluate this hazard for Category 1 and Category 2 event sequences, as applicable.	NA	NA
			Normal Operations	Some exposure to radiation is expected as a part of normal facility operations. Exposures are managed by design features and procedures that ensure that workers or the public do not receive excessive radiation doses.	Mitigative	Design-Procedural Safety
	2. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation (Rooms 1001, 1002, and 1003).	FHF-EMR-R2	NA (no significant exposure)	Operating procedures ensure that a loss of confinement during otherwise normal operations does not cause individuals to be exposed to significant amounts of radioactivity.	Mitigative	Procedural Safety
Fissile	No potential events identified.					

NOTES: EMR = empty site-specific cask removal; FHF = Fuel Handling Facility; NA = not applicable; R = radiation.

The Event Sequence Designator is a unique event sequence index for each event in this table. The prefix identifies the building or facility, for example "FHF," the middle identifies an activity, room, or area, for example "EMR," and the suffix identifies the hazard category and event number, for example "CC1."

Table III-31. Disposition of Internal Events That Occur During Waste Package Subsurface Transport and Emplacement

Generic Event Category	Potential Event	Potential Event Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Collision-Crushing	1. Collision involving the transport locomotive and the WP transporter (holding the sealed WP on a pallet) during coupling, prior to entering the North Portal (GA).	SS-TE-CC1	Beyond Category 2	A design requirement ensures that the WP transporter transports the WP in a manner such that if a collision or derailment (excluding tipover) occurs, the WP impact energy would be low enough to preclude a WP breach. Also, a design requirement ensures that the restraints used to immobilize the bedplate inside the shielded compartment of the transporter, and the mechanism for locking the doors of the shielded compartment withstand a collision or derailment (including tipover) of the transporter without resulting in a Category 1 or Category 2 event sequence. A design requirement ensure that the WP transporter transports the WP in a manner such that if a collision or derailment leading to a transporter tipover occurs, the WP impact energy would be low enough to preclude a WP breach.	Preventative	Design
	2. Derailment of a WP transporter outdoors, prior to entering the north ramp, followed by a load tipover or fall (GA).	SS-TE-CC2	Beyond Category 2	Same disposition as Potential Event SS-TE-CC1.	Preventative	Design
	3. Derailment of a WP transporter while on the north ramp, in a main drift, or in an emplacement drift turnout, after passing through the North Portal, followed by a load tipover or fall (GA).	SS-TE-CC3	Beyond Category 2	Same disposition as Potential Event SS-TE-CC1.	Preventative	Design
	4. Runaway of a loaded WP transporter while proceeding down the north ramp (GA).	SS-TE-CC4	Beyond Category 2	A design requirement ensures the WP transporter has design features with reliability goals to make the transporter runaway event beyond Category 2.	Preventative	Design
	5. Collision involving a WP transporter (holding a sealed WP on a pallet) and other stationary or moving equipment (GA).	SS-TE-CC5	Beyond Category 2	Same disposition as Potential Event SS-TE-CC1. Additionally, an operational requirement ensures that vehicle crossings of the railway are controlled to ensure that the potential for collisions between vehicles and the waste package transporter carrying a loaded waste package is minimized.	Preventative	Design-Procedural Safety
	6. Derailment of a WP transporter at the turnout drift switch, followed by a load tipover or fall (GA).	SS-TE-CC6	Beyond Category 2	Same disposition as Potential Event SS-TE-CC1.	Preventative	Design
	7. Collision involving a WP transporter (holding the sealed WP on a pallet) and the emplacement access doors (GA).	SS-TE-CC7	Beyond Category 2	Same disposition as Potential Event SS-TE-CC1.	Preventative	Design
	8. Emplacement access doors close on the WP transporter (holding the sealed WP on a pallet) (GA).	SS-TE-CC8	Beyond Category 2	A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transfer trolley, site-rail transfer cart (SRTC), MSC transporter, WP transporter, would not cause a tipover of the conveyance or cause the conveyance to drop its load. A design requirement ensures that closure of airlock doors, shield doors, and other applicable doors on a transportation cask, transfer cask, or MSC suspended from an overhead crane would not cause the crane to drop its load.	Preventative	Design
	9. Rockfall onto a WP transporter while in the subsurface (GA).	SS-TE-CC9	Beyond Category 2	Credible rockfall scenarios are evaluated and found that no damage to the transporter's shielded compartment occurs in a manner sufficient to jeopardize the structural integrity of the waste package. Therefore, a rockfall does not result in a Category 1 or Category 2 event sequence.	Preventative	Design
	10. Collision involving a WP transporter (holding the sealed WP on a pallet) and the emplacement transfer dock (while entering the dock) (GA).	SS-TE-CC10	Beyond Category 2	Same disposition as Potential Event SS-TE-CC1.	Preventative	Design

Table III-31. Disposition of Internal Events That Occur During Waste Package Subsurface Transport and Emplacement (Continued)

