OCRWM	DESIGN CALCULATION OR ANALYSIS COVER SHEET	1. QA: QA 2. Page 1 of 208

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Internal Hazards Analysis for License Application

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CONTENTS

Page

CONTENTS (Continued)

Page

CONTENTS (Continued)

Page

CONTENTS (Continued)

Page

TABLES

Page

TABLES (Continued)

Page

TABLES (Continued)

Page

TABLES (Continued)

Page

FIGURES

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ACRONYMS

BWR	boiling water reactor
CWPRB	Cask and Waste Package Receipt Building
CHF	Canister Handling Facility
DHLW	defense high-level radioactive waste
DOE	U.S. Department of Energy
DPC	dual-purpose canister
DTF	Dry Transfer Facility
FHF	Fuel Handling Facility
HAM	horizontal aging module
HEPA	high-efficiency particulate air
HLW	high-level radioactive waste
HVAC	heating, ventilation, and air-conditioning
LLW	low-level radioactive waste
LWT	legal-weight truck
MCO	multi-canister overpack
MGR	monitored geologic repository
MPC	multi-purpose canister
MSC	monitored geologic repository site-specific cask
NRC	U.S. Nuclear Regulatory Commission
OWT	overweight truck
PWR	pressurized water reactor
SNF	spent nuclear fuel
SRTC	site rail transfer cart
SSC	structure, system, or component
TCBA	Transportation Cask Buffer Area
TCRRA	Transportation Cask Receipt and Return Area
TCRRF	Transportation Cask Receipt/Return Facility
WNNRF	Warehouse and Non-Nuclear Receipt Facility
WP	waste package

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1. PURPOSE

The purpose of this internal hazards analysis is to identify and document the internal hazards and potential initiating events associated with preclosure operations of the repository at Yucca Mountain. Internal hazards are those hazards presented by the operation of the facility and by its associated processes that can potentially lead to a radioactive release or cause a radiological hazard. In contrast to external hazards, internal hazards do not involve natural phenomena and external man-made hazards. This internal hazards analysis was performed in support of the preclosure safety analysis and the License Application for the Yucca Mountain Project.

The methodology for this analysis provides a systematic means to identify internal hazards and potential initiating events that may result in a radiological hazard or radiological release during the repository preclosure period. These hazards are documented in tables of potential internal hazards and potential initiating events (Section 6.6) for input to the repository event sequence categorization process. The results of this analysis will undergo further screening and analysis based on the criteria that apply to the performance of event sequence analyses for the repository preclosure period. The evolving design of the repository will be re-evaluated periodically to ensure that internal hazards that have not been previously evaluated are identified.

2. QUALITY ASSURANCE

As determined using information presented in Section 2 of *Quality Assurance Requirements and Description* (DOE 2004a [DIRS 171539]), this analysis is subject to quality assurance program requirements because it is part of the preclosure safety analysis. This analysis was developed in accordance with procedures AP-3.12Q, *Design Calculations and Analyses* and AP-3.13Q, *Design Control.* Input data are identified and tracked in accordance with LP-3.15Q-BSC, *Managing Technical Product Inputs.*

3. USE OF SOFTWARE

No software required to be qualified under LP-SI.11Q-BSC, *Software Management*, was used for any part of this analysis. The text of this analysis is printed using Microsoft Word and is exempted from the requirements of LP-SI.11Q-BSC per Section 2.1.1 of the procedure.

4. METHOD

The development of an internal hazards analysis is an iterative process that evolves as the repository design develops and as operational features are identified. Assumptions were made concerning the repository design and facility operations when information was unavailable for this internal hazards analysis. Assumptions associated with the design and operation of functional areas of the repository are included in Section 5.2.

The internal hazards identified for the functional areas are described throughout Section 6.6. As the level of design detail continues to evolve and design concepts are put forth or further

developed, additional internal hazards analyses are performed to evaluate whether the design bases are met or to help the designers evaluate a proposed design. Throughout the design process potential internal hazards are identified, event sequences are developed, frequency assessments are performed, event sequences are categorized, and potential resultant consequences are evaluated.

This analysis was performed using the hazard analysis methodologies described in *System Safety Analysis Handbook* (Stephans and Talso 1997 [DIRS 101450]). This analysis addresses the internal hazards and potential initiating events that could potentially result in radiological hazards or radiological releases. The tables of potential initiating events and potential hazards (Section 6.6) were generated by applying a checklist of generic events to each functional area within the repository. Steps in the analysis process are described in Sections 4.1 through 4.4.

4.1 STEP 1: DEFINE THE REPOSITORY FUNCTIONAL AREAS

The first step of the analysis process involved dividing the repository into functional areas for which internal hazards and potential initiating events were identified. Functional areas are defined as areas where activities occur or processes are found that are associated with repository operations. Functional areas were defined by specific functions, by facility physical boundaries, or both. The division of the repository into functional areas was based upon available design documents and descriptions of operations. These functional areas are listed in Section 6.2. The repository structures, systems, and/or subsystems, as defined in "Facility, Equipment and System Names for Use in the SAR" (Lucas 2004 [DIRS 170073], Attachments 8 and 9), are also listed for each repository facility.

4.2 STEP 2: DEFINE THE REPOSITORY DESIGN CONFIGURATION AND OPERATIONS

In the second step of the analysis process, the design configuration and operations of the repository were established and documented for each functional area for use during hazard identification activities (Step 3). Functional areas are discussed in Section 6.2 and an overview of repository operations is provided in Section 6.4.

4.3 STEP 3: DEVELOP THE GENERIC EVENTS CHECKLIST

The third step of the analysis process involved the generation of a generic checklist of internal events. The list is comprised of events and hazards that, if determined to be applicable, could potentially result in radiological hazards or radiological releases. The generic checklist is not repository-specific; instead, it is a comprehensive list that attempts to identify potentially hazardous initiating events that can be used to ensure a thorough risk-informed treatment of possible events. The generic internal events checklist is provided in Section 6.1.

4.4 STEP 4: DETERMINE THE APPLICABILITY OF INTERNAL EVENTS

The fourth step of the analysis process included a review of functional areas, design, and operations to determine the applicability of generic events that could potentially result in radiological hazards or initiating events with radiological releases.

Specific criteria were developed for each generic event to support the determination of applicability. If the criteria were satisfied, then the generic event was determined to have the potential for radiological hazards or the potential for radiological releases; specific potential initiating events and hazards were then identified. Generic events that potentially produce radiological hazards or radiological releases were not applicable to every functional area.

In addition, previously performed safety evaluations of repository operations were reviewed to determine potential events applicable to the repository. This review was conducted for informational/background information purposes. This review was also conducted to ensure that previously identified relevant events or hazards were not overlooked, acknowledging that the design of the surface and subsurface facilities has evolved, in some instances significantly, since 1984 (the year of the first listed safety evaluation listed). These safety evaluations include:

- *Preliminary Worst-Case Accident Analysis to Support the Conceptual Design of a Potential Repository in Tuff* (Jackson et al. 1984 [DIRS 149025])
- *Nevada Nuclear Waste Storage Investigations Project, Site Characterization Plan Conceptual Design Report* (MacDougall et al. 1987 [DIRS 104779], Appendices F, L-1, and L-2)
- *Identification of Structures, Systems, and Components Important to Safety at the Potential Repository at Yucca Mountain* (Hartman and Miller 1991 [DIRS 149023])
- *Preclosure Radiological Safety Analysis for Accident Conditions of the Potential Yucca Mountain Repository: Underground Facilities* (Ma et al. 1992 [DIRS 101930])
- *Preclosure Radiological Safety Evaluation: Exploratory Studies Facility* (Schelling and Smith 1993 [DIRS 149028])
- *Preliminary MGDS Hazards Analysis* (CRWMS M&O 1996 [DIRS 100204])
- *Monitored Geologic Repository Internal Hazards Analysis* (CRWMS M&O 2000 [DIRS 146901])
- *Preliminary Internal Hazards Analysis for License Application* (BSC 2003a [DIRS 163704])
- *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE 2002a [DIRS 155970], Appendix H)
- *Yucca Mountain Site Suitability Evaluation* (DOE 2002b [DIRS 156958], Section 2).

5. DESIGN INPUTS

5.1 TECHNICAL INFORMATION

5.1.1. In this analysis the acronym for the Dry Transfer Facility (DTF) represents both DTF 1 and DTF 2 and implies that the same systems and components are located within both DTF 1 and DTF 2. Hazards associated with the construction of DTF 2 while DTF 1 is operational are addressed in Section 6.6.8.

Basis: Two DTFs are to be constructed (BSC 2004i [DIRS 171598], Section 1.1). The second DTF (DTF 2) will be constructed after the construction and startup of the first facility (DTF 1).

5.1.2 In this analysis, the potential initiating events or internal hazards that occur in the repository facilities are considered to encompass or bound those that may occur that involve transportation casks with impact limiters installed (casks configured for offsite transport under 10 CFR Part 71 [DIRS 104091]) in the truck parking lot, truck staging area, the railcar staging area, or other balance-of plant-areas through which the loaded offsite conveyances may pass or be staged.

Basis: This analysis does not consider the truck parking lot or the railcar staging area or other balance-of-plant areas through which the loaded offsite conveyances may pass or be staged. Inside the inner security gate, in areas including the truck parking lot, the railcar staging area, and the roads and rails leading to the Cask and Waste Package Receipt Building (CWPRB) and the Fuel Handling Facility (FHF), the transportation casks are configured according to the regulations that govern offsite transportation (specifically, 10 CFR Part 71 [DIRS 104091]). However, once the casks enter the repository site they are regulated under 10 CFR Part 63 [DIRS 156605].

This analysis considers the internal hazards associated with the transportation casks and their contents once they have entered the repository process facilities and are reconfigured, as applicable for each type of transportation cask, from offsite travel (in accordance with 10 CFR Part 71 [DIRS 104091]) to processing in the site waste handling facilities (in accordance with 10 CFR Part 63 [DIRS 156605]). Inside the repository facilities, casks are lifted and unloaded without impact limiters. These operations and the hazards associated with casks without impact limiters bound any hazard leading to a radiological release or exposure involving a cask (with impact limiters installed) sitting on a truck or railcar in the staging areas outside the repository facilities. No implication is made by this assumption concerning the use of preventive or mitigative features or controls.

5.1.3 The areas in which open casks, waste packages (WPs), or monitored geologic repository site-specific casks (MSCs) containing spent nuclear fuel (SNF)/high-level radioactive waste (HLW) are present and areas where bare commercial SNF is present are moderator control areas. Therefore, sources of water or other hydrogenous materials are minimized and only materials such as low-hydrogen content hydraulic

fluid are present in machinery or equipment located in these areas, excluding the pool in the remediation area of the DTF.

Basis: This assumption is based on the information pertaining to the repository design available as of December 2004, including *Fuel Handling Facility Description Document* (BSC 2004t [DIRS 172084], Sections 3.1.1.1.8 and 3.2.3.2); *Dry Transfer Facility Description Document* (BSC 2004i [DIRS 171598], Sections 3.1.1.1.8 and 4.1.1); and *Canister Handling Facility Description Document* (BSC 2004f [DIRS 171496], Section 3.1.1.1.6); this information is the best available and is suitable for use in this analysis.

5.1.4 Six types of site-specific aging casks will be used at the repository, as described in *SNF Aging System Description Document* (BSC 2004a [DIRS 172109], Section 2.3.3). These casks include concrete casks (or overpacks) for dual-purpose canisters (DPCs), metal casks (or overpacks) for DPCs, horizontal aging modules for DPCs, metal casks for uncanistered SNF assemblies, and concrete casks and metal casks for monitored geologic repository (MGR) canisters. The MGR canisters are described in *SNF Aging System Description Document* (BSC 2004a [DIRS 172109], Section 2.3.3) as canisters that are loaded at the repository in the FHF and DTF with SNF assemblies and then are sealed by welding. In this analysis, only the hazards associated with loading and unloading operations involving a metal site-specific cask with a bolt-on lid(s) are described.

Basis: The operations involving the six site-specific casks, as presented in *SNF Aging System Description Document* (BSC 2004a [DIRS 172109], Section 2.3.3), are not defined. The descriptions of operations in *Fuel Handling Facility Description Document* (BSC 2004t [DIRS 172084], Section 4.2); *Dry Transfer Facility Description Document* (BSC 2004i [DIRS 171598], Section 4.2); and *Canister Handling Facility Description Document* (BSC 2004f [DIRS 171496], Section 4.2); include the loading and unloading of a site-specific cask. However, detailed descriptions of operations involving the various types of overpacks and casks are not available for inclusion in this document. In addition, specific information concerning the loading, sealing, handling, and unsealing (if required) of the MGR canister is not available for inclusion in this document. The internal hazards associated with the SNF Aging System are presented in the *SNF Aging System Safety Study* (Cogema 2004c [DIRS 171793]). However, this document also does not discuss the use of the various site-specific/aging casks or the use of the MGR canister. Once a detailed description of the six site-specific casks and the MGR canister and a description of their handling operations are available, it will be included in a future revision of this hazards analysis.

In this analysis, the site-specific casks are referred to as MSCs since the current architecture (Lucas 2004 [DIRS 170073], Attachments 8 and 9) includes the acronym MSC in system names (e.g., Cask/MSC/WP Preparation System) and the current general arrangements diagrams include room names that use the acronym MSC (e.g., DTF room 1069: cask and MSC docking room) (BSC 2004j [DIRS 170273]).

5.1.5 U.S. Department of Energy (DOE) SNF standardized canisters and DOE HLW canisters are not sent to the aging pads, as described in *SNF Aging System Description Document* (BSC 2004a [DIRS 172109], Section 1.1). However, this analysis conservatively includes the hazards associated with the loading of these waste forms into MSCs for transport to the aging pads as well as the hazards associated with the unloading of these waste forms from MSCs upon their return.

Basis: Site operations previously included the option of staging DOE SNF canisters and DOE HLW canisters at an aging pad. The hazards associated with these operations are conservatively included in this analysis, for completeness, in the event that this operations option is used.

5.1.6 Multi-canister overpacks (MCOs) handled in the DTF, Canister Handling Facility (CHF), and FHF will be transferred directly from the transportation cask to the WP. The MCOs will not be placed into MSCs for staging and will not be staged in the SNF and canister staging cell (DTF room 1050).

Basis: Due to the hazards associated with the handling of MCOs, it is advantageous to involve these canisters in as few handling operations as required. Therefore, these canisters are transferred from a transportation cask directly to a WP; they are not staged in a rack inside a facility or sent to an aging pad. This input is based on the information pertaining to the repository design available as of December 2004, including *Canister Handling Facility Description Document* (BSC 2004f [DIRS 171496], Section 2.3.2), *Dry Transfer Facility Description Document* (BSC 2004i [DIRS 171598], Section 1.1), and *Fuel Handling Facility Description Document* (BSC 2004t [DIRS 172084], Section 1.1) (no MCOs will be handled in the FHF); it is suitable for use in this analysis.

5.2 ASSUMPTIONS

The following assumptions are used in Section 6.6:

5.2.1 If they are to be accepted for disposal, it is assumed that multi-purpose canisters (MPCs) will be handled in a similar manner as vertical DPCs, except that they will be placed directly into an appropriately sized WP.

Rationale: As of December 2004, no commercial MPCs have been licensed by the U.S. Nuclear Regulatory Commission (NRC) (BSC 2004a [DIRS 172109], Appendix A). This assumption is based on the information pertaining to the repository design available as of December 2004; it is suitable for use in this analysis.

5.2.2 It is assumed that the site prime mover, a multi-wheel, tractor tired and rail-guided vehicle used to tow or push railcars, trailers, and other heavy load transporters from the security gate to other surface facilities, including the CWPRB and the FHF, is battery-powered.

Rationale: Details concerning the power source for the site prime mover are not available for inclusion in this document. This assumption is made in order to determine the hazards applicable to the site prime mover, including fires, battery explosions, etc.

This assumption is based on the information pertaining to the repository design available as of December 2004; it is suitable for use in this analysis.

5.2.3 The forklifts and mobile elevated platforms used in the various surface facilities (including the CWPRB, Transportation Cask Buffer Area [TCBA], CHF, DTF, and FHF) are assumed to be battery-powered.

Rationale: The power source for these structures, systems, or components (SSCs) is not available for inclusion in this document. This assumption is made in order to determine the hazards applicable to the forklifts and mobile elevated platforms, including fires, battery explosions, etc. This assumption is based on the information pertaining to the repository design available as of December 2004; it is suitable for use in this analysis.

5.2.4 The site rail transfer cart (SRTC) positioner that operates in the TCBA is assumed to be electrically powered.

Rationale: The power source for the SRTC positioner is not available for inclusion in this document. *Transportation Cask Receipt/Return Facility Description Document* (BSC 2004d [DIRS 171702], Section 4.1.1) states that the SRTC positioner is self-propelled, but provides no details concerning the power source. This assumption is made in order to determine the hazards applicable to this piece of equipment. This assumption is based on the information pertaining to the repository design available as of December 2004; it is suitable for use in this analysis.

5.2.5 It is assumed that there are no sources of process water present in the emplacement side of the subsurface facilities.

Rationale: The emplacement side of the repository is a moderator control area. No water or other moderating materials are present in the emplacement portion of the repository. During the preclosure period, the presence of water is a criticality concern. Explicit details of the location and types of utilities to be used in the subsurface are not available for inclusion in this document. This assumption is based on the information pertaining to the repository design available as of December 2004, including *Subsurface Facility Description Document* (BSC 2004cc [DIRS 172344], Section 4.2); it is suitable for use in this analysis.

5.2.6 The transportation cask and the transfer cask used for transporting horizontal DPCs are assumed to have similar features and characteristics as the transportation casks licensed under 10 CFR Part 71 [DIRS 104091] for transporting SNF and HLW on the nation's highways and railroads. It is assumed that both casks are unloaded in the DTF in the same manner as transportation casks containing vertical DPCs.

Rationale: No explicit information concerning the transportation casks and site-specific casks that will transport horizontal DPCs to the site and onsite is available for inclusion in this document. This assumption is made in order to make a determination of the types of internal hazards that are associated with the operations involving these casks. This assumption is based on the information pertaining to the repository design

available as of December 2004, including *SNF Aging System Description Document* (BSC 2004a [DIRS 172109], Section 4.2); it is suitable for use in this analysis.

5.2.7 It is assumed that separate utility systems are provided for the subsurface construction and subsurface nuclear operations areas, such that there are no penetrations through the isolation barrier separating these areas.

Rationale: Explicit details of the utilities to be used in the subsurface are not available for inclusion in this document. This assumption is made in order to make a determination of the types of internal hazards that are associated with the subsurface construction and subsurface nuclear operations areas. This assumption is based on the information pertaining to the repository design available as of December 2004, including *Subsurface Facility Description Document* (BSC 2004cc [DIRS 172344], Section 4.1); it is suitable for use in this analysis.

5.2.8 During subsurface construction, isolation barrier locations change as construction is completed and the emplacement area is expanded. The interface point for the turnover of a new emplacement area (after construction is completed) is assumed to occur when the isolation barrier doors are considered operational.

Rationale: This assumption is made in order to make a determination of the types of internal hazards that are associated with the subsurface construction and subsurface nuclear operations areas. This assumption is based on the information pertaining to the repository design available as of December 2004, including *Construction Execution Plan* (DOE 2004b [DIRS 168857], Section 2.23); it is suitable for use in this analysis.

5.2.9 It is assumed that trolleys that transport casks and MSCs in the DTF and CHF are battery-powered and that trolleys that transport WPs in the DTF and CHF are electrically powered (with power supplied by an external source). In addition, the trolley in the DPC cutting/WP dry remediation cell (room 1097) in the DTF is assumed to be electrically powered.

Rationale: Trolleys that carry casks have to travel on turntables; therefore these trolleys are self-powered (by batteries). Trolleys that carry WPs in the DTF and CHF or do not travel on turntables are externally powered (including the trolley in DTF room 1097). This assumption is made in order to determine the hazards applicable to the trolleys, including fires, battery explosions, etc. This assumption is based on the information pertaining to the repository design available as of December 2004; it is suitable for use in this analysis.

5.2.10 The internal hazards and potential initiating events in this analysis are considered to have the potential to occur, regardless of the cause.

Rationale: The primary causes of events that result in the internal hazards and potential initiating events described in this analysis (such as human error, mechanical failure, software error, hardware malfunction, control room malfunctions or errors, etc.) are not explicitly listed or considered in this analysis.

5.2.11 No hazards are identified that are associated with, or caused by, the Central Control Center, its software, or the hardware associated with this facility that could lead to a radiological release or cause a radiological hazard different than the identified hazards.

Rationale: Details associated with these systems are not available for inclusion in this document. The internal hazards and potential initiating events considered in this analysis are assumed to occur, regardless of interaction with, or failure involving, the Central Control Center, software, hardware, etc. This assumption is based on the information pertaining to the repository design available as of December 2004; it is suitable for use in this analysis.

5.2.12 The storage locations for explosives used in subsurface development activities and the diesel fuel and/or gasoline storage depot(s) are located in areas where explosions or fires cannot affect waste handling operations, operations within the process facilities, or transportation casks that are not configured for travel on the public roads or railroads.

Rationale: Although the location of the fuel depot and the diesel fuel oil storage tank have been identified in *Geologic Repository Operations Area North Portal Site Plan* (BSC 2004b [DIRS 171816]), there are no descriptions of the location(s) where explosives will be stored or where combustible materials will be stored. In addition, the locations for the storage of hazardous or explosive materials in facilities such as the FHF, CHF, or DTF (if applicable) have not been identified. This assumption is based on the information pertaining to the repository design available as of December 2004; it is suitable for use in this analysis.

5.2.13 An SNF assembly is placed into a screened single-element canister prior to on-site storage at a nuclear power plant if the SNF assembly is known to be damaged. The SNF assemblies arriving in screened single-element canisters are handled and processed in the same manner as bare commercial SNF assemblies. However, these canisters are processed with other damaged or off-normal assemblies in the remediation area.

Rationale: No detailed information is available concerning the handling of assemblies in single-element canisters at the DTF, FHF, or any other repository facility. This assumption is based on the information pertaining to the repository design available as of December 2004; it is suitable for use in this analysis.

5.2.14 Wet fire suppression systems are present in areas in the surface facilities (including the moderator-controlled areas of the DTF, CHF, and FHF) where SNF and HLW are handled. However, the internal hazards associated with these systems are not considered in this analysis.

Rationale: Explicit details concerning the location and operations of these systems are not available for inclusion in this analysis. The design approach of the moderator-controlled area fire suppression and detection systems will be confirmed, or modified as necessary, during the preparation of the project detail design. Therefore, the hazards

associated with the operations of the wet fire suppression systems will be considered in a future revision of this analysis.

5.2.15 No naval SNF casks will be unloaded in the cask docking/dry remediation room (DTF room 1109) by the dry remediation subsystem. Therefore, it is also assumed that no naval SNF canisters will be transferred to the DPC cutting/WP dry remediation cell (DTF room 1097) for passage through the waste transfer cell (DTF room 2048) by this subsystem.

Rationale: Information specifying how naval SNF casks will be remediated is not explicitly detailed. Naval SNF canisters are handled in radiologically clean areas. For this reason, in the DTF the naval SNF canisters are transferred from the transportation cask located in the WP loading (navy canister)/docking ring removal cell (DTF room 1051) to the WP located in WP loading/docking ring removal cell (DTF room 1054) rather than unloading them through the waste transfer cell (DTF room 2048). Therefore, no naval SNF casks are transferred to a WP through the waste transfer cell as part of a remediation process. This assumption is based on the information pertaining to the repository design available as of December 2004, including *Remediation System Description Document* (BSC 2004s [DIRS 171166], Section 4.2); it is suitable for use in this analysis.

5.2.16 Drops of empty transportation casks, emptied DPCs, remediated/emptied WPs, and emptied MSCs are not considered explicitly in this analysis. These emptied containers will be inspected, decontaminated, and treated, as necessary, prior to removal from the site and/or reused.

Rationale: The hazards associated with the drops of these containers are bounded by the identified hazards associated with these containers when filled with a waste form. As stated in Section 1, the purpose of this analysis is to identify the hazards presented by the operation of a facility and by its associated processes (i.e., the internal hazards) that can potentially lead to a radioactive release or cause a radiological hazard. The internal hazards associated with filled casks, DPCs, WPs, and MSCs bound those associated with emptied casks and containers.

5.2.17 System architecture is established by "Facility, Equipment and System Names for Use in the SAR" (Lucas 2004 [DIRS 170073], Attachments 8 and 9). Although the Remediation Facility is included in the system architecture provided in Lucas (2004 [DIRS 170073]; Attachments 8 and 9), it has since been included as an integral part of the DTF and does not exist as a separate facility (BSC 2004i [DIRS 172109], Section 1.1).

Rationale: Although inconsistent with the architecture presented in Lucas (2004 [DIRS 170073], Attachments 8 and 9), this assumption is appropriate for use because it represents the latest design information and system architecture.

6. ANALYSIS

6.1 GENERIC INTERNAL EVENTS CHECKLIST

The development of the generic internal events checklist for the repository is based on three hazard evaluation techniques from *System Safety Analysis Handbook* (Stephans and Talso 1997 [DIRS 101450]), as follows:

1. Energy Analysis (p. 3-81)
2. Energy Trace Barrier Analysis (p. 3-83)
3. Energy Trace Checklist (p. 3-89).

The repository checklist is based upon Stephans and Talso (1997 [DIRS 101450]) techniques and lists. The repository checklist contains questions for each generic hazard to determine its applicability to a functional area, which is indicated by a positive response. There are six types of generic internal events that, if determined to be applicable, could potentially result in radiological hazards or radiological releases. The six types of generic internal events include the following:

1. Collision/Crushing
2. Chemical Contamination/Flooding
3. Explosion/Implosion
4. Fire
5. Radiation/Magnetic/Electrical/Fissile
6. Thermal.

Sections 6.1.1 to 6.1.6 describe each of the six types of generic internal events.

6.1.1 Collision/Crushing

Categories:

1. Uncontrolled mass/force. Examples include: excessive velocity or acceleration of mass, inadvertent operation of appendage, failure of primary/secondary structure, tumbling (or tipped-over) mass, uncontrolled robot, or uncontrolled fixed rotating equipment, falls, drops.

2. Protrusions into pathways. Examples include: extended appendages, protruding structural elements, or improperly placed equipment.

Applicability to Functional Area of Design:

1. Is kinetic or potential energy present?
2. Can the kinetic or potential energy be released in an unplanned way?
3. Can the release of kinetic or potential energy interact with the waste form?

6.1.2 Chemical Contamination/Flooding

Note: Chemical Contamination/Flooding is not normally a direct potential threat to the waste form; it is usually a contributing cause of another generic internal event.

Categories:

1. Reactions. Examples include: release of chemicals or materials that react with system materials causing system deterioration. The released materials may foster electrolytic reactions, galvanic reactions, stress corrosion, or oxidation.

2. Off-Gassing. Examples include: release of volatile/condensable materials.

3. Venting. Examples include: leaking or venting of materials, gases, or liquids.

4. Debris/Leaks. Examples include: small loose/free parts, flaking, leaking fluids or flooding, dirt or dust, or oxidized materials (e.g., metal rust).

5. Flooding. Examples include: water, water ingress leading to the potential for criticality.

Applicability to Functional Area of Design:

Applicability to Category 1: Reactions

1. Are corrosive or reactive chemicals or materials present?
2. Can these chemicals or materials be released?
3. Can the chemicals or materials interact with the waste form?

Applicability to Category 2: Off-Gassing

1. Are volatile or condensable materials present?
2. Can these materials be released?
3. Can these materials interact with the waste form?

Applicability to Category 3: Venting

1. Is there potential for venting materials in the area?
2. Can the materials interact with the waste form?

Applicability to Category 4: Debris and Leaks

1. Is there potential for debris or leaks in the area?
2. Can the debris or fluids interact with the waste form?

Applicability to Category 5: Flooding

1. Are sources of water present in the area?
2. Is there a potential to release the water?
3. Can the released water interact with the waste form with potential for criticality?

6.1.3 Explosion/Implosion

Note: This event is normally accompanied by shrapnel or other high velocity debris.

Categories:

1. Pressure Energy Release. Examples include: damage, failure, or rupture of pressurized containers or components and release of gases, implosion of containers, vessels, or enclosed structural volumes.

2. Electrical Energy Release. Examples include: faults, arcs, static charge, electrical component failure, battery overcharge or overdischarge, or out-of-phase source connection.

3. Chemical Energy Release. Examples include: chemical dissociation or reactions, fire internal to confined volumes, adiabatic detonation, or ignition of confined flammable gases.

4. Mechanical Equipment. Examples include: rotating equipment disintegration due to overspeed.

Applicability to Functional Area of Design:

1. Are pressure, electrical, chemical, or mechanical energy sources present?
2. Can an event occur that results in an explosion or implosion energy release?
3. Can the released energy impact the waste form directly?

6.1.4 Fire

A fire must have ignition, fuel, and oxidizer sources:

1. Ignition Sources. Examples include: electrical faults, shorts, arcs, chemical reactions, hot surfaces, small flames, or catalytic reaction (also see Section 6.1.3, Explosion/Implosion).

2. Fuel and Oxidizer Sources. Examples include: flammable materials (solids and liquids) and flammable atmospheres (gases), in addition to the presence of an oxidizing environment from ambient atmosphere or other chemical agents (also see Section 6.1.2, Chemical Contamination/Flooding).

Categories: Not Applicable

Applicability to Functional Area of Design:

1. Are fuel, oxidizers, and ignition sources present?
2. Is there sufficient fuel and oxidizer to sustain a fire?
3. Can fire interact with the waste form?

6.1.5 Radiation/Magnetic/Electrical/Fissile

Categories:

1. Ionizing. Examples include: radioactive materials, X-rays, high-voltage radio frequency equipment, or corona.

2. Non-Ionizing. Examples include: electromagnetic interference or radio frequency.

3. Magnetic. Examples include: permanent magnets and electromagnetic devices.

4. Nuclear Particles. Examples include: ion, electron beams, or radioactive materials.

5. Laser Light. Examples include: high energy laser beams and accompanying energy forms such as heat.

6. Fissile Material. Examples include: uranium-233, uranium-235 and plutonium-239.

Applicability to Functional Area of Design:

1. Are radiation, magnetic, or electrical energy sources present external to the waste form? Is fissile material present?

2. Is a mechanism present to release radioactive, magnetic, or electrical energy?

3. Can the release of radiation, magnetic, or electrical energy interact with the waste form?

4. Can fissile material be arranged in a manner that could result in criticality?

6.1.6 Thermal

Note: Also see Fire (Section 6.1.4).

Category:

> Heat. This category accommodates any heat energy source with sufficient energy to have an impact on the waste form.

Applicability to Functional Area of Design:

1. Are external heat energy sources present?
2. Can heat energy be released?
3. Can the heat energy affect the waste form?

6.2 APPLICABILITY OF GENERIC EVENTS TO FUNCTIONAL AREAS

The repository systems and facility architecture are identified in "Facility, Equipment and System Names for Use in the SAR" (Lucas 2004 [DIRS 170073], Attachments 8 and 9). The repository facilities and the repository process systems that are present in, or interface with, these facilities include the following:

- Transportation Cask Receipt/Return Facility
  - Cask Receipt and Return System

- Warehouse & Non-Nuclear Receipt Facility
  - DOE and Commercial Waste Package System
  - Naval Spent Nuclear Fuel Waste Package System
  - Non-Nuclear Handling System

- Dry Transfer Facility
  - DOE and Commercial Waste Package System
  - Naval Spent Nuclear Fuel Waste Package System
  - Cask Receipt and Return System
  - Non-Nuclear Handling System
  - Cask/MSC/WP Preparation System
  - SNF/HLW Transfer System
  - Waste Package Closure System
  - Remediation System
  - Emplacement and Retrieval System
  - SNF Aging System

- Canister Handling Facility
  - DOE and Commercial Waste Package System
  - Naval Spent Nuclear Fuel Waste Package System
  - Cask Receipt/Return System
  - Non-Nuclear Handling System

  - Cask/MSC/WP Preparation System
  - SNF/HLW Transfer System
  - Waste Package Closure System
  - Emplacement and Retrieval System
  - SNF Aging System

- Subsurface Facility
  - DOE and Commercial Waste Package System
  - Naval Spent Nuclear Fuel Waste Package System
  - Emplacement and Retrieval System
  - SNF Aging System

- Fuel Handling Facility
  - DOE and Commercial Waste Package System
  - Naval Spent Nuclear Fuel Waste Package System
  - Cask Receipt and Return System
  - Non-Nuclear Handling System
  - Cask/MSC/WP Preparation System
  - SNF/HLW Transfer System
  - Waste Package Closure System
  - Emplacement and Retrieval System
  - SNF Aging System

The repository facilities were subdivided into their functional areas for the purpose of identifying and documenting the internal hazards and potential initiating events associated with preclosure operations of the repository. Functional areas are defined as those areas where activities or processes associated with the repository operations and/or the handling of SNF/HLW occur. The functional areas (and/or processes, as applicable) considered in this analysis include:

- Cask and Waste Package Receipt Building, Transportation Cask Buffer Area

- Canister Handling Facility
  - Entrance vestibule (room 1036), tools/parts storage room (room 1035)
  - Canister transfer cell (room 1033)
  - WP positioning cells (room 1011, room 1042), WP closure cells (room 2010, room 2032)
  - Tools/parts storage room (room 1035), exit vestibule (room 1036)

- Dry Transfer Facility
  - WP and navy cask entrance vestibule (room 1060), cask and MSC entrance vestibule (room 1079)
  - WP/navy cask SRTC receipt area (room 1058), WP SRTC receipt area (room 1059), cask and MSC SRTC receipt area(room 1077)
  - WP/navy to trolley transfer room (room 1057), cask and MSC to trolley transfer room (room 1076)
  - WP/navy cask preparation room (room 1053), WP preparation room (room 1056),
  - Cask restoration room (room 1072)

  - Cask/MSC turntable room (room 1073)
  - Cask preparation room (room 1074)
  - WP docking cell (room 1052, room 1055), Cask and MSC docking room (room 1069)
  - WP loading (navy canister)/docking ring removal cell (room 1051), WP loading/docking ring removal cell (room 1054)
  - Waste transfer cell (room 2048)
  - SNF and canister staging cell (room 1050)
  - WP handling and staging cell (room 1044)
  - WP positioning cell (room 1039, room 1040, room 1041), WP closure cell (room 2032, room 2033, room 2035)
  - WP loadout cell (room 1088)
  - WP collar removal machine (room 1091)
  - WP transporter vestibule (room 1087)
  - Exit vestibule (room 1086)
  - WP/trolley decontamination room (room 1094)
  - DPC cutting/WP dry remediation cell (room 1097)
  - DPC preparation/cask dry remediation (room 1100)
  - DPC docking room (room 1101), cask docking/dry remediation room (room 1109)
  - Tool spare transfer room (room 1127)
  - Cask wet remediation/laydown area (room 1117)
  - Cask wet remediation entrance vestibule (room 1120)

- Fuel Handling Facility
  - Entrance vestibule (room 1001)
  - Preparation room (room 1002)
  - Main transfer room (room 1003)
  - Fuel transfer bays (room 1004, room 1005, and room 1006)
  - Fuel transfer room (room 2001)
  - WP positioning cell (room 1013)
  - WP closure cell (room 2006)

- Surface and Subsurface Facilities: WP Subsurface Transport and Emplacement

- Surface Facilities: SNF Aging System

- Subsurface Facility: Construction Hazards

- Surface Facilities: Construction Hazards

- Subsurface Facility: Drip Shield Installation

- Subsurface Facility: Retrieval

- Surface Facilities: Site-Generated Radiological Waste Disposal.

6.3 IDENTIFICATION OF INTERNAL HAZARDS AND POTENTIAL INITIATING EVENTS

The following approach was used to document internal hazards and potential initiating events in Section 6.6:

Area Description/Process Description: Establishes the baseline description of the repository functional areas and process description. Information is used to gain an understanding of the expected use of the functional area.

Generic Event Category Applicability: Summarizes the results from the applicability assessment for each of the following generic events:

- Collision/Crushing
- Chemical Contamination/Flooding
- Explosion/Implosion
- Fire
- Radiation/Magnetic/Electrical/Fissile
- Thermal.

Reference: Identifies the origin of the design information and/or functional area operational details.

Potential Events: Identifies the specific events based on the potential for interaction.

6.4 OPERATIONS OVERVIEW

The repository surface facilities are located near the North Portal entrance to the repository. The facilities include the North Portal area, the Construction Portal area, SNF Aging System pads, and the Balance of Plant area. Together these areas cover approximately 1,500 acres of land. The facilities in these areas house the SSCs needed for safe and effective repository operations. The repository Site Plan is presented in Figure 1.

Waste handling operations are carried out in the geologic repository operations area. This area is comprised of the facilities necessary to receive, package, age, and emplace waste in the repository. Waste transfer operations are conducted inside buildings that have been designed and constructed to withstand earthquakes and other natural phenomena, as necessary, to perform their defined functions. Waste handling facilities have been constructed for the receipt and inspection of transportation casks, the preparation of these casks for transfer to the waste transfer cells, and the preparation of empty casks for shipment offsite. Waste transfer operations occur in the DTF, the FHF, and the CHF.

The SNF and vitrified HLW are transported to the repository by the National and Nevada Transportation Projects in NRC-certified transportation casks in accordance with applicable U.S. Department of Transportation regulations. When the cask is received, personnel verify the shipping manifests and inspect and survey the SNF/HLW cask and its trailer or railcar. The waste is then moved to a restricted area for staging. From the staging area, casks are delivered to

the CWPRB for transfer to an SRTC and the TCBA, as applicable. Casks delivered to the FHF are delivered directly to the facility on public conveyance (truck trailer or railcar) from the staging area; there is no FHF interface with the SRTC or TCBA.

The repository also receives shipments of MSCs and engineered barrier components, including empty WPs, emplacement pallets, and drip shields. These SSCs are delivered to the CWPRB or the Heavy Equipment Maintenance Facility for inspection and staging, prior to use in the appropriate surface waste handling facility.

When an empty WP is scheduled for processing, it is moved into the appropriate waste handling facility. The waste handling facility operators prepare and configure the empty WP for SNF/HLW transfer. The steps for WP preparation include positioning the WP for transfer, inserting the inner vessel lid and transferring the WP to the appropriate SNF/HLW transfer area.