Generic Event Category	Potential Event	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	11. WP transporter doors close on the WP on a pallet (GA).	SS-TE-CC11	Beyond Category 2	A design requirement ensures that movement of the transporter shielded enclosure doors will not breach the waste package or cause it to fall from the bedplate of the transporter.	Preventative	Design
	12. WP rolls or slides out of a WP transporter on the surface (outdoors), in a ramp, in a main drift, or at the entrance of the emplacement drift (GA).	SS-TE-CC12	Beyond Category 2	Same disposition as Potential Event SS-TE-CC1. Also, a design requirement ensures that spurious or operator-induced opening of the waste package shielded compartment followed by a bedplate rollout is precluded when the transporter is in motion.	Preventative	Design
	13. WP and pallet drop from a WP emplacement gantry (GA).	SS-TE-CC13A SS-TE-CC13B SS-TE-CC13C	No collision No breach Beyond Category 2	(See GET-24) Design and operational requirements on the WP Emplacement Gantry reduce the drop probability. Design and operational requirements establish lift-height limits for WPs in horizontal orientation on the emplacement pallet. Design and operational requirements for the WP Emplacement Gantry limit the conditional probability of exceeding the WP lift height.	Preventative	Design- Procedural Safety
	14. Derailment of a WP emplacement gantry holding a WP on a pallet, followed by a load drop (drop of the WP and pallet) (GA).	SS-TE-CC14A SS-TE-CC13B SS-TE-CC13C	No collision No breach Beyond Category 2	(see GET-24) Same disposition as Potential Event SS-TE-CC13.	Preventative	Design- Procedural Safety
	15. WP emplacement gantry carrying a WP collides with another WP in the drift (GA).	SS-TE-CC15	Beyond Category 2	A design requirement ensures that the WP Emplacement Gantry is limited in speed such that it could not cause a waste-package breach in case of a collision.	Preventative	Design
	16. WP emplacement gantry carrying a WP travels to the end of the drift and drops off the end of the rails, falling to the ground below (GA).	SS-TE-CC16	Beyond Category 2	A design requirement ensures that the WP Emplacement Gantry, carrying a WP, is not capable of running off the end of the emplacement drift or transfer dock rails..	Preventative	Design
	17. WP emplacement gantry holding a WP on a pallet rolls off the emplacement transfer dock and either falls onto the drift rails (or surrounding ground) or impacts the WP transporter (if the transporter has not been moved) (GA).	SS-TE-CC17A SS-TE-CC13B SS-TE-CC13C	No collision No breach Beyond Category 2	(See GET-24) Same disposition as Potential Event SS-TE-CC13.	Preventative	Design- Procedural Safety
	18. Empty WP emplacement gantry rolls off the emplacement transfer dock and falls onto the WP transporter, impacting the WP on the pallet on the extended bedplate (GA).	SS-TE-CC18	Beyond Category 2	Design and operational requirements ensure that if the gantry falls onto the transporter and impacts the waste package, it does not cause the waste package to be breached.	Preventative	Design- Procedural Safety
	19. Collision of a WP emplacement gantry, holding a WP, on a pallet with a fallen rock, fallen ground support, or other object, followed by a load drop (drop of the WP and pallet) (GA).	SS-TE-CC19	Beyond Category 2	Same disposition as Potential Event SS-TE-CC15.	Preventative	Design
	20. Rockfall onto a WP (GA).	SS-TE-CC20	Beyond Category 2	In the emplacement drifts, credible rockfall scenarios do not damage the waste package in a manner sufficient as to jeopardize its structural integrity. Therefore, rockfalls do not initiate a Category 1 or Category 2 event sequence.	Preventative	Design
	21. Rockfall onto a WP emplacement gantry holding a WP on a pallet (GA).	SS-TE-CC21	Beyond Category 2	Same disposition as Potential Event SS-TE-CC20.	Preventative	Design
	22. Ground support drop onto a WP (GA).	SS-TE-CC22	Beyond Category 2	The consequences of failed ground support components falling on the waste package would not be more severe than those resulting from credible rockfall scenarios, which do not damage the waste package in a manner sufficient to jeopardize its structural integrity. The event does not initiate a Category 1 or Category 2 event sequence.	Preventative	Design
	23. Ground support drop onto a WP emplacement gantry holding a WP on a pallet (GA).	SS-TE-CC23	Beyond Category 2	Same disposition as Potential Event SS-TE-CC22.	Preventative	Design
	24. Runaway WP transporter in an access main and a collision with the barrier isolating the development side of the repository from the emplacement side of the repository (GA).	SS-TE-CC24	Beyond Category 2	Same disposition as Potential Event SS-TE-CC4.	Preventative	Design

Table III-31. Disposition of Internal Events That Occur During Waste Package Subsurface Transport and Emplacement (Continued)

Generic Event Category	Potential Event	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Chemical Contamination-Flooding	1. Flooding from a water pipe break originating on the development side of the repository (GA).	SS-TE-CCF1	Beyond Category 2	Operational requirements ensure that construction operations are sufficiently isolated from surface and subsurface repository operations to preclude interactions with waste receipt, handling, emplacement, or retrieval operations.	Preventative	Procedural Safety
	2. Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures or during off-normal conditions, (e.g., during a failure of the emplacement ventilation subsystem) (GA).	SS-TE-CCF2	NA—Accounted for in consequence analyses, if applicable	NA—SNF is contained inside a sealed waste package, therefore this event does not occur unless an event sequence leads to exposure of SNF to air. There are no Category 1 or Category 2 event sequences underground.	NA	NA
Explosion-Implosion	1. Hydrogen explosion involving batteries on the transport locomotive (GA).	SS-TE-EI1	Beyond Category 2	Operational controls pertaining to batteries for powering heavy equipment ensure the generation or accumulation of enough hydrogen gas to cause an explosion that could breach a transportation cask, site-specific cask, or waste package is prevented.	Preventative	Procedural Safety
	2. Hydrogen explosion involving batteries on the WP emplacement gantry (GA).	SS-TE-EI2	Beyond Category 2	Same disposition as Potential Event SS-TE-EI1.	Preventative	Procedural Safety
Fire-Thermal	1. Electrical fire associated with the transport locomotive (GA).	SS-TE-FT1	Beyond Category 2	Design and operational requirements ensure control of the presence and amount of combustibles in the different areas of the repository to preclude any Category 1 or Category 2 event sequences potentially initiated by a fire.	Preventative	Design Procedural Safety
	2. Fire/explosion (battery/electrical fire) associated with the transport locomotive (GA).	SS-TE-FT2	Beyond Category 2	Same disposition as Potential Event SS-TE-FT1.	Preventative	Design Procedural Safety
	3. Fire/explosion (battery/electrical fire) associated with the WP emplacement gantry (GA).	SS-TE-FT3	Beyond Category 2	Same disposition as Potential Event SS-TE-FT1.	Preventative	Design Procedural Safety
	4. Electrical fire associated with equipment on the WP transporter, including motors to extend the WP transporter bedplate (GA).	SS-TE-FT4	Beyond Category 2	Same disposition as Potential Event SS-TE-FT1.	Preventative	Design Procedural Safety
	5. Electrical fire associated with the WP emplacement gantry or other subsurface equipment (GA).	SS-TE-FT5	Beyond Category 2	Same disposition as Potential Event SS-TE-FT1.	Preventative	Design Procedural Safety
	6. WP overheating in the WP transporter due to solar insolation while stalled or stopped outdoors during transit from a surface facility to the subsurface facility (GA).	SS-TE-FT6	Beyond Category 2	Results of calculations evaluating the maximum temperature of the waste package show that the waste package does not lose its structural integrity due to solar insolation while stalled or stopped outdoors. This event does not initiate a Category 1 or Category 2 event sequence.	Preventative	Design
	7. Extended loss of the subsurface ventilation system (GA).	SS-TE-FT7	Beyond Category 2	The thermal effects of a loss of emplacement-drift ventilation have been examined and this event does not initiate a Category 1 or Category 2 event sequence as a result of a loss of ventilation.	Preventative	Design
Radiation	1. Radiation exposure of a facility worker and/or the offsite public (GA).	SS-TE-R1	NA—Accounted for in consequence analyses, if applicable Normal Operations	NA—Potential exposure of workers or the public to radiation is a hazard for the event sequences considered in this analysis. Consequence analyses evaluate this hazard for Category 1 and Category 2 event sequences, as applicable. Some exposure to radiation is expected as a part of normal facility operations. Exposures are managed by design features and procedures that ensure that workers or the public do not receive excessive radiation doses.	NA Mitigative	NA Design-Procedural Safety
	2. Early WP failure while in the subsurface during the preclosure period and a resultant release of radioactive material (GA).	SS-TE-R2	Beyond Category 2	No significant degradation of a defective waste package takes place during the 100-year preclosure period.	Preventative	Design

Table III-31. Disposition of Internal Events That Occur During Waste Package Subsurface Transport and Emplacement (Continued)

Generic Event Category	Potential Event	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	3. Release of activated air and dust to the environment (GA).	SS-TE-R3	Normal Operations	Activated air and dust are continuously released into the environment by the subsurface ventilation system and are a part of normal operations. Resulting exposure of workers to radiation is managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses.	Mitigative	Procedural Safety
	4. Inadvertent opening of the WP transporter shielded enclosure doors, leading to a worker exposure (GA).	SS-TE-R4	Beyond Category 2	Design and operational requirements ensure that exposure of workers due to inadvertent actuation of shield doors or pit protective covers is not Category 1.	Preventive	Design-Procedural Safety
	5. Radiation-induced damage to a facility SSC (GA).	SS-TE-R5	NA	Radiation-induced damage to a facility SSC is not a separate event for the purposes of categorization.	NA	NA
	6. Inadvertent opening of the emplacement access doors leading to a worker exposure (GA).	SS-TE-R6	Beyond Category 2	Same disposition as Potential Event SS-TE-R4.	Preventive	Design-Procedural Safety
Fissile	1. Criticality associated with a drop or collision of a WP and a rearrangement of the container internals (GA).	SS-TE-F1	Beyond Category 2	A design requirement ensures that sealed waste packages are designed so that drops, collisions, and other handling impacts, within their design bases cannot lead to a nuclear criticality, allowing for rearrangement of waste package internals, proximity of the waste package and without credit for burnup.	Preventive	Design

NOTES: CC = collision-crushing; CCF = chemical-contamination flooding; EI = explosion-implosion; FT = fire-thermal; GA = general area; GET = generalized event tree; NA = not applicable; R = radiation; SNF = spent nuclear fuel; SS = subsurface; TE = transport and emplacement.

The Event Sequence Designator is a unique event sequence index for each event in this table. The prefix identifies the building or facility, for example "SS." If localized, the middle identifies an activity, room, or area, for example "TE," and the suffix identifies the hazard category and event number, for example "CC1."

Table III-32. Disposition of Internal Events That Occur During Subsurface Construction

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Collision-Crushing	No potential events identified.					
Chemical Contamination-Flooding	1. Flooding from a pipe break originating on the development side of the repository.	SUBC-GA-CCF1	Beyond Category 2	Operational requirements ensure that construction operations are sufficiently isolated from surface and subsurface repository operations to preclude interactions with waste receipt, handling, emplacement, or retrieval operations.	Preventive	Procedural Safety
Explosion-Implosion	No potential events identified.					
Fire-Thermal	1. Diesel fuel fire/explosion associated with subsurface development equipment resulting in damage to the subsurface isolation barriers.	SUBC-GA-FT1	Beyond Category 2	Same disposition as Potential Event SUBC-GA-CCF1.	Preventive	Procedural Safety
	2. Electrical fire associated with subsurface development equipment or other equipment resulting in damage to the subsurface isolation barriers.	SUBC-GA-FT2	Beyond Category 2	Same disposition as Potential Event SUBC-GA-CCF1.	Preventive	Procedural Safety
	3. Transient combustible fire in the development side of the subsurface facilities resulting in damage to the subsurface isolation barriers.	SUBC-GA-FT3	Beyond Category 2	Same disposition as Potential Event SUBC-GA-CCF1.	Preventive	Procedural Safety
Radiation	No potential events identified.					
Fissile	No potential events identified.					

NOTES: CCF = chemical-contamination flooding; FT = fire-thermal; SUBC = subsurface construction.

The Event Sequence Designator is a unique event sequence index for each event in this table. The prefix identifies the building or facility, for example "SUBC," the middle identifies an activity, room, or area, for example "GA," and the suffix identifies the hazard category and event number, for example "CCF1."

Table III-33. Disposition of Internal Events That Occur During Surface Construction

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Collision-Crushing	1. Impacts on a loaded transportation cask, a loaded MSC, or a loaded WP as a result of construction operations (GA).	SC-GA-CC1	Beyond Category 2	Operational requirements ensure that construction operations are sufficiently isolated from surface and subsurface repository operations to preclude proximity interactions with waste receipt, handling, emplacement, or retrieval operations.	Preventative	Procedural Safety
Chemical Contamination-Flooding	No potential events identified.					
Explosion-Implosion	No potential events identified					
Fire-Thermal	1. Diesel fuel fire/explosion associated with construction equipment (GA).	SC-GA-FT1	Beyond Category 2	Same disposition as Potential Event SC-GA-CC1.	Preventive	Procedural Safety
	2. Electrical fire associated with construction equipment or other equipment (GA).	SC-GA-FT2	Beyond Category 2	Same disposition as Potential Event SC-GA-CC1.	Preventive	Procedural Safety
	3. Transient combustible fire (GA).	SC-GA-FT3	Beyond Category 2	Same disposition as Potential Event SC-GA-CC1.	Preventive	Procedural Safety
Radiation	1. Radiation exposure of a facility worker and/or the offsite public (GA).	SC-GA-R1	NA—Accounted for in consequence analyses, if applicable	NA—Potential exposure of workers or the public to radiation is a hazard for the event sequences considered in this analysis. Consequence analyses evaluate this hazard for Category 1 and Category 2 event sequences, as applicable.	NA	NA
			Normal Operations	Some exposure to radiation is expected as a part of normal facility operations. Exposures are managed by design features and procedures that ensure that workers or the public do not receive excessive radiation doses.	Mitigative	Design-Procedural Safety
Fissile	1. Criticality associated with an impact on a loaded transportation cask, a loaded MSC, or a loaded WP and a rearrangement of the container internals (GA).	SC-GA-F1	Beyond Category 2	Design requirements and waste acceptance criteria ensure that transportation casks, transfer casks, MSCs, and dual-purpose canisters (DPCs) are designed to ensure nuclear criticality safety with optimum moderation and most-reactive waste forms. Criticality safety will be maintained despite geometric rearrangements due to a drop or other handling incident. A design requirement ensures that sealed waste packages are designed such that drops, collisions, and other handling impacts within their design bases, allowing for rearrangement of cask internals, proximity of other sealed waste packages and without credit for burnup, cannot lead to a nuclear criticality.	Preventive	Design

NOTES: CC = collision-crushing; F = fissile; FT = fire-thermal; GA = general area; HLW = high-level radioactive waste; NA = not applicable; R = radiation; SC = surface construction; SNF = spent nuclear fuel.

The Event Sequence Designator is a unique event sequence index for each event in this table. The prefix identifies the building or facility, for example "SC," the middle identifies an activity, room, or area, for example "GA," and the suffix identifies the hazard category and event number, for example "CC1."