When a waste shipment is scheduled for processing, the transportation cask containing the SNF/HLW is moved into an appropriate waste handling facility. Cask preparation consists of surveying the cask for radiation and surface contamination, decontamination (if required), removal of impact limiters, upending the cask, positioning the cask for transfer, sampling gases inside the cask, venting the cask cavity to atmospheric pressure, removing the cask lid(s), transferring the cask to the SNF/HLW transfer area, and establishing radiological confinement between the cask and the waste handling facility, as required. Radiological confinement is attained using the cask unload port sealing device (if required).

If the cask shipment contains a DPC of commercial SNF, the DPC undergoes a series of preparation steps prior to commercial SNF transfer. These preparation steps include the rigging of the DPC for transfer, removing the DPC to the SNF/HLW transfer area, sampling gases inside the DPC, cutting the DPC lid off, and removing the DPC lid to allow for commercial SNF transfer. The empty DPC and lid are packaged as low-level radioactive waste (LLW) and transported to a LLW disposal site.

Thermal aging of waste may be required if the waste shipment contains high-heat commercial SNF. In this event, commercial SNF is transferred to an MSC for transport to the SNF Aging System pads. In addition, transportation casks containing horizontal DPCs may be lifted from their conveyance, loaded onto a horizontal cask transfer trailer, and transported to an SNF Aging System pad. Here the horizontal DPC is transferred from the transportation cask to a horizontal aging module (HAM) located on the pad. When the horizontal DPC is scheduled for processing, it is transferred from the HAM to a transfer cask and the cask is moved into an appropriate waste handling facility.

When an MSC is scheduled for processing, it is moved into an appropriate waste handling facility. The waste handling facility operators inspect, prepare, and configure the MSC for SNF transfer. Preparation of an MSC consists of positioning the cask for transfer, transferring the cask to the SNF/HLW transfer area, establishing radiological confinement between the empty cask and the waste handling facility (if required), and removing the cask lid(s). The SNF is remotely transferred from the transportation casks to the MSC. Once loaded, the MSC is closed, inerted (if required), and sealed prior to being transported to the SNF Aging System.

In addition, SNF may be placed in an MSC and transported to the SNF Aging System if staging is required. DOE SNF standardized canisters and DOE HLW canisters are not sent to the SNF Aging System.

After WP loading is completed, the WP is transferred to the WP closure cell where the WP is sealed. The WPs may be staged (DTF only) or transferred to the WP loadout area where the WP is surveyed for contamination, down-ended onto the emplacement pallet, positioned for lifting collar removal, and transferred into the WP transporter. The WP transporter is moved into the subsurface facilities to an emplacement drift, where the WP is remotely transferred to a WP emplacement gantry for final positioning in the emplacement drift (BSC 2003b [DIRS 166015], Section 4.2).

6.5 WASTE FORM AND WASTE PACKAGE OVERVIEW

6.5.1 Waste Form Overview

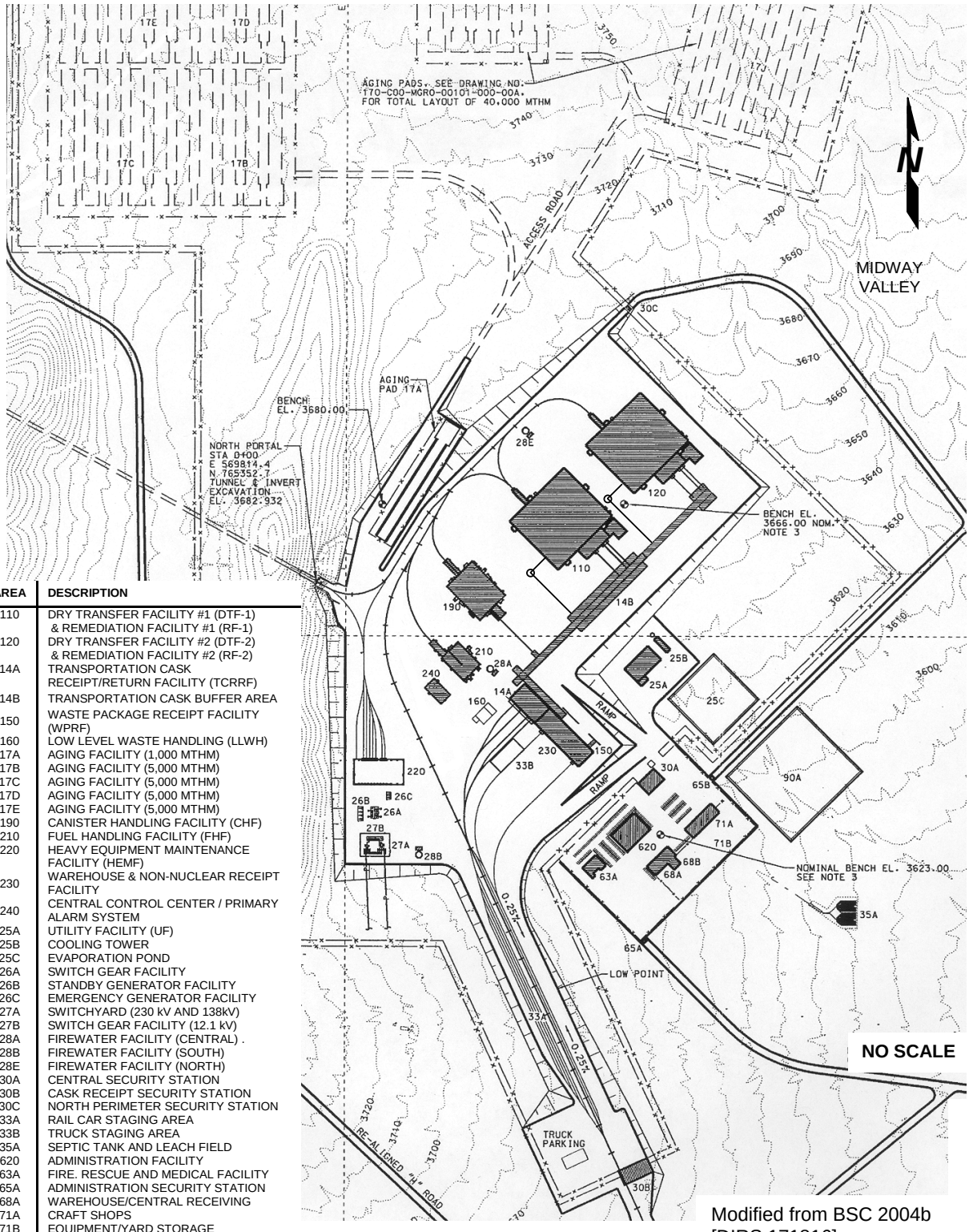
The SNF and HLW arrive at the repository in a variety of solid types and forms in NRC-certified transportation casks. Commercial SNF arrives as individual fuel assemblies that are placed directly into transportation casks. A portion of commercial SNF arrives in DPCs that are cut open to allow for the removal of fuel assemblies contained within the DPC. DOE SNF and HLW and naval SNF arrive in disposable canisters that are placed directly into WPs. Intact SNF of commercial origin owned by the DOE may arrive at the repository uncanistered. The various waste forms to arrive at the repository in truck and rail transportation casks include the following (BSC 2003b [DIRS 166015], Section 2):

Commercial SNF

- Individual commercial SNF assemblies from pressurized water reactors (PWRs) and boiling water reactors (BWRs)
- Small DPCs containing commercial SNF assemblies
- Large DPCs containing commercial SNF assemblies.

DOE SNF and HLW Canisters

- 18-inch diameter DOE SNF canister (long and short)
- 24-inch diameter DOE SNF canister (long and short)
- 25-inch diameter DOE SNF MCO
- 66.5-inch diameter naval SNF canister (long and short)
- 120-inch (length) DOE HLW canister
- 180-inch (length) DOE HLW canister.



AREA	DESCRIPTION
110	DRY TRANSFER FACILITY #1 (DTF-1) & REMEDIATION FACILITY #1 (RF-1)
120	DRY TRANSFER FACILITY #2 (DTF-2) & REMEDIATION FACILITY #2 (RF-2)
14A	TRANSPORTATION CASK RECEIPT/RETURN FACILITY (TCRRF)
14B	TRANSPORTATION CASK BUFFER AREA
150	WASTE PACKAGE RECEIPT FACILITY (WPRF)
160	LOW LEVEL WASTE HANDLING (LLWH)
17A	AGING FACILITY (1,000 MTHM)
17B	AGING FACILITY (5,000 MTHM)
17C	AGING FACILITY (5,000 MTHM)
17D	AGING FACILITY (5,000 MTHM)
17E	AGING FACILITY (5,000 MTHM)
190	CANISTER HANDLING FACILITY (CHF)
210	FUEL HANDLING FACILITY (FHF)
220	HEAVY EQUIPMENT MAINTENANCE FACILITY (HEMF)
230	WAREHOUSE & NON-NUCLEAR RECEIPT FACILITY
240	CENTRAL CONTROL CENTER / PRIMARY ALARM SYSTEM
25A	UTILITY FACILITY (UF)
25B	COOLING TOWER
25C	EVAPORATION POND
26A	SWITCH GEAR FACILITY
26B	STANDBY GENERATOR FACILITY
26C	EMERGENCY GENERATOR FACILITY
27A	SWITCHYARD (230 kV AND 138kV)
27B	SWITCH GEAR FACILITY (12.1 kV)
28A	FIREWATER FACILITY (CENTRAL) .
28B	FIREWATER FACILITY (SOUTH)
28E	FIREWATER FACILITY (NORTH)
30A	CENTRAL SECURITY STATION
30B	CASK RECEIPT SECURITY STATION
30C	NORTH PERIMETER SECURITY STATION
33A	RAIL CAR STAGING AREA
33B	TRUCK STAGING AREA
35A	SEPTIC TANK AND LEACH FIELD
620	ADMINISTRATION FACILITY
63A	FIRE. RESCUE AND MEDICAL FACILITY
65A	ADMINISTRATION SECURITY STATION
68A	WAREHOUSE/CENTRAL RECEIVING
71A	CRAFT SHOPS
71B	EQUIPMENT/YARD STORAGE
90A	STORM WATER RETENTION POND

Modified from BSC 2004b [DIRS 171816]

Figure 1. Site Plan

Commercial SNF rods are arranged in assemblies that range from approximately 6 to 16 feet in length.

The DOE SNF has a wide variety of physical, chemical, and nuclear characteristics. The repository accepts canisters of DOE SNF, including naval SNF canisters and DOE canisters containing various types of material irradiated at commercial nuclear reactors. The DOE SNF canisters are sealed by welding before they are transported to the repository. The canisters for DOE SNF are standardized to allow for efficient placement of the canisters of the various DOE waste forms in the WPs. Fuel from the N-reactor located at Hanford, Washington, is placed in sealed MCOs. MCOs are stainless-steel containers that are slightly wider at the top than at the bottom. Liquid DOE HLW is processed at other DOE locations to yield a borosilicate glass, which is a solid leach-resistant material. The DOE HLW glass is shipped in DOE canisters.

In the internal hazards identification portion of this analysis (Section 6.6), the term "DOE SNF canister" refers to either an 18-inch diameter or a 24-inch diameter (long or short) DOE SNF (standardized) canister. This term does not refer to the 25-inch diameter DOE SNF MCO.

6.5.2 Waste Package Overview

Waste packages have a dual-metal design that utilizes two concentric cylinders. The inner vessel is constructed of Type 316 stainless steel; the outer cylinder is constructed of corrosion-resistant Alloy 22. After a WP is loaded, it is sealed by successive remote operations that install, weld, and inspect the inner vessel lid. The inner vessel is filled with an inert gas, a purge port cap is installed, and the middle lid and outer lid are welded to the outer corrosion barrier. The outer lid weld is then subjected to a stress mitigation process such as laser peening or low-plasticity burnishing.

Waste packages are designed for the different forms of commercial SNF, DOE SNF, DOE HLW, and naval SNF. Five WP design configurations accommodate the anticipated types of commercial SNF assemblies. DOE SNF and DOE HLW arrive in welded canisters that are placed directly into WPs. The DOE WPs are a co-disposal design; each holds both SNF canisters and HLW canisters within the same WP. Two WPs, long and short, were designed to hold naval SNF fuel, which arrives sealed in either long or short welded canisters (BSC 2003b [DIRS 166015], Section 2).

The various WPs used at the repository for the emplacement of waste include the following (BSC 2003b [DIRS 166015], Section 2):

Commercial SNF

- 21-PWR Absorber Plate: WP with interlocking absorber plates and a capacity of 21 PWR commercial SNF assemblies
- 21-PWR Control Rod: WP with a capacity of 21 PWR commercial SNF assemblies, each containing a control (absorber) rod
- 12-PWR Absorber Plate: WP with a capacity of 12 PWR commercial SNF assemblies of new manufacture

- 44-BWR Absorber Plate: WP with a capacity of 44 BWR commercial SNF assemblies
- 24-BWR Absorber Plate: WP with a capacity of 24 BWR commercial SNF assemblies.

DOE SNF and DOE HLW

- 5 defense high-level radioactive waste (DHLW)/DOE Short: WP with a capacity of one short 18-inch diameter DOE SNF canister and five short DOE HLW canisters, each having a length of 120 inches. This WP can alternatively be loaded with one short 24-inch diameter DOE SNF canister and four DOE HLW canisters.
- 5 DHLW/DOE Long: WP with a capacity of one long 18-inch diameter DOE SNF canister and five long DOE HLW canisters, each having a length of 180 inches. This WP can alternatively be loaded with one long 24-inch diameter DOE SNF canister and four DOE HLW canisters.
- 2 MCO/2-DHLW: WP with a capacity of two MCOs and two long DOE HLW canisters, each having a length of 180 inches.
- Naval Short: WP with a capacity of one naval short canister.
- Naval Long: WP with a capacity of one naval long canister.

6.5.3 Other Canisters and Casks

- MSC: a radiation-shielded vertical site-specific transfer and staging cask (metal or concrete) to accommodate two configurations of SNF/HLW: (1) a site-specific vertical metal cask with an internal basket assembly containing commercial SNF assemblies that are received uncanistered, and (2) a metal or concrete shielded cask containing commercial SNF or DOE SNF/HLW in certified, vertical DPCs or vertical MPCs. The MSCs will be licensed by the NRC according to 10 CFR Part 63 [DIRS 156605] (BSC 2004a [DIRS 172109], Appendix A).
- DPC: a sealed metal container with an internal basket assembly which is used to transfer, store, and transport commercial SNF from a commercial reactor site to the repository site. The canister is licensed to be oriented in a vertical or horizontal position. The container and its transportation cask are licensed by the NRC according to 10 CFR Part 71 [DIRS 104091] and 10 CFR Part 72 [DIRS 127267] (BSC 2004a [DIRS 172109], Appendix A).
- MPC: a metal canister with an internal basket assembly containing commercial SNF or other forms of HLW (e.g., HLW immobilized in vitrified-glass or SNF assemblies) that meets applicable regulatory requirements for handling, storage, transportation, and disposal in the geologic repository. As of January 2005, no MPCs have been licensed by the NRC (BSC 2004a [DIRS 172109], Appendix A).

- Transfer cask: a shielded cask specifically designed for on-site transferring of the horizontal DPC between the SNF Aging System pads, the DTF, and the Transportation Cask Receipt/Return Facility (TCRRF) (BSC 2004a [DIRS 172109], Appendix A).

- Transportation cask: a heavily shielded cask with impact limiters and personnel barriers which is licensed by the NRC according to 10 CFR Part 71 [DIRS 104091] and is used for transporting SNF and HLW on the nation's highways and railroads (BSC 2004a [DIRS 172109], Appendix A).

6.6 INTERNAL HAZARDS IDENTIFICATION

6.6.1 Cask and Waste Package Receipt Building, Transportation Cask Buffer Area

Area Description/Process Description: The cask receipt and return system receives NRC-licensed transportation casks that contain SNF and HLW. The system starts with the initial receipt inspection and survey at the security gate and ends with the casks at the entrance to the process facilities. The transportation casks arrive at the site via railcars or trucks that are operated by the national transportation system. Casks are inspected and surveyed at the site security gate and are brought to the staging areas near the TCRRF and then to the TCRRF. The railcars and trucks are pushed or pulled by a battery-powered site prime mover; a multiwheel, tractor-tired, and rail-guided vehicle (Assumption 5.2.2), after initial inspection and survey at the security gate. Cask transfer operations are conducted in the transportation cask receipt/return area (TCRRA) of the TCRRF. Additionally, the casks can by-pass the TCRRF and go directly to the process facilities if they are truck-mounted (BSC 2004c [DIRS 171159], Section 2).

The Warehouse & Non-Nuclear Receipt Facility (WNNRF) and the TCRRA of the TCRRF share the same structure, the CWPRB. Housed within a single structure, the two areas are considered separate facilities, with one containing nuclear materials (the TCRRF) and the other only housing non-nuclear items (the WNNRF). Each of the two facilities has its own foundation and superstructure, but they share the outer architectural panel walls and roof at the boundary between the two facilities. An interior wall also separates the two facilities (BSC 2004d [DIRS 171702], Section 2.3). The locations of the TCRRF and WNNRF are depicted in Figure 1.

The WNNRF provides the space, layout, structures, and integral systems that support the receipt and warehousing of empty WPs, WP drip shields, and empty MSCs. Space is also provided for associated components such as closure lids, lifting collars, and shop parts. The facility also provides space for installing the lifting collars on WPs, space for storing 50 WPs and 50 MSCs, and space to load empty WPs and empty MSCs onto an SRTC for transfer to other process facilities or for loading WPs and MSCs onto railcars or truck trailers for transport to the FHF (BSC 2004e [DIRS 171629], Section 1.1).

The TCRRF provides the space, layout, structures, and embedded systems that support transferring loaded transportation casks from commercial transporters to site vehicles and transferring empty transportation casks from site vehicles back to commercial transporters for transportation of the casks offsite for re-use. The facility also provides a staging area for loaded casks prior to entering the process buildings and an empty cask staging area prior to transfer to commercial transporters. Space, layout, and structures are also provided for continued receipt

inspections of the casks and for final inspection of the casks prior to leaving the site (BSC 2004d [DIRS 171702], Section 1.1). The cask receipt/return subsystem in the TCRRF uses one cask handling crane that has sufficient capacity and is configured to allow the transfer of loaded casks from conveyances (or cask carriers) to SRTCs or other site-specific transporters (e.g., aging cask transporters) and to allow the transfer of unloaded casks from SRTCs to offsite conveyances (BSC 2004c [DIRS 171159], Section 4.1.1.1). A maintenance crane is provided to facilitate cask handling crane maintenance operations and to provide for miscellaneous lifting operations, such as removing personnel barriers from conveyances (BSC 2004c [DIRS 171159], Section 2.3.1).

The function of the TCBA is to provide a queuing area for both loaded transportation casks that feed the operations in the waste handling buildings and empty casks waiting to be transported offsite for future use (BSC 2004d [DIRS 171702], Section 4.1.1.4). The location of the TCBA is depicted in Figure 1.

Equipment in the SRTC buffer subsystem includes the SRTCs, the SRTC positioner, and the SRTC tractor. The SRTCs are carts used to transport casks throughout the TCRRF and to and from waste-processing facilities (e.g., the DTF and CHF). They also transport empty MSCs and WPs from the WNNRF to the waste processing facilities. These carts travel on a rail network and are moved using an SRTC tractor or the SRTC positioner. SRTCs are designed to accommodate incoming casks, MSCs, and WPs using interchangeable adapters and attachment points designed for intermodal cask-skid packages. The SRTC positioner is an electrically powered (Assumption 5.2.4) platform for moving empty and loaded SRTCs to and from the TCBA. The SRTC positioner moves SRTCs and associated loads to rails leading to the waste processing facilities and to buffer and staging stations. The SRTC positioner framework is mounted on wheels to form a base platform that runs on a dedicated set of steel rails. The SRTC positioner receives loaded and unloaded SRTCs and it moves them in a direction perpendicular to the SRTC rail system. The SRTC tractors are diesel engine-powered (Cogema 2003a [DIRS 167161]) vehicles used to push or pull SRTCs within the TCRRF and between the TCRRF and other facilities or systems. A turntable is used to change the direction of the SRTC positioner on the rail system. The turntable, located between the CWPRB and the TCBA, is connected to the SRTC positioner rail system (BSC 2004c [DIRS 171159], Section 4.1.1.2).

Operations in this area begin when the conveyances (railcars, legal weight trucks [LWTs], and overweight trucks [OWTs]) enter the TCRRF, where a receipt inspection is performed. Personnel barriers covering casks are removed to allow detailed receipt inspection to be performed. If the inspection of the transportation cask and vehicle fails the receipt inspection, an evaluation will be performed to assess the final disposition of the shipment. If necessary, the impact limiters can also be removed at this point (BSC 2004c [DIRS 171159], Section 2.3.1). Following a successful receipt inspection, transportation casks are removed from the transport vehicle and placed on a configured SRTC using the cask handling crane. This lift is performed using trunnions supplied with the cask, or by lifting an intermodal skid that supports the cask. As part of the receipt inspection, the cask and SRTC may be surveyed again for contamination and radiation (BSC 2004c [DIRS 171159], Section 2). The mobile elevated platforms used for access to the casks and the forklifts used in the CWPRB are battery powered (Assumption 5.2.3). Naval SNF casks require special handling. They are designed to be tilted vertically about their lower set of trunnions and then lifted off their skid with a lifting yoke attached to the top trunnions (BSC 2004c [DIRS 171159], Section 4.1.1.1).

Depending on the design of a specific transportation cask, casks are transferred from the commercial carriers to SRTCs with impact limiters installed or removed. Impact limiters are reinstalled on transportation casks, as appropriate, prior to leaving the CWPRB (BSC 2004c [DIRS 171159], Section 4.2.3.1).

After a transportation cask is loaded on an SRTC inside the CWPRB, the SRTC is moved outside by the SRTC tractor to the SRTC positioner. The SRTC positioner and positioner trench rail system are shown in Figure 1, the Site Plan. The MSCs are loaded directly onto SRTCs already placed on the SRTC positioner. The SRTC positioner then moves the SRTC to an empty staging station in the buffer area or to the appropriate set of rails for transfer to a waste processing facility. If an SRTC is directed to the TCBA, an SRTC tractor is connected to the SRTC and the cart is moved to a preselected staging station in the TCBA. When an SRTC in a staging station is identified to be moved to one of the waste processing facilities, an SRTC tractor is dispatched to the appropriate location and connected to the SRTC. The SRTC positioner is moved to the staging station and aligned to receive the SRTC. A locking device prevents the SRTC from being moved if the SRTC positioner is not properly aligned with the staging station. The SRTC is moved onto the SRTC positioner and the SRTC tractor is disconnected. The SRTC positioner moves the SRTC to the rail line that connects to the desired waste handling facility. Whether the SRTC originates from the CWPRB or the TCBA, an SRTC tractor is reconnected to the SRTC. The tractor then pushes the SRTC to a waste processing facility for unloading (BSC 2004c [DIRS 171159], Section 4.2.3.1).

The DPCs presently stored in a horizontal orientation at nuclear power plants arrive at the repository in an NRC-approved transportation cask (BSC 2004a [DIRS 172109], Section 4). The transportation casks containing horizontal DPCs are received at the TCRRF on railcars (BSC 2004a [DIRS 172109], Section 4.1.1.3). Upon arrival at the TCRRF, the impact limiters are removed from the cask (BSC 2004a [DIRS 172109], Section 2.3.4). The casks are unloaded from the railcars using the 250-ton crane in the TCRRF. The transportation casks going directly to the DTF are loaded onto SRTCs, configured for transfer with impact limiters, and moved to the DTF where they are further processed. Some transportation casks may contain fuel in horizontal DPCs that are transported directly to the aging pads since the cask contents are compatible with the HAMs. These casks are moved from a railcar to a horizontal cask transfer trailer. The transportation casks are towed to the aging pads (no impact limiters are used during the transfer) on horizontal cask transfer trailers (BSC 2004a [DIRS 172109], Section 4.2.3.1).

When an aged DPC is needed by a handling facility, a transfer cask mounted on a horizontal cask transfer trailer with an integral hydraulic ram is taken to the aging pad and to the appropriate HAM for retrieval (BSC 2004a [DIRS 172109], Section 4.2.3.1). A transfer cask will interface with the TCRRF when the aging process is complete. The cask with the aged horizontal DPC is brought back to the TCRRF on a horizontal cask transfer trailer and is transferred there to an SRTC (BSC 2004a [DIRS 172109], Section 4.1.2). The cask is configured for transfer, with impact limiters installed, and is then moved to the DTF for processing and WP loading (BSC 2004a [DIRS 172109], Section 4.2.3.1).

Unloaded transportation casks leave the repository area through the CWPRB in reverse order. Unloaded transportation casks are transferred from the waste processing facilities to the TCRRA on SRTCs. Transportation casks are transferred from SRTCs to commercial carriers using the

250-ton cask-handling crane. After performing necessary external surveys and inspections, casks are released for transfer offsite (BSC 2004c [DIRS 171159], Section 4.2.3.2).

Table 1a lists the applicability of generic events to the CWPRB and TCBA operations; Table 1b lists potential events for each applicable category.

Table 1a. Generic Events Applicability to the CWPRB, TCBA

Generic Event Category	Is Generic Event Applicable?
Collision/Crushing	Yes
Chemical Contamination/Flooding	Yes
Explosion/Implosion	Yes; also see Fire
Fire	Yes
Radiation/Magnetic/Electrical/Fissile	Yes, Radiation/Fissile
Thermal	Yes (see Fire)

Sources: BSC 2004c [DIRS 171159], Sections 2, 2.3.1, 4.1.1.1, 4.1.1.2, 4.2.3.1, and 4.2.3.2; BSC 2004d [DIRS 171702], Sections 1.1, 2.3, and 4.1.1.4; BSC 2004e [DIRS 171629], Section 1.1; Cogema 2003a [DIRS 167161]; BSC 2004a [DIRS 172109], Sections 2.3.4, 4, 4.1.1.3, 4.1.2, and 4.2.3.1

Table 1b. Potential Events for the CWPRB, TCBA

Generic Event Category	Potential Event
Collision/Crushing	1. Overturning or collision of a site prime mover moving an LWT or OWT trailer holding a transportation cask (with impact limiters and personnel barrier installed). 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. 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). 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). 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. 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. 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 the SNF Aging System) from the cask receipt and return area overhead crane during transfer to an SRTC.

Generic Event Category	Potential Event
	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 the SNF Aging System) from the cask receipt and return area overhead crane onto or against a sharp object during transfer to an SRTC. 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). 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). 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. 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. 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. 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 a HAM. 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. 16. Drop or collision of handling equipment onto or against a transportation cask (with impact limiters and personnel barrier installed). 17. Drop or collision of handling equipment onto or against a transportation cask (without impact limiters or personnel barrier installed). 18. Drop or collision of heavy loads from the maintenance crane onto or against a transportation cask (with or without impact limiters or personnel

Generic Event Category	Potential Event
	barrier installed). 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. 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. 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. 22. Collision of an SRTC tractor and an SRTC holding a transportation cask (with impact limiters and personnel barrier installed). 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. 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. 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. 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. 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. 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. 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.

Generic Event Category	Potential Event
	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.
Chemical Contamination/Flooding	Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures.
Explosion/Implosion	1. Hydrogen explosion involving batteries on a forklift. 2. Hydrogen explosion involving batteries on a mobile elevated platform. 3. Hydrogen explosion involving batteries on a site prime mover.
Fire, Thermal	1. Fire/explosion (battery/electrical fire) involving a site prime mover moving an LWT or OWT trailer holding a transportation cask. 2. Fire/explosion (battery/electrical fire) involving a site prime mover moving a railroad car holding a rail transportation cask. 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). 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). 5. Diesel fuel fire/explosion involving an SRTC tractor pushing or pulling an SRTC holding a transportation cask. 6. Electrical fire involving the cask receipt and return area overhead crane, handling equipment, or other electrical equipment. 7. Electrical fire involving the SRTC positioner holding an SRTC loaded with a transportation cask. 8. Electrical fire involving the turntable carrying the SRTC positioner holding an SRTC loaded with a transportation cask. 9. Fire/explosion (battery/electrical fire) associated with a forklift. 10. Fire/explosion (battery/electrical fire) associated with a mobile elevated platform. 11. Transient combustible fire in CWPRB or the TCBA. 12. Cask overheating due to solar insolation while on an offsite transport or an SRTC.

Generic Event Category	Potential Event
Radiation	1. Radiation exposure of a facility worker and/or the offsite public. 2. Radiation-induced damage to a facility SSC.
Fissile	1. Criticality associated with a transportation cask collision, drop, or slapdown (involving a crane) and a rearrangement of the cask internals. 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. 3. Criticality associated with a collision or overturning of an LWT or OWT trailer (holding a transportation cask) and a rearrangement of the cask internals. 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. 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. 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. 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. 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. 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.

6.6.2 Canister Handling Facility

The CHF provides the space, radiological confinement, structures, and internal systems that support stand-alone canister handling operations that are independent of the other waste handling facilities. The CHF is located on the surface at the North Portal Pad of the repository. The CHF is designed to receive and handle canister shipments consisting of naval SNF canisters, DOE SNF canisters, DOE HLW canisters, MCOs, vertical DPCs, and MPCs (if and when they become available; Assumption 5.2.1). Uncanistered commercial SNF, commercial horizontal DPCs, off-normal and nonstandard SNF, or off-normal HLW canisters are not processed at the CHF (BSC 2004f [DIRS 171496], Section 4.1.1).

There are three types of DOE SNF and HLW WPs that will be handled in the CHF (BSC 2004f [DIRS 171496], Section 4.1.2.1.3):

- 5 DHLW/DOE Long
- 5 DHLW/DOE Short
- 2-MCO/2-DHLW.

There are two naval WPs types that the CHF will handle (BSC 2004f [DIRS 171496], Section 4):

- Naval Long
- Naval Short.

The CHF provides space for canister transfer operations, closure of WPs, loading of MSCs, transfer of WPs onto WP transporters for underground emplacement, and transfer of loaded MSCs onto SRTCs for transfer outside to the MSC transporter. The CHF has the capacity to stage, characterize, survey, and close empty transportation casks for return to waste-generating sites. The CHF has a limited-capacity for in-process waste staging, consisting of below-grade shielded staging for 10 DOE SNF and HLW canisters (BSC 2004f [DIRS 171496], Section 4.1.1).

The CHF is located on the surface at the North Portal of the repository as depicted in Figure 1. Figure 2 provides the room legend for the CHF. Figure 3 illustrates the general arrangement ground floor plan for the CHF. Entrances to the shielded canister transfer cell are through shield doors. The floor plan of the facility includes entrance and exit vestibule with material flow through the facility basically from east to west (BSC 2004f [DIRS 171496], Section 4.1.1). The facility provides space for the entrance vestibule crane, which is utilized to remove impact limiters and personnel barriers. Inside the CHF, the system uses the 200-ton capacity cask handling crane and the 100-ton capacity WP and canister handling crane to perform heavy lifting tasks (BSC 2004f [DIRS 171496], Section 4.1.2.1.2).

6.6.2.1 Canister Handling Facility: Entrance Vestibule, Tools/Parts Storage Room

Area Description/Process Description: The CHF has the capability to directly receive casks and waste packages on LWTs and OWTs. After repository facilities are completed, LWTs, OWTs, and rail transportation casks are received and processed at the TCRRF before being transferred to the CHF. Empty waste packages and site-specific casks coming to the repository are received at the WNNRF. After completion of the intra-plant rail system, transportation casks, waste packages, and site-specific casks are transferred to the CHF on SRTCs. (BSC 2004f [DIRS 171496], Section 4.1.4).

When canister shipments are delivered to the CHF, the transportation cask or MSC is moved into the entrance vestibule (room 1036). The SRTC is pushed into and pulled out of the CHF by the diesel-powered SRTC tractor (Cogema 2003a [DIRS 167161]). The steel structure vestibule is equipped with a roll-up entry door. The vestibule normally receives transportation casks, MSCs, and WPs via the SRTC, but it is also sized to directly receive casks and waste packages on an LWT, or an OWT (BSC 2004f [DIRS 171496], Section 4.1.4.1).

ROOM LEGEND
CANISTER HANDLING FACILITY

GROUND FLOOR

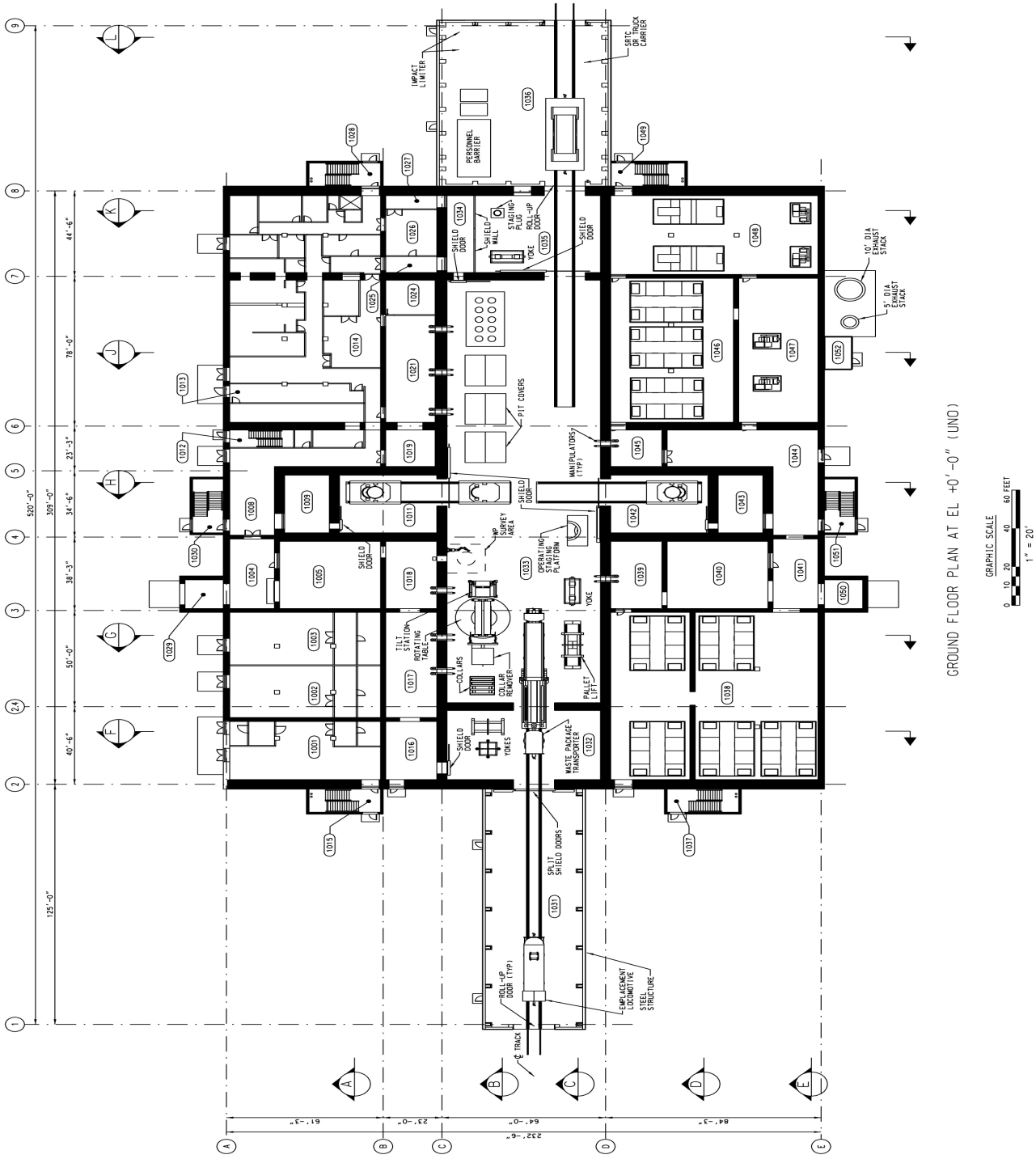
1001 ELECTRICAL ROOM (NORMAL POWER)
1001A BATTERY ROOM
1001B BATTERY ROOM
1002 ELECTRICAL ROOM TRAIN "A"
1002A BATTERY ROOM
1003 ELECTRICAL ROOM TRAIN "B"
1003A BATTERY ROOM
1004 ELEVATOR VESTIBULE A
1005 CLOSURE SUPPORT ROOM A
1006 NOT USED
1007 NOT USED
1008 CORRIDOR
1009 TROLLEY RECOVERY EQUIPMENT ROOM A
1010 NOT USED
1011 WP POSITIONING CELL A
1012 STAIR #6
1013 COMMUNICATIONS ROOM
1014 SUPPORT AREA
1015 ELEVATOR VESTIBULE
1016 RADIATION PROTECTION LAB
1017 WP LOADOUT OPERATING GALLERY
1018 NOT USED
1019 DOOR RECOVERY ROOM A
1020 NOT USED
1021 CANISTER TRANSFER OPERATING GALLERY A
1022 CONTROL SYSTEMS ROOM
1023 CONTROL SYSTEMS ROOM
1024 GAS SAMPLING ROOM
1025 CORRIDOR
1026 RADIATION PROTECTION CONTROL POINT
1027 CORRIDOR
1028 NOT USED
1029 NOT USED
1030 NOT USED
1031 EXIT VESTIBULE
1032 WP TOOL STORAGE ROOM
1033 CANISTER TRANSFER CELL
1034 CORRIDOR
1035 TOOLS/PARTS STORAGE ROOM
1036 ENTRANCE VESTIBULE
1037 TERTIARY RECIRCULATING HVAC EQUIPMENT ROOM A
1038 TERTIARY RECIRCULATING HVAC EQUIPMENT ROOM B
1039 WP LOADOUT OPERATING GALLERY & DOOR RECOVERY ROOM B
1040 CLOSURE SUPPORT ROOM B
1041 ELEVATOR VESTIBULE B
1042 WP POSITIONING CELL B
1043 TROLLEY RECOVERY EQUIPMENT ROOM B
1044 CORRIDOR
1045 CANISTER TRANSFER CELL OPERATING GALLERY B
1046 TERTIARY RECIRCULATING HVAC EQUIPMENT ROOM C
1047 STAGING EXHAUST HVAC EQUIPMENT ROOM
1048 TRANSFER PITS SUPPLY/RECIRCULATING HVAC EQUIPMENT ROOM
1049 STAIR #1
1050 STAIR #2
1051 STAIR #7
1052 STAIR #3
1053 STAIR #4
1054 STAIR #5
1055 FREIGHT ELEVATOR A
1056 FREIGHT ELEVATOR B
1057 STACK MONITORING ROOM
1058 ELEVATOR

PITS

P001 CANISTER STAGING PIT
P002 CASK PREPARATION PIT
P003 MSC/WP LOADING PIT
P004 MSC/WP LOADING PIT

Source: BSC 2004g [DIRS 171808]

Figure 2. Canister Handling Facility Ground Floor Plan Room Legend



Source: BSC 2004h [DIRS 171663] (without hold data illustrated)

Figure 3. Canister Handling Facility Ground Floor Plan

The entrance vestibule is equipped with a 20-ton capacity overhead bridge crane that is used for removing transportation cask impact limiters and personnel barriers. The vestibule is sized to provide staging for one set of impact limiters and a personnel barrier. The heaviest impact limiters are expected to be approximately 12.5 tons.

After removal of the impact limiters and the personnel barrier, the cask shipment is inspected, surveyed for radiological contamination and inspected for damage. If necessary, decontamination using dry wipes is performed in the entrance vestibule (BSC 2004f [DIRS 171496], Section 4.1.4.1). Forklifts and mobile elevated platforms used in this area are battery-powered (Assumption 5.2.3).

Table 2a lists the applicability of generic events to the CHF entrance vestibule and tools/parts storage room operations; Table 2b lists potential events for each applicable category.

Table 2a. Generic Events Applicability to the CHF Entrance Vestibule and Tools/Parts Storage Room

Generic Event Category	Is Generic Event Applicable?
Collision/Crushing	Yes
Chemical Contamination/Flooding	Yes
Explosion/Implosion	Yes; also see Fire
Fire	Yes
Radiation/Magnetic/Electrical/Fissile	Yes, Radiation/Fissile
Thermal	Yes (see Fire)

Sources: BSC 2004f [DIRS 171496], Sections 4, 4.1.1, 4.1.2.1.2, 4.1.2.1.3, 4.1.4, and 4.1.4.1; Cogema 2003a [DIRS 167161]

Table 2b. Potential Events for the CHF Entrance Vestibule and Tools/Parts Storage Room

Generic Event Category	Potential Event
Collision/Crushing	1. SRTC derailment, overturning, or collision involving a loaded cask followed by a load tipover or fall. 2. Overturning or collision involving an LWT trailer or an OWT trailer holding a cask. 3. SRTC derailment, overturning, or collision involving a loaded MSC followed by a load tipover or fall. 4. Collision of an SRTC, an LWT trailer, or an OWT trailer carrying a loaded cask with the entrance vestibule doors, tool/parts storage room doors, or the canister transfer cell shield doors. 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. 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. 7. The entrance vestibule doors, tool/parts storage room doors, or the canister

Generic Event Category	Potential Event
	transfer cell shield doors close on an SRTC carrying a loaded MSC. 8. Collision of a mobile elevated platform with a cask during removal of personnel barriers and impact limiters or during survey activities. 9. Drop or collision of personnel barriers or impact limiters from the entrance vestibule overhead crane onto or against a cask. 10. Collision between a forklift and a cask on an SRTC, an LWT trailer or an OWT trailer or the conveyance holding the cask. 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. 12. Collision between a forklift and an MSC on an SRTC or the SRTC holding the cask. 13. Collision between a mobile elevated platform and an MSC on an SRTC or the SRTC holding the MSC. 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.
Chemical Contamination/Flooding	Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures.
Explosion/Implosion	1. Hydrogen explosion involving batteries on a forklift. 2. Hydrogen explosion involving batteries on a mobile elevated platform. 3. Hydrogen explosion involving batteries on a site prime mover.
Fire, Thermal	1. Electrical fire associated with the entrance vestibule overhead crane. 2. Electrical fire associated with handling equipment or other entrance vestibule electrical equipment. 3. Diesel fuel fire/explosion involving a diesel-powered SRTC tractor pulling or pushing an SRTC holding a loaded cask or MSC. 4. Fire/explosion (battery/electrical fire) involving a site prime mover pulling or pushing an LWT or an OWT trailer holding a loaded cask. 5. Fire/explosion (battery/electrical fire) associated with a forklift. 6. Fire/explosion (battery/electrical fire) associated with a mobile elevated platform. 7. Transient combustible fire in the entrance vestibule or the tools/parts storage

Generic Event Category	Potential Event
	room.
Radiation	1. Radiation exposure of a facility worker and/or the offsite public. 2. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation. 3. Radiation-induced damage to a facility SSC.
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. 2. Criticality associated with overturning or collision involving an LWT or an OWT trailer holding a cask and rearrangement of cask internals. 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.

6.6.2.2 Canister Handling Facility (Canister Transfer): Canister Transfer Cell

Area Description/Process Description: The canister transfer cell includes a cask preparation pit, two MSC/WP loading pits, a canister staging pit, a WP turntable, a WP tilting machine, a WP collar removal machine, a 100-ton WP and canister handling crane, and a 200-ton cask handling crane (BSC 2004f [DIRS 171496], Section 2.3.2).

The cask is moved into the shielded canister transfer cell (room 1033). Cask tie-downs are removed and the cask is upended on the SRTC, LWT trailer, or OWT trailer using the 200-ton capacity bridge crane. Tools and parts to assist in unloading the cask are stored in the tools/parts storage room (room 1035). The cask is lifted and positioned into the cask preparation pit (pit P002) utilizing the 200-ton overhead bridge crane. A moveable platform for cask and MSC preparation is positioned over the pit to provide worker access for lid bolt removal and gas sampling operations. The cask interior cavity gas contents are sampled, and if normal, the internal pressure is equalized with ambient pressure, and the cask lid bolts are removed. If a gas sample indicates that the cask contains a breached canister, the cask is removed to a remediation area, if available, or other holding area while a mitigation plan is developed. Gas sampling is facilitated from a gas sampling room on the ground floor.

After removal of the cask lid bolts and sampling is complete, the moveable platform for cask and MSC preparation is transferred to a staging area in the canister transfer cell. Subsequent activities that include removal of the cask lid and installation of a shield ring (if required) are performed by the SNF/HLW transfer system.

If aging a commercial vertical DPC is required, an empty MSC is transferred from either the WNNRF or an aging pad, and moved through the entrance vestibule (room 1036) to the canister transfer cell (room 1033). The MSC design has not been completed and the cask may be

delivered vertically or horizontally, depending on the final design configuration of the MSC. Tie-downs are removed, and the empty MSC is lifted, positioned into an MSC loading pit (pit P003 or P004), its lid is removed, and the cask is prepared for canister transfer (BSC 2004f [DIRS 171496], Section 4.1.4.1).

Canister transfer operations are performed in a dry canister transfer cell (Room 1033) located on the ground floor of the CHF. The canister transfer cell includes two MSC and WP loading pits (pits P003 and P004), a cask preparation pit (pit P002), and a canister staging pit (pit P001) that are located below-grade (see Figure 3). Operators remotely remove the lids from the transportation casks. Operators use shield windows, closed-circuit television, manually and remotely operated manipulators, and remotely controlled cranes to perform canister transfer operations.

Canisters that require manual attachment of a pintle or lifting device (commercial vertical DPCs and naval SNF canisters) require that the moveable platform for cask and MSC preparation be repositioned over the cask after lid removal. Since the top of the canister is shielded, but the sides are not, a shield ring is installed to shield the annulus between the canister and the cask inner wall. Workers can then manually install the lift fixture with pintle.

Remote operations are performed from adjacent shielded canister transfer operating galleries (rooms 1021 and 1045). The 100-ton capacity waste package and canister handling crane is positioned over the pit and a canister lifting grapple is used to engage and lift each canister one at a time. Canisters are lifted out of the cask using the remotely operated overhead crane. The canister is lifted slightly above the floor and moved to a location over the prepositioned WP in the WP loading pit (pit P003 or pit P004). The overhead crane position is secured and the canister is lowered into the WP. The canister grapple is remotely disconnected, and the crane is returned to a staging position. Space for various grapples, yokes, and grapple/yoke stands is provided in the CHF and located within the crane hook reach.

For DOE SNF and HLW canisters, several transfer operations from one or more transportation casks are required to fill the WP. In the case where DOE SNF and HLW canisters are not to be immediately loaded into a WP, the operations are performed to transfer a canister into the canister staging pit. Prior to transferring a canister to the canister staging pit (pit P001) the shield plug must be removed from the designated staging location. The shield plug is replaced after transfer of the canister.

Naval SNF canisters require one transfer to load the naval SNF canister into the naval SNF WP. The commercial vertical DPC requires only one transfer to load it into an MSC. Prior to canister transfer operations the canister shield ring is removed, the moveable platform for cask and MSC preparation is repositioned, and personnel leave the canister transfer cell. The 100-ton crane with grapple is lowered and it remotely engages with the pintle on the lift fixture. The naval SNF canister is lifted and transferred to either a naval long WP, or a naval short WP, as appropriate. The DPC is only transferred to an MSC. The 100-ton crane auxiliary hook, attached with a remotely operated torque wrench, is lowered and disconnects the canister lifting fixture. The main hook with grapples remotely transfers the lift fixture to a staging area in the canister transfer cell. The inner lid is mechanically restrained in the WP to prevent canister ejection due to an accidental drop. The WP is then ready for transfer to the WP trolley and WP

positioning cell for closure operations (BSC 2004f [DIRS 171496], Section 4.1.4.2).

An MSC is capable of being loaded in the CHF with a commercial vertical DPC for aging. A transportation cask containing a canister requiring aging is placed in the transportation cask pit, lid bolts are removed, and the lid or lids are removed. After shielding the canister, personnel manually install a canister lifting fixture with pintle, if necessary, and exit the transfer cell. The transfer of the DPC to the shielded MSC is performed remotely. If needed, shielding is installed, and personnel reenter the canister transfer cell to remove the lifting fixture with pintle, or the fixture could be removed remotely as required for the unshielded waste package (BSC 2004f [DIRS 171496], Section 4.1.4.2).

Commercial vertical DPCs are only transferred to MSCs. Naval SNF canisters and MCOs are only transferred to WPs (BSC 2004f [DIRS 171496], Section 2.3.2).

Table 3a lists the applicability of generic events to canister transfer operations in the CHF canister transfer cell; Table 3b lists potential events for each applicable category.

Table 3a. Generic Events Applicability to the Canister Transfer Operations in the CHF Canister Transfer Cell

Generic Event Category	Is Generic Event Applicable?
Collision/Crushing	Yes
Chemical Contamination/Flooding	Yes
Explosion/Implosion	Yes; also see Fire
Fire	Yes
Radiation/Magnetic/Electrical/Fissile	Yes, Radiation/Fissile
Thermal	Yes (see Fire)

Sources: BSC 2004f [DIRS 171496], Sections 2.3.2, 4.1.4.1, and 4.1.4.2

Table 3b. Potential Events for Canister Transfer Operations in the CHF Canister Transfer Cell

Generic Event Category	Potential Event
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. 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. 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. 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. 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.

Generic Event Category	Potential Event
	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. 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. 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. 9. Drop or collision involving the pit moveable platform onto or against a cask or MSC in the cask preparation pit. 10. Handling equipment drop onto or against a cask or MSC. 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. 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. 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. 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. 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 DOE SNF canister). 16. Drop or collision of a DOE HLW canister or a DOE SNF canister from a canister transfer cell overhead crane onto or against another DOE SNF canister, or DOE HLW canister in the cask being unloaded, as applicable. 17. Horizontal movement of a canister before it is fully vertically lifted out of a cask or MSC. 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. 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. 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.

Generic Event Category	Potential Event
	21. Drop or collision of a DPC, DOE HLW canister, or DOE SNF canister from a canister transfer cell overhead crane into or against the empty MSC being loaded. 22. Drop or collision of a naval SNF canister, a DOE HLW canister, a DOE SNF MCO, or a DOE SNF canister from a canister transfer cell overhead crane into or against the WP being loaded. 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 DOE SNF canister in a WP. 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 DOE SNF canister in an MSC. 25. Drop or collision of a DOE SNF canister from a canister transfer cell overhead crane onto or against a DOE HLW canister in a WP or MSC. 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. 27. Drop or collision of a DOE SNF MCO from a canister transfer cell overhead crane onto or against a DOE SNF canister or a drop of a DOE SNF canister onto or against another DOE SNF canister in a WP due to a misload. 28. Drop or collision of a DOE SNF MCO from a canister transfer cell overhead crane onto or against a DOE SNF canister or onto or against a DOE HLW canister or another misloaded DOE SNF MCO in an MSC due to a misload. 29. Drop or collision of a DOE HLW canister or a DOE SNF canister from a canister transfer cell overhead crane into or against a canister staging pit. 30. Slapdown of a DOE HLW canister or a 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. 31. Drop or collision of a DOE HLW canister or a DOE SNF canister from a canister transfer cell overhead crane onto or against the top of another DOE HLW canister or DOE SNF canister in a canister staging pit. 32. Impact due to horizontal movement of a canister before it is fully vertically lifted out of a canister staging pit. 33. Drop of or collision of handling equipment onto or against a DOE HLW canister or a DOE SNF canister in a canister staging pit. 34. Drop of or collision of a canister staging pit shield plug onto or against a canister in the canister staging pit. 35. Drop or collision involving the pit moveable platform onto or against a

Generic Event Category	Potential Event
	loaded MSC in an MSC/WP loading pit. 36. Drop of a WP inner lid into an open, loaded WP. 37. Drop of the MSC lid into an open, loaded MSC. 38. Drop or collision of tools or handling equipment into or against an open, loaded or partially loaded, WP. 39. Drop or collision of tools or handling equipment into or against an open, loaded, or partially loaded MSC. 40. Drop or collision of tools or equipment (including a lid-lifting fixture) onto or against a loaded WP inner lid. 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.
Chemical Contamination/Flooding	Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures.
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. 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. 3. Hydrogen explosion involving batteries on a forklift. 4. Hydrogen explosion involving batteries on a site prime mover.
Fire, Thermal	1. Electrical fire associated with the canister transfer cell overhead cranes. 2. Electrical fire associated with handling equipment or other canister transfer cell electrical equipment. 3. Diesel fuel fire/explosion on an SRTC tractor pushing an SRTC holding a loaded cask into the canister transfer cell. 4. Fire/explosion (battery/electrical fire) involving a site prime mover pulling or pushing an LWT or an OWT trailer holding a loaded cask. 5. Diesel fuel fire/explosion associated with the SRTC tractor pushing an SRTC holding an MSC. 6. Fire/explosion (battery/electrical fire) associated with a forklift. 7. High-efficiency particulate air (HEPA) filter fire due to excessive radioactive decay within the filter bed.

Generic Event Category	Potential Event
	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. 9. Transient combustible fire in the canister transfer cell. 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.
Radiation	1. Radiation exposure of a facility worker and/or the offsite public. 2. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation. 3. Damage or rupture of cask sampling and purging system, leading to a release of cask internal gasses and radioactive material. 4. Thermal expansion of gases or other loss of confinement in an unsealed cask or MSC, leading to radiological release. 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. 6. Radiation-induced damage to a facility SSC.
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. 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. 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. 4. Criticality associated with a drop or slapdown of a DOE SNF canister, a naval SNF canister, a DOE SNF MCO, a DPC, or a DOE HLW canister and a rearrangement of canister internals. 5. Criticality associated with a misload of a WP or an MSC. 6. Criticality associated with a misload of a canister staging pit. 7. Criticality associated with a drop of heavy equipment onto an unsealed, loaded cask, WP, or MSC and a rearrangement of the container internals.

6.6.2.3 Canister Handling Facility (WP Transfer to WP Closure, MSC Closure and Removal): Canister Transfer Cell

Area Description/Process Description: The loaded WP is remotely engaged with the 100-ton capacity WP and canister handling crane, lifting yoke, and WP upper lifting collar; lifted out of the pit, and placed on a WP trolley. The WP trolley travels between a WP positioning cell (room 1011 or room 1042) and the WP trolley parking area located in the canister transfer cell. Operations in the CHF are performed by a combination of manual operations and remote operations controlled from adjacent galleries that are shielded, and thus protected from the ionizing radiation. The operators use remote controls, shield windows, closed-circuit television, manual and power manipulators, remotely controlled overhead bridge cranes, and other remote equipment to perform the SNF and HLW canister transfer operations (BSC 2004f [DIRS 171496], Section 4.1.4.2).

After the MSC has been loaded, the cask lid is installed and bolted. The lift fixture with pintle must be removed prior to the MSC lid being installed. Metallic MSCs go through additional processing steps, including filling the cask with an inert gas and performing seal leak tests as necessary. Concrete casks that are used to age canisters are not filled with an inert gas and no leak tests are necessary. Using the 200-ton cask handling crane with the proper yoke, the MSC is placed on an SRTC that has been moved back into the canister transfer cell (Room 1033). External radiation and contamination surveys are performed prior to exiting the building. Contamination on the cask, if encountered, is dispositioned as necessary.

The MSC transporter retrieves the MSC directly from the SRTC. The transporter moves the MSC to an SNF aging system pad (BSC 2004f [DIRS 171496], Section 4.1.4.5.2).

Table 4a lists the applicability of generic events to WP transfer operations for WP closure and MSC closure in the CHF canister transfer cell; Table 4b lists potential events for each applicable category.

Table 4a. Generic Events Applicability to the WP Transfer for WP Closure and MSC Closure and Removal in the CHF Canister Transfer Cell

Generic Event Category	Is Generic Event Applicable?
Collision/Crushing	Yes
Chemical Contamination/Flooding	Yes
Explosion/Implosion	Yes, also see Fire
Fire	Yes
Radiation/Magnetic/Electrical/Fissile	Yes, Radiation/Fissile
Thermal	Yes (see Fire)

Sources: BSC 2004f [DIRS 171496], Sections 4.1.4.2 and 4.1.4.5.2

Table 4b. Potential Events for WP Transfer for WP Closure and MSC Closure and Removal in the CHF Canister Transfer Cell

Generic Event Category	Potential Event
Collision/Crushing	1. Drop or collision of handling equipment or a lifting fixture onto or against a loaded WP inner lid. 2. Drop or collision of handling equipment or a lifting fixture onto or against a loaded MSC lid. 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. 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. 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. 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. 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. 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. 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. 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. 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. 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.

Generic Event Category	Potential Event
	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. 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. 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. 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. 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. 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. 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. 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. 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. 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. 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.
Chemical Contamination/Flooding	Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures.

Generic Event Category	Potential Event
Explosion/Implosion	MSC inerting system (or other pneumatic or pressurized system) missile due to a fractured nozzle/valve stem/pneumatic device.
Fire, Thermal	1. Electrical fire associated with the canister transfer cell overhead cranes. 2. Electrical fire associated with handling equipment or other canister transfer cell electrical equipment. 3. Diesel fuel fire/explosion associated with the SRTC tractor pulling an SRTC holding an MSC. 4. HEPA filter fire due to excessive radioactive decay within the filter bed. 5. Transient combustible fire in the canister transfer cell. 6. Thermal hazard (from decay heat) associated with a vertical orientation of a non-inerted, loaded, unsealed WP with normal cooling. 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.
Radiation	1. Radiation exposure of a facility worker and/or the offsite public. 2. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation. 3. Inadvertent opening of a canister transfer cell shield door or a WP positioning cell shield door, leading to a worker exposure. 4. Radiation-induced damage to a facility SSC.
Fissile	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. 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. 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. 4. Criticality associated with a drop of heavy equipment onto an unsealed, loaded WP or MSC and a rearrangement of the container internals.

6.6.2.4 Canister Handling Facility: WP Closure

Area Description/Process Description: WP welding is performed in the WP closure cells (rooms 2010 and 2032). The WP trolley is located in the canister transfer cell at the entrance to the WP positioning cell (rooms 1011 and 1042) and conveys the unsealed WP into position to be closed (BSC 2004f [DIRS 171496], Section 4.1.4.3). The WP trolley in the CHF is powered by external means (with power supplied by an external source; Assumption 5.2.9) (Cogema 2004a [DIRS 168925]).

Closure operations include inerting, welding, nondestructive examination, and stress mitigation. After the loaded WP is received in a WP closure cell, the spread ring is seal welded, the WP inner vessel is evacuated and filled with inert gas, the middle and outer lids are welded in place, the welds are nondestructively examined, and residual stresses on the outer lid weld are mitigated. WP closure operations are monitored and controlled from the closure operating galleries (Rooms 2011 and 2033) (BSC 2004f [DIRS 171496], Section 4.1.4.3).

Each closure cell is provided with a glove box maintenance capability that directly interfaces with the closure cell. The interface occurs through the cell wall from the closure cell into the closure support room. The interface is in the form of a shielded air lock system that provides contamination control and adequate shielding to protect operating personnel occupying the closure support room. An air lock is also provided on the closure support room side of the glove box for the introduction of WP lids, materials, and equipment into this unit as a means of providing access of these items into the closure cell (BSC 2004q [DIRS 171499], Section 4.1.1.4).

After WP closure is completed, the WP trolleys moves the welded WP back into the canister transfer cell for WP loadout. If needed, the WP closure system can repair minor defects in closure welds. The system ensures that WPs are closed and meet established acceptance criteria prior to WP delivery for underground emplacement.

WP closure cell control systems manage the remote operations and data collection. The WP closure cell control systems are comprised of components and devices that support WP closure. The WP closure systems perform closure operations, including mechanical handling within the boundaries of the WP closure support area. The WP closure process is performed remotely using remote welding, testing, and stress mitigation equipment deployed by a 3-ton electromechanical manipulator and a 15-ton precision crane. The equipment requires periodic adjustments, repairs, and replacements. To facilitate repairs, the equipment is moved either into an adjacent maintenance area that is separated from the WP closure cell with a partial shield door, moved into the closure support area, or moved to a third floor closure maintenance room (BSC 2004f [DIRS 171496], Section 4.1.4.3).

A more complete description of the WP closure process is presented in Section 6.6.3.10.

Table 5a lists the applicability of generic events to CHF WP closure operations; Table 5b lists potential events for each applicable category.

Table 5a. Generic Events Applicability to CHF Waste Package Closure

Generic Event Category	Is Generic Event Applicable?
Collision/Crushing	Yes
Chemical Contamination/Flooding	Yes
Explosion/Implosion	Yes, also see Fire
Fire	Yes
Radiation/Magnetic/Electrical/Fissile	Yes, Radiation/Fissile
Thermal	Yes (see Fire)

Sources: BSC 2004f [DIRS 171496], Section 4.1.4.3; BSC 2004q [DIRS 171499], Section 4.1.1.4; Cogema 2004a [DIRS 168925]

Table 5b. Potential Events for CHF Waste Package Closure

Generic Event Category	Potential Event
Collision/Crushing	1. Derailment of a trolley holding a loaded, unsealed WP followed by a load tipover or fall. 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. 3. Collision involving the trolley holding the loaded, unsealed WP and the shield doors between the canister transfer cell and the WP positioning cell. 4. Shield doors between the canister transfer cell and the WP positioning cell close on the trolley holding the loaded, unsealed WP. 5. Lid drop onto a WP from the lid placement fixture equipment during the welding process. 6. Equipment drop onto a WP during the welding process. 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. 8. Collision involving the trolley holding the loaded, sealed WP and the shield doors between the WP positioning cell and the canister transfer cell. 9. Shield doors between the WP positioning cell and the canister transfer cell close on the trolley holding the loaded, sealed WP.
Chemical Contamination/Flooding	Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures.
Explosion/Implosion	1. WP inerting system (or other pneumatic or pressurized system) missile due to a fractured nozzle/valve stem/pneumatic device. 2. Explosion hazard associated with the WP purging and inerting system and the ignition of hydrogen that may have accumulated in the WP.

Generic Event Category	Potential Event
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. 2. Electrical fire associated with a motor on a WP trolley. 3. Canister/SNF damage by burn-through during welding process/heat damage. 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. 5. Overheating of a loaded WP due to a loss of cooling resulting in excessive temperature and possible damage to the canister contents. 6. Transient combustible fire in the WP closure cell or the WP positioning cell.
Radiation	1. Radiation exposure of a facility worker and/or the offsite public. 2. Glovebox leak leads to a radiological release. 3. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation. 4. Inadvertent opening of a canister transfer cell shield door or a WP positioning cell shield door, leading to a worker exposure. 5. Radiation-induced damage to a facility SSC.
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. 2. Criticality associated with a drop of heavy equipment onto an unsealed, loaded WP and a rearrangement of the container internals.

6.6.2.5 Canister Handling Facility (WP Loadout): Canister Transfer Cell, WP Tool Storage Room, Exit Vestibule

Area Description/Process Description: Once the WP is sealed, the WP is ready for transfer to the WP loadout area. Before the sealed WP is moved from the WP positioning cell (rooms 1011 and 1042), the WP transporter is moved through the exit vestibule area (room 1031) to the WP loadout area, and the shield door(s) on the WP transporter are opened to receive the sealed WP. The bedplate, loaded with an empty pallet, is extended out from the enclosed area to the open deck area of the WP transporter. The WP pallet is lifted from the WP transporter bedplate and

placed on the WP turntable by the 100-ton crane using the WP/pallet lifting yoke. Personnel exit the canister transfer cell and the shield doors are closed and secured.

The WP and WP trolleys are remotely positioned in the canister transfer cell so that the 100-ton capacity overhead bridge crane can lift the WP. The overhead bridge crane and WP lifting yoke are used to lift and position the WP to the survey area where the completed WP is surveyed for surface contamination and defects. The WP survey area is located adjacent to the north wall of the canister transfer cell west of the WP trolley. The WP survey entails examining the entire WP surface for defects and removable radiological contamination. Data and information concerning the survey and the examination results are entered into the repository data collection and inventory system. Remote WP loadout operations are conducted from the WP loadout operating galleries. Tools to assist in the loadout operation are stored near the exit vestibule in the WP tool storage room.

The 100-ton bridge crane and WP lifting yoke engages the upper WP trunnions and transfers the WP vertically to the WP tilting machine. The WP is lowered until the lower WP trunnions engage with the WP tilting machine pivot pockets. The 100-ton crane down-ends the WP to a horizontal orientation onto the WP pallet supported by the WP turntable. The turntable then lifts and disengages the lower trunnions from the WP tilting machine pivot pockets, and aligns the WP with the WP collar removal machine for remote removal of the WP upper and lower lifting collars prior to emplacement. The WP tilting machine is moved away from the turntable.

A WP collar removal machine is used to remove the trunnion collar from the WP. The 100-ton crane transfers the collar and places it on the collar stand. The turntable then rotates the WP to align with the collar removal machine for removal of the other trunnion collar. The trunnion collar is removed and transferred to the collar stand. The WP lifting yoke is then disengaged and the WP/Pallet lifting yoke is attached to the 100-ton crane.

The 100-ton capacity WP and canister handling crane with lifting yoke is positioned over the WP and emplacement pallet. The lifting fixture is remotely engaged to the emplacement pallet. The WP and emplacement pallet are lifted as an entire unit, transferred, and lowered onto the WP transporter bedplate. The WP, pallet, and bedplate are retracted into the shielded area of the WP transporter and the WP transporter shield doors are closed. The emplacement locomotive is connected to the WP transporter and a final radiological survey is performed in the exit vestibule. The WP transporter is then moved from the CHF to the subsurface repository for emplacement (BSC 2004f [DIRS 171496], Section 4.1.4.4).

Table 6a lists the applicability of generic events to CHF WP loadout in the canister transfer cell, the WP tool storage room, the exit vestibule; Table 6b lists potential events for each applicable category.

Table 6a. Generic Events Applicability to CHF WP Loadout in the Canister Transfer Cell, WP Tool Storage Room, and Exit Vestibule

Generic Event Category	Is Generic Event Applicable?
Collision/Crushing	Yes
Chemical Contamination/Flooding	Yes
Explosion/Implosion	Yes, also see Fire
Fire	Yes
Radiation/Magnetic/Electrical/Fissile	Yes, Radiation/Fissile
Thermal	Yes (see Fire)

Sources: BSC 2004f [DIRS 171496], Section 4.1.4.4

Table 6b. Potential Events for the CHF WP Loadout in the Canister Transfer Cell, WP Tool Storage Room, Exit Vestibule

Generic Event Category	Potential Event
Collision/Crushing	1. Derailment of a trolley holding a loaded, sealed WP followed by a load tipover or fall. 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. 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. 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. 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. 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. 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. 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. 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

Generic Event Category	Potential Event
	the tilting machine. 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. 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. 12. Collision of the tilting machine against a loaded, sealed WP on a pallet on the WP turntable. 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. 14. Collision or impact of the trunnion collar removal machine and a loaded, sealed WP positioned on a pallet positioned on the WP turntable. 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. 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. 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. 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. 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). 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. 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). 22. Collision involving WP transporter (holding the sealed WP on a pallet) and the doors between the exit vestibule and the ambient air (outside). 23. Doors between the exit vestibule and the ambient air (outside) close on the

Generic Event Category	Potential Event
	WP transporter (holding the sealed WP on a pallet). 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.
Chemical Contamination/Flooding	Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures.
Explosion/Implosion	Hydraulic system or other pneumatic or pressurized system missile due to a fractured nozzle/valve stem/pneumatic device.
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). 2. Electrical fire associated with the overhead bridge cranes. 3. Electrical fire associated with equipment on the WP transporter, including motors to extend the WP transporter bedplate. 4. Electrical fire associated with the WP transporter locomotive. 5. Electrical fire associated with a motor on a WP trolley. 6. Overheating of a loaded, sealed WP due to a loss of cooling resulting in excessive temperature and possible damage to the canister contents. 7. Transient combustible fire in the canister transfer area, the WP tool storage room, or the exit vestibule.
Radiation	1. Radiation exposure of a facility worker and/or the offsite public. 2. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation. 3. Inadvertent opening of a canister transfer cell shield door, leading to a worker exposure. 4. Inadvertent opening of the WP transporter shielded enclosure doors, leading to a worker exposure.
Fissile	1. Criticality associated with a trolley holding a WP derailment followed by a load tipover or fall and rearrangement of the WP internals. 2. Criticality associated with a WP transporter derailment followed by a load tipover or fall and rearrangement of the WP internals. 3. Criticality associated with a drop, slapdown, or collision of a WP and a rearrangement of the container internals.

6.6.2.6 Canister Handling Facility (Empty Transportation Cask and MSC Removal): Canister Transfer Cell, WP Tool Storage Room, Entrance Vestibule

Area Description/Process Description: Cask restoration is the process of returning transportation casks and site-specific cask from the CHF out through the entrance vestibule (BSC 2004f [DIRS 171496], Section 4.1.4.5).

After the transportation cask has been unloaded, the transportation cask lid is manually installed and bolted, and a leak test is performed on the cask, as required. Using the 200-ton cask handling crane with the proper yoke, the empty transportation cask is placed on its conveyance (SRTC, LWT, or OWT) that has been moved back into the canister transfer cell (room 1033). External contamination surveys are performed prior to exiting the building. The empty transportation cask is decontaminated as necessary.

The transportation cask is moved out of the canister transfer cell and back to the entrance vestibule (room 1036) where the impact limiters and personnel barrier are installed on the transportation cask using the 20-ton entrance vestibule crane. In some cases, the impact limiters may be reinstalled in the canister transfer cell. Empty transportation casks are returned to the cask receipt and return system for staging or preparation to be sent offsite (BSC 2004f [DIRS 171496], Section 4.1.4.5.1).

Table 7 lists the applicability of generic events to empty transportation cask and MSC preparation and removal from the CHF.

Table 7. Generic Events Applicability to CHF Empty Transportation Cask and MSC Removal in the Canister Transfer Cell, WP Tool Storage Room, and Entrance Vestibule

Generic Event Category	Is Generic Event Applicable?
Collision/Crushing	None identified that affect/interact with a waste form
Chemical Contamination/Flooding	None identified that affect/interact with a waste form
Explosion/Implosion	None identified that affect/interact with a waste form
Fire	None identified that affect/interact with a waste form
Radiation/Magnetic/Electrical/Fissile	None identified that affect/interact with a waste form
Thermal	None identified that affect/interact with a waste form

Sources: BSC 2004f [DIRS 171496], Sections 4.1.4.5 and 4.1.4.5.1

6.6.3 Dry Transfer Facility

The mission of the DTF is to receive and package commercial SNF, DOE SNF, naval SNF, and DOE HLW for emplacement in the repository. Two identical dry transfer facilities are planned. Initially, only one will be constructed and operated. Throughput requirements will determine the timing of construction and operation of the second DTF. Throughout this document the acronym DTF represents both DTFs.

The DTF is located on the surface at the north portal pad of the geologic repository operations area. The DTF provides structural support, space, and layout for embedded systems that (BSC 2004i [DIRS 171598], Section 1.1):

- Prepare loaded casks, empty WPs, and empty or loaded MSCs for waste transfer
- Open DPCs containing commercial SNF
- Transfer canistered SNF, canistered HLW, and bare fuel assemblies to WPs or MSCs
- Close loaded WPs for emplacement
- Close loaded MSCs for SNF aging
- Load MSCs onto surface transporters for transportation to an aging area
- Load closed WPs onto a WP transporter for emplacement
- Stage bare fuel assemblies, DOE SNF canisters, and DOE HLW canisters prior to transfer to WPs
- Stage loaded WPs prior to emplacement
- Remediate damage waste packages, waste forms and casks
- Decontaminate unloaded casks prior to reuse
- Decontaminate closed WPs prior to return to the national transportation system.

The DTF is a multi-level, low rise, concrete shear wall structure located at the north portal of the geologic repository operations area. The DTF has three operating levels. The DTF is divided into distinct areas for normal waste processing, for remediation operations, and for areas that support these activities. The waste handling support areas include equipment rooms, maintenance areas, tool storage, control areas, and areas needed to support personnel. Waste processing operations in the DTF (cask receipt and return, cask preparation, SNF and HLW transfer, SNF and HLW staging, WP closure, and WP loadout) are conducted in a number of rooms. Remediation operations are performed in the remediation area (integral to the DTF) (BSC 2004i [DIRS 171598], Section 4.1.1).

The location of the DTF is depicted in Figure 1, the Site Plan. Figure 4 provides a legend to the rooms in the DTF. Figures 5 through 8 illustrate the general arrangement ground floor plans for the DTF.

6.6.3.1 Dry Transfer Facility: Cask and MSC Entrance Vestibule, Cask and MSC SRTC Receipt Area, Cask and MSC to Trolley Transfer Room

Area Description/Process Description: The cask and MSC entrance vestibule (room 1079) is a single-story steel frame structure with two electrically operated roll-up doors, one at each end of the vestibule. Rail tracks pass through the structure. There are no cranes in this vestibule, but space is provided for operating a 10-ton forklift in the room. The primary function of the vestibule is to allow the SRTC or other site transfer trailers (including the MSC transporter) to enter the facility without exposing the interior of the facility to the external environment. The design allows for the entire transport vehicle, including the SRTC and an SRTC tractor, to be moved into the facility and the door closed. The inner door is opened and the SRTC is moved into the cask and MSC SRTC receipt area (room 1077), positioned, and disengaged from the site tractor. The SRTC tractor is moved back into the entrance vestibule and the inner door closed. The entrance vestibule outer door is opened and the SRTC tractor is removed for other activities. The cask and MSC entrance vestibule is used to store at least three sets of impact limiters and personnel barriers, as well as cask yokes, yoke stands, and cask restraints (BSC 2004i [DIRS 171598], Section B.1.1.1).

The cask and MSC SRTC receipt area (room 1077) is used to accept the SRTC from the cask and MSC entrance vestibule (room 1079) and provides the space, layout and equipment to visually inspect the cask, unload it from the SRTC, and transfer the cask to a transfer trolley in the cask and MSC to trolley transfer room (room 1076). The cask and MSC SRTC receipt area is designed with enough space to position the SRTC so that the personnel barrier and impact limiters can be removed from the cask. Once the SRTC is positioned within the room, mobile elevated platforms are positioned next to the cask for personnel to remove the personnel barrier and impact limiters. The cask is lifted off the SRTC and placed onto a transfer trolley in room 1076. If an unloaded cask is being removed from the DTF, the cask is lifted off the transfer trolley in room 1076 and placed onto the SRTC in room 1077. The cask and MSC SRTC receipt area has a 25-ton overhead bridge crane for removing and re-installing impact limiters and a 200-ton overhead bridge crane for handling loaded and unloaded casks (BSC 2004i [DIRS 171598], Section B.1.1.1).

The cask trolleys associated with the Cask/MSC/WP Preparation System are powered by battery (Cogema 2004b [DIRS 168043]).

The cask and MSC to trolley transfer room (room 1076) is a single story room adjacent to the cask and MSC SRTC receipt area (room 1077) and the cask/MSC turntable room (room 1073). This room is sized to receive a transportation cask from either adjacent room through two electrically operated, sliding, air lock, and shield doors. The east-side door is designed to provide a through-the-wall and a through-the-ceiling opening for the movement (via the 200-ton overhead bridge crane) of casks from the SRTC in room 1077 to the transfer trolley in room 1076 and vice-versa. The west-side door provides a through-the-wall opening for the movement of casks (via transfer trolley on rail tracks) between rooms 1076 and 1073 (BSC 2004i [DIRS 171598], Section B.1.1.1).