Table III-34. Disposition of Internal Events That Occur During Subsurface Drip Shield Installation

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Collision-Crushing	1. Derailment of a drip shield emplacement gantry carrying a drip shield, followed by a load drop (drop of the drip shield); the drip shield and/or the gantry impacts a WP or several WPs.	SS-DS-CC1	Beyond Category 2	The designs of the drip shield and its emplacement gantry ensure that it is not physically possible for the drip shield or drip-shield emplacement gantry to contact the waste package during installation.	Preventive	Design
	2. Drip shield emplacement gantry carrying a drip shield collides with a WP or WPs due to gantry failure.	SS-DS-CC2	Beyond Category 2	Same disposition as Potential Event SS-DS-CC1.	Preventive	Design
	3. Collision of a drip shield emplacement gantry, holding a drip shield, with a fallen rock, fallen ground support, or other object, followed by a load drop (drop of the drip shield) onto a WP or WPs.	SS-DS-CC3	Beyond Category 2	Same disposition as Potential Event SS-DS-CC1.	Preventive	Design
	4. Rockfall onto a drip shield emplacement gantry carrying a drip shield, leading to gantry damage or failure and impact of the rock or drip shield with a WP.	SS-DS-CC4	Beyond Category 2	Same disposition as Potential Event SS-TE-CC20. Rockfall scenarios do not initiate a Category 1 or Category 2 event sequence.	Preventive	Design
	5. Rockfall onto a WP.	SS-DS-CC5	Beyond Category 2	Same disposition as Potential Event SS-DS-CC4.	Preventive	Design
	6. Ground support drop onto a WP.	SS-DS-CC6	Beyond Category 2	Same disposition as Potential Event SS-TE-CC22. The event does not initiate a Category 1 or Category 2 event sequence.	Preventive	Design
	7. Ground support drop onto a drip shield emplacement gantry carrying a drip shield, leading to gantry damage or failure and impact of the ground support or drip shield with a WP.	SS-DS-CC7	Beyond Category 2	Same disposition as Potential Event SS-DS-CC6.	Preventive	Design
Chemical Contamination-Flooding	1. Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures or during off-normal conditions (e.g., during a failure of the emplacement ventilation subsystem.)	SS-DS-CCF1	NA	SNF is contained inside a sealed waste package, therefore SNF is not exposed to air and this event does not occur.	NA	NA
Explosion-Impllosion	No potential events identified					
Fire-Thermal	1. Electrical fire associated with the drip shield emplacement gantry or other subsurface equipment.	SS-DS-FT1	Beyond Category 2	Design and operational requirements ensure control of the presence and amount of combustibles in the different areas of the repository to preclude any Category 1 or Category 2 event sequences potentially initiated by a fire.	Preventive	Design-Procedural Safety
	2. Loss of the subsurface ventilation system.	SS-DS-FT2	Beyond Category 2	The thermal effects of a loss of emplacement-drift ventilation have been examined and this event does not initiate a Category 1 or Category 2 event sequence as a result of a loss of ventilation.	Preventive	Design
Radiation	1. Early WP failure while in the subsurface during the preclosure period and a resultant release of radioactive material.	SS-DS-R1	Beyond Category 2	No significant degradation of a defective waste package takes place during the 100-year preclosure period.	Preventive	Design
	2. Release of activated air and dust to the environment.	SS-DS-R2	Normal Operations	Activated air and dust are continuously released into the environment by the subsurface ventilation system and is a part of normal operations. Resulting exposure of workers to radiation is managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses.	Mitigative	Procedural Safety

Table III-34. Disposition of Internal Events That Occur During Subsurface Drip Shield Installation (Continued)

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Fissile	1. Criticality associated with an impact or collision with a WP and a rearrangement of the container internals.	SS-DS-F1	Beyond Category 2	A design requirement ensures that sealed waste packages are designed such that drops, collisions, and other handling impacts within their design bases, allowing for rearrangement of waste package internals, proximity of other sealed waste packages and without credit for burnup, cannot lead to a nuclear criticality.	Preventive	Design

NOTES: CC = collision-crushing; CCF = chemical-contamination flooding; DS = drip shield; F = fissile; FT = fire-thermal; NA = not applicable; R = radiation; SS = subsurface; SNF = spent nuclear fuel.

The Event Sequence Designator is a unique event sequence index for each event in this table. The prefix identifies the building/facility, for example "SS," the middle identifies an activity, room, or area, for example "DS," and the suffix identifies the hazard category and event number, for example "CC1."

Table III-35. Disposition of Internal Events That Occur During Disposal of Low-Level Radioactive Waste

Generic Event Category	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Collision-Crushing	1. Drop of a heavy load onto a tank, piping, or a container containing liquid or solid radioactive waste (GA).	LLW-GA-CC1	Normal Operations	Minor radioactive releases are expected as a part of normal operations. Any resulting potential exposure of workers to radiation is managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses.	Mitigative	Procedural Safety
	2. Drop of a container or drum containing solid low level radioactive waste (LLW) (GA).	LLW-GA-CC2	Normal Operations	Same disposition as Potential Event LLW-GA-CC1.	Mitigative	Procedural Safety
Chemical Contamination-Flooding	1. Drop of a container or drum containing liquid LLW (GA).	LLW-GA-CCF1	Normal Operations	Same disposition as Potential Event LLW-GA-CC1.	Mitigative	Procedural Safety
	2. Release of radioactive gas from the gas filtration systems or cavity gas sampling systems, WP evacuating and inerting systems, cask evacuating and inerting systems, or the system involved with the cooling of casks prior to immersion in the DTF remediation area pool (GA).	LLW-GA-CCF2	Normal Operations	Minor release of gases from these operations is to be expected as a part of normal operations. Any resulting potential exposure of workers to radiation is managed as a normal-operations dose by procedures for monitoring radiation doses and assigning work, which ensure that workers do not receive excessive radiation doses.	Mitigative	Procedural Safety
Explosion-Implosion	No potential events identified.					
Fire-Thermal	1. Transient combustible fire in areas where dry, flammable low level radioactive waste is stored (GA).	LLW-GA-FT1	Beyond Category 2	Operational requirements provide a control program ensuring that any fire that may occur in areas where low level radioactive waste forms are stored will not be of intensity, duration, or magnitude to initiate an event sequence.	Preventive	Procedural Safety
Radiation	1. Radiation exposure of a facility worker (GA).	LLW-GA-R1	NA—Accounted for in consequence analyses, if applicable	NA—Potential exposure of workers or the public to radiation is a hazard for the event sequences considered in this analysis. Consequence analyses evaluate this hazard for Category 1 and Category 2 event sequences, as applicable.	NA	NA
			Normal Operations	Some exposure to radiation is expected as a part of normal facility operations. Exposures are managed by design features and procedures that ensure that workers or the public do not receive excessive radiation doses.	Mitigative	Design-Procedural Safety
Fissile	No potential events identified.					

NOTES: CC = collision-crushing; CCF = chemical-contamination flooding; FT = fire-thermal; GA = general area; LLW = low-level radioactive waste processing area; NA = not applicable; R = radiation.

The Event Sequence Designator is a unique event sequence index for each event in this table. The prefix identifies the building or facility, for example "LLW," the middle identifies an activity, room, or area, for example "GA," and the suffix identifies the hazard category and event number, for example "CC1."