ROOM LEGEND

DRY TRANSFER FACILITY #1/REMEDIATION FACILITY

GROUND FLOOR

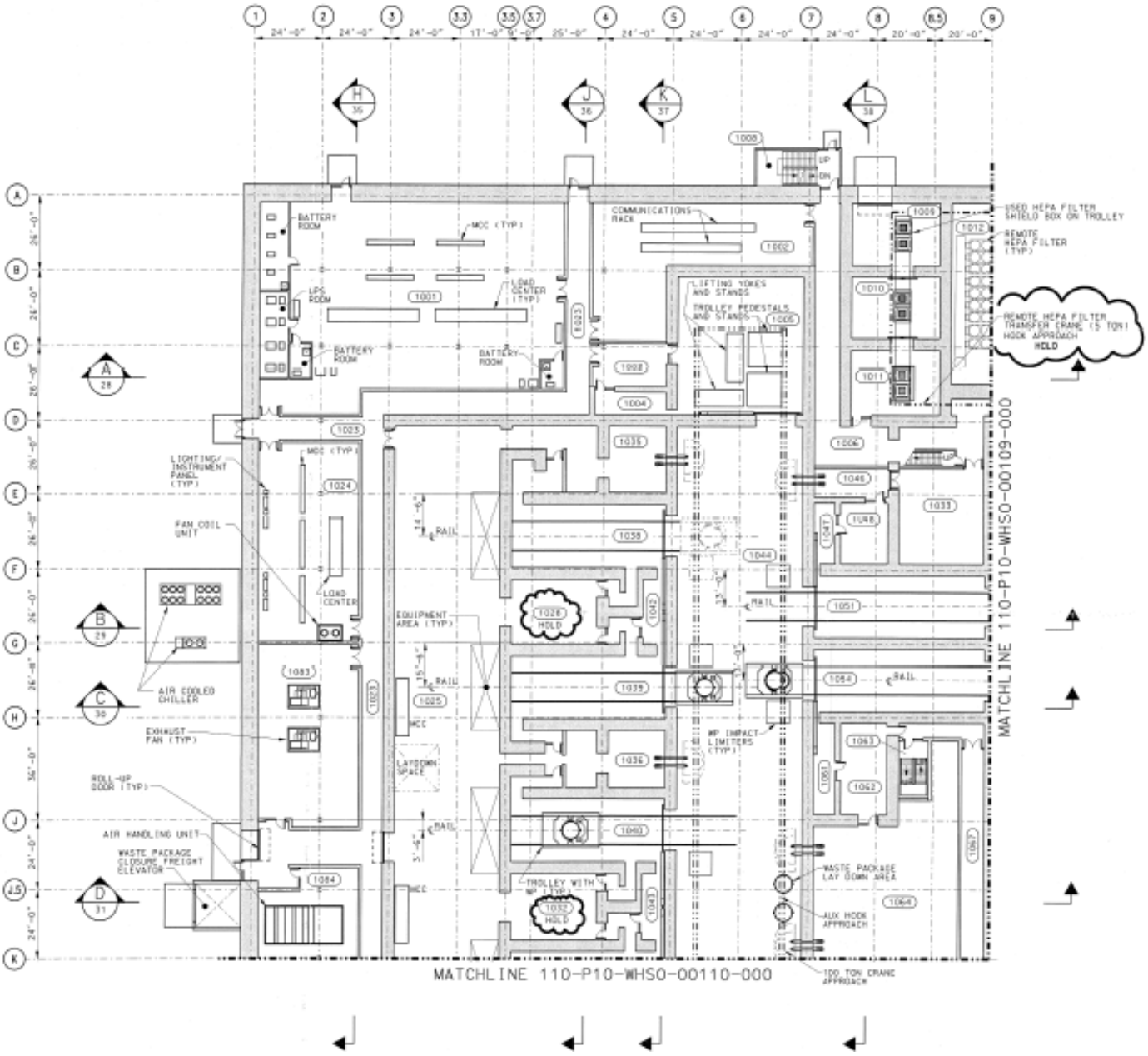
1001	ELECTRICAL EQUIPMENT ROOM (NORMAL POWER)
1002	COMMUNICATIONS ROOM
1003	AIRLOCK
1004	DOOR PARK AND MAINTENANCE ROOM
1005	CRANE PARK CELL
1006	CORRIDOR
1007	NOT USED
1008	STAIR #4
1009	HEPA FILTER LOADOUT AIRLOCK
1010	HEPA FILTER LOADOUT AIRLOCK
1011	HEPA FILTER LOADOUT AND DECONTAMINATION CELL
1012	HVAC ROOM (HEPA FILTER SYSTEM)
1013	HVAC ROOM (PRIMARY EXHAUST SYSTEM)
1014	NOT USED
1015	AIRLOCK
1016	NOT USED
1017	NOT USED
1018	NOT USED
1019	NOT USED
1020	NOT USED
1021	STAIR #5
1022	SUPPORT AREA
1023	CORRIDOR
1024	ELECTRICAL ROOM TRAIN "A"
1025	CLOSURE SUPPORT AREA
1026	NOT USED
1027	NOT USED
1028	AIRLOCK *(HOLD)*
1029	NOT USED
1030	NOT USED
1031	NOT USED
1032	AIRLOCK *(HOLD)*
1033	NOT USED
1034	AIRLOCK *(HOLD)*
1035	WP HANDLING WORK STATION
1036	WP HANDLING WORK STATION
1037	WP HANDLING WORK STATION
1038	WP POSITIONING CELL A (FUTURE)
1039	WP POSITIONING CELL B
1040	WP POSITIONING CELL C
1041	WP POSITIONING CELL D
1042	DOOR PARK AND MAINTENANCE ROOM
1043	DOOR PARK AND MAINTENANCE ROOM
1044	WP HANDLING AND STAGING CELL
1045	NOT USED
1046	WP HANDLING WORK STATION
1047	DOOR PARK AND MAINTENANCE ROOM
1048	AIRLOCK
1049	LOADOUT WORKING AREA
1050	SNF AND CANISTER STAGING CELL
1051	WP LOADING (NAVY CANISTER) / DOCKING RING REMOVAL CELL
1052	WP DOCKING CELL
1053	WP / NAVY CASK PREPARATION ROOM
1054	WP LOADING / DOCKING RING REMOVAL CELL
1055	WP DOCKING CELL
1056	WP PREPARATION ROOM
1057	WP / NAVY TO TROLLEY TRANSFER ROOM
1058	WP / NAVY CASK SRTC RECEIPT AREA
1059	WP SRTC RECEIPT AREA
1060	WP AND NAVY CASK ENTRANCE VESTIBULE
1061	DOOR PARK AND MAINTENANCE ROOM
1062	AIRLOCK
1063	STAIR #7
1064	WP HANDLING WORK STATION
1065	AIRLOCK
1066	DOOR PARK AND MAINTENANCE ROOM
1067	CORRIDOR
1068	CORRIDOR
1069	CASK AND MSC DOCKING ROOM
1070	NOT USED
1071	NOT USED
1072	CASK RESTORATION ROOM
1073	CASK / MSC TURNTABLE ROOM
1074	CASK PREPARATION ROOM
1075	NOT USED
1076	CASK AND MSC TO TROLLEY TRANSFER ROOM
1077	CASK AND MSC SRTC RECEIPT AREA
1078	TRANSPORTATION CASK PEDESTAL AND LIFTING YOKE STORAGE AREA
1079	CASK AND MSC ENTRANCE VESTIBULE
1080	CORRIDOR

GROUND FLOOR (CONT.)

1081	CORRIDOR
1082	CORRIDOR
1083	HVAC ROOM (MCC EXHAUST)
1084	HVAC ROOM (FOR MCC)
1085	STAIR #3
1086	EXIT VESTIBULE
1087	WP TRANSPORTER VESTIBULE
1088	WP LOADOUT CELL
1089	DOOR PARK AND MAINTENANCE ROOM
1090	SUPPORT AREA
1091	COLLAR REMOVAL MACHINE
1092	AIRLOCK
1093	DOOR PARK AND MAINTENANCE ROOM
1094	WP / TROLLEY DECONTAMINATION ROOM
1095	AIRLOCK
1096	DOOR PARK AND MAINTENANCE ROOM
1097	DPC CUTTING / WP DRY REMEDIATION CELL
1098	DPC CUTTING / WP DRY REMEDIATION WORK STATION
1099	CORRIDOR
1100	DPC PREPARATION / CASK DRY REMEDIATION
1101	DPC DOCKING ROOM
1102	SUPPLIES & EQUIPMENT RECEIVING BAY
1103	NOT USED
1104	NOT USED
1105	SUPPORT AREA
1106	STAIR #2
1107	WP TRANSFER CORRIDOR
1108	DPC CUTTING / WP REMEDIATION WORK STATION
1109	CASK DOCKING/DRY REMEDIATION ROOM
1110	SUPPORT AREA
1111	NOT USED
1112	AIRLOCK *(HOLD)*
1113	NOT USED
1114	NOT USED
1115	DOOR PARK AND MAINTENANCE ROOM
1116	STAIR #1
1117	CASK WET REMEDIATION/LAYDOWN AREA
1118	NOT USED
1119	NOT USED
1120	CASK WET REMEDIATION ENTRANCE VESTIBULE
1121	AIRLOCK
1122	STAIR #6
1123	STACK MONITORING ROOM
1124	NOT USED
1125	NOT USED
1126	NOT USED
1127	TOOL SPARE TRANSFER ROOM
1128	NOT USED
1129	CASK FLUSHING/LLW ROOM

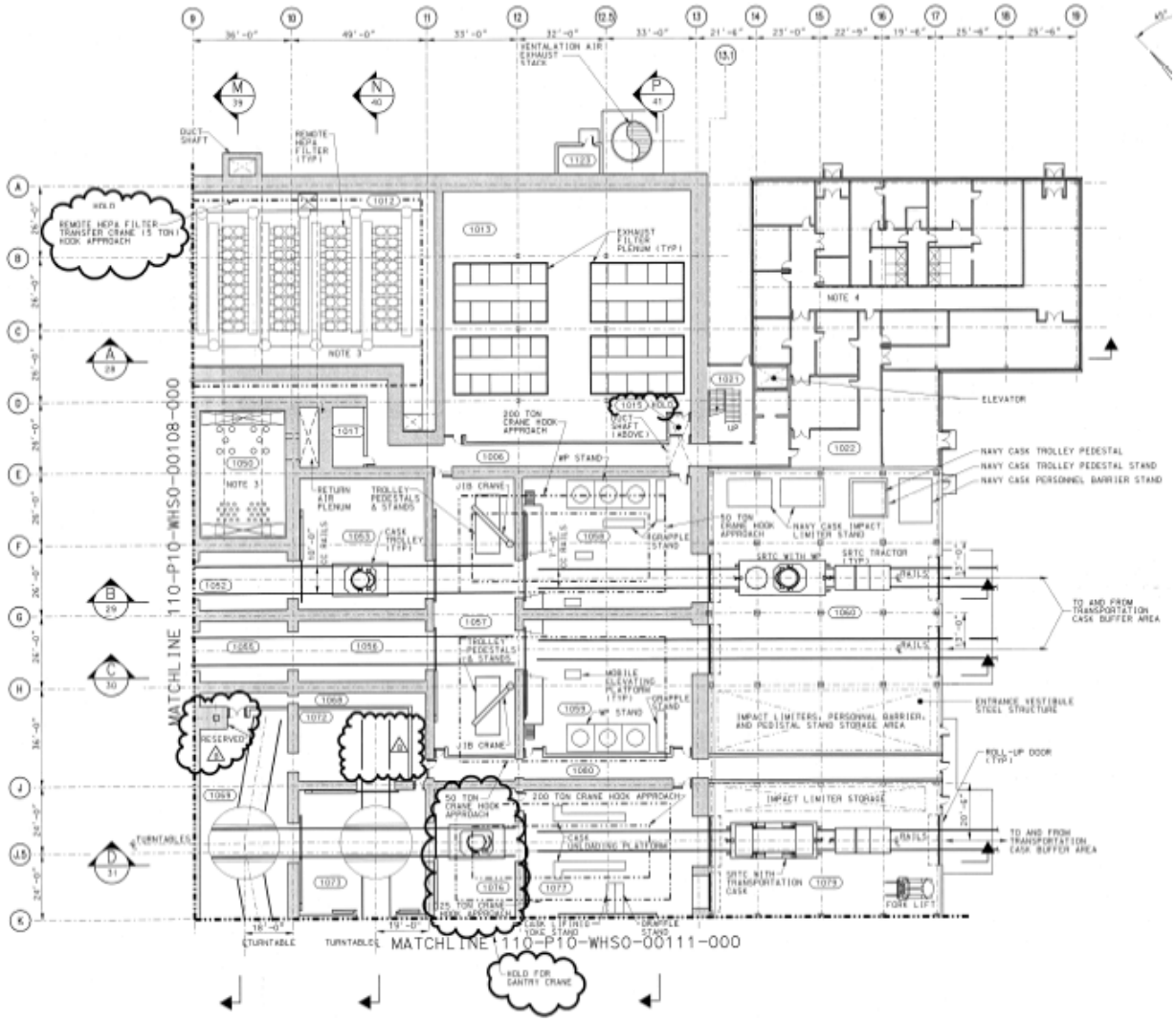
Source: BSC 2004j [DIRS 170273]

Figure 4. Dry Transfer Facility / Remediation Area Legend



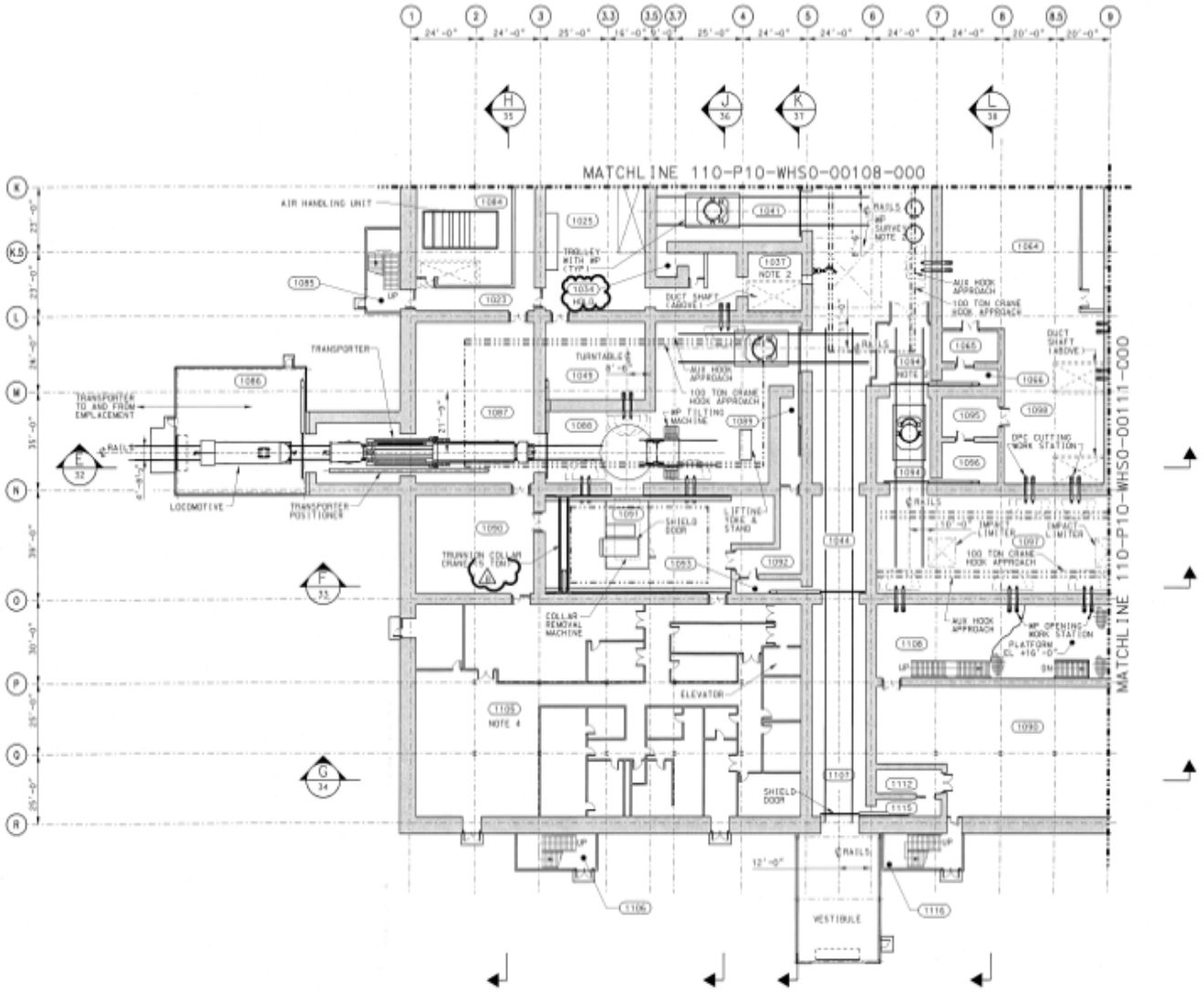
Source: BSC 2004k [DIRS 169068]

Figure 5. Dry Transfer Facility General Arrangement Ground Floor Plan A



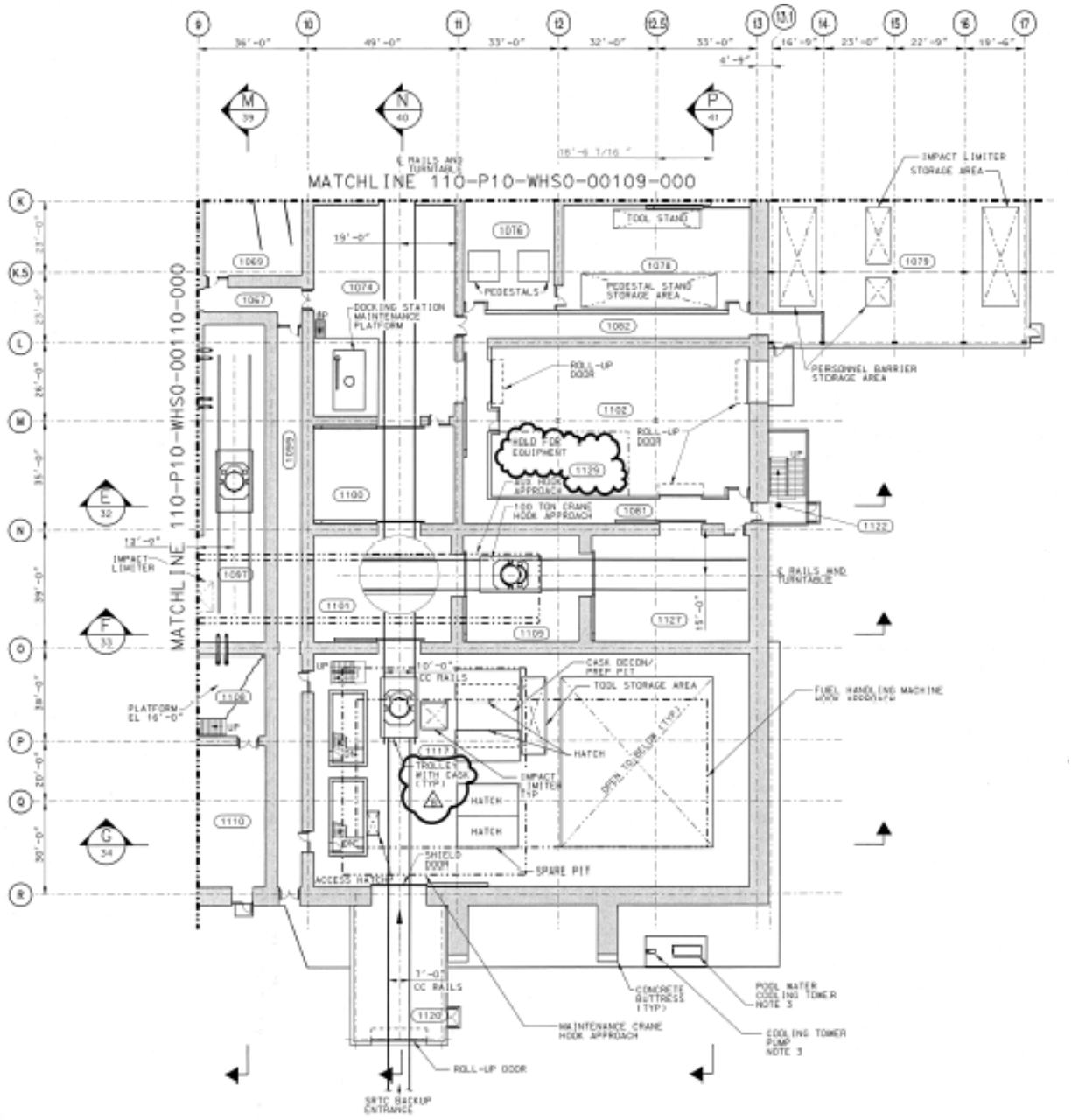
Source: BSC 2004l [DIRS 170345]

Figure 6. Dry Transfer Facility General Arrangement Ground Floor Plan B



Source: BSC 2004m [DIRS 170346]

Figure 7. Dry Transfer Facility General Arrangement Ground Floor Plan C



Source: BSC 2004n [DIRS 170347]

Figure 8. Dry Transfer Facility General Arrangement Ground Floor Plan D

SRTCs carrying loaded transportation casks with installed impact limiters and personnel barriers, if applicable, arrive in the cask and MSC SRTC receipt area (room 1077) of the DTF. Handling tools required for the type of cask to be received are prestaged. A radiological survey is performed on the cask upon arrival. The impact limiters and personnel barriers, if applicable, are unbolted and the 25-ton material handling crane removes the items and stages them adjacent to the SRTC. Additional inspections and radiological surveys are performed on the cask and impact limiters surfaces that were inaccessible. A forklift then moves the impact limiters and personnel barriers, if applicable, to the storage area inside the cask and MSC entrance vestibule (room 1079) of the DTF. A cask trolley is prepared with the appropriate pedestal and hold-down devices for the transportation cask and is staged in the cask and MSC to trolley transfer room (room 1076). The 200-ton cask handling crane upends the transportation cask from a horizontal to vertical position on the trolley and moves the cask from room 1077 to the trolley in room 1076. The crane places the transportation cask on the pedestal in the trolley and hold-down devices are fastened to the cask to secure it in place. The 200-ton cask handling crane is detached and returned to room 1077. An operator initiates automatic control with operator validation from a local workstation, which opens the shield door and moves the cask trolley into the cask/MSC turntable room (room 1073). The shield door closes after the trolley enters and the turntable rotates to align its tracks with the tracks leading into the cask preparation room (1074) when the trolley is in place (BSC 2004o [DIRS 171163], Section 4.2.3.1).

A horizontal DPC may be taken directly to the DTF or indirectly via the Cask Receipt and Return System. For the case that the Cask Receipt and Return System receives the transfer cask, it off-loads the cask to an SRTC, configures the cask for transfer with impact limiters, and transfers the cask to the DTF for waste processing and packaging to permit underground emplacement in the repository (BSC 2004a [DIRS 172109], Section 4.2.3.1). The transportation casks carrying horizontal DPCs are handled in the same manner as transportation casks licensed under 10 CFR Part 71 [DIRS 104091] for transporting SNF and HLW on the nation's highways and railroads and unloaded in the same manner as casks containing vertical DPCs (Assumption 5.2.6).

Loaded MSCs are prepared for waste transfer operations in a similar manner as that of loaded transportation casks and in the same locations, except that loaded MSCs are received in the DTF entrance vestibule in a vertical position by an MSC transporter (BSC 2004o [DIRS 171163], Section 4.2.3.1).

Table 8a lists the applicability of generic events to the DTF cask and MSC entrance vestibule, the cask and MSC SRTC receipt area, and the cask and MSC to trolley transfer room; Table 8b lists potential events for each applicable category.

Table 8a. Generic Events Applicability to the DTF Cask and MSC Entrance Vestibule, the Cask and MSC SRTC Receipt Area, and the Cask and MSC to Trolley Transfer Room

Generic Event Category	Is Generic Event Applicable?
Collision/Crushing	Yes
Chemical Contamination/Flooding	Yes
Explosion/Implosion	Yes; also see Fire
Fire	Yes
Radiation/Magnetic/Electrical/Fissile	Yes, Radiation/Fissile
Thermal	Yes (see Fire)

Sources: BSC 2004a [DIRS 172109], Section 4.2.3.1; BSC 2004i [DIRS 171598], Section B.1.1.1; BSC 2004o [DIRS 171163], Section 4.2.3.1; Cogema 2004b [DIRS 168043]

Table 8b. Potential Events for the DTF Cask and MSC Entrance Vestibule, the Cask and MSC SRTC Receipt Area, and the Cask and MSC to Trolley Transfer Room

Generic Event Category	Potential Event
Collision/Crushing	1. SRTC derailment involving a loaded cask (with impact limiters installed) followed by a load tipover or fall. 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. 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). 4. MSC transporter collision or overturning involving a loaded MSC followed by a load tipover or fall. 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. 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. 7. Collision of a mobile elevated platform with a loaded cask during removal of the personnel barriers and impact limiters or during survey activities. 8. Forklift collision with a cask on an SRTC (with or without impact limiters installed on the cask) or the SRTC holding the cask. 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. 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.

Generic Event Category	Potential Event
	11. Drop or collision of personnel barriers or impact limiters from the receipt area crane onto or against a loaded cask. 12. Slapdown of a loaded cask onto an SRTC during the upending of the loaded cask to the vertical orientation by the overhead crane. 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. 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. 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. 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. 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. 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. 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. 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. 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. 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. 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.

Generic Event Category	Potential Event
	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. 25. Drop or collision of handling equipment from an overhead bridge crane onto or against a loaded cask or MSC. 26. Drop or collision of equipment from the maintenance crane onto or against a loaded cask or MSC. 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. 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. 29. Derailment of a trolley holding a cask or MSC on a pedestal followed by a load tipover or fall.
Chemical Contamination/Flooding	Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures.
Explosion/Implosion	1. Hydrogen explosion involving batteries on a cask trolley. 2. Hydrogen explosion involving batteries on a forklift. 3. Hydrogen explosion involving batteries on a mobile elevated platform.
Fire, Thermal	1. Electrical fire associated with the cask and MSC SRTC receipt area overhead cranes. 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. 3. Diesel fuel fire/explosion involving an SRTC tractor pulling or pushing an SRTC holding a loaded cask. 4. Diesel fuel fire/explosion involving an MSC transporter holding a loaded MSC. 5. Fire/explosion (battery/electrical fire) associated with the cask trolley. 6. Fire/explosion (battery/electrical fire) associated with a forklift. 7. Fire/explosion (battery/electrical fire) associated with a mobile elevated platform.

Generic Event Category	Potential Event
	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. 9. Thermal hazard (from decay heat) associated with a vertical orientation of a loaded cask.
Radiation	1. Radiation exposure of a facility worker and/or the offsite public. 2. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation. 3. Radiation-induced damage to a facility SSC.
Fissile	1. Criticality associated with an SRTC derailment or collision followed by a load tipover or fall and a rearrangement of cask internals. 2. Criticality associated with a cask drop, slapdown, or collision and rearrangement of cask internals. 3. Criticality associated with an MSC drop, slapdown, or collision and rearrangement of cask internals. 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.

6.6.3.2 Dry Transfer Facility: Cask/MSC Turntable Room, Cask Preparation Room

Area Description/Process Description: The cask preparation room (room 1074) is a concrete cell with two electrically operated, sliding, shield doors, on directly opposite walls. The cask docking ring installation room (room 2051) is located directly above room 1074. Two hatches provide access between the rooms. When a loaded cask is positioned properly under the northern-most hatch, cask preparations are performed from room 2051. When SNF or HLW is transferred to an MSC, the loaded MSC is returned to room 1074 for bolting the inner lid, inerting, installation of the outer lid, exterior surface surveying, and decontamination (BSC 2004i [DIRS 171598], Section B.1.1.1).

From the cask/MSC turntable room (room 1073), the trolley moves forward and passes a shielded door to the cask preparation room (room 1074). The shield door then closes. The transportation cask is prepared manually for unloading. Personnel at shielded workstations above room 1074 perform gas-sampling operations on the cask, which may vary between cask designs. The cask is sent to the Remediation System if the gas sampling results exceed the requirements. For casks with double lid designs, after removing the outer lid, personnel check and sample the interior cask pressure and gas and then vent the cask interior according to the cask specific procedures. Personnel then remove the inner lid bolts and install the cask docking rings. For casks with single-lid designs, personnel check and sample interior cask pressure and

gas before removing the lid bolts and installing the docking rings with the 20-ton cask docking ring crane. The levelness of the docking ring sealing surface is verified and adjusted as necessary. Sufficient lid bolts are left engaged to prevent the lid from coming off during cask transfer. After the docking ring is installed, the cask is ready to be moved to the cask and MSC docking room (room 1069). The prepared cask is moved from room 1074 to room 1073, oriented, and moved to the cask and MSC docking room (room 1069) (BSC 2004o [DIRS 171163], Section 4.2.3.1.1).

Table 9a lists the applicability of generic events to the DTF Cask/MSC Turntable Room and the Cask Preparation Room; Table 9b lists potential events for each applicable category.

Table 9a. Generic Events Applicability to the DTF Cask/MSC Turntable Room and the Cask Preparation Room

Generic Event Category	Is Generic Event Applicable?
Collision/Crushing	Yes
Chemical Contamination/Flooding	Yes
Explosion/Implosion	Yes, also see Fire
Fire	Yes
Radiation/Magnetic/Electrical/Fissile	Yes, Radiation/Fissile
Thermal	Yes (see fire)

Sources: BSC 2004i [DIRS 171598], Section B.1.1.1; BSC 2004o [DIRS 171163], Sections 4.2.3.1.1

Table 9b. Potential Events for the DTF Cask/MSC Turntable Room and the Cask Preparation Room

Generic Event Category	Potential Event
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. 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. 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. 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). 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). 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. 7. Drop of a cask or MSC outer lid from the overhead crane onto the cask or

Generic Event Category	Potential Event
	MSC (if applicable) in the cask preparation room. 8. Drop or collision of a docking ring onto or against a cask or MSC in the cask preparation room.
Chemical Contamination/Flooding	Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures.
Explosion/Implosion	1. Cask purging or sampling system (or other pneumatic or pressurized system) missile due to a fractured nozzle/valve stem/pneumatic device. 2. Explosion hazard associated with the cask sampling and purging system and the ignition of hydrogen that may have accumulated in the cask. 3. Hydrogen explosion involving batteries on a trolley.
Fire, Thermal	1. Electrical fire associated with the cask preparation area 20-ton overhead crane (in room 2051). 2. Electrical fire associated with handling equipment or other cask preparation area equipment, including the turntable. 3. Fire/explosion (battery/electrical fire) associated with the trolley. 4. Transient combustible fire in the cask preparation room or the cask/MSC turntable room. 5. Thermal hazard (from decay heat) associated with vertical orientation of the loaded cask. 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.
Radiation	1. Radiation exposure of a facility worker and/or the offsite public. 2. Damage or rupture of cask sampling and purging system, leading to a release of cask or MSC internal gases and radioactive material. 3. Thermal expansion of gases or other loss of confinement in an unsealed cask or MSC, leading to radiological release. 4. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation. 5. Radiation-induced damage to a facility SSC.
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.

Generic Event Category	Potential Event
	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.

6.6.3.3 Dry Transfer Facility: Cask and MSC Docking Room

Area Description/Process Description: The cask and MSC docking room (room 1069) is a concrete cell adjacent to the cask/MSC turntable room (room 1073). It has one electrically operated; sliding shield door that provides an air lock between rooms 1069 and 1073. Trolley tracks extend from room 1073 into room 1069 to a cask turntable. On the north and south sides, trolley tracks extend from the cask turntable to a room directly under a docking port (BSC 2004i [DIRS 171598], Section B.1.1.1).

Three subcomponents comprise a docking station: a docking port, docking rings, and gantry crane. The docking port consists of a mobile slab and a cell plug. The slab provides the confinement seal between the inside of the waste transfer cell and a docking room, while allowing vertical movement to facilitate the docking of a transportation cask, MSC, or WP. The cell plug is placed inside the slab to complete the closure of the port when nothing is docked to the waste transfer cell floor. The plug is normally locked to the mobile slab and includes a latching mechanism that attaches to a lift fixture on the lid of the transportation cask, MSC, or WP being docked. The plug is removed along with the lid.

The docking rings are installed by the Cask/MSC/WP preparation system. Docking rings are placed on an incoming transportation cask, MSC, or WP during the cask or WP preparation process. Docking rings enable the connection of transportation casks, MSCs, and WPs of various diameters to the fixed diameter docking port and minimize the spread of contamination.

The gantry crane places or removes the cell plug; the transportation cask, MSC or WP lid; and the inner docking ring, together as one element. It consists of a two-drum hoist with a pulley block directly connected to the cell plug. It travels on a short length of track to place or remove the cell plug, lid, and inner docking ring allowing access to the inside of the transportation cask, MSC, and WP during waste transfer operations (BSC 2004p [DIRS 171164], Section 4.1.1.1.2).

When a prepared cask is ready to be brought into the cask and MSC docking room (room 1069), the sliding door is opened and the trolley with the cask is brought in and secured to the turntable. The door is closed. The turntable is oriented toward the selected docking port and the trolley-locking device disengaged. The trolley is moved under one of two transfer docking ports. When positioning of the trolley results in cask alignment with the docking port, the trolley is secured in place, and control is passed to the SNF/HLW transfer system. The SNF/HLW transfer system establishes a confinement seal between the docking ring on the loaded cask and the docking port. A lifting device is inserted through the port plug and attached to the cask inner lid. The inner lid is lifted and locked in place against the port plug. The port plug with inner lid attached is then removed from the port and staged in the waste transfer cell (room 2048) (BSC 2004i [DIRS 171598], Section B.1.1.1).

Table 10a lists the applicability of generic events to the DTF cask docking room; Table 10b lists potential events for each applicable category.

Table 10a. Generic Events Applicability to the DTF Cask and MSC Docking Room

Generic Event Category	Is Generic Event Applicable?
Collision/Crushing	Yes
Chemical Contamination/Flooding	Yes
Explosion/Implosion	Yes, also see Fire
Fire	Yes
Radiation/Magnetic/Electrical/Fissile	Yes, Radiation/Fissile
Thermal	Yes (see fire)

Sources: BSC 2004i [DIRS 171598], Section B.1.1.1; BSC 2004p [DIRS 171164, Section 4.1.1.1.2

Table 10b. Potential Events for the DTF Cask and MSC Docking Room

Generic Event Category	Potential Event
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. 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. 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. 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). 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). 6. Drop or collision of a docking port (mobile slab) onto or against a cask or MSC. 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). 8. Drop of an inner lid into a cask or MSC (with outer lid removed [if applicable]).

Chemical Contamination/Flooding	Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures.
Explosion/Implosion	Hydrogen explosion involving batteries on a cask trolley.
Fire, Thermal	1. Electrical fire associated with handling equipment or other cask and MSC docking room equipment (including the turntable). 2. Fire/explosion (battery/electrical fire) associated with the cask trolley. 3. Transient combustible fire in the cask and MSC docking room. 4. Thermal hazard (from decay heat) associated with vertical orientation of the loaded cask. 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.
Radiation	1. Radiation exposure of a facility worker and/or the offsite public. 2. Docking ring failure leads to a radiological release. 3. Radiological release due to installation of incorrect docking ring. 4. Thermal expansion of gases or other loss of confinement in an unsealed cask or MSC, leading to radiological release. 5. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation. 6. Radiation-induced damage to a facility SSC.
Fissile	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.

6.6.3.4 Dry Transfer Facility: Empty WP and MSC Processing Prior to Loading

Area Description/Process Description: Empty WPs are received at the Waste Package Receipt Facility and placed in storage with a matched set of lids (inner, middle, and outer) and a transfer pedestal. These items are moved on an SRTC to the TCBA. When needed, a WP with lids and pedestal are moved from the TCBA into the WP and navy cask entrance vestibule (room 1060) of the DTF via one of two WP rail lines. When a WP is brought into the DTF using the south WP rail, the exterior door of room 1060 is closed and the WP, pedestal, and lids are moved into the WP SRTC receipt area (room 1059). Any protective enclosures and WP tie-downs are released and removed. The pedestal is removed from the SRTC to the WP/navy to trolley transfer room (room 1057) where it is placed and secured on a WP transfer trolley. The empty

WP is lifted from the SRTC and moved to room 1057, where it is lowered onto the WP pedestal and secured. The WP outer and middle lids are removed from the SRTC to the WP closure support room (room 2024) and stored until needed. The inner lid is moved from room 1059 and placed into the WP. The transfer trolley is moved from room 1057 to the WP preparation room (room 1056). A WP docking ring is removed from the WP docking ring installation room (room 2050), and manually installed on the WP (BSC 2004i [DIRS 171598], Section 4.1.4). Cask docking rings are used to connect the transportation casks and MSCs to the waste transfer cell docking ports and to minimize the spread of contamination. An assembly, consisting of an inner-docking ring and an outer docking ring, performs these functions. The inner ring forms the seal with the upper face of the lid and forms the seal with the lower face of the cell plug to protect the bottom face of the plug and the upper face of the lid from contamination. The outer ring forms a seal to the mobile slab and to the top of the cask to minimize the spread of contamination from the waste transfer cell to the cask and MSC docking room (room 1069) (BSC 2004o [DIRS 171598], Section 4.1.4).

If required, other damage and contamination control materials are manually installed. The transfer trolley with a WP is moved into the WP docking cell (room 1055) and positioned for subsequent transfer operations.

Similar operations occur when a WP is brought into the DTF using the north WP rail line, and processed through the WP and navy cask entrance vestibule (room 1060), the WP/navy cask SRTC receipt area (room 1058), the WP/navy to trolley transfer room (room 1057), and the WP/navy cask preparation room (room 1053) to the WP docking cell (room 1052) (BSC 2004i [DIRS 171598], Section 4.1.4).

If a waste shipment contains high-heat commercial SNF, thermal aging may be required. In this event, commercial SNF is transferred to an MSC for transport to the SNF Aging System. An empty MSC is moved from the WNNRF or the TCBA to the cask and MSC entrance vestibule (room 1079). The exterior door of room 1079 is closed and the MSC is moved into the cask and MSC SRTC receipt area (room 1077). A smear test and radiation survey of the MSC surface are taken if necessary, MSC tie-downs are released and removed, and the cask is upended to a vertical position. The MSC is lifted from the SRTC and moved to the cask and MSC to trolley transfer room (room 1076) where it is lowered and secured onto the transfer trolley. The MSC is moved through the Cask/MSC turntable room (room 1073) to the cask preparation room (room 1074) where the MSC outer lid is removed and stored, access cover is removed, gas samples are taken and analyzed if the MSC has been previously used, the inner lid bolts removed, and an MSC docking ring installed. The MSC is then moved through the cask/MSC turntable room (room 1073) to the cask and MSC docking room (room 1069) and positioned for subsequent transfer operations (BSC 2004i [DIRS 171598], Section 4.1.4).

Table 11 lists the applicability of generic events to empty WP and MSC processing prior to loading in the DTF.