Table III-36. Disposition of Internal Events That Occur in the Spent Nuclear Fuel Aging System: Vertical Aging Systems

Generic Event Type	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Collision-Crushing	1. Failure of the site-specific cask transporter during transfer of a vertical cask and the vertical cask drops resulting in damage to the aging system (AP, RW, and SF).	SNFAS-VAS-CC1	Beyond Category 2	Design requirements ensure that site-specific casks can withstand a drop from the maximum handling height of a site-specific cask transporter/horizontal transfer cask trailer without breach. A design requirement limits site-specific cask/horizontal transfer cask maximum potential drop height.	Preventive	Design
	2. Failure of the site-specific cask transporter during transfer of a vertical cask and the site-specific cask transporter tips over resulting in damage to the aging system (AP, RW, and SF).	SNFAS-VAS-CC2	Beyond Category 2	Design requirements preclude tip-over during transfer by ensuring that transfer equipment design precludes failure modes that could result in tip-over under design basis load handling conditions.	Preventive	Design
	3. Failure of the roadway surface during transfer of a vertical cask results in a site-specific cask transporter tip-over and damage to aging system (RW).	SNFAS-VAS-CC3	Beyond Category 2	Design requirements preclude tip-over during transfer by ensuring minimum tip-over resistance/stability standards are maintained consistent with roadway design.	Preventive	Design
	4. Misdirection of the site-specific cask transporter off edge of roadway/pad surface during transfer of a vertical cask causing damage in a tip-over event (AP and RW).	SNFAS-VAS-CC4	Beyond Category 2	Design requirements limit the size, mass, maximum speed and motive force of vehicles to limit potential damage caused by collisions from initiating an event sequence. Design requirements ensure reliable means to stop and maintain stability.	Preventive	Design
	5. Collision of the site-specific cask transporter with vehicles or equipment staged or moving along transfer route causing direct damage, a cask drop, or tip-over event (AP and RW).	SNFAS-VAS-CC5	Beyond Category 2	Same disposition as Potential Event SNFAS-VAS-CC4.	Preventive	Design
	6. Collision of the site-specific cask transporter with aging cask or module staged on aging pad causing direct damage, a cask drop, or tip-over event (AP).	SNFAS-VAS-CC6	Beyond Category 2	Same disposition as Potential Event SNFAS-VAS-CC4.	Preventive	Design
	7. Collision of the site-specific cask transporter following mechanical failure that results in runaway and the site-specific cask transporter rolls down inclined roadway and collides with fixed object or tips over (RW).	SNFAS-VAS-CC7	Beyond Category 2	Design requirements ensure reliable means to stop and maintain stability such that no Category 1 or Category 2 event sequence occurs.	Preventive	Design
	8. Misdirection of the site-specific cask transporter off of the edge of the aging pad resulting in a tip-over and damage to aging cask (AP).	SNFAS-VAS-CC8	Beyond Category 2	Same disposition as Potential Event SNFAS-VAS-CC4.	Preventive	Design
	9. Collision of the aging pad maintenance/surveillance vehicle with an aging cask or module staged on aging pad during maintenance/ surveillance activity on aging pad causing direct damage to an aging cask, or tip-over event (AP).	SNFAS-VAS-CC9	Beyond Category 2	Operational requirements limit aging pad maintenance/surveillance vehicle maximum speed and motive force to limit potential damage caused by collisions involving such vehicles from initiating an event sequence.	Preventive	Procedural Safety
Chemical Contamination-Flooding	1. Chemical spill following collision of the site-specific cask transporter with a staged cask system, a SSC, or a site vehicle causing an acid spill (i.e., batteries). Acid or other chloride containing chemical contact with aging system surface results in damage to the aging system (e.g., stainless steel stress corrosion cracking). Collisions with other vehicles (security vehicles, etc.) or a structure, system, or component could also initiate the same event sequence (AP, RW, and SF).	SNFAS-VAS-CCF1	Beyond Category 2	Same disposition as Potential Event SNFAS-VAS-CC4. Additionally, operational requirements restrict staging or operation of vehicles along the transfer route or on aging pad during transfer operations. Operational requirements implement spill prevention and cleanup procedures.	Preventive	Design-Procedural Safety

Table III-36. Disposition of Internal Events That Occur in the Spent Nuclear Fuel Aging System: Vertical Aging Systems (Continued)

Generic Event Type	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	2. Chemical spill following collision an aging pad maintenance-surveillance vehicle with a cask system, a structure, system, or component, or a site vehicle causing an acid spill (i.e., batteries). Acid or other liquid chemical contact with aging system surface results in damage to the aging system (e.g., stainless steel stress corrosion cracking) (AP).	SNFAS-VAS-CCF2	Beyond Category 2	Same disposition as Potential Event SNFAS-VAS-CC9. Additionally, operational requirements implement spill prevention and cleanup procedures. Operational requirements limit the presence of combustible and flammable materials stored near or used by the SNF aging system structures, systems, or components, including those along the transfer route.	Preventive	Procedural Safety
Explosion-Implosion	1. Explosion and/or fire following collision of the site-specific cask transporter with a staged cask system, a structure, system, or component, or a site vehicle causing a volatile fuel or hydraulic fluid spill, or hydrogen release (i.e., batteries). Collisions with other vehicles (security vehicles, etc.) or a structure, system, or component could also initiate the same event sequence (AP, RW, and SF).	SNFAS-VAS-EI1	Beyond Category 2	Same disposition as Potential Event SNFAS-VAS-CC4. Additionally, design requirements ensure casks are capable of withstanding limited hydrogen explosions or fires involving batteries or limited quantities of fuel without loss of cask function. Operational requirements limit the presence of combustible and flammable materials stored near or used by the SNF aging system structures, systems, and components, including those along the transfer route.	Preventive	Design-Procedural Safety
	2. Explosion and/or fire following collision of an aging pad maintenance-surveillance vehicle with aging cask or module causing a volatile fuel or hydraulic fluid spill, or hydrogen release (i.e., batteries) (AP).	SNFAS-VAS-EI2	Beyond Category 2	Operational requirements limit aging pad maintenance-surveillance vehicle maximum speed and motive force to limit potential damage caused by collisions involving such vehicles from initiating an event sequence. Design requirements ensure casks are capable of withstanding limited hydrogen explosions or fires involving batteries or limited quantities of fuel without loss of cask function. Operational requirements limit the presence of combustible and flammable materials stored near or used by the SNF aging system structures, systems, and components, including those along the transfer route.	Preventive	Design-Procedural Safety
	3. Explosion and/or fire due to welding or cutting activity for cask system specific operation (i.e., seismic restraint, vent bird screen, radiation shield, or security feature installation-removal) or maintenance activity requiring welding/cutting ignites volatile fuel or combustibles in the area (AP).	SNFAS-VAS-EI3	Beyond Category 2	Operational requirements ensure walk-downs are conducted and explosive materials are removed from the area prior to initiating welding activities and require safety training as part of welder qualification program.	Preventive	Procedural Safety
	4. Explosion and/or fire due to gas cylinder drop, crush, or tip over during cask system specific operation (i.e., seismic restraint, vent bird screen, radiation shield, or security feature installation-removal) or maintenance activity requiring welding/cutting (AP).	SNFAS-VAS-EI4	Beyond Category 2	Same disposition as Potential Event SNFAS-VAS-EI3. Additionally, operational requirements ensure welding gas cylinders are properly secured and protected from damage when located near SNF aging system structures, systems, and components containing SNF or HLW.	Preventive	Procedural Safety
Fire-Thermal	1. Transient combustible fire from flammable liquids or combustible materials staged on or near the aging pad ignited by unspecified ignition source and burn (AP, RW, and SF).	SNFAS-VAS-FT1	Beyond Category 2	Operational requirements limit the presence of combustible and flammable materials stored near or used by the SNF Aging System SSCs, including along the transfer route. This ensures that the intensity, duration and magnitude of any fire will not be significant enough to initiate a damaged aging cask event sequence.	Preventive	Procedural Safety
	2. Malfunction of vent temperature monitoring system results in loss of indication or inaccurate monitoring data being observed and interpreted by surveillance personnel. Inaccurate monitoring data results in a misloaded aging system not being detected and damage to contained SNF clad or HLW packaging barriers (AP).	SNFAS-VAS-FT2	Beyond Category 2	Operational surveillance requirements for monitoring inlet and outlet vent temperature alert operators to monitoring system anomaly and initiate corrective actions.	Preventive	Procedural Safety
	3. Incorrect use or improper installation of inlet and/or outlet vent screens results in inadequate ventilation air flow through aging system and damage to contained SNF clad or HLW packaging barriers (AP).	SNFAS-VAS-FT3	Beyond Category 2	Operational requirements provide administrative controls on aging system hardware configuration management and require training of aging system workers on specific tasks and checking of work performed to minimize potential for installation errors. Operational surveillance requirements for monitoring inlet and outlet vent temperature alert operators to monitoring system anomaly and initiate corrective actions.	Preventive	Procedural Safety