Table 11. Generic Events Applicability to Empty WP and MSC Processing Prior to Loading in the DTF.

Generic Event Category	Is Generic Event Applicable?
Collision/Crushing	None identified that affect/interact with a waste form
Chemical Contamination/Flooding	None identified that affect/interact with a waste form
Explosion/Implosion	None identified that affect/interact with a waste form
Fire	None identified that affect/interact with a waste form
Radiation/Magnetic/Electrical/Fissile	None identified that affect/interact with a waste form
Thermal	None identified that affect/interact with a waste form

Source: BSC 2004i [DIRS 171598], Section 4.1.4

6.6.3.5 Dry Transfer Facility (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

Area Description/Process Description: The WP and navy cask entrance vestibule (room 1060) is a single story steel frame structure with four electric operated roll-up doors, two at each end of the vestibule. Two sets of rail tracks pass through the structure. There are no cranes in this vestibule, but space is provided for operation of a 10-ton forklift in the room. The primary function of the vestibule is to allow the SRTC with WP or naval SNF cask to enter the facility without exposing the interior of the facility to the external environment. The design allows for the entire transport vehicle including the SRTC and an SRTC tractor to be moved into the facility and the outer door closed. The inner door is opened and the SRTC is moved into the WP/navy cask SRTC receipt area (room 1058) or the WP SRTC receipt area (room 1059), positioned, and disengaged from the site tractor. The SRTC tractor is moved back into the entrance vestibule and the inner door closed. The entrance vestibule outer door is opened and the SRTC tractor removed for other activities. The WP and navy entrance vestibule is used to store at least one set of naval SNF cask impact limiters. Waste package and naval SNF cask identification is performed in the entrance vestibule to verify the proper naval SNF cask or WP has been received to support operations (BSC 2004i [DIRS 171598], Section B.1.1.1).

A naval SNF cask is brought into the WP/navy cask SRTC receipt area (room 1058) using the north WP rail line. Personnel barriers (if any) and impact limiters are removed and stored. A smear test and radiation survey of the cask surface is taken, cask tie-downs are released and removed, and the cask is upended to a vertical position. The cask is lifted from a horizontal to vertical position on the SRTC and moved to the WP/navy to trolley transfer room (room 1057), where it is lowered and secured onto the transfer trolley. The transfer trolley is moved to the WP/navy cask preparation room (room 1053) where gas samples are taken and analyzed, and lid bolts removed (BSC 2004i [DIRS 171598], Section 4.1.4). Docking rings are not used for naval SNF casks or for WPs prepared for receiving naval SNF canisters (BSC 2004o [DIRS 171163], Section 4.1.1.1.4.2).

The WP trolleys associated with the Cask/MSC/WP Preparation System are powered by external means (with power supplied by an external source; Assumption 5.2.9) (Areva 2004 [DIRS 168042]).

The WP/navy cask preparation room (room 1053) is a concrete cell with one set of trolley tracks that extend through the room. The room is located between the WP/navy to trolley transfer room (room 1057) and the WP docking cell (room 1052), and is open to the roof. This room has two sliding doors. The WP/navy cask preparation room (room 1053) is sized to handle naval SNF casks. Preparing the naval SNF cask for waste transfer includes cask cavity gas sampling and analysis, and venting to normalize cask cavity pressure. Gas sampling and venting is performed via the cask sampling ports and couplings. The cask lid bolts are removed and the cask is moved to the WP loading (navy canister)/docking ring removal cell (room 1051) for transfer operations (BSC 2004i [DIRS 171598], Section B.1.1.1).

Table 12a lists the applicability of generic events to naval SNF receipt in the WP and navy cask entrance vestibule, WP/navy cask SRTC receipt area, and the WP/navy to trolley transfer room. Table 12b lists potential events for each applicable category.

Table 12a. Generic Events Applicability to Naval SNF Receipt in the DTF WP and Navy Cask Entrance Vestibule, WP/Navy Cask SRTC Receipt Area, WP/Navy to Trolley Transfer Room, and WP/Navy Cask Preparation Room

Generic Event Category	Is Generic Event Applicable?
Collision/Crushing	Yes
Chemical Contamination/Flooding	None identified that affect/interact with a waste form
Explosion/Implosion	Yes; also see Fire
Fire	Yes
Radiation/Magnetic/Electrical/Fissile	Yes, Radiation/Fissile
Thermal	Yes (see fire)

Sources: Areva 2004 [DIRS 168042]); BSC 2004i [DIRS 171598], Section B.1.1.1; BSC 2004o [DIRS 171163], Section 4.1.1.1.4.2

Table 12b. Potential Events for Naval SNF Receipt in the DTF WP and Navy Cask Entrance Vestibule, WP/Navy Cask SRTC Receipt Area, WP/Navy to Trolley Transfer Room, and WP/Navy Cask Preparation Room

Generic Event Category	Potential Event
Collision/Crushing	1. SRTC derailment involving a loaded naval SNF cask followed by a load tipover or fall. 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. 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. 4. Collision of mobile elevated platforms with a loaded naval SNF cask during removal of personnel barriers and impact limiters or during survey activities. 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.

Generic Event Category	Potential Event
	6. Drop or collision of personnel barriers or impact limiters from the receipt area crane onto or against a loaded naval SNF cask. 7. Slapdown of a loaded naval SNF cask onto an SRTC during upending of the loaded cask to the vertical orientation. 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. 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. 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. 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. 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. 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. 14. Drop or collision of handling equipment from the overhead bridge crane onto or against a loaded naval SNF cask. 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. 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. 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. 18. Derailment of a trolley holding a naval SNF cask on a pedestal followed by a load tipover or fall.
Explosion/Implosion	1. Hydrogen explosion involving batteries on a forklift.

Generic Event Category	Potential Event
	2. Hydrogen explosion involving batteries on a mobile elevated platform.
Fire, Thermal	1. Electrical fire associated with the WP/navy cask SRTC receipt area overhead cranes. 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. 3. Diesel fuel fire/explosion involving an SRTC tractor pulling or pushing an SRTC holding a naval SNF cask containing a naval SNF canister. 4. Electrical fire associated with a trolley holding a naval SNF cask containing a naval SNF canister. 5. Fire/explosion (battery/electrical fire) associated with a forklift. 6. Fire/explosion (battery/electrical fire) associated with a mobile elevated platform. 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. 8. Thermal hazard (from decay heat) associated with a vertical orientation of a loaded naval SNF cask.
Radiation	1. Radiation exposure of a facility worker and/or the offsite public. 2. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation. 3. Radiation-induced damage to a facility SSC.
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. 2. Criticality associated with a naval SNF cask drop, slapdown, or collision and rearrangement of cask internals. 3. Criticality associated with naval SNF cask trolley derailment followed by a load tipover or fall and a rearrangement of the cask internals.

6.6.3.6 Dry Transfer Facility (Naval SNF Processing): WP Docking Cell, WP Loading (Navy Canister)/Docking Ring Removal Cell, WP Loading/Docking Ring Removal Cell

Area Description/Process Description: The WP docking cell (room 1052) provides a path to the WP (navy canister)/docking ring removal cell (room 1051) to position a naval SNF cask for naval SNF canister transfer operations.

The WP loading (navy canister)/docking ring removal cell (room 1051) is a concrete cell located adjacent to the WP docking cell (room 1052) and the WP handling and staging cell (room 1044). One set of trolley tracks connects the three rooms. The WP loading (navy canister)/docking ring removal cell (room 1051) has one shield door separating it from room 1044. Room 1051 provides a clean area where naval SNF casks can be positioned for canister transfer. The cask/MSC/WP preparation system positions the navy cask for transfer operations. The SNF/HLW transfer system assumes control, removes the cask lid, and initiates transfer operations between the naval SNF cask (in room 1051) and an empty WP positioned in the WP loading/docking ring removal cell (room 1054) (transfer is conducted over the wall between the two rooms) (BSC 2004i [DIRS 171598], Section B.1.1.1).

The WP trolleys associated with the Cask/MSC/WP Preparation System are powered by external means (with power supplied by an external source; Assumption 5.2.9) (Areva 2004 [DIRS 168042]).

The 70-ton navy canister-handling crane is used to perform naval SNF canister handling operations in the WP loading (navy canister)/docking ring removal cell (room 1051) (BSC 2004p [DIRS 171164], Section 4.1.1.1.2).

Once the transfer is completed, the dose rate in the cask is monitored, the cask interior is visually inspected for remaining items, and the lids are returned to the naval SNF cask and WP (BSC 2004i [DIRS 171598], Section 4.1.4).

Table 13a lists the applicability of generic events to naval SNF processing in the DTF WP/navy cask preparation room, WP docking cell, and the WP loading (navy canister)/docking ring removal cell; Table 13b lists potential events for each applicable category.

Table 13a. Generic Events Applicability to Naval SNF Processing in the DTF WP Docking Cell, the WP Loading (Navy Canister)/Docking Ring Removal Cell, and the WP Loading/Docking Ring Removal Cell

Generic Event Category	Is Generic Event Applicable?
Collision/Crushing	Yes
Chemical Contamination/Flooding	None identified that affect/interact with a waste form
Explosion/Implosion	None identified that affect/interact with a waste form
Fire	Yes
Radiation/Magnetic/Electrical/Fissile	Yes, Radiation/Fissile
Thermal	Yes (see fire)

Sources: Areva 2004 [DIRS 168042]; BSC 2004i [DIRS 171598], Sections B.1.1.1 and 4.1.4; BSC 2004p [DIRS 171164], Section 4.1.1.1.2

Table 13b. Potential Events for Naval SNF Processing in the DTF WP Docking Cell, the WP Loading (Navy Canister)/Docking Ring Removal Cell, and the WP Loading/Docking Ring Removal Cell

Generic Event Category	Potential Event
Collision/Crushing	1. Derailment of a trolley holding a loaded naval SNF cask on a pedestal followed by a load tipover or fall. 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. 3. Drop of a naval SNF cask inner lid (if applicable) from the 70-ton navy canister handling crane onto a naval SNF canister. 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. 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. 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. 7. Drop or collision of a naval SNF canister from the 70-ton navy canister handling crane onto or against a sharp object. 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. 9. Drop of a naval SNF canister from the 70-ton navy canister handling crane onto the navy transfer/docking ring removal cell floor. 10. Impact due to horizontal movement of the naval SNF canister before it is

Generic Event Category	Potential Event
	completely removed from the naval transportation cask. 11. Drop or collision of a naval SNF canister from the 70-ton navy canister handling crane into or against the WP. 12. Drop or collision of handling equipment into or against an open WP loaded with a naval SNF canister. 13. Drop of a WP inner lid from the WP docking cell crane into a loaded naval WP.
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.). 2. Electrical fire associated with the trolley holding either a loaded, unsealed WP or a loaded naval SNF cask holding a naval SNF canister. 3. Thermal hazard (from decay heat) associated with a vertical orientation of the naval SNF cask. 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. 5. Transient combustible fire in the WP docking cell or the WP loading (naval SNF canister)/docking ring removal cell.
Radiation	1. Radiation exposure of a facility worker and/or the offsite public. 2. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation. 3. Inadvertent opening of a shield door, leading to a worker exposure. 4. Radiation-induced damage to a facility SSC.
Fissile	Criticality associated with a naval SNF cask drop, slapdown, or collision and rearrangement of cask internals

6.6.3.7 Dry Transfer Facility: Cask and MSC Docking Room, Waste Transfer Cell, WP Docking Cell, WP Loading/Docking Ring Removal Cell

Area Description/Process Description: The dry transfer subsystem consists of a lower level and multiple upper levels inside the DTF building to transfer the SNF/HLW from a loaded cask, MSC, staging, or DPC to an empty WP, empty or unloaded MSC, or staging area. The lower level of the subsystem houses the casks, MSCs, and WPs that are docked (except for naval SNF

canister transfer) and prepared for transfer operations. The upper level of the subsystem includes various components to transfer the SNF/HLW out of the loaded cask, MSC, or DPC and into the empty WP, empty or unloaded MSC, or staging area (BSC 2004p [DIRS 171164], Section 4.1.1.1.2).

The waste transfer cell (room 2048) is a concrete cell located directly over five ground floor transfer rooms: DPC cutting/WP dry remediation cell (room 1097), cask and MSC docking room (room 1069), WP docking cell (room 1052), the WP docking cell (room 1055), and SNF and canister staging cell (room 1050). The waste transfer cell (room 2048) is open from the operating floor to the roof. One shield door at the south end separates it from the canister/HLW handling crane park cell (room 2068). The operating floor has penetrations into the five processing rooms, including two in room 1069. Room 2048 has four (30-ton) WP docking gantry cranes located over the two port plugs in room 1069 and those of rooms 1052 and 1055 (BSC 2004i [DIRS 171598], Section B.1.1.2).

Major rooms and equipment used by the dry transfer subsystem at the lower level include (BSC 2004p [DIRS 171164], Section 4.1.1.1.2):

- The cask and MSC docking room (room 1069) for most casks, including MSCs
- The WP loading (navy canister)/docking ring removal cell (room 1051)
- The WP docking cells (rooms 1052, 1055)
- The WP loading (navy canister)/docking ring removal cells (rooms 1054, 1051) for transfer of naval SNF canisters
- DPC docking room (room 1101) for casks containing DPCs
- Tools for remote maintenance.

Major equipment used by the subsystem at the upper levels includes:

- The spent fuel transfer machine: the spent fuel transfer machine is used to move SNF assemblies in the waste transfer cell (room 2048)
- Grapples and recovery devices to move the SNF assemblies
- The 70-ton canister/HLW handling crane: this crane is used to engage, lift, transfer, and position DOE canisters in the waste transfer cell (room 2048) and naval SNF canisters from remediated WPs. The crane is designed to engage and lift different types of canisters arriving in different types of casks. The crane is designed to handle DOE SNF and DOE HLW canisters, naval SNF canisters, and MCO canisters.
- Grapples and recovery devices to move the DOE canisters and the MCOs
- A naval SNF canister grapple

- A naval SNF cask lid grapple
- A naval WP inner lid grapple and inner lid restraining device actuator
- A WP inner lid grapple
- Two cask docking stations (one also used for MSC loading/unloading) with a shielded-lid handling device
- Two WP docking stations with a WP inner lid handling device and inner lid restraining device actuator
- DPC docking station
- The fuel assembly and canister staging (staging racks) for SNF assemblies and DOE SNF/HLW canisters (10 canisters, 72 BWR assemblies, and 48 PWR assemblies)
- Master/slave manipulators
- Shielded viewing windows
- Tools for remote maintenance
- Crane park shield door.

Docking stations provide mechanisms and confinement boundaries that enable the docking of transportation casks, MSCs, and WPs to the waste transfer cell (room 2048) or the DPC cutting/WP dry remediation cell (room 1097). Docking stations also provide the mechanisms to remove and replace transportation cask, MSC, and WP lids. Two transportation cask or MSC docking stations connect the waste transfer cell (room 2048) with the cask and MSC docking room (room 1069). The two WP docking stations connect the WP docking cells (rooms 1052 and 1055) to the waste transfer cell (room 2048). One docking station connects the DPC docking room (room 1101) to the DPC cutting/WP dry remediation cell.

Each docking station includes a docking port plug, a mobile slab, and a gantry crane for docking port plug and transportation cask, MSC, and WP lid removal operations. Docking stations are designed to minimize the waste transfer cell leakage rate during transfer operations and not overturn, derail or lose structural components during a seismic event. Three subcomponents comprise a docking station: a docking port, docking rings, and gantry crane. The docking port consists of a mobile slab and a cell plug. The slab provides the confinement seal between the inside of the waste transfer cell and a docking room, while allowing vertical movement to facilitate the docking of a transportation cask, MSC, or WP. The cell plug is placed inside the slab to complete the closure of the port when nothing is docked to the waste transfer cell floor. The plug is normally locked to the mobile slab and includes a latching mechanism that attaches to a lift fixture on the lid of the transportation cask, MSC, or WP being docked. The plug is removed along with the lid. The docking rings are installed by the Cask/MSC/WP Preparation System. Docking rings are placed on an incoming transportation cask, MSC, or WP during the

cask or WP preparation process. Docking rings enable the connection of transportation casks, MSCs, and WPs of various diameters to the fixed diameter docking port and minimize the spread of contamination. The gantry crane places or removes the cell plug; the transportation cask, MSC, or WP lid; and the inner docking ring together as one element (BSC 2004p [DIRS 171164], Section 4.1.1.1.2).

The dry transfer subsystem performs the following normal operations (BSC 2004p [DIRS 171164], Section 4.2.3.1.2):

- Transfer from cask/MSC to WP or to staging
- Transfer from (opened) DPC to WP or to staging
- Transfer from cask to MSC
- Transfer from staging to WP or MSC.

Except for naval SNF canisters, transfer operations begin with the activation of a port docking device by the SNF/HLW transfer system. For a loaded cask and MSC, the port docking device is lowered to engage the cask-docking ring and establish confinement, the docking port plug and cask inner lid are removed, and the contents verified. These removal operations are accomplished using a WP docking gantry crane. Similar operations are conducted to establish confinement with an empty WP positioned in room 1052 or room 1055. If SNF aging is required, similar operations are conducted to establish confinement with an empty or unloaded MSC positioned at one of the docking ports of room 1069.

Appropriate grapples are used with the spent fuel transfer machine to remove commercial SNF assemblies from loaded casks and MSCs. The spent fuel transfer machine has a lifting capacity of 1.5-tons. The spent fuel transfer machine transfers SNF from the loaded cask or MSC into the empty WP, MSC, or staging racks in room 1050, as appropriate (BSC 2004i [DIRS 171598], Section B.1.1.2).

The SNF and canister staging cell (room 1050) provides space for staging bare fuel assemblies and DOE canisters. This staging room provides space for 72 BWR fuel assemblies, 48 PWR fuel assemblies, and 10 DOE canisters. Staging fuel assemblies or canisters could be required for the following reasons (BSC 2004i [DIRS 171598], Section 4.1.4.1):

- Thermal management of WPs (keeping the thermal limit of the WP at or below 11.8 kW)
- A transportation cask may contain more fuel assemblies than can be placed in a WP (i.e., transportation casks can deliver 1 to 85 fuel assemblies; while WPs can be loaded with 12 to 44 fuel assemblies)
- Mismatch of fuel assemblies types: 5 different fuel assembly types require different WPs
- Mismatch of canister types: 3 different canisters with fuel assemblies and defense high level waste (5-DHLW/DOE Short, 5-DHLW/DOE Long, 2-MCO/2-DHLW)

- To meet WP thermal limits, the DTF provides space to stage approximately 120 fuel assemblies until they can be loaded directly into a WP. Additional staging space is provided outside the DTF.

Ultimately, staged fuel will be put into a WP or MSC. When the transfer is completed, the dose rate in the cask is remotely mapped and the cask interior is visually inspected for remaining items using remotely operated cameras. Following transfer operations, the inner lid lip of the WP and cask or MSC is visually inspected for debris, debris removed as required, and inner lids are replaced (BSC 2004i [DIRS 171598], Section B.1.1.2). The inner lid is mechanically restrained in place before the WP is moved to the closure area (BSC 2004q [DIRS 171499], Section 2.3).

For DOE SNF/HLW canister transfers, the cask lid is removed, the content identification verified, the canister transferred from the cask or MSC to a WP or to the staging racks in room 1050 using the overhead 70-ton overhead bridge crane, and the WP and cask or MSC inner lids are replaced.

If the transfer of commercial SNF from an opened DPC is required, the spent fuel transfer machine with appropriate grapples is used to transfer the fuel assemblies from the opened DPC to a WP positioned in a WP docking cell (room 1052 or room 1055), or to the staging racks in room 1050. Access to the DPC is made through the hatch between the waste transfer cell (room 2048) and the DPC cutting/WP dry remediation cell (room 1097). After the transfer, the WP inner lid lip is visually inspected for debris, debris removed as required, and the inner lid is replaced (BSC 2004i [DIRS 171598], Section B.1.1.2). The inner lid is mechanically restrained in place before the WP is moved to the closure area (BSC 2004q [DIRS 171499], Section 2.3).

For remediated WPs containing SNF assemblies, the spent fuel transfer machine transfers the assemblies from the DPC cutting and WP dry remediation cell (room 1097) through the waste transfer cell (room 2048) to the new WP in the WP docking cell (room 1052 or room 1055). For remediated WPs containing DOE SNF or HLW canisters or naval SNF canisters, the canister and HLW handling crane transfers the canister from the DPC cutting/WP dry remediation cell (room 1097) through the waste transfer cell (room 2048) to the new WP in the WP docking cell (room 1052 or room 1055).

For an unloaded cask, visual and physical checks are performed, and the cask is undocked and transferred to the Cask/MSC/WP Preparation System for restoration operations prior to leaving the DTF.

For a loaded WP or MSC, visual checks and record verifications are performed. MSCs are undocked and returned to the Cask/MSC/WP Preparation System for cask restoration (BSC 2004p [DIRS 171164], Section 4.2.3.1.2). For a WP docked at the WP docking cell (room 1055), the WP is moved from room 1055 to the WP loading/docking ring removal cell (room 1054). For a WP docked at the WP docking cell (room 1052), the WP is moved from room 1052 to the WP loading (navy canister)/docking ring removal cell (room 1051). The docking ring is removed, moved to the WP docking ring decon room (room 2053), placed into the docking ring decontamination station, decontaminated, placed into a docking ring transfer cart, and moved

through the transfer cell work station (room 2045) to the docking ring staging room (room 2049) (BSC 2004i [DIRS 171598], Section 4.1.4).

Table 14a lists the applicability of generic events to the DTF waste transfer cell, WP docking cell, and WP loading/docking ring removal cell; Table 14b lists potential events for each applicable category.

Table 14a. Generic Events Applicability to the DTF Cask and MSC Docking Room, Waste Transfer Cell, WP Docking Cell, and WP Loading/Docking Ring Removal Cell

Generic Event Category	Is Generic Event Applicable?
Collision/Crushing	Yes
Chemical Contamination/Flooding	Yes
Explosion/Implosion	Yes, also see Fire
Fire	Yes
Radiation/Magnetic/Electrical/Fissile	Yes, Radiation/Fissile
Thermal	Yes (see fire)

Sources: BSC 2004i [DIRS 171598], Sections 4.1.4, 4.1.4.1, and B.1.1.2; BSC 2004q [DIRS 171499], Section 2.3; BSC 2004p [DIRS 171164], Sections 4.1.1.1.2 and 4.2.3.1.2

Table 14b. Potential Events for the DTF Cask and MSC Docking Room, Waste Transfer Cell, WP Docking Cell, and WP Loading/Docking Ring Removal Cell

Generic Event Category	Potential Event
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 DOE SNF canister. 2. Drop or collision of an SNF assembly from the spent fuel transfer machine back into or against a cask or MSC being unloaded. 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. 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. 5. Drop of an SNF assembly from the spent fuel transfer machine onto the waste transfer cell floor. 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). 7. Drop or collision of an SNF assembly from the spent fuel transfer machine onto or against a sharp object. 8. Drop or collision of an SNF assembly from the spent fuel transfer machine

Generic Event Category	Potential Event
	into or against an empty WP or MSC being loaded. 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. 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. 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. 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. 13. Drop or collision of an SNF assembly from the spent fuel transfer machine onto or against a DOE HLW canister or DOE SNF canister in a staging rack. 14. Drop or collision of a DOE HLW canister or a DOE SNF canister from the waste transfer cell overhead crane back into or against the cask or MSC being unloaded. 15. Drop or collision of a DOE SNF MCO from the waste transfer cell overhead crane back into or against the cask being unloaded. 16. Impact due to horizontal movement of a DOE HLW canister or a DOE SNF canister with the waste transfer cell overhead crane before the canister is completely removed from the cask or MSC. 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. 18. Drop and slapdown of a DOE HLW canister or a 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. 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. 20. Drop or collision of a DOE HLW canister, a DOE SNF canister, or a DOE SNF MCO from the waste transfer cell overhead crane onto or against a sharp object. 21. Collision involving a DOE HLW canister, a 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.

Generic Event Category	Potential Event
	22. Drop of a DOE HLW canister, a DOE SNF canister, or a DOE SNF MCO from the waste transfer cell overhead crane onto the waste transfer cell floor. 23. Drop or collision of a DOE HLW canister or a DOE SNF canister from the waste transfer cell crane into or against an empty canister staging rack. 24. Drop or collision of a DOE HLW canister or a DOE SNF canister from the waste transfer cell crane into or against an SNF assembly staging rack loaded with SNF assemblies. 25. Drop or collision of a DOE HLW canister or a DOE SNF canister from the waste transfer cell crane onto or against another DOE HLW canister or DOE SNF canister in a staging rack. 26. Drop or collision of a DOE HLW canister or a DOE SNF canister from the waste transfer cell crane into or against an empty WP or into or against an empty MSC being loaded. 27. Drop or collision of a DOE SNF MCO from the waste transfer cell crane into or against an empty WP being loaded. 28. Drop or collision of a DOE HLW canister from the waste transfer cell crane onto or against another DOE HLW canister, a DOE SNF canister, or a DOE SNF MCO in a WP being loaded. 29. Drop or collision of a DOE HLW canister from the waste transfer cell crane onto or against another DOE HLW canister or a DOE SNF canister in a WP or in an MSC being loaded. 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. 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. 32. Drop or collision of a DOE SNF canister from the waste transfer cell crane onto or against another DOE SNF canister in a WP or in an MSC in a misload situation. 33. Drop or collision of a DOE SNF MCO from the waste transfer cell crane onto or against a DOE SNF canister in a WP in a misload situation. 34. Drop or collision of a DOE HLW canister, a 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. 35. Drop or collision of an SNF assembly from the spent fuel transfer machine onto or against a DOE HLW canister or a DOE SNF canister in a WP or in an MSC in a misload situation.

Generic Event Category	Potential Event
	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. 37. Drop or collision of handling equipment onto or against SNF assemblies in the SNF staging rack. 38. Drop or collision of handling equipment onto or against a DOE HLW canister or a DOE SNF canister in a canister staging rack. 39. Drop or collision of handling equipment into or against an open MSC or an open WP filled with SNF assemblies. 40. Drop or collision of handling equipment into or against an open WP loaded with SNF assemblies, DOE HLW canisters, and/or a DOE SNF canister, and/or DOE SNF MCOs. 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. 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). 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. 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. 45. Derailment of a trolley holding a loaded, unsealed WP (with lid in place but not sealed) followed by a load tipover or fall.
Chemical Contamination/Flooding	Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures.
Explosion/Implosion	Hydrogen explosion involving batteries on a cask trolley.
Fire, Thermal	1. HEPA filter fire due to excessive radioactive decay within the filter bed. 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). 3. Fire/explosion (battery/electrical fire) associated with a cask trolley holding an unsealed, partially filled or filled cask or MSC. 4. Electrical fire associated with a WP trolley holding an unsealed, partially

Generic Event Category	Potential Event
	filled or filled WP. 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. 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.
Radiation	1. Radiation exposure of a facility worker and/or the offsite public. 2. Docking ring failure leads to a radiological release. 3. Radiological release due to installation of incorrect docking ring. 4. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne contamination. 5. Thermal expansion of gases or other loss of confinement in an unsealed cask or MSC, leading to radiological release. 6. Inadvertent opening of a shield door, leading to a worker exposure. 7. Radiation-induced damage to a facility SSC.
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. 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. 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. 4. Criticality associated with a drop or slapdown of a DOE SNF canister, a DOE SNF MCO, or a DOE HLW canister. 5. Criticality associated with the drop of heavy equipment onto a loaded, unsealed cask, MSC, or WP and a rearrangement of the container internals. 6. Criticality associated with a misload of a WP or an MSC. 7. Criticality associated with a misload of a commercial SNF staging rack. 8. Criticality associated with a misload of a canister staging rack.

6.6.3.8 Dry Transfer Facility (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

Area Description/Process Description: Once SNF/HLW transfer operations are completed, the transportation cask inner lid is retrieved from storage in the waste transfer cell (room 2048) and lowered into the unloaded cask. The docking port plug is placed into the docking port and the cask port docking device is disengaged (BSC 2004i [DIRS 171598], Section 4.1.4).

The cask restoration subsystem prepares casks following waste transfer operations. Unloaded transportation casks (except naval transportation casks) and loaded or unloaded MSCs are returned to the Cask/MSC/WP Preparation System from the SNF/HLW Transfer System following waste transfer operations. Unloaded transportation casks and loaded or unloaded MSCs are undocked from the cask and MSC docking room (room 1069) or the DPC Docking room (room 1101). The cask trolley is moved to the cask restoration room (room 1072). Within room 1072 and the cask docking ring installation room (room 2051) at the cask restoration station, the docking ring is removed, decontaminated, and sent back to the cask preparation subsystem. The inner lid is fastened and checked for tightness. The outer lid is installed (depending on cask design). For a loaded site-specific cask, the cask cavity is inerted. An external radiological survey is performed on the cask, trolley, pedestal, and the cask trolley is moved to the cask and MSC to trolley transfer room (room 1076). From room 1076, the unloaded transportation cask is lifted with the cask handling crane (200- ton), placed on the SRTC in the cask and MSC SRTC receipt area (room 1077), and down-ended back to a horizontal position. The cask tie downs are installed, as necessary. The impact limiters and personnel barrier are installed, if necessary. A radiological survey and final inspection are performed, then the unloaded transportation cask is moved through the cask and MSC entrance vestibule (room 1079) to the Cask Receipt and Return System on the SRTC. The cask transporter moves the loaded or unloaded site-specific cask to the SNF Aging System (BSC 2004o [DIRS 171163], Section 4.1.1.1.3).

Unloaded naval SNF casks are returned to the Cask/MSC/WP Preparation System by the SNF/HLW Transfer System following waste transfer operations. The cask lid is set in place and the unloaded navy cask and WP trolley moves from the WP loading (navy canister)/docking ring removal cell (room 1051) to the WP/navy cask preparation room (room 1053). The cask lid bolts are installed and a radiological survey is performed. The naval SNF cask is then moved to the WP/navy to trolley transfer room (room 1057), lifted by the 200-ton navy cask handling crane, placed on the SRTC and down-ended to the horizontal position in the WP/navy cask SRTC receipt area (room 1058). The naval SNF cask tie downs are installed, as necessary, and a radiological survey is performed. The impact limiters and personnel barrier are installed, if necessary. A second radiological survey and final inspection are performed. The unloaded naval SNF cask on the SRTC is moved through the WP and navy cask entrance vestibule (room 1060) to the cask receipt and return system (BSC 2004o [DIRS 171163], Section 4.1.1.1.3).

Unloaded DPC casks are moved from the DPC docking room (room 1101) to the cask restoration room (room 1072) and are handled in a similar manner as that of other transportation casks during cask restoration operations. Unloaded MSCs are moved from the cask and MSC docking

room (room 1069) to the cask restoration room (room 1072) and handled in a similar manner as that of other transportation casks (BSC 2004o [DIRS 171163], Section 4.2.3.1.3).

Table 15a. Generic Events Applicability to DTF Empty Transportation Cask/MSC/DPC Removal in the 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, and Cask and MSC Entrance Vestibule

Generic Event Category	Is Generic Event Applicable?
Collision/Crushing	None identified that affect/interact with a waste form
Chemical Contamination/Flooding	None identified that affect/interact with a waste form
Explosion/Implosion	None identified that affect/interact with a waste form
Fire	None identified that affect/interact with a waste form
Radiation/Magnetic/Electrical/Fissile	Yes
Thermal	None identified that affect/interact with a waste form

Sources: BSC 2004i [DIRS 171598], Section 4.1.4; BSC 2004o [DIRS 171163], Sections 4.1.1.1.3 and 4.2.3.1.3

Table 15b. Potential Events for the DTF Empty Transportation Cask/MSC/DPC Removal in the 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, and Cask and MSC Entrance Vestibule

Generic Event Category	Potential Event
Radiation	1. Radiation exposure of a facility worker. 2. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation.
Fissile	Criticality associated with the collection and concentration of fissile material collected from casks during cask restoration activities.

6.6.3.9 Dry Transfer Facility (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

Area Description/Process Description: After an MSC is loaded, the inner lid is placed into the MSC and the docking port plug is returned to the docking port. The MSC is moved from the cask and MSC docking room (room 1069) to the cask preparation room (room 1074). The docking ring is removed, moved to the cask docking ring installation room (room 2051), decontaminated as necessary, and staged for reuse. The MSC inner lid is bolted in place, the MSC is filled with an inert gas, pressure tested, and the sampling port cover is bolted in place. A pressure boundary monitoring system (for use during aging) is installed, and the second lid is bolted in place. A final cover, designed to protect the pressure boundary monitoring system, is installed. Exterior surfaces are surveyed and decontaminated as necessary (BSC 2004i [DIRS 171598], Section 4.1.4). The cask is moved through the cask/MSC turntable room (room 1073) is aligned to the tracks in the cask and MSC to trolley transfer room (room 1076) and positioned.

The shield doors are opened. The 200-ton cask handling crane is attached and the loaded MSC is placed on the lay-down area in the cask and MSC SRTC receipt area (room 1077) for retrieval by the MSC transporter and moved to the SNF Aging System (BSC 2004o [DIRS 171163], Section 4.2.3.1).

Table 16a lists the applicability of generic events for loaded MSC removal from the DTF; Table 16b lists potential events for each applicable category.

Table 16a. Generic Events Applicability to DTF Loaded MSC Removal 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, and Cask and MSC Entrance Vestibule

Generic Event Category	Is Generic Event Applicable?
Collision/Crushing	Yes
Chemical Contamination/Flooding	Yes
Explosion/Implosion	Yes; also see Fire
Fire	Yes
Radiation/Magnetic/Electrical/Fissile	Yes, Radiation/Fissile
Thermal	Yes (see fire)

Sources: BSC 2004o [DIRS 171163], Section 4.2.3.1; BSC 2004i [DIRS 171598], Section 4.1.4

Table 16b. Potential Events for the DTF Loaded MSC Removal 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, and Cask and MSC Entrance Vestibule

Generic Event Category	Potential Event
Collision/Crushing	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). 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). 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/MSC turntable room or the cask/MSC turntable room and the cask preparation room (before or after the outer lid [as applicable] is fastened). 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). 5. Collision involving two trolleys holding casks on pedestals (including a loaded MSC) (before or after the outer lid [as applicable] is fastened). 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.

Generic Event Category	Potential Event
	7. Drop of an MSC outer lid from the overhead crane onto the loaded MSC inner lid, as applicable. 8. Drop or collision of a docking ring onto or against a loaded MSC. 9. Collision of a trolley holding a loaded, sealed MSC on a pedestal with shield doors separating the cask/MSC turntable room and the cask and MSC to trolley transfer room. 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. 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. 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. 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. 14. Drop or collision of handling equipment from the overhead bridge crane onto or against a loaded MSC. 15. Drop or collision of equipment from the 25-ton material handling crane onto or against a loaded, sealed MSC. 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. 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. 18. Drop of a loaded MSC from the MSC transporter onto the floor inside the DTF while in-transit to the SNF Aging System. 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. 20. MSC transporter collision while carrying a loaded, sealed MSC followed by an MSC tipover or fall. 21. MSC transporter collision into a loaded, sealed MSC followed by an MSC tipover or fall.

Generic Event Category	Potential Event
	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. 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.
Chemical Contamination/Flooding	Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures.
Explosion/Implosion	1. MSC inerting system (or other pneumatic or pressurized system) missile due to a fractured nozzle/valve stem/pneumatic device. 2. Hydrogen explosion involving batteries on a cask trolley. 3. Hydrogen explosion involving batteries on a mobile elevated platform. 4. Hydrogen explosion involving batteries on a forklift. 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.
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. 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). 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. 4. Fire/explosion (battery/electrical fire) associated with the cask trolley. 5. Fire/explosion (battery/electrical fire) associated with a forklift. 6. Fire/explosion (battery/electrical fire) associated with a mobile elevated platform. 7. Diesel fuel fire/explosion involving an MSC transporter holding a loaded MSC.
Radiation	1. Radiation exposure of a facility worker and/or the offsite public. 2. Damage or rupture of cask inerting system leading to a release of MSC internal gases.

Generic Event Category	Potential Event
	3. Expansion of gases in the loaded, unsealed MSC, leading to radiological release. 4. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation. 5. Radiation-induced damage to a facility SSC.
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). 2. Criticality associated with a drop or slapdown of a loaded, sealed MSC from an overhead crane and a rearrangement of cask internals. 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.

6.6.3.10 Dry Transfer Facility: WP Handling and Staging Cell, WP Positioning Cells, WP Closure Cells, and the WP/Trolley Decontamination Room

Area Description/Process Description: The WP handling and staging cell (room 1044), with the exception of the north end, is open from the ground floor to the upper level floor. The west half of the south end merges into the WP transfer corridor (room 1107). The east half of the south end provides access to the WP/trolley decontamination room (room 1094). The west side provides access to and from the WP positioning cells (rooms 1038, 1039, 1040, and 1041), and the WP loadout cell (room 1088). The east side provides access from the WP loading (navy canister)/docking ring removal cell (room 1051) and the WP loading/docking ring removal cell (room 1054). All rooms are separated from room 1044 by sliding shield doors. Trolley tracks running east and west connect the four WP positioning cells, the two WP loading/docking ring removal cells, and the WP loadout cell with room 1044. Trolley tracks running north and south connect rooms 1107 and 1094 with room 1044. A 100-ton overhead bridge crane runs the length of room 1044. All trolley tracks extend into room 1044 so the 100-ton overhead bridge crane can access WPs on the trolleys (BSC 2004i [DIRS 171598], Section B.1.1.2).

The WP trolleys associated with the WP trolley to closure are powered by external means (with power supplied by an external source; Assumption 5.2.9) (Cogema 2003b [DIRS 167145]).

The WP handling and staging cell (room 1044) provides space for the SNF/HLW Transfer System to receive loaded WPs and transfer them to the WP positioning cells for closure operations and to receive closed WP from the WP positioning cells and transfer them to the WP staging area in room 1044, to the WP survey area at the south end of room 1044, or to the trolley tracks connecting to room 1094. The WP handling and staging cell (room 1044) allows for

staging of up to 15 WPs in the event the WP transporter is unavailable or there are issues in the subsurface areas that require the WPs to be staged (BSC 2004i [DIRS 171598], Section B.1.1.2).