Table III-36. Disposition of Internal Events That Occur in the Spent Nuclear Fuel Aging System: Vertical Aging Systems (Continued)

Generic Event Type	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
	4. Incorrect installation or defective vent temperature monitoring system component(s) results in inaccurate monitoring data being observed and interpreted by surveillance personnel. Inaccurate monitoring data results in a misloaded aging system not being detected and damage to contained SNF clad or HLW packaging barriers (AP).	SNFAS-VAS-FT4	Beyond Category 2	Same disposition as Potential Event SNFAS-VAS-FT3. Additionally, operational requirements include start-up testing and calibration of newly installed instrumentation required to monitor thermal heat transfer performance of aging casks.	Preventive	Procedural Safety
Radiation	1. Incorrect or malfunctioning confinement barrier monitoring system component(s) on bolted closure aging system results in inaccurate monitoring data being observed and interpreted by surveillance personnel. Inaccurate monitoring data results in a defective aging system seal not being detected and unmonitored radiological releases to occur (AP).	SNFAS-VAS-R1	Beyond Category 2	Operational requirements provide administrative controls on aging system hardware configuration management and require training of aging system workers on specific tasks and checking of work performed to minimize potential for installation errors. Operational requirements include start-up testing and calibration of newly installed instrumentation required to monitor confinement system performance of bolted closure aging casks. Operational surveillance requirements for monitoring confinement systems alert operators to monitoring system anomaly and initiate corrective actions.	Preventive	Procedural Safety
	2. Malfunction of confinement monitoring system results in loss of indication or inaccurate monitoring data being observed and interpreted by surveillance personnel. Inaccurate monitoring data results in a defective aging system seal not being detected and unmonitored radiological releases to occur (AP).	SNFAS-VAS-R2	Beyond Category 2	Operational surveillance requirements for monitoring confinement systems alert operators to monitoring system anomaly and initiate corrective actions.	Preventive	Procedural Safety
	3. Failure of primary confinement boundary seal welds for welded closure cask systems caused by mechanical loads on system (from thermal stress, cask drop, or some other hazard) (AP).	SNFAS-VAS-R3	Beyond Category 2	Design requirements ensure welded closure casks/canister confinement system design precludes loss of confinement during life cycle operations and events following closure. Operational requirements minimize the potential for mechanical damage to the SNF aging system structure, system, or component cask closure systems.	Preventive	Design-Procedural Safety
	4. Failure of primary inner lid confinement boundary o-ring seals for bolted closure cask systems caused by mechanical damage to the closure system (from cask drop or some other hazard) (AP).	SNFAS-VAS-R4	Beyond Category 2	Design requirements ensures the bolted closure casks design protects seals from damage during life cycle operations and events following closure to maintain its primary confinement boundary function. Operational requirements minimize the potential for mechanical damage to the SNF aging system structure, system, or component cask closure systems.	Preventive	Design-Procedural Safety
Fissile	1. Criticality associated with a collision or drop of a site-specific cask and a rearrangement of the cask internals (AP, RW, and SF).	SNFAS-VAS-F1	Beyond Category 2	Design requirements and waste acceptance criteria ensure criticality safety in transportation casks, transfer casks, site-specific casks, and dual-purpose canisters even with most reactive credible configuration of fissile material and with optimal moderation.	Preventive	Design

NOTES: AP = aging pad 17A to 17J; CC = collision-crushing; CCF = chemical contamination flooding; EI = explosion-implosion; F = fissile; FT = fire-thermal; HLW = high-level radioactive waste; R = radiation; RW = roadway to and from the aging pads; SF = surface facilities delivering or receiving aging casks; SNF = spent nuclear fuel; SNFAS = spent nuclear fuel aging system; VAS = vertical cask aging systems.

The Event Sequence Designator is a unique event sequence index for each event in this table. The prefix identifies a building or facility, for example "SNFAS," the middle identifies an activity, room, or area, for example "VAS," and the suffix identifies the hazard category and event number, for example "CC1."

Source: Cogema 2004 [DIRS 171793]

Table III-37. Disposition of Internal Events That Occur in the SNF Aging System: Horizontal Aging Systems