When the WP is loaded, the inner lid lip is checked for debris, debris is removed as required, the WP inner lid is placed into the WP, and the docking port plug is returned to the docking port. For a WP docked at the WP docking cell (room 1055), the WP is moved from room 1055 to the WP loading/docking ring removal cell (room 1054). For a WP docked at the WP docking cell (room 1052), the WP is moved from room 1052 to the WP loading (navy canister)/docking ring removal cell (room 1051). The docking ring is removed, moved to the WP docking ring decontamination room (room 2053), and moved to storage.

The WP is moved from room 1054 or room 1051 to the WP handling and staging cell (room 1044). At the same time, a WP welding pedestal is moved from storage to an empty WP positioning cell trolley. The DTF has four WP positioning cells, (WP positioning cells A, B, C, and D (rooms 1038, 1039, 1040, and 1041, respectively). The WP is moved from the transfer trolley pedestal to the welding trolley pedestal and moved into the WP positioning cell (BSC 2004i [DIRS 171598], Section B.1.1.2).

Waste package closure operations are performed using remotely controlled equipment located in the WP Closure Cells A, B, C, and D (rooms 2030, 2032, 2033, and 2035, respectively) located above the WP positioning cells. Initially, rooms 2032, 2033, and 2035 will be fully equipped and operational. Space will be provided for room 2030 with provisions for adding the necessary equipment later, if required (BSC 2004i [DIRS 171598], Section B.1.1.2).

Each WP Closure Cell (rooms 2030, 2032, 2033, and 2035, respectively) is a concrete cell located directly over a corresponding WP positioning cell. Each cell includes a 3-ton electro-mechanical manipulator traveling the full width and length of the closure cell. An overhead bridge crane (15-ton) is also included in each cell, traveling the full width and length of the closure cell to augment the electro-mechanical manipulators (BSC 2004i [DIRS 171598], Section B.1.1.3).

Each closure cell is provided with a glove box maintenance capability that directly interfaces with the closure cell. The interface occurs through the cell wall from the closure cell into the closure support room. The interface is in the form of a shielded air lock system that provides contamination control and adequate shielding to protect operating personnel occupying the closure support area. An air lock also is provided on the closure support room side of the glove box for introduction of WP lids, materials, and equipment into this unit as a means of providing access of these items into the closure cell. In order to perform handling and maintenance activities in the glove box with those items that are too heavy or cumbersome to effectively manipulate by hand via glove ports, the remote handling subsystem will be used (BSC 2004q [DIRS 171499], Section 4.1.1.4).

A WP consists of a stainless steel inner vessel and an Alloy 22 outer corrosion barrier. The stainless steel inner lid is mechanically retained by the spread ring. The spread ring is tack-welded to the inner lid and stainless steel inner vessel and then welded to the inner vessel and inner lid by a two-pass seal weld. The spread ring segment ends are welded by a two-pass seal weld. This seal weld is then visually inspected. The inner vessel is evacuated and backfilled

with inert gas through a purge port on the inner lid. The spread ring seal welds are leak-tested using a mass spectrometer. A plug is inserted in the purge port and then leak-tested using a mass spectrometer. The purge port is covered by a purge port cap, which is welded to the inner lid using a two-pass seal weld. The seal weld of the purge port cap is then visually inspected.

Next, two Alloy 22 lids are welded to the Alloy 22 outer corrosion barrier. The first of these, the middle lid, is placed in the Alloy 22 outer corrosion barrier and a multi-pass fillet weld is made between the lid and the Alloy 22 outer corrosion barrier. This weld is visually and eddy current inspected. A second Alloy 22 lid, the outer lid, is placed in the Alloy 22 outer corrosion barrier and a multi-pass narrow groove weld is made joining the lid to the Alloy 22 outer corrosion barrier. This weld is inspected using visual, eddy current, and ultrasonic methods. Following inspection, the weld is stress-mitigated by inducing residual compressive stresses near the outer surface of the weld. A second inspection using visual, eddy current, and ultrasonic is performed after the stress mitigation.

All welding is performed using the gas tungsten arc welding process. In the event that any of the various inspections reveal a noncompliance condition, corrective actions are taken in the closure cell depending on the condition. These actions include, but are not limited to, (1) cleaning of weld joints; (2) repositioning of components; (3) weld repair of mechanical damage to components or weld joints; and (4) weld repair of weld defects. If repair of noncompliance conditions is not reasonably possible in the closure cell, the WP is transferred out of the closure cell (BSC 2004q [DIRS 171499], Section 2.3).

After closure is completed, the WP is moved by the trolley back into the WP handling and staging cell (room 1044). At this point, the WP handling crane moves the WP to the WP survey station, the remediation system, or to the staging area.

If the WP does not pass the closure weld inspections and is unable to be repaired in the closure cell, the crane places it on a trolley for movement through the WP/trolley decontamination room (room 1094) to the DPC cutting/WP dry remediation cell (room 1097) for remediation. If the WP needs to be staged prior to emplacement, the crane transfers it to the staging area. When the WP is authorized for emplacement, the crane transfers it to the WP survey station, where contamination surveys are performed. If it is contaminated beyond emplacement limits, the WP is moved to the WP/trolley decontamination cell (room 1094) (BSC 2004p [DIRS 171164], Section 4.2.3.1.3). When a thorough decontamination is required, the sealed WP is moved to the WP/trolley decontamination cell (room 1094) for decontamination with a high-pressure water spray applied by a remotely controlled manipulator (BSC 2004ee [DIRS 172070], Section 4.1.1.4). Once the WP passes the survey, the crane transfers the WP from the survey station to the WP trolley, which moves it to the WP loadout cell (room 1088) (BSC 2004p [DIRS 171164], Section 4.2.3.1.3).

Table 17a lists the applicability of generic events to DTF WP handling and staging cells, the WP positioning cells, the WP closure cells, and the WP/trolley decontamination room; Table 17b lists the potential events for each applicable category.

Table 17a. Generic Events Applicability to the DTF WP Handling and Staging Cell, WP Positioning Cells, WP Closure Cells, and the WP/Trolley Decontamination Room

Generic Event Category	Is Generic Event Applicable?
Collision/Crushing	Yes
Chemical Contamination/Flooding	Yes
Explosion/Implosion	Yes, also see Fire
Fire	Yes
Radiation/Magnetic/Electrical/Fissile	Yes, Radiation/Fissile
Thermal	Yes (see fire)

Sources: BSC 2004p [DIRS 171164], Section 4.2.3.1.3; BSC 2004q [DIRS 171499], Sections 2.3 and 4.1.1.4; Cogema 2003b [DIRS 167145]; BSC 2004i [DIRS 171598], Sections B.1.1.2 and B.1.1.3; BSC 2004ee [DIRS 172070], Section 4.1.1.4

Table 17b. Potential Events for the DTF WP Handling and Staging Cell, WP Positioning Cells, WP Closure Cells, and the WP/Trolley Decontamination Room

Generic Event Category	Potential Event
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. 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. 3. Derailment of a trolley holding a loaded, unsealed WP followed by a load tipover or fall. 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. 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. 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. 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. 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. 9. Collision involving the trolley holding the loaded, unsealed WP and the

Generic Event Category	Potential Event
	shield doors between WP handling and staging cell and the WP positioning cell. 10. Shield doors between the WP handling and staging cell and the WP positioning cell close on the trolley holding the loaded, unsealed WP. 11. Lid drop onto a WP from the lid placement fixture equipment during the welding process. 12. Equipment drop onto a WP during the welding process. 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. 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. 15. Shield doors between the WP positioning cell and the WP handling and staging cell close on the trolley holding the loaded, sealed WP. 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. 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. 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. 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. 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. 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. 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

Generic Event Category	Potential Event
	cell. 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. 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. 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. 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. 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. 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. 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. 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. 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. 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.

Generic Event Category	Potential Event
	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. 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. 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. 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. 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. 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. 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. 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. 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.
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. 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.
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.

Generic Event Category	Potential Event
	2. WP decontamination system missile due to a fractured nozzle/valve stem/pneumatic device. 3. WP inerting system (or other pneumatic or pressurized system) missile due to a fractured nozzle/valve stem/pneumatic device.
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. 2. Electrical fire associated with a trolley holding a loaded WP (unsealed or sealed). 3. Fuel damage by burn-through during welding process/heat damage. 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. 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. 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. 7. Transient combustible fire in the WP handling and staging cell, WP positioning cells, WP closure cells, and the WP/trolley decontamination room.
Radiation	1. Radiation exposure of a facility worker and/or the offsite public. 2. Glovebox leak leads to a radiological release of airborne contamination. 3. Thermal expansion of gases within WP (prior to seal of inner lid) leads to radiological release. 4. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation. 5. Inadvertent opening of a shield door, leading to a worker exposure. 6. Radiation-induced damage to a facility SSC.
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. 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

Generic Event Category	Potential Event
	move out of the WP). 3. Criticality associated with the drop of heavy equipment onto a loaded, unsealed WP and a rearrangement of the container internals. 4. Criticality associated with a drop or slapdown of a loaded, sealed WP and a rearrangement of the container internals.

6.6.3.11 Dry Transfer Facility: WP Loadout Cell, WP Transporter Vestibule, Exit Vestibule

Area Description/Process Description: The WP loadout cell (room 1088) is located between the WP handling and staging cell (room 1044) and the WP transporter vestibule (room 1087). These rooms are separated from room 1088 by sliding shield doors and connected by trolley tracks. Adjacent to room 1088, to the south, is the collar removal machine room (room 1091). The WP loadout cell (room 1088) is open from ground floor to the upper floor. A 100-ton overhead crane runs the entire length and width of the WP loadout cell (room 1088) (BSC 2004i [DIRS 171598], Section B.1.1.2). The WP loadout handling crane is equipped with an auxiliary trolley and hoist to perform maintenance and repair operations in the WP loadout cell (BSC 2004p [DIRS 171164], Section 4.1.1.1.3).

The WP loadout cell (room 1088) provides space to: receive a closed WP from the WP handling and staging cell (room 1044), receive an emplacement pallet from the WP transporter positioned in room 1088 (and partially in the WP transporter vestibule [room 1087]), place the closed WP onto the emplacement pallet, remove the trunnion collars, and return the pallet with the closed WP (minus the trunnion collars) to the WP transporter. The WP loadout cell (room 1088) also provides space to receive a WP from the subsurface requiring remediation, install trunnion collars, and transfer it to the WP handling and staging cell (room 1044) for transfer to the WP trolley/decontamination room (room 1094) and on to the DPC cutting/WP dry remediation cell (room 1097) (BSC 2004i [DIRS 171598], Section B.1.1.2).

The WP trolley in the WP loadout cell (room 1088) is powered by external means (with power supplied by an external source; Assumption 5.2.9) (Cogema 2003c [DIRS 167147]).

When ready for emplacement, the closed WP is moved from the WP handling and staging cell (room 1044) to the WP loadout cell (room 1088) on a WP trolley. The WP transfer trolley is remotely positioned in the WP loadout cell (room 1088) so that the 100-ton overhead bridge crane can lift the WP. The overhead bridge crane, hoist, WP lifting yoke, and WP lifting collar trunnions are used to slowly lift the WP, transfer it to the WP tilting fixture, and downend it to a horizontal orientation onto the emplacement pallet positioned within the WP turntable. The turntable is used to reposition the WP for remote removal of the WP trunnion collars (BSC 2004i [DIRS 171598], Section B.1.1.2).

The collar removal machine room (room 1091) is a concrete cell located adjacent to the WP loadout cell (room 1088). These rooms are connected by an opening through which a trunnion collar removal machine, located in the collar removal machine room (room 1091), can be extended to remove trunnion collars from a WP located on a turntable in the WP loadout cell (room 1088). A 5-ton overhead bridge crane runs the entire length and width of the collar removal machine room (room 1091).

When a closed WP is placed on the turntable in the WP loadout cell (room 1088), the turntable is rotated to align a trunnion collar with the trunnion collar removal machine. Collar removal is accomplished through an opening in the wall between the WP loadout cell (room 1088) and the collar removal machine room (room 1091). The trunnion collar removal machine, located in room 1091, moves through the opening, and engages the collar on the WP, and removes it. This is repeated for the second collar by rotating the WP 180 degrees to align the second trunnion collar with the trunnion collar removal machine. Following removal from the WP, the trunnion collars are lifted from the removal machine using the 100-ton overhead bridge crane in the WP loadout cell (room 1088) and placed into a trunnion collar stand in the WP loadout cell (room 1088). A visual inspection of the WP is performed (BSC 2004i [DIRS 171598], Section B.1.1.2).

The WP transporter vestibule (room 1087) is a reversed L-shaped concrete cell located between the WP loadout cell (room 1088) and the exit vestibule (room 1086). The WP loadout cell (room 1088) provides a sliding shield door between the WP loadout cell (room 1088) and the WP transporter vestibule (room 1087). The exit vestibule (room 1086) provides a shield door between the exit vestibule (room 1086) and the WP transporter vestibule (room 1087). The WP transporter vestibule (room 1087) and the WP loadout cell (room 1088) provide space to park the WP transporter. A 100-ton overhead bridge crane located in the WP loadout crane park cell (room 2081) runs the entire length of the WP transporter vestibule (room 1087) and the WP loadout cell (room 1088) (BSC 2004i [DIRS 171598], Section B.1.1.2).

The emplacement pallet with the WP is raised by the turntable, the WP transporter is moved into position under the emplacement pallet, and the emplacement pallet with closed WP is lowered onto the WP transporter bedplate. The WP, pallet, and bedplate are retracted into the WP transporter and the transporter shield doors are closed. The WP transporter is moved from the DTF through the exterior door of exit vestibule (room 1086) to the subsurface repository for WP emplacement operations (BSC 2004i [DIRS 171598], Section B.1.1.2).

Table 18a lists the applicability of generic events to the DTF WP loadout cell, WP transporter vestibule and the exit vestibule; Table 18b lists the potential events for each applicable category.

Table 18a. Generic Events Applicability to the DTF WP Loadout Cell, WP Transporter Vestibule and Exit Vestibule

Generic Event Category	Is Generic Event Applicable?
Collision/Crushing	Yes
Chemical Contamination/Flooding	Yes
Explosion/Implosion	Yes, also see Fire
Fire	Yes
Radiation/Magnetic/Electrical/Fissile	Yes, Radiation/Fissile
Thermal	Yes (see fire)

Sources: BSC 2004i [DIRS 171598], Section B.1.1.2; BSC 2004p [DIRS 171164], Section 4.1.1.1.3; Cogema 2003c [DIRS 167147]

Table 18b. Potential Events for the DTF WP Loadout Cell, WP Transporter Vestibule and Exit Vestibule

Generic Event Category	Potential Event
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. 2. Shield doors between the WP handling and staging cell and the WP loadout cell close on the trolley holding the loaded, sealed WP. 3. Derailment of a trolley in the WP loadout cell holding a loaded, sealed WP followed by a load tipover or fall. 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. 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. 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. 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. 8. Collision of the tilting machine against a loaded, sealed WP on a pallet on the WP turntable. 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. 10. Collision of the WP trunnion collar removal machine and the WP during trunnion collar removal.

Generic Event Category	Potential Event
	11. Drop of trunnion collar from the 100-ton overhead bridge crane in the WP loadout cell onto a WP during trunnion collar removal. 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. 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. 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. 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. 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). 17. Collision involving a WP transporter (holding the loaded, sealed WP on a pallet) and the shield doors between the WP transporter vestibule and the exit vestibule. 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). 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). 20. Doors between the exit vestibule and the ambient air (outside) close on the WP transporter (holding the loaded, sealed WP on a pallet). 21. Derailment of a WP transporter in the exit vestibule, WP transporter vestibule, or WP loadout cell followed by a load tipover or fall. 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.
Chemical Contamination/Flooding	Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures.
Explosion/Implosion	Hydraulic system or other pneumatic or pressurized system missile due to a fractured nozzle/valve stem/pneumatic device.
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).

Generic Event Category	Potential Event
	2. Electrical fire associated with a trolley holding a sealed WP. 3. Electrical fire associated with the WP loadout cell overhead bridge crane. 4. Electrical fire associated with equipment on the WP transporter, including motors to extend the WP transporter bedplate. 5. Electrical fire associated with the WP transport locomotive. 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. 7. Transient combustible fire in the WP loadout cell, the WP transporter vestibule, or the exit vestibule.
Radiation	1. Radiation exposure of a facility worker and/or the offsite public. 2. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation. 3. Inadvertent opening of a shield door, leading to a worker exposure. 4. Inadvertent opening of the WP transporter shielded enclosure doors, leading to a worker exposure. 5. Radiation-induced damage to a facility SSC.
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. 2. Criticality associated with a drop, slapdown, or collision of a loaded, sealed WP and a rearrangement of the container internals. 3. Criticality associated with a WP transporter derailment followed by a load tipover or fall and rearrangement of the WP internals.

6.6.3.12 Dry Transfer Facility (WP Remediation): DPC Cutting/WP Dry Remediation Cell

Area Description/Process Description: The WP remediation subsystem provides the capability to address and correct off-normal conditions that occur with sealed WPs after closure operations and with sealed WPs after retrieval from emplacement. In the DTF, remediation of WPs with a failed closure typically is performed inside the DPC cutting/WP dry remediation cell (room 1097). If the WP can be repaired without being opened, it is remediated and directly returned to the SNF/HLW Transfer System. If the lids must be removed, they are cut off and the WP is

moved to the unloading port by the DPC cutting/WP dry remediation cell trolley. The waste in the opened WP is transferred to another WP by the SNF/HLW Transfer System, and the unloaded WP is disposed of as radioactive (BSC 2004s [DIRS 171166], Section 2.3.3).

Major equipment pieces used in the WP remediation area include a 100-ton WP remediation crane, a 15-ton maintenance crane, a WP lifting yoke, DPC cutting/WP dry remediation cell trolley, WP/DPC pedestals, a WP/DPC cutting machine, and master slave manipulators and associated windows. The trolleys that carry the WPs are powered by external means (with power supplied by an external source; Assumption 5.2.9) (Areva 2004 [DIRS 168042]).

The 100-ton capacity crane is used to transfer DPCs and WPs within the DPC cutting/WP remediation cell (room 1097). The crane is also used in the dry remediation cell (room 1109) to perform operations on casks docked at the cask remediation docking port. Interfaces between the WP remediation crane and other facility systems include the basic structural connections between the crane runways and the supporting building walls. The WP remediation crane is located in DPC cutting/WP remediation cell (room 1097). The 15-ton maintenance crane is used to provide maintenance on the WP remediation crane (BSC 2004r [DIRS 170600], Section 4.1.1).

In the event that off-normal conditions are detected with a WP, the WP is transferred to the WP/trolley decontamination room (room 1094) and then to the DPC cutting/WP dry remediation cell (room 1097) for remediation. In the case of a weld defect or if a similar off-normal condition is detected during WP closure operations, or if the WP contents are to be inspected for compliance with specified criteria, WP closure welds are cut in the DPC cutting/WP dry remediation cell (1097) in the DTF. Following lid cutting and removal, the WP is transferred to the DPC/WP unload port in DTF, and the waste forms are unloaded from the WP.

A WP requiring opening for inspection or opening and unloading due to welding defect is received at the WP/trolley decontamination room (room 1094). Transfer to this location is by means of a WP trolley operated by the SNF/HLW Transfer System. The WP is then transferred from the WP trolley to the WP opening station using the WP remediation crane. After tooling preparation, the WP is sampled and purged, and the WP lids are cut and removed at the WP opening station. The WP is then transferred to the WP/DPC trolley with the WP remediation crane. The WP/DPC trolley holding the opened WP is moved to the DPC/WP unload port and the port sliding door is opened. The contents of the WP are removed by the SNF/HLW Transfer System. A check of the empty WP for residual fissile material is made with a probe, followed by the closure of the WP by replacing the inner lid. The port sliding door is closed and the unloaded WP on the WP/DPC trolley is moved to the other end of the rail. The WP removal takes place in the WP loadout cell (room 1088), where the WP is loaded into a railcar, or possibly in the DPC transfer room if the WP is required to be placed into an overpack, and sent out as low-level waste (BSC 2004s [DIRS 171166], Section 4.2.3.3).

Table 19a lists the applicability of generic events to the DTF DPC cutting/WP dry remediation cell; Table 19b lists the potential events for each applicable category.

Table 19a. Generic Events Applicability to WP Remediation in the DTF DPC Cutting/WP Dry Remediation Cell

Generic Event Category	Is Generic Event Applicable?
Collision/Crushing	Yes
Chemical Contamination/Flooding	Yes
Explosion/Implosion	Yes, also see Fire
Fire	Yes
Radiation/Magnetic/Electrical/Fissile	Yes, Radiation/Fissile
Thermal	Yes (see Fire)

Sources: BSC 2004s [DIRS 171166], Sections 2.3.3 and 4.2.3.3; BSC 2004r [DIRS 170600], Section 4.1.1; Areva 2004 [DIRS 168042]

Table 19b. Potential Events for WP Remediation in the DTF DPC Cutting/WP Dry Remediation Cell

Generic Event Category	Potential Event
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. 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). 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. 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. 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. 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. 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). 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. 9. Damage to the WP contents (fuel assembly[ies], canisters, etc.) during lid-

Generic Event Category	Potential Event
	cutting operations. 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. 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. 12. Drop or collision of handling equipment (lid grapple) onto or against the unsealed (open), loaded WP. 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. 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. 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. 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. 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. 18. Drop or collision of an SNF assembly from the spent fuel transfer machine into or against the WP. 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. 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. 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. 22. Drop or collision of a naval SNF canister, a DOE HLW canister, a DOE SNF canister, or a DOE SNF MCO from the waste transfer cell overhead crane back into or against the WP being unloaded.

Generic Event Category	Potential Event
	23. Impact due to horizontal movement of a naval SNF canister, a DOE HLW canister, a DOE SNF canister, or a DOE SNF MCO with the waste transfer cell overhead crane before the canister is completely removed from the WP. 24. Drop or collision of a DOE HLW canister from the waste transfer cell crane back onto or against, another DOE HLW canister, a DOE SNF canister, or a DOE SNF MCO in a WP. 25. Drop or collision of a DOE SNF canister from the waste transfer cell crane onto or against, a DOE HLW canister in the WP. 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. 27. Drop and slapdown of a DOE HLW canister, a DOE SNF MCO, a 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). 28. Drop or collision of handling equipment into or against an opened WP filled with SNF assemblies. 29. Drop or collision of handling equipment into or against an opened WP loaded with a naval SNF canister, DOE HLW canisters, and/or DOE SNF canisters, and/or DOE SNF MCOs.
Chemical Contamination/Flooding	Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures.
Explosion/Implosion	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. 2. Cask/WP purging or sampling system (or other pneumatic or pressurized system) missile due to a fractured nozzle/valve stem/pneumatic device.
Fire, Thermal	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.). 2. Electrical fire associated with the trolley. 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. 4. Thermal hazard (from decay heat) associated with vertical orientation of the non-inerted, opened, loaded WP.

Generic Event Category	Potential Event
	5. Transient combustible fire in the DPC cutting/WP dry remediation cell.
Radiation	1. Radiation exposure of a facility worker and/or the offsite public. 2. Damage or rupture of the WP sampling and purging system, leading to a release of WP internal gases and radioactive material. 3. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation. 4. Thermal expansion of gases or other loss of confinement in an unsealed cask, leading to radiological release. 5. Radiation-induced damage to a facility SSC.
Fissile	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. 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. 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. 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. 5. Criticality associated with a drop or slapdown of a naval SNF canister, a DOE SNF canister, a DOE SNF MCO, or a DOE HLW canister from the waste transfer cell overhead crane during WP unloading. 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. 7. Criticality associated with the drop of heavy equipment onto an unsealed, open WP and a rearrangement of the container internals.

6.6.3.13 Dry Transfer Facility (Dry Remediation): Cask Docking/Dry Remediation Room, Tool Spare Transfer Room, DPC Cutting/WP Dry Remediation Cell

Area Description/Process Description: The dry remediation subsystem provides remediation in the following cases where off-normal conditions may occur:

- Remediation of a loaded transportation cask/MSC when the repair does not require opening the cask
- Remediation of DOE SNF/HLW canisters
- Remediation of commercial SNF
- Remediation of a transportation cask or MSC after waste transfer.

In these cases, the transportation cask or MSC requiring remediation (or containing SNF/HLW requiring remediation) is transported on a trolley from the location where the condition was detected to the tool spare transfer room (room 1127). If the repair does not require opening of the cask, repair is performed in the tool spare transfer room. Once the cask is repaired, it is returned to the Cask/MSC/WP Preparation System. If the remediation necessitates that the cask must be opened, the transportation cask or MSC preparation is finished in the tool spare transfer room (room 1127). The cask or MSC is then transferred to the cask docking/dry remediation room (room 1109) and the waste is transferred to a basket located on the WP/DPC trolley in DPC cutting/WP dry remediation cell (room 1097). The cask or MSC is then returned to the Cask/MSC/WP Preparation System for restoration and return to the Cask Receipt and Return System (BSC 2004s [DIRS 171166], Section 2.3.1).

In the tool spare transfer room (room 1127) space is provided to perform external dry remediation activities on casks/MSCs. This limited dry capability is an efficient process for external remediation of casks/MSCs. Examples of limited dry remediation activities include repair to threads on bolts or replacement of bolts, detorquing of inner bolts, repair of sealing surfaces, and replacement of seal rings. A 15-ton capacity crane is available in this area, if needed (BSC 2004r [DIRS 170600], Section B.2.1.1.3).

The cask docking/dry remediation room (room 1109) is used to perform dry fuel transfer activities and internal cask remediation or decontamination required during off-normal conditions. Space is provided for the SSCs required to perform dry remediation activities on SNF/HLW and associated casks/MSCs. This dry remediation capability involves a process of docking the cask or MSC and establishing a containment seal prior to removal and remediation/transfer of the SNF/HLW. A 100-ton capacity crane is used for SNF/HLW remediation activities, such as the removal of the port plug, cask lids, and removal and remediation of the SNF/HLW and other associated tasks. SNF/HLW that is ready for packaging in a WP is transported to the adjacent DPC cutting/WP dry remediation cell (room 1097) and transferred to a WP (BSC 2004r [DIRS 170600], Section B.2.1.1.3). There is one docking station in the cask docking/dry remediation room (room 1109) to connect it to the DPC cutting/WP dry remediation cell (room 1097). The cask docking station is similar to the design used in the SNF/HLW Transfer System (BSC 2004s [DIRS 171166], Section 4.1.1.1).

Off-normal condition involving damaged DOE SNF/HLW canisters, damaged commercial SNF, and loaded transportation cask and MSCs can be detected in the Cask/MSC/WP Preparation System. The transportation cask or MSC requiring remediation (or containing the waste necessitating remediation) is transferred from the cask preparation room (room 1074) through the DPC preparation/cask dry remediation (room 1100), the turntable in the DPC docking room

(room 1101), the cask docking/dry remediation room (room 1109) and, if appropriate to the tool spare transfer room (room 1127). The cask stays on the trolley it was loaded on in the Cask/MSC/WP Preparation System for this transfer. If the repair does not require opening the cask, the transportation cask or MSC is repaired and returned on its trolley to the Cask/MSC/WP Preparation System (BSC 2004s [DIRS 171166], Section 4.2.3.1).

If the repair requires opening of the cask, the cask is moved to the cask docking/dry remediation room (room 1109) and docked. The waste or the cask is remediated, as necessary. Using the WP remediation crane, the SNF/HLW is then transferred to a basket located on the WP/DPC trolley in the DPC cutting/WP dry remediation cell (room 1097). The basket on its WP/DPC trolley is moved to the DPC/WP unload port and the sliding door of the port is opened. The basket contents are transferred to a WP; this transfer is part of the SNF/HLW Transfer System. The unloaded basket is returned on its WP/DPC Trolley to the other end of the trolley rails. In the cask docking/dry remediation room (room 1109), the cask is undocked and returned on its trolley to the Cask/MSC/WP Preparation System for restoration and subsequent disposition by the Cask Receipt and Return System (BSC 2004s [DIRS 171166], Section 4.2.3.1). The trolleys that carry the WPs, including the trolleys in the DPC cutting/WP dry remediation cell (room 1097), are powered by external means (with power supplied by an external source; Assumption 5.2.9) (Areva 2004 [DIRS 168042]).

An off-normal condition may be detected during SNF/HLW transfer. In this case, the transportation cask or MSC is closed and undocked, as appropriate in the cask and MSC docking room (room 1069). This operation is part of the SNF/HLW Transfer System. The transportation cask or MSC containing the damaged waste is then transferred from the cask and MSC docking room (room 1069) through the cask/MSC turntable room (room 1073), the cask preparation room (room 1074), the DPC preparation/cask dry remediation room (room 1100), onto the turntable in the DPC docking room (room 1101) and to the cask docking/dry remediation room (room 1109) and docked. The cask stays on the trolley it was loaded on in the Cask/MSC/WP Preparation System for this transfer. The waste is then transferred to a basket located on the WP/DPC trolley in the DPC cutting/WP dry remediation cell (room 1097). The basket on its WP/DPC trolley is then moved to the DPC/WP unload port and the sliding door of the port is opened. The basket contents are transferred to a WP; this transfer is part of the SNF/HLW Transfer System. The unloaded basket is returned on its WP/DPC trolley to the other end of the trolley rail. In the cask docking/dry remediation room (room 1109), the cask is undocked and returned on its trolley to the Cask/MSC/WP Preparation System for restoration and disposition by the Cask Receipt and Return System.

Finally, if remediation is needed on a transportation cask or MSC after unloading, the transportation cask or MSC is remediated in cask restoration room (room 1072). The cask is then returned to the Cask/MSC/WP Preparation System (BSC 2004s [DIRS 171166], Section 4.2.3.1).

Table 20a lists the applicability of generic events to the dry cask remediation in the DTF cask docking/dry remediation room, the tool spare transfer room, and the DPC Cutting/WP Dry Remediation Cell; Table 20b lists the potential events for each applicable category.

Table 20a. Generic Events Applicability to Dry Cask Remediation in the DTF Cask Docking/Dry Remediation Room, the Tool Spare Transfer Room, and the DPC Cutting/WP Dry Remediation Cell

Generic Event Category	Is Generic Event Applicable?
Collision/Crushing	Yes
Chemical Contamination/Flooding	Yes
Explosion/Implosion	Yes, also see Fire
Fire	Yes
Radiation/Magnetic/Electrical/Fissile	Yes, Radiation/Fissile
Thermal	Yes (see fire)

Sources: Areva 2004 [DIRS 168042]; BSC 2004s [DIRS 171166], Sections 2.3.1, 4.1.1.1, and 4.2.3.1; BSC 2004r [DIRS 170600], Section B.2.1.1.3

Table 20b. Potential Events for Dry Cask Remediation in the DTF Cask Docking/Dry Remediation Room, the Tool Spare Transfer Room, and the DPC Cutting/WP Dry Remediation Cell

Generic Event Category	Potential Event
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. 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. 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. 4. Drop or collision of tools or equipment onto or against a cask or MSC requiring remediation. 5. Collision involving an access platform or a mobile elevated platform (if required) and a cask or MSC requiring remediation. 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.

Generic Event Category	Potential Event
	7. Drop or collision of a docking port (mobile slab) onto or against a cask or MSC. 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). 9. Drop of an inner lid on a cask or MSC (with outer lid removed [if applicable]). 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 DOE SNF canister. 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. 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. 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. 14. Drop of an SNF assembly from the DPC cutting/WP dry remediation cell crane onto the DPC cutting/WP dry remediation cell floor. 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). 16. Drop or collision of an SNF assembly from the DPC cutting/WP dry remediation cell crane onto or against a sharp object. 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. 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. 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. 20. Drop or collision of a DPC, a DOE HLW canister, a 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. 21. Drop or collision of a DPC, a DOE HLW canister, a DOE SNF canister, or a DOE SNF MCO from the DPC cutting/WP dry remediation cell crane back onto

Generic Event Category	Potential Event
	or against a DPC, a DOE HLW canister, a DOE SNF canister, or a DOE SNF MCO in the cask or MSC, as applicable. 22. Impact due to horizontal movement of a DPC, a DOE HLW canister, a 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. 23. Drop and slapdown of a DPC, a DOE HLW canister, a DOE SNF MCO, or a 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. 24. Drop or collision of a DPC, a DOE HLW canister, a DOE SNF canister, or a DOE SNF MCO from the DPC cutting/WP dry remediation cell crane onto or against a sharp object. 25. Collision involving a DPC, a DOE HLW canister, a 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. 26. Drop of a DPC, a DOE HLW canister, a 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. 27. Drop or collision of a DPC, a DOE HLW canister, a 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. 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 DOE SNF canister or a DOE SNF MCO in a basket, as applicable, on a trolley in the DPC cutting/WP dry remediation cell. 29. Drop or collision of a 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. 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. 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. 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 DOE

Generic Event Category	Potential Event
	SNF canister, and/or DOE SNF MCOs, as applicable. 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). 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. 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, DOE SNF canisters, or DOE SNF MCOs, as applicable, in the DPC cutting/WP dry remediation cell, followed by a load tipover or fall. 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. 37. 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. 38. 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. 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. 40. Drop or collision of a DPC (if not emptied), a DOE HLW canister, a 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. 41. Impact due to horizontal movement of a DPC (if not emptied), a DOE HLW canister, a 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. 42. Drop or collision of a DOE HLW canister from the waste transfer cell crane back onto or against another DOE HLW canister, a DOE SNF canister, or a DOE SNF MCO, as applicable, in the basket on a trolley. 43. Drop or collision of a DOE SNF canister from the waste transfer cell crane onto or against a DOE HLW canister in the basket on a trolley. 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. 45. Drop and slapdown of a DOE HLW canister, a DOE SNF MCO, or a DOE

Generic Event Category	Potential Event
	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). 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. 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 DOE SNF canisters, and/or DOE SNF MCOs, as applicable.
Chemical Contamination/Flooding	Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures.
Explosion/Implosion	1. Hydrogen explosion involving batteries on a mobile elevated platform. 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.
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, manipulators, turntable, etc.). 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. 3. Thermal hazard (from decay heat) associated with vertical orientation of the cask, MSC, or basket. 4. Transient combustible fire in the cask docking/dry remediation room, the tool spare transfer room, or the DPC cutting/WP dry remediation cell. 5. Electrical fire associated with the trolley. 6. Fire/explosion (battery/electrical fire) associated with a mobile elevated platform.
Radiation	1. Radiation exposure of a facility worker and/or the offsite public. 2. Damage or rupture of the cask and MSC sampling and purging system, leading to a release of canister internal gases and radioactive material. 3. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation. 4. Thermal expansion of gases or other loss of confinement in an unsealed cask or MSC, leading to radiological release.

Generic Event Category	Potential Event
	5. Radiation-induced damage to a facility SSC.
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. 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. 3. Criticality associated with a drop or slapdown of a 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). 4. Criticality associated with a trolley (holding a basket containing SNF assemblies, a naval SNF canister, or various combinations of 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. 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. 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. 7. Criticality associated with a drop or slapdown of a 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). 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.

6.6.3.14 Dry Transfer Facility (Wet Remediation): Cask Wet Remediation/Laydown Area, Cask Wet Remediation Entrance Vestibule

Area Description/Process Description: The wet remediation subsystem provides capabilities for remediation of the following off-normal situations:

- Unload off-normal transportation casks or MSCs that cannot be remediated in the dry remediation subsystem
- Remediation of damaged or non-standard commercial SNF that cannot be performed in the dry remediation subsystem

- Decontamination of transportation casks or MSCs that cannot be decontaminated manually (dry).

For the off-normal operations that require the handling of SNF, the wet remediation subsystem provides the ability to place transportation casks and MSCs into the pool for lid removal and under-water fuel transfer operations.

If the off-normal event is external contamination, and does not require handling of SNF, the decontamination can take place in the cask preparation pit/cask decontamination pit (BSC 2004s [DIRS 171166], Section 2.3.2). Note that casks containing canisters are not subject to wet remediation as there are no potential scenarios that would require wet handling of canisters sent to the repository (BSC 2004s [DIRS 171166], Section 4.2.3.2).

The cask preparation pit/cask decontamination pit (in room 1117) is a work area designed for external dry remediation and preparation activities on the cask or MSC prior to internal remediation tasks. If internal inspection or removal of fuel elements is to be performed, the cask or MSC is placed in the cask preparation pit/cask decontamination pit to remove the outer lid, perform gas sampling, and cool the cask/MSC, if necessary, prior to immersing it in the pool for fuel transfer operations. Impact limiters (crushable pads) are installed on the floor of the pit to mitigate cask damage in the unlikely event of a cask drop (BSC 2004r [DIRS 170600], Section B.2.1.1.4.2).

There is one turntable and one hanging platform located in the cask preparation pit/cask decontamination pit of the cask wet remediation/laydown area (room 1117). The turntable is used to rotate transportation casks and MSCs inside the cask preparation pit/cask decontamination pit during their preparation to enter the pool, restoration, and for cask and MSC decontamination activities. The turntable turning system uses one electric motor (BSC 2004s [DIRS 171166], Section 4.1.1.2).

Cask cooling is a preparatory step required in the process of placing a transportation cask or MSC into the remediation pool for wet transfer operations. The cooling is required to prevent or reduce the generation of steam as the fuel assemblies within the transportation cask or MSC come into contact with water used to fill the cask. If water comes into contact with hot fuel assemblies two events can occur, the first is excessive steam generation which can lead to the over pressuring of the cask and the second is the spalling off of crud and other debris on the surface of the fuel assemblies due to thermal shock. These particulates could become airborne in the steam and if the pressure cannot be contained within the cask the resultant steam explosion would result significant contamination in the pool area of the remediation area (BSC 2004r [DIRS 170600], Section 2.3.3).

Casks and MSCs that are opened under water are placed in the cask/MSC wet transfer section of the pool. There are crush pads in the bottom of the pool to absorb any accidental cask drops and a separation wall to protect the staged fuel in the event a cask accidentally tips over. The pool is constructed of stainless-steel-lined, reinforced concrete walls and floor sized to accept the largest transportation cask, fuel staging baskets, and transfer equipment. A 200-ton capacity overhead bridge crane is used to transport and place a cask or MSC into the pool and remove empty and loaded casks or MSCs to the cask decontamination pit. Two cask stands are used to restrain the

casks/MSCs in the pool. Other lifting tasks within the pool, such as transfer of fuel to and from fuel baskets or racks, are performed using a fuel-handling machine. Fuel staging baskets or racks will be designed to hold SNF assemblies. The fuel will be placed in the staging baskets and racks until remediation activities are completed on the transportation cask or MSC (BSC 2004r [DIRS 170600], Section B.2.1.1.4.1).