Generic Event Type	Potential Event (Room or Area)	Event Sequence Designator	Disposition of Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety, or Operational Requirement		
Collision-Crushing	1. Failure of the horizontal transfer cask transfer trailer/tractor during transfer of a horizontal transfer cask and the horizontal transfer cask drops resulting in damage to the aging system (AP, RW, and SF).	SNFAS-HAS-CC1	Beyond Category 2	Design requirements ensure that site-specific casks can withstand a drop from the maximum handling height of a site-specific cask transporter/horizontal transfer cask trailer without breach. A design requirement limits site-specific cask/horizontal transfer cask maximum potential drop height.	Preventive	Design
	2. Failure of the horizontal transfer cask transfer trailer/tractor during transfer of a horizontal transfer cask and the horizontal transfer cask transfer trailer/tractor tips over resulting in damage to the aging system (AP, RW, and SF).	SNFAS-HAS-CC2	Beyond Category 2	Design requirements preclude tip-over during transfer by ensuring that transfer equipment design precludes failure modes that could result in tip-over under design basis load handling conditions.	Preventive	Design
	3. Failure of the Roadway surface during transfer of a horizontal transfer cask results in a horizontal transfer cask transfer trailer/tractor tip-over and damage to aging system (RW).	SNFAS-HAS-CC3	Beyond Category 2	Design requirements preclude tip-over during transfer by ensuring minimum tip-over resistance/stability standards are maintained consistent with roadway design.	Preventive	Design
	4. Misdirection of the horizontal transfer cask transfer trailer/tractor off edge of roadway/pad surface during transfer of a vertical cask causing damage in a tip-over event (AP and RW).	SNFAS-HAS-CC4	Beyond Category 2	Design requirements limit the size, mass, maximum speed and motive force of vehicles to limit potential damage caused by collisions from initiating an event sequence. Design requirements ensure reliable means to stop and maintain stability.	Preventive	Design
	5. Collision of the horizontal transfer cask transfer trailer/tractor with vehicles or equipment staged or moving along transfer route causing direct damage, a cask drop, or tip-over event (AP and RW).	SNFAS-HAS-CC5	Beyond Category 2	Same disposition as Potential Event SNFAS-HAS-CC4.	Preventive	Design
	6. Collision of the horizontal transfer cask transfer trailer/tractor with aging cask or module staged on aging pad causing direct damage, a cask drop, or tip-over event (AP).	SNFAS-HAS-CC6	Beyond Category 2	Same disposition as Potential Event SNFAS-HAS-CC4.	Preventive	Design
	7. Collision of the horizontal transfer cask transfer trailer/tractor following mechanical failure or tow attachment failure that results in horizontal transfer cask transfer trailer runaway and the trailer rolls down inclined roadway and collides with fixed object or tips over (RW).	SNFAS-HAS-CC7	Beyond Category 2	Design requirements ensure reliable means to stop and maintain stability such that no Category 1 or Category 2 event sequence occurs.	Preventive	Design
	8. Misdirection of the horizontal transfer cask transfer trailer/tractor off of the edge of the aging pad resulting in a tip-over and damage to aging cask (AP).	SNFAS-HAS-CC8	Beyond Category 2	Same disposition as Potential Event SNFAS-HAS-CC4.	Preventive	Design
	9. Collision of the aging pad maintenance/surveillance vehicle with an aging cask or module staged on aging pad during maintenance/ surveillance activity on aging pad causing direct damage to an aging cask, or tip-over event (AP).	SNFAS-HAS-CC9	Beyond Category 2	Operational requirements limit aging pad maintenance/surveillance vehicle maximum speed and motive force to limit potential damage caused by collisions involving such vehicles from initiating an event sequence.	Preventive	Procedural Safety
	10. Collision of the cask tractor with aging cask transporter to be towed that causes the horizontal transfer cask tractor to collide with aging cask during attachment procedure causing resulting in direct damage or tip-over event that damages dual-purpose canister (AP and SF).	SNFAS-HAS-CC10	Beyond Category 2	Same disposition as Potential Event SNFAS-HAS-CC4	Preventive	Design
	11. Drop of horizontal transfer cask ram access cover plate during removal or installation from a mobile crane onto the horizontal transfer cask (without impact limiters) causing damage (AP).	SNFAS-HAS-CC11	Beyond Category 2	Design requirements ensure that a horizontal transfer cask can withstand a drop of heavy objects handled during transfer operations, such as an access cover plate, from the maximum handling height without adverse effects.	Preventive	Design

Table III-37. Disposition of Internal Events That Occur in the SNF Aging System: Horizontal Aging Systems (Continued)

Generic Hazard Type	Potential Event (Room or Area)	Potential Event Sequence Designator	Disposition of a Potential Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety or Operational Requirement		
	12. Drop of the horizontal aging module shield door from a mobile crane during removal or installation onto the horizontal transfer cask (without impact limiters), horizontal aging module, or directly onto dual-purpose canister during ram transfer operations causing damage (AP).	SNFAS-HAS-CC12	Beyond Category 2	Same disposition as Potential Event SNFAS-HAS-CC11.	Preventive	Design
	13. Misalignment or interference of a cask/canister during horizontal transfer operation causes dual-purpose canister to jam prior to full insertion into a horizontal aging module. Hydraulic ram exerts excessive force on misaligned/jammed dual-purpose canister causing damage to the dual-purpose canister (AP).	SNFAS-HAS-CC13	Beyond Category 2	Same disposition as Potential Event SNFAS-HAS-CC14. Additionally, operational requirements ensure pre-transfer inspections of empty modules and transfer cask/dual-purpose canister interface to prevent interference caused by damaged structures, systems, and components or foreign material.	Preventive	Design- Procedural Safety
	14. Excessive force exerted on the dual-purpose canister by the hydraulic ram following full insertion of dual-purpose canister resulting in damage to the dual-purpose canister (AP).	SNFAS-HAS-CC14	Beyond Category 2	Design requirements ensure hydraulic ram can not fail or be operated in a manner that can cause dual-purpose canister breach through excess force or ram over-travel. Design requirements ensure horizontal dual-purpose canister has sufficient structural design margin to withstand maximum ram force events.	Preventive	Design
	15. Damage to dual-purpose canister following a seismic event due to incorrect component(s) and/or material used or improper installation (e.g., not installed) of seismic restraint (AP).	SNFAS-HAS-CC15	Beyond Category 2	Operational requirements provide administrative controls on aging system hardware configuration management. Operational requirements ensure training of aging system workers on specific tasks and checking of work performed to minimize potential for installation errors.	Preventive	Procedural Safety
Chemical Contamination-Flooding	1. Chemical spill following collision of the cask tractor with a staged cask system, a structure, system, or component, or site vehicle causing an acid spill (i.e., batteries). Acid or other chloride containing chemical contact with aging system surface results in damage to the aging system (e.g., stainless steel stress corrosion cracking). Collisions with other vehicles (security vehicles, etc.) or a structure, system, or component could also initiate the same event sequence (AP, RW, and SF).	SNFAS-HAS-CCF1	Beyond Category 2	Same disposition as Potential Event SNFAS-HAS-CC4. Additionally, operational requirements restrict staging or operation of vehicles along the transfer route or on aging pad during transfer operations. Operational requirements develop and implement spill prevention and cleanup procedures.	Preventive	Design- Procedural Safety
	2. Chemical spill following collision an aging pad maintenance/surveillance vehicle with a cask system, a structure, system, or component, or a site vehicle causing an acid spill (i.e., batteries). Acid or other liquid chemical contact with aging system surface results in damage to the aging system (e.g., stainless steel stress corrosion cracking) (AP).	SNFAS-HAS-CCF2	Beyond Category 2	Same disposition as Potential Event SNFAS-HAS-CC9. Additionally, operational requirements implement spill prevention and cleanup procedures. Operational requirements limit the presence of combustible and flammable materials stored near or used by the SNF aging system structures, systems, and components, including those along the transfer route.	Preventive	Procedural Safety
Explosion-Implosion	1. Explosion-fire following collision of the horizontal transfer cask transfer trailer/tractor and/or cask tractor with a staged cask system, a structure, system, or component, or a site vehicle causing a volatile fuel or hydraulic fluid spill, or hydrogen release (i.e., batteries). Collisions with other vehicles (security vehicles, etc.) or structure, system, or component could also initiate the same event sequence (AP, RW, and SF).	SNFAS-HAS-EI1	Beyond Category 2	Same disposition as Potential Event SNFAS-HAS-CC4. Additionally, design requirements ensure capability of withstanding limited hydrogen explosions or fires involving batteries or limited quantities of fuel without loss of cask function. Operational requirements limit the presence of combustible and flammable materials stored near or used by the SNF aging system structures, systems, and components, including those along the transfer route.	Preventive	Design- Procedural Safety
	2. Explosion and/or fire following collision of an aging pad maintenance/surveillance vehicle with aging cask or module causing a volatile fuel or hydraulic fluid spill, or hydrogen release (i.e., batteries) (AP).	SNFAS-HAS-EI2	Beyond Category 2	Operational requirements limit aging pad maintenance/surveillance vehicle maximum speed and motive force to limit potential damage caused by collisions involving such vehicles from initiating an event sequence. Design requirements ensure casks are capable of withstanding limited hydrogen explosions or fires involving batteries or limited quantities of fuel without loss of cask function. Operational requirements limit the presence of combustible and flammable materials stored near or used by the SNF aging system structures, systems, and components, including those along the transfer route.	Preventive	Design- Procedural Safety