A transportation cask or MSC requiring wet remediation, or an empty MSC intended to receive waste forms, is received in the cask wet remediation/laydown area (room 1117). The cask is transported to this location by means of a trolley associated with the Cask/MSC/WP Preparation System or by an SRTC (via the cask wet remediation entrance vestibule [room 1120]) through the Cask Receipt and Return System. If required, the cask impact limiters are removed and the cask is upended on the SRTC. The transportation cask or MSC is then transferred from the trolley or SRTC into the cask preparation pit/cask decontamination pit using the cask handling crane. The following activities are performed in the cask preparation pit/cask decontamination pit to prepare the transportation cask or MSC for wet remediation:

- The cask or MSC to be remediated is connected to the cask cooling system and cooling gas is circulated through the cask, cooling the fuel assemblies
- After cooling, the cask is filled with pool water
- The fasteners that secure the cask lid in place are unscrewed
- A lifting yoke and associated short immersion rod are installed to allow for lowering the cask into the pool.

Using the cask handling crane, the loaded transportation cask or MSC is then transferred to the intermediate step in the pool and the short immersion rod is replaced by a long immersion rod. The cask is transferred to the unloading location in the pool. After positioning the loaded cask, the long immersion rod is fastened in a location that does not obstruct fuel transfer or remediation actions. The transportation cask or MSC lid is removed using the fuel transfer machine, and the lid is placed in the location within the pool designated for lid storage.

Next, the unloaded or empty MSC is received in the cask wet remediation/laydown area (room 1117). The unloaded or empty MSC is conveyed by a trolley associated with the Cask/MSC/WP Preparation System or by an SRTC associated with the Cask Receipt and Return System. The unloaded or empty MSC is prepared in a manner similar to the loaded transportation cask or MSC: it is filled with pool water and transferred to the cask preparation pit/cask decontamination pit, the lid fasteners are unscrewed, and a lifting yoke and a short immersion rod are attached. The cask handling crane is then used to transfer the unloaded or empty MSC to the intermediate step in the pool and the short immersion rod is replaced by a long immersion rod. The MSC is then placed in the pool loading location, the long immersion rod is fastened in place, and the MSC lid is removed using the fuel transfer machine.

The SNF is transferred from the loaded transportation cask or MSC to the empty MSC using the fuel transfer machine. The transfer may make use of staging racks in the pool to stage fuel assemblies during this transfer operation. In the event the cask contains damaged fuel

assemblies, operating procedures may require that these assemblies be placed in specific canisters prior to being loaded in the empty MSC.

The lids are replaced on the unloaded cask and the loaded MSC using the fuel transfer machine. The cask or MSC is then transferred to the cask preparation pit/cask decontamination pit using the cask handling crane. The lifting yoke and immersion rod are removed and placed in the tool storage pit A in the cask wet remediation/laydown area (room 1117). A decontamination hood is placed over the cask or MSC using the maintenance crane and the exterior of the cask or MSC is decontaminated. Afterwards, the decontamination hood is removed and stored. A radiological survey on the external surfaces of the cask or MSC is then performed. These decontamination actions are repeated until the results of the survey meets the acceptance criteria defined in operating procedures.

Next, restoration activities are performed on the transportation cask or MSC. Liquids are drained from the cask or MSC, the cask or MSC interior is dried, the loaded MSC is filled with inert gas, and the leaktightness of the MSC is checked. The unloaded cask or MSC (that meets survey acceptance criteria) is then transferred to the cask trolley associated with the Cask/MSC/WP Preparation System using the cask handling crane. The unloaded cask or MSC is routed, as required, for further processing. Unloaded casks that require major repairs may be directed to a cask maintenance facility (BSC 2004s [DIRS 171166], Section 4.2.3.2).

Table 21a lists the applicability of generic events to wet remediation in the cask wet remediation/laydown area and cask wet remediation entrance vestibule; Table 21b lists the potential events for each applicable category.

Table 21a. Generic Events Applicability to Wet Remediation in the DTF Cask Wet Remediation/Laydown Area and Cask Wet Remediation Entrance Vestibule

Generic Event Category	Is Generic Event Applicable?
Collision/Crushing	Yes
Chemical Contamination/Flooding	Yes, Flooding
Explosion/Implosion	Yes, also see Fire
Fire	Yes
Radiation/Magnetic/Electrical/Fissile	Yes, Radiation/Fissile
Thermal	Yes (see Fire)

Sources: BSC 2004s [DIRS 171166], Sections 2.3.2, 4.1.1.2, and 4.2.3.2; BSC 2004r [DIRS 170600], Sections 2.3.3, B.2.1.1.4.1, and B.2.1.1.4.2

Table 21b. Potential Events for Wet Cask Remediation in the DTF Cask Wet Remediation/Laydown Area and Cask Wet Remediation Entrance Vestibule

Generic Event Category	Potential Event
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.

Generic Event Category	Potential Event
	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). 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. 4. SRTC derailment involving a loaded cask (with or without impact limiters installed) or MSC. 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. 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. 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. 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). 9. Slapdown of a loaded cask onto an SRTC during upending of the loaded cask to the vertical orientation. 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. 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. 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. 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. 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. 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

Generic Event Category	Potential Event
	cask or MSC before or after transfer of the cask to the cask decontamination pit/cask prep pit. 16. Collision involving an access platform and a cask or MSC in the cask decontamination pit/cask prep pit. 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.). 18. Drop of a cask or MSC outer lid from the overhead crane onto the cask or MSC. 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. 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. 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. 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. 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. 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. 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. 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. 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. 28. Drop or collision of an empty cask or MSC from the overhead bridge crane

Generic Event Category	Potential Event
	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. 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. 30. Drop or collision of an empty SNF basket onto or against the cask to be unloaded. 31. Drop or collision of an empty or full canister for damaged SNF onto or against the cask being unloaded. 32. Drop or collision of an empty or full canister for damaged SNF onto or against the empty or full SNF basket being loaded. 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. 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. 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. 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. 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. 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. 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. 40. Collision of the fuel handling machine basket grapple with a filled SNF basket during the closing (or opening) of the SNF basket. 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. 42. Drop or collision of a filled SNF basket from the fuel handling machine onto

Generic Event Category	Potential Event
	or against a sharp object during transfer of the filled SNF basket to (or from) the pool area basket storage rack. 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. 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. 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. 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). 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. 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. 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. 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. 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. 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. 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. 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.

Generic Event Category	Potential Event
	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. 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. 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. 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. 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. 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. 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. 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. 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. 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. 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. 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.

Generic Event Category	Potential Event
	67. Collision involving an access platform and a loaded cask or MSC in the cask decontamination pit/cask prep pit. 68. Drop of a cask or MSC outer lid from the overhead crane onto the loaded cask or MSC. 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. 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. 71. Derailment of a trolley holding a loaded, sealed, remediated cask or MSC followed by a load tipover or fall. 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. 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.
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). 2. Uncontrolled pool water overfill resulting in flooding (including an overfill resulting from cask or MSC placement into an overfilled pool, malfunction of make-up water equipment, etc.). 3. Cask decontamination pit/cask prep pit flooding due to pool overfill, flooding, pool equipment malfunction, cask preparation system (cask cooling) equipment malfunction, etc. 4. Uncontrolled water spill from the cask decontamination system or the cask preparation system (cask cooling) in the cask wet remediation/laydown area. 5. Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures.
Explosion/Implosion	1. Hydrogen explosion involving batteries on a trolley. 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. 3. Cask cooling system (nitrogen, air, etc.) or MSC drying system (or other pneumatic or pressurized system) missile due to fractured nozzle/valve

Generic Event Category	Potential Event
	stem/pneumatic device. 4. Hydrogen explosion involving batteries on a mobile elevated platform. 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.
Fire, Thermal	1. Electrical fires associated with the vacuum drier, pool water makeup equipment, or other pool-related equipment. 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.). 3. Fire/explosion (battery/electrical fire) associated with the trolley. 4. Fire/explosion (battery/electrical fire) associated with the mobile elevated platform. 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. 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. 7. Rapid cooling of SNF assemblies, leading to excessive thermal stresses in the SNF cladding. 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. 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. 10. Thermal hazard (from decay heat) associated with vertical orientation of a cask or MSC. 11. Transient combustible fire in the cask wet remediation/laydown area or the cask wet remediation entrance vestibule.
Radiation	1. Damage or rupture of the cask sampling and purging system, leading to a release of internal gases and radioactive material. 2. Uncontrolled pool water draindown/fill or leak of pool cooling or water treatment system resulting in flooding and radioactive contamination of

Generic Event Category	Potential Event
	adjoining areas. 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). 4. Radiation exposure of a facility worker and/or the offsite public. 5. Loss of confinement zone due to a ventilation system malfunction or other breach of a confinement barrier leading to a release of radiation. 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. 7. Thermal expansion of gases or other loss of confinement in an unsealed cask or MSC, leading to radiological release. 8. Radiation-induced damage to a facility SSC.
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. 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. 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. 4. Criticality associated with a drop of an SNF assembly while unloading a transportation cask, loading a cask or MSC, or filling or emptying an SNF basket in the pool, and a rearrangement of SNF in the cask, MSC, or basket. 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. 6. Criticality associated with a misload of a cask or MSC in the pool. 7. Criticality associated with a misload of an SNF basket or SNF baskets in the basket storage rack. 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. 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

Generic Event Category	Potential Event
	a rearrangement of the contents of the basket or baskets. 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).

6.6.3.15 Dry Transfer Facility (DPC Cutting): DPC Preparation/Cask Dry Remediation Room, DPC Docking Room, DPC Cutting/WP Dry Remediation Cell

Area Description/Process Description: The DPC cutting subsystem of the SNF/HLW Transfer System, located in DTF only, is designed to perform the following functions:

- Dock DPC Casks to the DPC cutting/WP dry remediation cell
- Transfer DPCs within the DPC cutting cell/WP dry remediation cell to the cutting station and unloading area
- Sample DPC cavity and vent
- Open DPCs to allow the transfer of SNF
- Prepare the unloaded DPC for processing as LLW.

The operations associated with DPC preparation, DPC docking, DPC transfer, and DPC cutting and SNF transfer include the DPC preparation/cask dry remediation room (room 1100), the DPC docking room (room 1101), and the DPC cutting/WP dry remediation cell (room 1097).

The DPC casks are delivered to the DPC cutting subsystem from the Cask/MSC/WP Preparation System (BSC 2004p [DIRS 171164], Section 2.3.1).

The DPC preparation/cask dry remediation room (room 1100) is a concrete cell located in the southeast area of the DTF. It has two doorways located at the north and south walls. Room 1100 has an electrically operated, sliding shield door at the southern entrance. The room adjacent to the north, the cask preparation room (room 1074), has a similar door at the northern entrance. Both doors provide an air lock. One set of trolley tracks runs through room 1100. Transportation casks and MSCs loaded with DPCs are moved to this room for DPC transfer preparations. The cask is vented and purged using equipment located directly above room 1100 in the DPC preparation station (room 2057). Once the cask has been vented, purged, internal gasses sampled, and results analyzed, the cask lid bolts are loosened, and the outer lid is removed (as appropriate) and stored in room 2057. A docking ring is installed. The loosening of lid bolts, the removal of the outer lid, and the installation of the docking ring are performed from room 2057. The cask is then moved from room 1100 to the DPC docking room (room 1101). The cask is moved into position for docking and subsequent transfer operations (BSC 2004i [DIRS 171598], Section B.1.1.1).

The DPC docking room (room 1101) is a concrete cell located south of the DPC preparation/cask dry remediation room (room 1100), north of the cask wet remediation/laydown area (room 1117), and west of the cask docking/dry remediation room (room 1109). Trolley tracks extend from each of the three adjacent rooms to a turntable located in room 1101.

The DPC cutting/WP dry remediation cell (room 1097) extends over room 1101. Room 1097 has a 100-ton overhead bridge crane that runs the entire length of room 1101. The DPC docking room (room 1101) is used to receive a trolley with a cask containing DPCs and either position it for docking with the operating floor of room 1097 or orient it towards the appropriate adjacent room to accomplish the next processing step. Once properly oriented, the trolley with cask is moved from the turntable into the appropriate room. A cask with a DPC is moved from room 1100 and is positioned for docking directly underneath the DPC docking port of room 1101. The SNF/HLW transfer system assumes control and proceeds with DPC preparations for SNF/HLW transfer operations (BSC 2004i [DIRS 171598], Section B.1.1.2)

The DPC cutting/WP dry remediation cell (room 1097) is a T-shaped concrete cell. The east-west leg is at the ground floor level. The operating level of room 1097 extends over the DPC docking room (room 1101). The east-west leg is open from floor to roof with the exception of the area extended over room 1101. The east-west leg has a 100-ton overhead bridge crane that runs the entire length of the third floor, including over the DPC docking room (room 1101). The north-south leg has one set of trolley tracks that run the length of the ground floor. The DPC cutting/WP dry remediation cell (room 1097) has one doorway with a sliding shield door providing access to the WP/trolley decontamination room (room 1094). One set of trolley tracks connects the two rooms at the ground floor.

A cask with a DPC is positioned directly underneath the DPC docking port of the DPC docking room (room 1101), the port docking device is activated, establishing confinement, the port plug is removed, the DPC is transferred from the cask to a trolley in the DPC cutting/WP dry remediation cell (room 1097), and moved to the DPC cutting station in room 1097. The port plug and the DPC are moved using the 100-ton overhead bridge crane. Prior to breaching its containment, the atmospheric conditions inside the DPC are tested to determine the steps necessary to prevent uncontrolled releases of flammable gases, crud, or other contaminants. Gas sampling and analysis is performed at the DPC cutting station. The DPC is vented as required after sampling.

A cutting machine is positioned to cut the DPC wall. The cutting station raises the severed lid high enough for a power shear to reach in and cut off the long drainpipe that was used during loading of the DPC. The severed drainpipe is allowed to drop into its cavity in the fuel basket.

The DPC lid is removed and the DPC transferred to a pedestal on a trolley on the north-south set of trolley tracks that run the length of the ground floor. The trolley is moved to a position directly underneath the transfer hatch of the waste transfer cell (room 2048). This position is located at the southern most end of room 2048 and the northern most end of the DPC cutting/WP dry remediation cell (room 1097). The hatch is opened remotely and the exposed fuel assemblies are transferred using the spent fuel transfer machine to a WP docked at one of the WP docking cells (rooms 1052 and 1055) or to the staging racks in the SNF canister and staging cell (room 1050). When the DPC is unloaded, the dose rate of the unloaded DPC is monitored and visually

inspected for remaining items, the hatch is closed and the unloaded DPC is returned to its initial position in room 1097. The DPC lid is placed into the unloaded DPC.

As soon as the cask is unloaded of the DPC, the cask dose rate is monitored, the cask is visually inspected for remaining items, and moved through the DPC preparation/cask dry remediation room (room 1100), the cask preparation room (room 1074), and the cask/MSC turntable room (room 1073) to the cask restoration room (room 1072) for cask restoration. The cask is moved back through room 1073 to the cask and MSC to trolley transfer room (room 1076), transferred to an SRTC in the cask and MSC SRTC receipt area (room 1077), and removed from the DTF.

An overpack is brought into the DTF through the same rooms and docked in room 1101. The unloaded DPC is transferred from room 1097 into the overpack using the 100-ton overhead bridge crane. A lid is remotely placed on the overpack. The overpack with unloaded DPC is processed out through the same rooms to room 1072, where it is surveyed for external contamination and removed from the DTF for disposal (BSC 2004i [DIRS 171598], Section B.1.1.2).

Table 22a provides a list of the applicability of generic events to DPC handling in the DTF DPC preparation/cask dry remediation room, the DPC docking room, and the DPC cutting/WP dry remediation cell; Table 22b provides a list of potential events for each applicable category.

Table 22a. Generic Events Applicability to DPC Handling in the DTF DPC Preparation/Cask Dry Remediation Room, DPC Docking Room, and DPC Cutting/WP Dry Remediation Cell

Generic Event Category	Is Generic Event Applicable?
Collision/Crushing	Yes
Chemical Contamination/Flooding	Yes
Explosion/Implosion	Yes, also see Fire
Fire	Yes
Radiation/Magnetic/Electrical/Fissile	Yes, Radiation/Fissile
Thermal	Yes (see fire)

Sources: BSC 2004i [DIRS 171598], Sections B.1.1.1 and B.1.1.2; BSC 2004p [DIRS 171164], Section 2.3.1

Table 22b. Potential Events for DPC Handling in the DTF DPC Preparation/Cask Dry Remediation Room, DPC Docking Room, and DPC Cutting/WP Dry Remediation Cell

Generic Event Category	Potential Event
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. 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. 3. Derailment of a trolley in the DPC preparation/cask dry remediation room or DPC docking room (including derailment due to turntable malfunction or

Generic Event Category	Potential Event
	operational error) while holding a cask containing a loaded DPC followed by a load tipover or fall. 4. Drop or collision of a docking ring (or tools, or equipment) onto or against the cask containing the DPC. 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. 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. 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. 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. 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. 10. Drop or collision of a docking port (mobile slab) onto or against a cask containing the loaded DPC. 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). 12. Drop of an inner lid on a cask containing the loaded DPC (with outer lid removed [if applicable]). 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. 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. 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. 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. 17. Drop or collision of a loaded DPC from the DPC Cutting/WP Dry

Generic Event Category	Potential Event
	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. 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. 19. Damage to one or more fuel assembly(ies) during lid-cutting operations or the DPC drainpipe cutting operation. 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. 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. 22. Drop or collision of handling equipment (lid grapple, etc.) onto or against the unsealed (open) loaded DPC. 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. 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. 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. 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. 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. 28. Drop or collision of an SNF assembly from the spent fuel transfer machine back into or against the DPC being unloaded. 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. 30. Impact due to horizontal movement of an SNF assembly by the spent fuel

Generic Event Category	Potential Event
	transfer machine before the assembly is fully lifted out of the DPC. 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). 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.
Chemical Contamination/Flooding	Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures.
Explosion/Implosion	1. Hydrogen explosion involving batteries on a cask-handling trolley. 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. 3. DPC sampling and purging system (or other pneumatic or pressurized system) missile due to a fractured nozzle/valve stem/pneumatic device.
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, turntable, manipulators, the chipless cutting equipment, etc.). 2. Fire/explosion (battery/electrical fire) associated with the cask-handling trolley. 3. Electrical fire associated with the trolley in the DPC cutting/WP dry remediation cell. 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. 5. Thermal hazard (from decay heat) associated with vertical orientation of the cask holding the DPC. 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.
Radiation	1. Radiation exposure of a facility worker and/or the offsite public. 2. Damage or rupture of the DPC sampling and purging system, leading to a release of canister internal gases and radioactive material. 3. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation. 4. Thermal expansion of gases or other loss of confinement in an unsealed

Generic Event Category	Potential Event
	cask, leading to radiological release. 5. Radiation-induced damage to a facility SSC.
Fissile	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. 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. 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. 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. 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. 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. 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.

6.6.4 Fuel Handling Facility

The FHF is located in the North Portal area. The FHF building is a multi-level, reinforced concrete and steel frame structure with walls and floors primarily constructed using reinforced concrete. The FHF has no in-process waste staging areas. However, the FHF provides the means to transfer SNF from transportation casks to MSCs for staging. Transportation casks and empty WPs are expected to be delivered on-demand and closed WPs are expected to be removed on-demand. The SNF requiring aging or off-normal SNF is removed from the FHF in MSCs and staged at the aging pads. The FHF has the capacity to characterize, survey, and close unloaded transportation casks for return to the national transportation system (BSC 2004t [DIRS 172084], Section 4).

The FHF is designed to receive and handle the following:

- Transportation casks shipped by truck or railcar

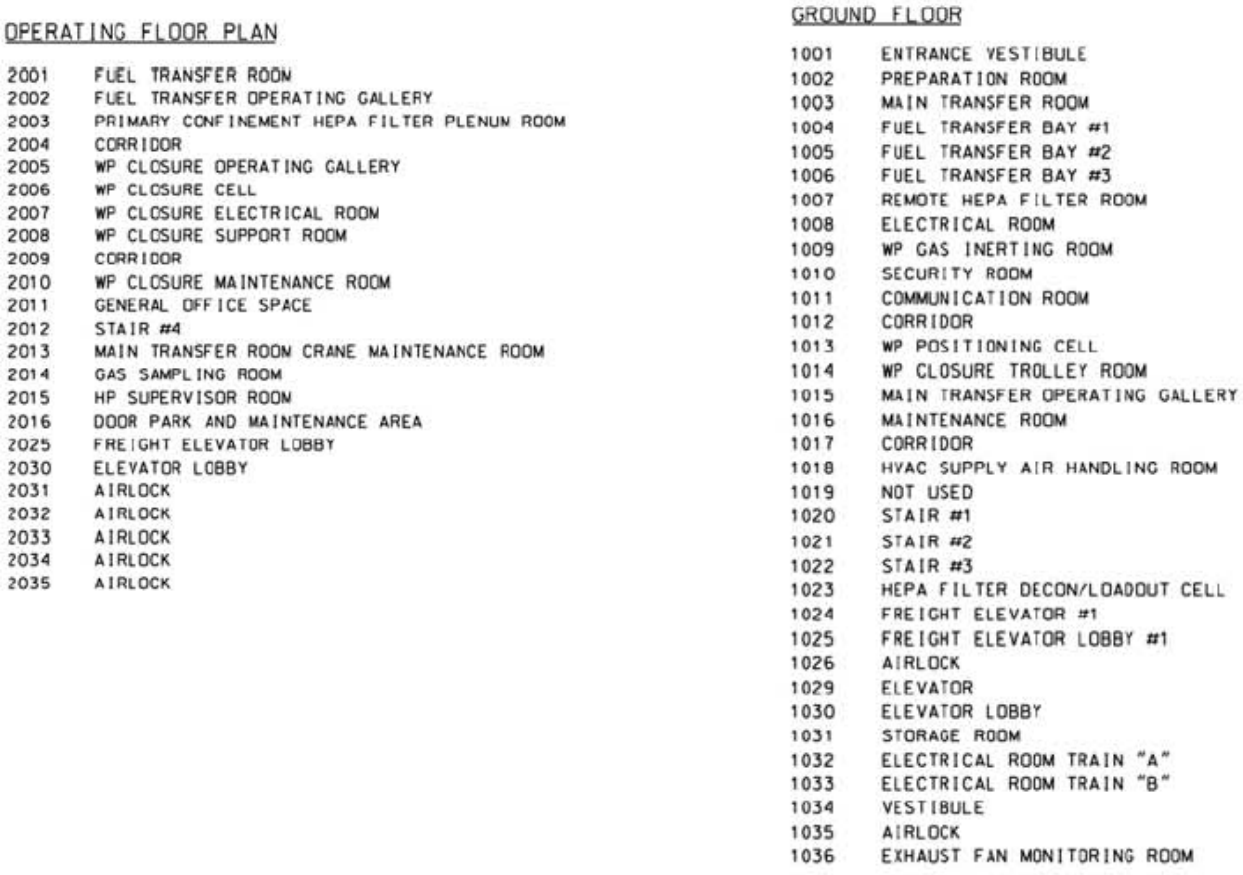
- Commercial SNF
- DOE SNF (except MCOs, horizontal DPCs, and non-standard fuel), including naval SNF canisters
- DOE HLW
- DPCs containing SNF (canisters transferred to Aging only)
- DOE standard canisters
- Empty WPs
- Empty or unloaded MSCs for waste requiring thermal aging
- Loaded MSCs
- Naval SNF canisters.

The FHF provides the structural support, space, and layout for embedded systems that:

- Prepare loaded transportation casks, empty WPs, and empty and unloaded MSCs for SNF/HLW transfer
- Transfer canistered SNF, canistered HLW, or bare fuel assemblies from loaded transportation casks or MSCs to empty WPs (or empty or unloaded MSCs)
- Close (weld, inert, inspect, stress mitigate) loaded WPs for emplacement
- Close loaded MSCs for aging
- Load closed WPs onto a WP transporter for emplacement
- Prepare loaded MSCs for aging
- Place loaded MSCs outside of the FHF for pick-up by the MSC transporter for delivery to an aging pad
- Prepare unloaded transportation casks for return to the national transportation system
- Prepare unloaded MSCs for re-use by the SNF Aging System.

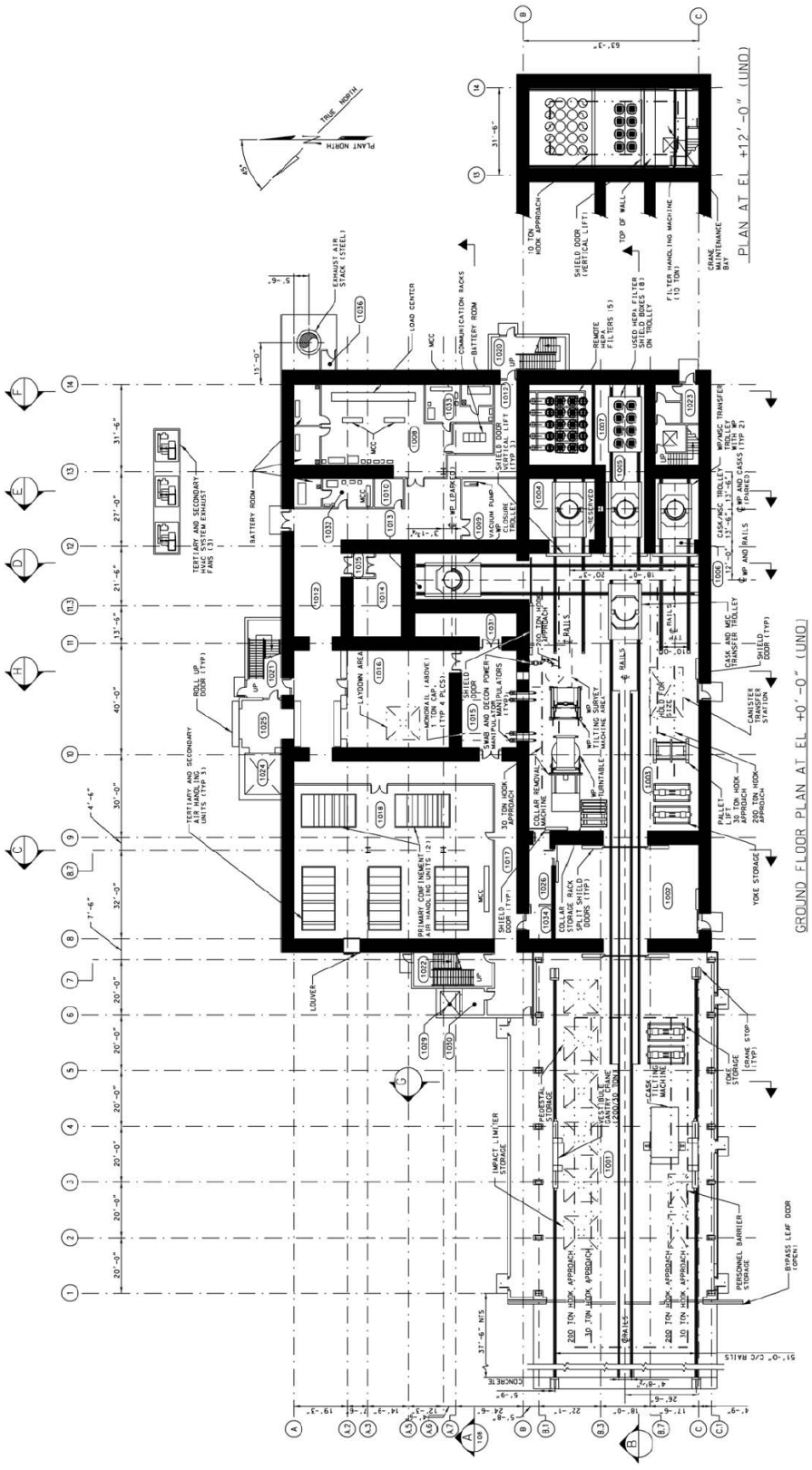
The FHF integrates waste handling systems within its protective structure to support waste processing operations (BSC 2004t [DIRS 172084], Section 1).

The location of the FHF is depicted in Figure 1, the Site Plan. The FHF room legend is presented in Figure 9; the FHF ground floor plan is presented in Figure 10.



Source: BSC 2004u [DIRS 171814]

Figure 9. Fuel Handling Facility Room Legend



Source: BSC 2004v [DIRS 171716]

Figure 10. Fuel Handling Facility General Arrangement Ground Floor Plan

6.6.4.1 FHF Entrance Vestibule (Cask and MSC Receipt)

Area Description/Process Description: The FHF entrance vestibule (room 1001) is a single-story steel frame structure with steel sheet siding on a concrete foundation. It is located adjacent to the preparation room (room 1002). Rail tracks connect the two rooms and a shield door separates them. A confinement door provides large component entrance to, and exit from, the FHF. The FHF entrance vestibule (room 1001) has a 200-ton gantry crane for handling casks and WPs with a 30-ton auxiliary hook for removing and re-installing impact limiters, pedestals, and other heavy components. The 200-ton gantry crane runs the entire length of the vestibule and has the ability to move out of the vestibule to pick up and deliver MSCs. Space is provided for staging the appropriate set of lifting yokes, stands, pedestals, tie downs, impact limiters, personnel barriers, and a cask tilting machine. The vestibule allows the cask/MSC or WP conveyance to enter the facility without exposing the interior processing areas to the external environment. The entire conveyance, including a site prime mover, is moved into the building and the door closed. The vestibule is designed to accommodate a railcar (not including the prime mover) (BSC 2004t [DIRS 172084], Appendix B).

When required, a site prime mover is used to move a loaded conveyance to the FHF. When a loaded transportation cask is scheduled for processing at FHF, the import-export trolley is moved along the FHF central rail tracks to a loading position near the inner vestibule door in the FHF entrance vestibule (room 1001). The vestibule inner door is closed and the outer door opened. The transportation cask conveyance is backed into the vestibule by a site prime mover. The conveyance air brakes are set, wheels blocked, and the site prime mover engine shut off. The outer door is closed. The FHF ventilation system design is based on cascading airflow from an area of lower contamination potential to an area of higher contamination potential. Therefore, diesel engine prime movers (truck cabs or rail locomotives) will not be used within the vestibule that will serve as the transportation airlock (BSC 2004t [DIRS 172084], Appendix B). A battery-powered site prime mover (Assumption 5.2.2) will be used to move the conveyance holding a transportation cask into the entrance vestibule.

Loaded transportation cask tie-downs are released, removed, and stored in the vestibule. A mobile elevated platform is positioned next to the cask for personnel, using the auxiliary hook as necessary, to remove the personnel barrier (if not already removed and staged at the restricted area near the site security gate), impact limiters, and tie-downs. A surface smear test and radiation survey of the cask impact limiters, tie-downs, and cask is conducted, any loose contamination wiped clean, and a cask condition inspection performed. The auxiliary hook lifts the cask pedestal from its staging location within room 1001 and places it onto the import-export trolley (previously positioned in room 1001). Using the 200-ton gantry crane, the cask is up-ended to a vertical position, lifted from the conveyance, moved to the import-export trolley, lowered onto it, and secured (BSC 2004t [DIRS 172084], Appendix B).

Transportation casks except for the HI-STAR can be up-ended to the vertical position while on the conveyance. The HI-STAR must be lifted off the conveyance in the horizontal position and up-ended using a tilting frame located within the vestibule area (BSC 2004t [DIRS 172084], Appendix B). The impact limiters and tie-downs are returned to the conveyance or stored in the vestibule. The trolley is moved into the preparation room (room 1002). A site prime mover removes the conveyance from the vestibule. For an unloaded cask returning from room 1002 to

room 1001, the operational steps performed within room 1001 are reversed (BSC 2004t [DIRS 172084], Appendix B).

When a loaded MSC is scheduled for return to the FHF from an SNF Aging System aging pad, it is delivered in a vertical orientation via the MSC transporter to a point near the entrance vestibule (room 1001). The gantry crane moves out of the entrance vestibule (room 1001), lifts the MSC and moves it inside room 1001. From this point MSC preparation follows a similar process as that of a loaded transportation cask (BSC 2004t [DIRS 172084], Appendix B).

The import-export trolley is powered by battery (BSC 2004w [DIRS 171921].

Table 23a lists the applicability of generic events to the FHF Entrance vestibule; Table 23b lists potential events for each applicable category.

Table 23a. Generic Events Applicability to the FHF Entrance Vestibule

Generic Event Category	Is Generic Event Applicable?
Collision/Crushing	Yes
Chemical Contamination/Flooding	Yes
Explosion/Implosion	Yes; also see Fire
Fire	Yes
Radiation/Magnetic/Electrical/Fissile	Yes, Radiation/Fissile
Thermal	Yes (see Fire)

Sources: BSC 2004t [DIRS 172084], Appendix B; BSC 2004w [DIRS 171921]

Table 23b. Potential Events for the FHF Entrance Vestibule

Generic Event Category	Potential Event
Collision/Crushing	1. Railcar derailment, overturning, or collision involving a loaded cask followed by a load tipover or fall. 2. Overturning or collision involving an LWT or OWT holding a loaded cask (with impact limiters and personnel barrier installed). 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. 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). 5. Collision of the gantry crane carrying a loaded MSC with the entrance vestibule doors. 6. The entrance vestibule doors close on the entrance vestibule gantry crane carrying a loaded MSC. 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

Generic Event Category	Potential Event
	during survey activities. 8. Drop or collision of personnel barriers or impact limiters from the entrance vestibule gantry crane onto or against the loaded cask. 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. 10. Collision between a mobile elevated platform and a loaded cask on a railcar, an LWT, an OWT, or the conveyance holding the cask. 11. Collision between the entrance vestibule gantry crane carrying a loaded MSC and a forklift. 12. Collision between the entrance vestibule gantry crane carrying the loaded MSC and a mobile elevated platform. 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. 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). 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. 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. 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. 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. 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. 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. 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

Generic Event Category	Potential Event
	pedestal on an import-export trolley. 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. 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. 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. 25. Handling equipment drop onto a loaded cask or loaded MSC.
Chemical Contamination/Flooding	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).
Explosion/Implosion	1. Hydrogen explosion involving batteries on a forklift. 2. Hydrogen explosion involving batteries on a mobile elevated platform. 3. Hydrogen explosion involving batteries on the import-export trolley. 4. Hydrogen explosion involving batteries on a site prime mover.
Fire, Thermal	1. Electrical fire associated with the entrance vestibule gantry crane. 2. Electrical fire associated with handling equipment or other entrance vestibule electrical equipment. 3. Fire/explosion (battery/electrical fire) involving a site prime mover pulling or pushing a conveyance holding a loaded cask. 4. Fire/explosion (battery/electrical fire) associated with the import-export trolley. 5. Fire/explosion (battery/electrical fire) associated with a forklift. 6. Fire/explosion (battery/electrical fire) associated with the mobile elevated platform. 7. Thermal hazard (from decay heat) associated with vertical orientation of a loaded cask. 8. Transient combustible fire in the entrance vestibule.
Radiation	1. Radiation exposure of a facility worker and/or the offsite public.

Generic Event Category	Potential Event
	2. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation. 3. Radiation-induced damage to a facility SSC.
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. 2. Criticality associated with an overturning or collision involving an LWT or an OWT holding a loaded cask and rearrangement of cask internals. 3. Criticality associated with a drop or slapdown of a cask and a rearrangement of the container internals. 4. Criticality associated with a drop or slapdown of an MSC and a rearrangement of the container internals. 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.

6.6.4.2 FHF Preparation Room

Area Description/Process Description: The preparation room (room 1002) is a concrete cell located between the entrance vestibule (room 1001) and the main transfer room (room 1003). Rail tracks connect the three rooms and shield doors separate them. When a cask, MSC, or WP is brought into the preparation room (room 1002) from the entrance vestibule (room 1001), a mobile elevated platform is moved in place next to it for personnel access to the outer and inner lids. Cask/MSC/WP preparations are conducted primarily from the main transfer room crane maintenance room with assistance from personnel on the platform. These activities include venting and gas sampling of the cask interior (BSC 2004t [DIRS 172084], Appendix B). For subsequent SNF transfer between the transfer bays, a lid lifting fixture is installed (BSC 2004t [DIRS 172084], Appendix B). When cask/MSC/WP preparations are completed, the mobile platform is moved away from the trolley to a staging position within the preparation room (room 1002) and the trolley is moved into the main transfer room (room 1003) (BSC 2004t [DIRS 172084], Appendix B).

Table 24a lists the applicability of generic events to the FHF preparation room; Table 24b lists potential events for each applicable category.

Table 24a. Generic Events Applicability to the FHF Preparation Room

Generic Event Category	Is Generic Event Applicable?
Collision/Crushing	Yes
Chemical Contamination/Flooding	Yes
Explosion/Implosion	Yes; also see Fire
Fire	Yes
Radiation/Magnetic/Electrical/Fissile	Yes, Radiation/Fissile
Thermal	Yes (see Fire)

Sources: BSC 2004t [DIRS 172084], Appendix B

Table 24b. Potential Events for the FHF Preparation Room

Generic Event Category	Potential Event
Collision/Crushing	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. 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. 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. 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. 5. Collision of a mobile elevated platform with a loaded cask or loaded MSC during preparation activities on top of the cask or MSC. 6. Drop of a cask or MSC outer lid onto the loaded cask or loaded MSC (if applicable) in the preparation room. 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. 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 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).

Generic Event Category	Potential Event
Chemical Contamination/Flooding	Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures.
Explosion/Implosion	1. Cask sampling and inerting system (or other pneumatic or pressurized system) missile due to a fractured nozzle/valve stem/pneumatic device. 2. Explosion hazard associated with the cask sampling and inerting system and the ignition of hydrogen that may have accumulated in the cask. 3. Hydrogen explosion involving batteries on the import-export trolley. 4. Hydrogen explosion involving batteries on a mobile elevated platform.
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). 2. Fire/explosion (battery/electrical fire) associated with the import-export trolley. 3. Fire/explosion (battery/electrical fire) associated with the mobile elevated platform. 4. Transient combustible fire in the preparation area. 5. Thermal hazard (from decay heat) associated with vertical orientation of the loaded cask. 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.
Radiation	1. Radiation exposure of a facility worker and/or the offsite public. 2. Damage or rupture of cask sampling and purging system, leading to a release of cask internal gases and radioactive material. 3. Thermal expansion of gases or other loss of confinement in an unsealed cask or MSC, leading to radiological release. 4. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation. 5. Radiation-induced damage to a facility SSC.
Fissile	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.