Table III-37. Disposition of Internal Events That Occur in the SNF Aging System: Horizontal Aging Systems (Continued)

Generic Hazard Type	Potential Event (Room or Area)	Potential Event Sequence Designator	Disposition of a Potential Event		Preventive or Mitigative Requirement	Design or Procedural Safety Control
			Event Sequence Category	Design, Procedural Safety or Operational Requirement		
Fire-Thermal	3. Explosion and/or fire due to welding or cutting activity for cask system specific operation (i.e., seismic restraint, vent bird screen, radiation shield, or security feature installation-removal) or maintenance activity requiring welding/cutting ignites volatile fuel or combustibles in the area (AP).	SNFAS-HAS-EI3	Beyond Category 2	Operational requirements ensure walk-downs are conducted and the potentially explosive materials are removed from the area prior to initiating welding activities and require safety training as part of welder qualification program.	Preventive	Procedural Safety
	4. Explosion and/or fire due to gas cylinder drop, crush, or tip over during cask system specific operation (i.e., seismic restraint, vent bird screen, radiation shield, or security feature installation-removal) or maintenance activity requiring welding/cutting (AP).	SNFAS-HAS-EI4	Beyond Category 2	Same disposition as Potential Event SNFAS-HAS-EI3. Additionally, operational requirements ensure welding gas cylinders are properly secured and protected from damage when located near SNF aging system structures, systems, and components containing SNF or HLW.	Preventive	Procedural Safety
	5. Explosion and/or fire due to release and ignition of hydraulic ram hydraulic fluid is ignited that damages the aging system (AP).	SNFAS-HAS-EI5	Beyond Category 2	Same disposition as Potential Event SNFAS-HAS-FT1.	Preventive	Procedural Safety
	1. Transient combustible fire from flammable liquids or combustible materials staged on or near the aging pad ignited by unspecified ignition source and burn (AP, RW, and SF).	SNFAS-HAS-FT1	Beyond Category 2	Operational requirements limit the presence of combustible and flammable materials stored near or used by the SNF Aging System SSCs, including along the transfer route. This ensures that the intensity, duration and magnitude of any fire will not be significant enough to initiate a damaged aging cask event sequence.	Preventive	Procedural Safety
	2. Malfunction of vent temperature monitoring system results in loss of indication or inaccurate monitoring data being observed and interpreted by surveillance personnel. Inaccurate monitoring data results in a misloaded aging system not being detected and damage to contained SNF clad or HLW packaging barriers (AP).	SNFAS-HAS-FT2	Beyond Category 2	Operational surveillance requirements for monitoring inlet and outlet vent temperature alert operators to monitoring system anomaly and initiate corrective actions.	Preventive	Procedural Safety
Radiation	4. Incorrect installation or defective vent temperature monitoring system component(s) results in inaccurate monitoring data being observed and interpreted by surveillance personnel. Inaccurate monitoring data results in a misloaded aging system not being detected and damage to contained SNF clad or HLW packaging barriers (AP).	SNFAS-HAS-FT3	Beyond Category 2	Operational requirements provide administrative controls on aging system hardware configuration management and require training of aging system workers on specific tasks and checking of work performed to minimize potential for installation errors. Operational surveillance requirements for monitoring inlet and outlet vent temperature alert operators to monitoring system anomaly and initiate corrective actions. Operational requirements include start-up testing and calibration of newly installed instrumentation required to monitor thermal heat transfer performance of aging casks.	Preventive	Procedural Safety
	1. Release of radioactive contamination present inside horizontal transfer cask following removal of horizontal transfer cask ram closure plate or top closure lid (AP).	SNFAS-HAS-R1	Beyond Category 2	Operational requirements provide for sampling horizontal transfer cask/dual-purpose canister inter-space for contamination at the Transportation Cask Receipt/Return Facility prior to transfer to the SNF aging system.	Preventive	Procedural Safety
	2. Failure of primary confinement boundary seal welds for welded closure cask systems caused by mechanical loads on system (from thermal stress, cask drop, or some other hazard) (AP).	SNFAS-HAS-R2	Beyond Category 2	Design requirements ensure welded closure casks/canister confinement system design precludes loss of confinement during life cycle operations and events following closure. Operational requirements minimize the potential for mechanical damage to the SNF aging system structure, system, or component cask closure systems.	Preventive	Design- Procedural Safety
Fissile	1. Criticality associated with a collision or drop of a horizontal transfer cask and a rearrangement of the cask internals (AP, RW, and SF).	SNFAS-HAS-F1	Beyond Category 2	Design requirements and waste acceptance criteria ensure criticality safety in transportation casks, transfer casks, site-specific casks, and dual-purpose canisters even with most reactive credible configuration of fissile material and with optimal moderation.	Preventive	Design

NOTES: AP = aging pad 17A to 17J; CC = collision-crushing; CCF = chemical contamination flooding; EI = explosion-implosion; F = fissile; FT = fire-thermal; HAS = horizontal cask aging system; R = radiation; RW = roadway to and from aging pads; SF = surface facilities delivering or receiving aging casks; SNF = spent nuclear fuel; SNFAS = spent nuclear fuel aging system.

The Event Sequence Designator is a unique event sequence index for each event in this table. The prefix identifies the building or facility, for example "SNFAS," the middle identifies an activity, room, or area, for example "HAS," and the suffix identifies the hazard category and event number, for example "CC1."

Source: Cogema 2004 [DIRS 171793]