6.6.4.3 FHF Entrance Vestibule, Preparation Room, Main Transfer Room, and Fuel Transfer Bay (Empty WP/Empty MSC Processing)

Area Description/Process Description: Empty WPs are received at the WNNRF and placed into storage with a matched set of inner, middle, and outer lids, and a transfer pedestal. When needed, the WP with matching lids and pedestal is moved to the FHF using the site prime mover and site conveyance. The WP is delivered in the vertical position with the inner lid and protective cap in place. In the entrance vestibule (room 1001) the protective end cap and tie-downs are removed and stored. The pedestal is removed from the conveyance and placed onto the import-export trolley. The WP is lifted from the conveyance, moved to the import-export trolley, and secured. The outer and middle lids are removed from the conveyance and taken to the WP closure support room where they are stored until needed. The transfer trolley is moved to the main transfer room (room 1003) and secured in place. For subsequent SNF transfer between transfer bays, the empty WP is lifted from the import-export trolley to a transfer bay trolley previously prepared with a matching pedestal, and a docking ring is installed. The transfer trolley is moved into the corresponding fuel transfer bay 1 (room 1004) or fuel transfer bay 3 (room 1006) and adjusted into position for subsequent SNF transfer operations. For subsequent SNF/HLW canister transfer in the main transfer room (room 1003) the empty WP is lifted from the import-export trolley, placed into position at the canister transfer station, and secured for canister transfer operations. The inner lid is removed and a collar installed to protect sealing surfaces during transfer (BSC 2004t [DIRS 172084], Appendix B).

If available, an unloaded, reusable MSC from the SNF Aging System aging pad is moved in a vertical orientation to the entrance vestibule of FHF via the MSC transporter. The vestibule gantry crane moves the MSC into the entrance vestibule (room 1001) to the import-export trolley (previously moved into position in the entrance vestibule and prepared with a pedestal, if necessary). The trolley is moved to the preparation room (room 1002) and the lid bolts are removed. The trolley is moved to the main transfer room (room 1003) and secured in place. If an unloaded MSC is not available from the SNF Aging System, a new, empty MSC from the WNNRF is delivered in a horizontal orientation into the entrance vestibule (room 1001) using the site prime mover and site conveyance. The vestibule gantry crane upends the MSC from the conveyance to vertical and moves it to the import-export trolley (previously moved into position in the entrance vestibule (room 1001) and prepared with a pedestal, if necessary). The trolley is moved to the preparation room (room 1002) and the lid bolts are removed. The trolley is moved to the main transfer room (room 1003) and secured in place (BSC 2004t [DIRS 172084], Appendix B).

For subsequent SNF transfer between transfer bays, the empty MSC is lifted from the import-export trolley to a transfer bay trolley previously prepared with the appropriate pedestal. A docking ring is installed. The transfer trolley with the loaded cask is moved into the corresponding fuel transfer bay 3 (room 1006) or fuel transfer bay 1 (room 1004). The trolley is adjusted into position for subsequent SNF transfer operations. For subsequent SNF/HLW canister transfer in the main transfer room (room 1003) the empty MSC is lifted from the import-export trolley, placed into position at the canister transfer station, and secured for canister transfer operations. The lid is removed and a collar is installed on the MSC to protect sealing surfaces during transfer operations (BSC 2004t [DIRS 172084], Appendix B).

Table 25 lists the applicability of generic events to empty WP and empty MSC processing in the FHF entrance vestibule, preparation room, main transfer room, and the fuel transfer bay.

Table 25. Generic Events Applicability to Empty WP/Empty MSC Processing in the FHF Entrance Vestibule, Preparation Room, Main Transfer Room, and Fuel Transfer Bay

Generic Event Category	Is Generic Event Applicable?
Collision/Crushing	None identified that affect/interact with a waste form
Chemical Contamination/Flooding	None identified that affect/interact with a waste form
Explosion/Implosion	None identified that affect/interact with a waste form
Fire	None identified that affect/interact with a waste form
Radiation/Magnetic/Electrical/Fissile	None identified that affect/interact with a waste form
Thermal	None identified that affect/interact with a waste form

Sources: BSC 2004t [DIRS 172084] Appendix B

6.6.4.4 FHF Main Transfer Room, Fuel Transfer Bay, Fuel Transfer Room (SNF Assembly Transfer)

Area Description/Process Description: The main transfer room (room 1003) is a two-story concrete shielded cell located between the preparation room (room 1002) and fuel transfer bays 1, 2, and 3 (rooms 1004, 1005, and 1006 respectively). Located adjacent to room 1003 is the WP positioning cell (room 1013) and the main transfer operating gallery (room 1015). Rail tracks connect the preparation room (room 1002) with the main transfer room (room 1003). Trolley tracks connect the main transfer room (room 1003) with the three transfer bays. A 200-ton overhead bridge crane with 30-ton auxiliary hook runs the length of the main transfer room (room 1003) (BSC 2004t [DIRS 172084], Appendix B).

The fuel transfer bays (rooms 1004, 1005, and 1006, respectively) are single-story concrete cells located between the main transfer room (room 1003) and the remote HEPA filter room (room 1007). Trolley tracks connect the three transfer bays with between the main transfer room (room 1003) and shield doors separate them (BSC 2004t [DIRS 172084], Appendix B).

The WP transfer trolley, which services transfer bay 1 (room 1004), is powered by battery (BSC 2004x [DIRS 172631]. The cask transfer trolley, which services transfer bay 2 (room 1005), is powered by battery (Cogema 2004b [DIRS 168043], as is the MSC trolley that services transfer bay 3 (room 1006) (BSC 2004y [DIRS 172630]).

The fuel transfer room is located directly overhead of the three transfer bays and adjacent to and overhead of the fuel transfer operating gallery. A 1.5-ton capacity spent fuel transfer machine runs north-to-south and covers the entire length of the fuel transfer room, traversing the three transfer bays. A 30-ton fuel transfer maintenance crane located above the spent fuel transfer machine runs east-west and covers the entire length and width of the fuel transfer room. Access from the fuel transfer operating gallery into the fuel transfer room is provided via three sets of master-slave manipulators (BSC 2004t [DIRS 172084], Appendix B).

For uncanistered SNF transfer involving a loaded cask between the transfer bays, a matching cask pedestal is brought into the main transfer room (room 1003). The 30-ton auxiliary hook is used to place the pedestal onto the transfer trolley of the fuel transfer bay 2 (room 1005). A loaded cask is brought into the main transfer room (room 1003) with the outer lid, sample port access cover, and inner lid bolts removed and a lid lifting fixture attached to the inner lid. Using the 200-ton overhead crane, the loaded cask is lifted from the import-export trolley to the transfer bay trolley. A mobile elevated platform is moved into place next to the loaded cask for personnel to install a docking ring. The 30-ton auxiliary hook moves a docking ring from the main transfer room crane maintenance room to the main transfer room (room 1003) for installation on the cask (BSC 2004t [DIRS 172084], Appendix B).

For uncanistered SNF transfer between the transfer bays involving a loaded cask, the transfer bay trolley with loaded cask is moved into fuel transfer bay 2 (room 1005) and positioned under the docking port for subsequent transfer operations. For uncanistered SNF transfer between the transfer bays involving a loaded MSC, the transfer bay trolley with loaded MSC is moved into fuel transfer bay 1 (room 1004) or fuel transfer bay 3 (room 1006) and positioned under the docking port for subsequent transfer operations. If uncanistered SNF transfer is to occur between the transfer bays involving a WP or an empty or unloaded MSC, the transfer bay trolley with a WP or an MSC is moved into fuel transfer bay 1 (room 1004) or fuel transfer bay 3 (room 1006) and positioned under the docking port for subsequent transfer operations (BSC 2004t [DIRS 172084], Appendix B).

Following positioning of the loaded cask/MSC and empty WP/MSC by the Cask/MSC/WP Preparation System, the SNF/HLW Transfer System assumes control and extends a lifting device from the 30-ton overhead fuel transfer maintenance crane through the port plug, engages the inner lid of the cask, retracts the lifting device securing the inner lid to the port plug, lifts the port plug/inner lid assembly, and moves it to a staging location within the fuel transfer room. The SNF/HLW Transfer System engages the port docking device with the docking rings of the cask, MSC and/or WP. The transfer of bare fuel assemblies is accomplished using the spent fuel transfer machine with appropriate grapple (BSC 2004t [DIRS 172084], Appendix B).

When transfer operations are completed, the dose rate in the cask is monitored, the cask interior is visually inspected for remaining items, the docking port plugs with inner lids attached are returned to their respective ports using the 30-ton fuel transfer maintenance crane, the inner lids are released from their respective port plugs and returned to the cask, WP and/or MSC, and the respective port docking devices disengaged. Limited dry wipe decontamination of the exposed unloaded cask or MSC upper surfaces may be performed using a power manipulator on the SFTM or the master slave manipulators. The Cask/MSC/WP Preparation System assumes control, returns the empty cask and/or MSC to the main transfer room (room 1003) for restoration operations. The loaded WP lid is secured and the SNF/HLW Transfer System transfers it to the main transfer room (room 1003) for closure preparation operations (BSC 2004t [DIRS 172084], Appendix B).

Table 26a lists the applicability of generic events to SNF assembly transfer and the FHF main transfer room, the fuel transfer bay, and the fuel transfer room; Table 26b lists potential events for each applicable category.

Table 26a. Generic Events Applicability to SNF Assembly Transfer and the FHF Main Transfer Room, the Fuel Transfer Bay, and the Fuel Transfer Room

Generic Event Category	Is Generic Event Applicable?
Collision/Crushing	Yes
Chemical Contamination/Flooding	Yes
Explosion/Implosion	Yes; also see Fire
Fire	Yes
Radiation/Magnetic/Electrical/Fissile	Yes, Radiation/Fissile
Thermal	Yes (see Fire)

Sources: BSC 2004t [DIRS 172084], Appendix B; BSC 2004x [DIRS 172631]; BSC 2004y [DIRS 172630]; Cogema 2004b [DIRS 168043]

Table 26b. Potential Events Associated With SNF Assembly Transfer and the FHF Main Transfer Room, the Fuel Transfer Bay, and the Fuel Transfer Room

Generic Event Category	Potential Event
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. 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. 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. 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. 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. 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. 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. 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. 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)

Generic Event Category	Potential Event
	followed by a load tipover or fall. 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 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). 12. Drop or collision of a docking port onto or against a cask or MSC. 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). 14. Drop of an inner lid onto a cask or MSC (with outer lid removed [if applicable]). 15. Drop or collision of an SNF assembly from the spent fuel transfer machine back into or against a cask or MSC being unloaded. 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. 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. 18. Drop of an SNF assembly from the spent fuel transfer machine onto the fuel transfer room floor. 19. Collision involving an SNF assembly suspended from the spent fuel transfer machine with wall-mounted equipment located in the fuel transfer room. 20. Drop or collision of an SNF assembly from the spent fuel transfer machine onto or against a sharp object. 21. Drop or collision of an SNF assembly from the spent fuel transfer machine into or against an empty WP or MSC being loaded. 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. 23. Drop or collision of handling equipment into or against an open MSC or an open WP filled with commercial SNF assemblies. 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.

Generic Event Category	Potential Event
	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.
Chemical Contamination/Flooding	Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures.
Explosion/Implosion	1. Hydrogen explosion involving batteries on a cask transfer trolley, an MSC trolley, or a WP transfer trolley. 2. Hydrogen explosion involving batteries on a mobile elevated platform.
Fire, Thermal	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). 2. Fire/explosion (battery/electrical fire) associated with an import-export trolley, 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). 3. Fire/explosion (battery/electrical fire) associated with a WP transfer trolley holding a filled WP, open and unsealed and filled or partially filled, or filled and unsealed with inner lid in place. 4. Fire/explosion (battery/electrical fire) associated with the mobile elevated platform. 5. HEPA filter fire due to excessive radioactive decay within the filter bed. 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. 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. 8. Transient combustible fire in the main transfer room, the fuel transfer bays, or the fuel transfer room.
Radiation	1. Radiation exposure of a facility worker and/or the offsite public. 2. Docking ring failure leads to a radiological release. 3. Radiological release due to installation of incorrect docking ring. 4. Thermal expansion of gases or other loss of confinement in an unsealed cask or MSC, leading to radiological release. 5. Loss of confinement zone due to ventilation system malfunction or other

Generic Event Category	Potential Event
	breach of a confinement barrier leading to a release of airborne contamination. 6. Inadvertent opening of a fuel transfer bay door, leading to a worker exposure. 7. Radiation-induced damage to a facility SSC.
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. 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. 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. 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. 5. Criticality associated with the drop of heavy equipment onto a loaded, open cask, MSC, or WP and a rearrangement of the container internals. 6. Criticality associated with a misload of a WP or an MSC.

6.6.4.5 FHF Main Transfer Room (Canister Transfer)

Area Description/Process Description: Canister transfer operations are conducted within the main transfer room (room 1003) between a cask and WP (or MSC) positioned at the canister transfer station. The overhead 200-ton crane is used to remove the inner lids to a staging location within the main transfer room (room 1003) and, with the appropriate canister grapple, to lift and transfer the canisters (BSC 2004t [DIRS 172084], Appendix B).

For canistered SNF/HLW transfer in the main transfer room (room 1003), the loaded transportation cask is brought into the main transfer room (room 1003) without the inner lid lifting attachment. The cask is lifted from the import-export trolley, placed into position on the floor at the canister transfer station, and secured for canister transfer operations (BSC 2004t [DIRS 172084], Appendix B).

An empty WP or MSC and a loaded cask are positioned at the canister transfer station on the floor of the main transfer room. The WP or MSC and cask inner lids are removed and staged within the main transfer room. Canistered DOE SNF/HLW is transferred from the loaded cask, to the empty WP or MSC. Once the transfer is completed, the dose rate in the unloaded cask is

monitored and the cask interior is visually inspected for remaining items. Following completion of transfer operations to a WP, the inner lid is returned to the WP (BSC 2004p [DIRS 171164], Section 4).

The only handling of DPCs in the FHF is the transfer of the DPCs to MSCs for aging. Transfer of DPCs is conducted from a transportation cask to an MSC in the main transfer room (room 1003). The MSC lids are removed and staged. The DPC is transferred from the loaded cask to the empty MSC. Once the transfer is complete, the dose rate in the unloaded transportation cask is monitored and the cask interior is visually inspected for remaining items (BSC 2004p [DIRS 171164], Section 4).

Transfer of canistered naval SNF is also conducted within the main transfer room (1003). A cask loaded with canistered naval SNF and an empty WP are positioned with inner lids removed at the canister transfer station on the floor of the main transfer room (room 1003). Canistered naval SNF is transferred from the loaded cask to an empty WP. Once the transfer is completed, the dose rate in the unloaded cask is monitored and the cask interior is visually inspected for remaining items. Following completion of transfer operations to a WP, the inner lid is returned to the WP (BSC 2004p [DIRS 171164], Section 4).

Table 27a lists the applicability of generic events canister transfer operations in the FHF main transfer room; Table 27b lists potential events for each applicable category.

Table 27a. Generic Events Applicability to Canister Transfer in the FHF Main Transfer Room

Generic Event Category	Is Generic Event Applicable?
Collision/Crushing	Yes
Chemical Contamination/Flooding	Yes
Explosion/Implosion	Yes; see also Fire
Fire	Yes
Radiation/Magnetic/Electrical/Fissile	Yes, Radiation/Fissile
Thermal	Yes (see Fire)

Sources: BSC 2004p [DIRS 171164], Section 4; BSC 2004t [DIRS 172084], Appendix B

Table 27b. Potential Events for Canister Transfer in the FHF Main Transfer Room

Generic Event Category	Potential Event
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. 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. 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.

Generic Event Category	Potential Event
	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. 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. 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. 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. 8. Drop of a cask inner lid, as appropriate, from the main transfer room overhead crane into a loaded cask to be unloaded. 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 DOE SNF canister. 10. Drop or collision of a DPC, a DOE HLW canister, a DOE SNF canister, or a naval SNF canister from the main transfer room overhead crane back into or against the cask being unloaded. 11. Impact due to horizontal movement of a naval SNF canister, a DPC, a DOE HLW canister, or a DOE SNF canister with the main transfer room overhead crane before the canister is completely removed from the cask. 12. Drop and slapdown of a naval SNF canister, a DOE HLW canister or a 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). 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. 14. Drop or collision of a DPC, a DOE HLW canister, a 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. 15. Drop of a DPC, a DOE HLW canister, a DOE SNF canister, or a naval SNF canister from the main transfer room overhead crane onto the canister transfer station floor. 16. Drop or collision of a DOE HLW canister, a DOE SNF canister, or a naval SNF canister from the main transfer room crane into or against an empty WP or empty MSC.

Generic Event Category	Potential Event
	17. Drop or collision of a naval SNF canister from the main transfer room crane into or against an empty WP. 18. Drop or collision of a DPC from the main transfer room crane into or against an empty MSC. 19. Collision involving a DPC, a DOE HLW canister, a DOE SNF canister, or a naval SNF canister and the canister transfer station. 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 DOE SNF canister in a WP or in an MSC. 21. Drop or collision of a DOE SNF canister from the main transfer room overhead crane onto or against a DOE HLW canister in a WP or in an MSC. 22. Drop or collision of handling equipment into or against an open WP or MSC loaded with a DPC, DOE HLW canisters, and/or DOE SNF canisters, and/or a naval SNF canister, as appropriate. 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.
Chemical Contamination/Flooding	Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures.
Explosion/Implosion	1. Hydrogen explosion involving batteries on the import-export trolley. 2. Hydrogen explosion involving batteries on a mobile elevated platform.
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.). 2. Fire/explosion (battery/electrical fire) associated with the import-export trolley. 3. Fire/explosion (battery/electrical fire) associated with the mobile elevated platform. 4. Thermal hazard (from decay heat) associated with a vertical orientation of a loaded cask (with inner lid in place, unbolted). 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. 6. Transient combustible fire in the main transfer room.
Radiation	1. Radiation exposure of a facility worker and/or the offsite public.

Generic Event Category	Potential Event
	2. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne contamination. 3. Thermal expansion of gases or other loss of confinement in an unsealed cask, leading to radiological release. 4. Inadvertent opening of the main transfer room shield door, leading to a worker exposure. 5. Radiation-induced damage to a facility SSC.
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. 2. Criticality associated with a drop or slapdown of a DPC, a DOE SNF canister, a naval SNF canister, or a DOE HLW canister and a rearrangement of canister internals. 3. Criticality associated with the drop of heavy equipment onto a loaded, open cask, MSC, or WP and a rearrangement of the container internals. 4. Criticality associated with a misload of a WP or an MSC.

6.6.4.6 FHF Main Transfer Room, WP Positioning Cell, WP Closure Cell (WP Closure)

Area Description/Process Description: The WP positioning cell (room 1013) is adjacent to the main transfer room (room 1003). A sliding shield door separates these two rooms; trolley tracks connect them. This trolley track has a dedicated closure transfer trolley. Above room 1013, is the WP closure cell. The WP positioning cell (room 1013) provides space and layout for a loaded WP to be positioned under the closure equipment of the overhead closure cell. The Cask/MSC/WP Preparation System moves the WP from the main transfer room (room 1003) to the WP positioning cell (room 1013) and secures it within the required tolerances in both the lateral and vertical directions. The WP Closure System assumes control, and performs the necessary WP closure operations. When closure operations are completed, the Cask/MSC/WP Preparation System moves the sealed WP back into room 1003 (BSC 2004t [DIRS 172084], Appendix B).

The WP closure cell is a concrete shielded cell located directly over the WP positioning cell (room 1013) and the WP closure transfer trolley room (room 1014), adjacent to the WP closure maintenance room. A 15-ton WP closure cell overhead bridge crane traverses north-south and covers the length of the WP closure cell and the WP closure maintenance room. The WP closure cell provides space for an electro-mechanical WP closure robotic arm. A second overhead bridge crane, the remote handling crane (3-ton), travels the full width and length of the closure cell to augment the electro-mechanical manipulator and the 15-ton WP closure cell overhead bridge crane (BSC 2004t [DIRS 172084], Appendix B).

The WP closure transfer trolley that services the WP positioning cell (room 1013) is powered by battery (BSC 2004z [DIRS 172632]).

When uncanistered transfer operations between transfer bays are completed, the loaded WP is returned to the main transfer room (room 1003). The docking ring is remotely removed using the 30-ton auxiliary hook. The 200–ton crane raises the loaded WP from the WP transfer trolley. The WP transfer trolley is brought further into the main transfer room (room 1003) to clear room for the WP closure transfer trolley. The WP closure transfer trolley, previously prepared with a pedestal, is moved from the WP positioning cell (room 1013) into position under the WP. The 200-ton crane lowers the WP onto the WP closure transfer trolley. The WP closure transfer trolley moves the WP into the WP positioning cell (room 1013) for subsequent closure operations. When the loaded WP has been moved into the WP positioning cell (room 1013) and the shield door of the WP positioning cell (room 1013) is closed, the WP transfer trolley is returned to the transfer bay. The docking ring is decontaminated and returned to staging in the WP positioning cell (room 1013), or bagged for storage pending aggressive decontamination capability on site.

When canister transfer operations are completed, the 30-ton auxiliary hook is used to remotely return the inner lid to the WP. The 200-ton crane is used to lift the WP from the canister transfer stand to the closure transfer trolley, previously prepared with the appropriate pedestal. The closure transfer trolley moves the WP into the WP positioning cell (room 1013) for subsequent closure operations (BSC 2004t [DIRS 172084], Appendix B).

The SNF/HLW Transfer System moves the loaded WP into the WP positioning cell (room 1013) and positions it with the WP in place for closure operations. The Waste Package Closure System assumes control and welds the inner lid, spread ring, middle and outer lids in place, fills the WP with inert gas, non-destructively examines the closure welds, and mitigates residual welding stresses on the outer lid. When closure operations are completed, control is returned to the SNF/HLW Transfer System. The SNF/HLW Transfer System moves the sealed WP back into the main transfer room (room 1003) (BSC 2004t [DIRS 172084], Appendix B).

A more complete description of the WP closure process is presented in Section 6.6.3.10.

Table 28a lists the applicability of generic events related to WP closure in the FHF main transfer room and the WP closure room; Table 28b lists potential events for each applicable category.

Table 28a. Generic Events Applicability to FHF Waste Package Closure

Generic Event Category	Is Generic Event Applicable?
Collision/Crushing	Yes
Chemical Contamination/Flooding	Yes
Explosion/Implosion	Yes, also see Fire
Fire	Yes
Radiation/Magnetic/Electrical/Fissile	Yes, Radiation/Fissile
Thermal	Yes (see Fire)

Sources: BSC 2004t [DIRS 172084], Appendix B; BSC 2004z [DIRS 172632]

Table 28b. Potential Events for FHF Waste Package Closure

Generic Event Category	Potential Event
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. 2. Shield doors between the main transfer room and the WP positioning cell close on the trolley holding the loaded, unsealed WP. 3. Derailment of a trolley holding a loaded, unsealed WP followed by a load tipover or fall. 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. 5. Drop or collision of an unsealed, loaded WP from the main transfer room overhead crane back into or against the canister transfer station. 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. 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. 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. 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. 10. Lid drop onto a WP from the lid placement fixture equipment during the welding process. 11. Equipment drop onto a WP during the welding process. 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. 13. Collision involving the trolley holding the loaded, sealed WP and the shield doors between the WP positioning cell and the main transfer room. 14. Shield doors between the WP positioning cell and the main transfer room close on the trolley holding the loaded, sealed WP.
Chemical Contamination/Flooding	Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures.

Generic Event Category	Potential Event
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. 2. WP inerting system (or other pneumatic or pressurized system) missile due to a fractured nozzle/valve stem/pneumatic device. 3. Hydrogen explosion involving batteries on the WP closure transfer trolley.
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 the welding subsystem in the WP closure cell. 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. 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. 4. Canister/fuel damage by burn-through during welding process/heat damage. 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. 6. Transient combustible fire in the WP closure cell and the WP positioning cell.
Radiation	1. Radiation exposure of a facility worker and/or the offsite public. 2. Glovebox leak leads to a radiological release. 3. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation. 4. Inadvertent opening of a transfer bay shield door or the WP positioning cell shield door, leading to a worker exposure. 5. Radiation-induced damage to a facility SSC.
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. 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.

Generic Event Category	Potential Event
	3. Criticality associated with the drop of heavy equipment onto a loaded, unsealed WP and a rearrangement of the container internals.

6.6.4.7 FHF Main Transfer Room, Preparation Room, Entrance Vestibule (WP Loadout)

Area Description/Process Description: During WP loadout operations, the preparation room (room 1002) and the main transfer room (room 1003) provide space for positioning of the WP transporter. To receive a closed WP, the subsurface WP transporter is positioned partially in the preparation room (room 1002) and partially in the main transfer room (room 1003) so that the WP emplacement pallet is located near the WP trunnion collar removal machine (BSC 2004t [DIRS 172084], Appendix B).

When the WP transporter is parked, the exterior shield door of the preparation room (room 1002) is closed, the shield door(s) on the transporter are opened, and the bedplate with the WP emplacement pallet extended. The emplacement pallet is lifted from the transporter bedplate using the 200-ton overhead crane and placed on the trunnion removal machine turntable (BSC 2004t [DIRS 172084], Appendix B).

Following WP closure operations, the emplacement pallet and WP transporter are moved into position in the preparation room (room 1002) and the main transfer room (room 1003), the door between the entrance vestibule (room 1001) and the preparation room (room 1002) is closed; the door of the WP positioning cell (room 1013) is opened, and the SNF/HLW Transfer System returns the WP to the main transfer room (room 1003). Loaded WP handling operations in the main transfer room (room 1003) are performed remotely using the 200-ton main transfer room crane and various staged equipment. The WP is moved from the closure transfer trolley to the survey station, remotely inspected for damage and surveyed for contamination. If necessary, limited dry-wipe decontamination is remotely performed to clean loose contamination from the WP. Following decontamination, the WP is moved to the tilting fixture within the main transfer room (room 1003) and downended to a horizontal position onto the emplacement pallet. The turntable repositions the WP for remote removal of trunnion collars by a collar removal machine. The collars are removed and placed into a holding rack within the main transfer room (room 1003) (BSC 2004t [DIRS 172084], Appendix B).

The emplacement pallet with the WP is lifted from the turntable, moved to the transporter, and lowered into place onto the transporter bedplate. The transporter bedplate is retracted into the WP transporter, the shield door(s) of the transporter are closed, and the WP transporter is removed from FHF (BSC 2004t [DIRS 172084], Appendix B).

Table 29a lists the applicability of generic events to WP loadout in the FHF main transfer room, preparation room, and entrance vestibule; Table 29b lists potential events for each applicable category.

Table 29a. Generic Events Applicability to WP Loadout in the FHF Main Transfer Room, Preparation Room, and Entrance Vestibule

Generic Event Category	Is Generic Event Applicable?
Collision/Crushing	Yes
Chemical Contamination/Flooding	Yes
Explosion/Implosion	Yes, also see Fire
Fire	Yes
Radiation/Magnetic/Electrical/Fissile	Yes, Radiation/Fissile
Thermal	Yes (see Fire)

Sources: BSC 2004t [DIRS 172084], Appendix B

Table 29b. Potential Events for WP Loadout in the FHF Main Transfer Room, Preparation Room, and Entrance Vestibule

Generic Event Category	Potential Event
Collision/Crushing	1. Derailment of a trolley holding a loaded, sealed WP followed by a load tipover or fall. 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. 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. 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. 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. 6. Collision of the tilting machine against a loaded, sealed WP on a pallet on the WP turntable. 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. 8. Collision or impact of the lifting collar removal machine and a loaded, sealed WP placed on a pallet positioned on the WP turntable. 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.

Generic Event Category	Potential Event
	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. 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. 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). 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. 14. The doors between the main transfer room and the preparation room close on the WP transporter (holding the sealed WP on a pallet). 15. Collision involving WP transporter (holding the sealed WP on a pallet) and the shield doors between the preparation room and the entrance vestibule. 16. Shield doors between the preparation room and the entrance vestibule close on the WP transporter (holding the sealed WP on a pallet). 17. Collision involving WP transporter (holding the sealed WP on a pallet) and the doors between the entrance vestibule and the ambient air (outside). 18. Doors between the entrance vestibule and the ambient air (outside) close on the WP transporter (holding the sealed WP on a pallet). 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.
Chemical Contamination/Flooding	Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures.
Explosion/Implosion	1. Hydraulic system or other pneumatic or pressurized system missile due to a fractured nozzle/valve stem/pneumatic device. 2. Hydrogen explosion involving batteries on a trolley.
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. 2. Electrical fire associated with the main transfer room overhead crane. 3. Electrical fire associated with equipment on the WP transporter, including motors to extend the WP transporter bedplate.

Generic Event Category	Potential Event
	4. Electrical fire associated with the WP transport locomotive. 5. Fire/explosion (battery/electrical fire) associated with the WP closure transfer trolley. 6. Transient combustible fire in the main transfer room, preparation room, or the entrance vestibule.
Radiation	1. Radiation exposure of a facility worker and/or the offsite public. 2. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation. 3. Inadvertent opening of the main transfer room shield door, leading to a worker exposure. 4. Inadvertent opening of the WP transporter shielded enclosure doors, leading to a worker exposure. 5. Radiation-induced damage to a facility SSC.
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. 2. Criticality associated with a drop, slapdown, or collision of a sealed WP and a rearrangement of the container internals. 3. Criticality associated with a WP transporter derailment followed by a load tipover or fall and rearrangement of the WP internals.

6.6.4.8 FHF Main Transfer Room, Preparation Room, Entrance Vestibule (Loaded MSC Removal)

Area Description/Process Description: Once an MSC in a transfer bay is loaded for aging, the docking port plug with the attached shielded, inner lid is returned to the docking port. The inner lid is released from the port plug and returned to the MSC. The port docking device is disengaged and the loaded MSC is moved to the main transfer room (room 1003). The MSC docking ring is removed, surveyed, decontaminated as necessary, and placed onto a docking ring stand. If more aggressive decontamination of the docking ring is required than that available at the FHF, the docking ring is bagged and placed in storage for decontamination when more aggressive capabilities are established onsite. The inner lid is bolted into place and the loaded MSC is lifted from the transfer trolley to the import-export trolley located on the FHF central rails.

For an MSC loaded at the canister transfer station in the main transfer room (room 1003), the inner lid is returned to the MSC and bolted in place, and the MSC is transferred to the import-export trolley. The MSC is moved to the preparation room (room 1002) where external surfaces

are swipe surveyed and wipe decontaminated to remove loose contamination, the MSC interior is inerted, and the outer lid is installed. The loaded MSC is then moved to the entrance vestibule (room 1001) (BSC 2004t [DIRS 172084], Appendix B).

When the MSC has been closed and returned to the entrance vestibule (room 1001), the gantry crane moves the loaded MSC (in the vertical position) outside of the FHF to a position near the exterior door of the entrance vestibule. The gantry crane is withdrawn and the loaded MSC is picked up by the MSC transporter. The MSC transporter then moves the loaded MSC to the SNF Aging System aging pad (BSC 2004t [DIRS 172084], Appendix B).

Table 30a lists the applicability of generic events to loaded MSC removal activities in the FHF main transfer room, preparation room, and entrance vestibule; Table 30b lists potential events for each applicable category.

Table 30a. Generic Events Applicability to Loaded MSC Removal Operations in the FHF Main Transfer Room, Preparation Room, and Entrance Vestibule

Generic Event Category	Is Generic Event Applicable?
Collision/Crushing	Yes
Chemical Contamination/Flooding	Yes
Explosion/Implosion	Yes, see also Fire
Fire	Yes
Radiation/Magnetic/Electrical/Fissile	Yes, Radiation/Fissile
Thermal	Yes (see Fire)

Sources: BSC 2004t [DIRS 172084], Appendix B

Table 30b. Potential Events for Loaded MSC Removal Operations in the FHF Main Transfer Room, Preparation Room, and Entrance Vestibule

Generic Event Category	Potential Event
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. 2. Collision of a loaded MSC from the main transfer room overhead crane with the canister transfer station. 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). 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. 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. 6. Collision of a mobile elevated platform with a loaded MSC during docking

Generic Event Category	Potential Event
	ring removal activities associated with the MSC. 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. 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. 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. 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. 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. 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. 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. 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. 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. 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. 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. 18. Drop or collision of equipment in the preparation room onto or against a loaded MSC on a pedestal on an import-export trolley. 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

Generic Event Category	Potential Event
	trolley. 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. 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. 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. 23. Collision of the entrance vestibule gantry crane holding a loaded MSC with the entrance vestibule doors. 24. The entrance vestibule doors close on the entrance vestibule gantry crane holding a loaded MSC.
Chemical Contamination/Flooding	Non-intact SNF oxidation or oxidation of damaged SNF and degradation due to exposure to a non-inerted environment at normal operating temperatures.
Explosion/Implosion	1. MSC inerting system (or other pneumatic or pressurized system) missile due to a fractured nozzle/valve stem/pneumatic device. 2. Hydrogen explosion involving batteries on the import-export trolley. 3. Hydrogen explosion involving batteries on a mobile elevated platform. 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.
Fire, Thermal	1. Electrical fire associated with the main transfer room overhead crane or the entrance vestibule gantry crane. 2. Electrical fire associated with handling equipment or other equipment located in the main transfer room, the preparation room, or the entrance vestibule. 3. Transient combustible fire in the main transfer room, preparation room, or the entrance vestibule. 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. 5. Fire/explosion (battery/electrical fire) associated with the import-export trolley or the MSC trolley.

Generic Event Category	Potential Event
	6. Fire/explosion (battery/electrical fire) associated with a mobile elevated platform.
Radiation	1. Radiation exposure of a facility worker and/or the offsite public. 2. Damage or rupture of cask inerting system leading to a release of cask internal gases. 3. Expansion of gasses in the MSC, leading to radiological release. 4. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation. 5. Radiation-induced damage to a facility SSC.
Fissile	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. 2. Criticality associated with a drop or slapdown of a loaded MSC from an overhead crane and a rearrangement of cask internals. 3. Criticality associated with the drop of heavy equipment onto an unsealed MSC and a rearrangement of the container internals.

6.6.4.9 FHF Main Transfer Room, Preparation Room, Entrance Vestibule (Empty Transportation Cask, MSC Removal)

Area Description/Process Description: For an unloaded cask/MSC in a transfer bay, the cask or MSC docking port plug with the attached inner lid is retrieved from its storage area in the fuel transfer room and returned to the port. The inner lid is released and returned to the cask or MSC cask. The port docking device is disengaged and the transfer trolley with the unloaded cask or MSC is moved to the main transfer room (room 1003). The docking ring is removed, surveyed, decontaminated as necessary, and placed onto a docking ring stand (or bagged for later decontamination). The cask or MSC is lifted from the transfer bay trolley, or the floor of the main transfer room (room 1003), and moved to the import-export trolley. The import-export trolley is moved to the preparation room (room 1002). The inner and outer lids are bolted in place.

The unloaded cask or MSC is inspected for external damage, sealing surfaces are inspected, external surfaces are swipe-surveyed and decontaminated as necessary, and moved to the entrance vestibule (room 1001).

For an unloaded cask, an unloaded truck or rail conveyance is moved from the appropriate staging area near the site security gate into the entrance vestibule (room 1001). The unloaded cask is moved from the cask transfer trolley to the conveyance and down ended in place. Cask tie downs are secured in place and cask impact limiters, tamper-indicating devices, and personnel

barrier are installed. The unloaded transportation cask is removed from the FHF for return to the National Transportation System. An unloaded MSC is moved just outside the entrance vestibule (room 1001) using the gantry crane. The SNF Aging System transporter picks up the unloaded MSC and returns it to the SNF Aging System aging pad (BSC 2004t [DIRS 172084], Appendix B).

Table 31a lists the applicability of generic events to empty cask and MSC preparation and removal from the FTF; Table 31b lists the potential events for each applicable category.

Table 31a. Generic Events Applicability to FHF Empty Transportation Cask and Empty MSC Removal Operations in the Main Transfer Room, Preparation Room, and Entrance Vestibule

Generic Event Category	Is Generic Event Applicable?
Collision/Crushing	None identified that affect/interact with a waste form
Chemical Contamination/Flooding	None identified that affect/interact with a waste form
Explosion/Implosion	None identified that affect/interact with a waste form
Fire	None identified that affect/interact with a waste form
Radiation/Magnetic/Electrical/Fissile	Yes, Radiation
Thermal	None identified that affect/interact with a waste form

Sources: BSC 2004t [DIRS 172084], Appendix B

Table 31b. Potential Events for FHF Empty Transportation Cask and Empty MSC Removal Operations in the Main Transfer Room, Preparation Room, and Entrance Vestibule

Generic Event Category	Potential Event
Radiation	1. Radiation exposure of a facility worker and/or the offsite public. 2. Loss of confinement zone due to ventilation system malfunction or other breach of a confinement barrier leading to a release of airborne radiation.

6.6.5 Surface and Subsurface Facilities: WP Subsurface Transport and Emplacement

Area Description/Process Description: The principal purpose of the emplacement and retrieval system is to receive individual WPs from within the load-out areas of the DTF, CHF, or FHF (the surface facilities). The system then transports each WP individually to the subsurface repository for final emplacement within the emplacement drifts. Transportation of the WPs between surface and subsurface occurs in a radiation-shielded transporter, referred to as the WP transporter. Waste package emplacement within drifts is performed by a remotely operated WP emplacement gantry (BSC 2004aa [DIRS 171251], Section 4). The primary mobile equipment used for WP emplacement operations in the emplacement drifts of the subsurface repository consists of the transport locomotive, the WP transporter, the WP emplacement gantry, and the gantry carrier.

The primary function of the transport locomotive is to move the WP transporter and any other rail-based support equipment utilized by the emplacement and retrieval system, such as the

gantry carrier. The transport locomotive is based on commercially available mining locomotive technology that is utilized extensively throughout underground rail transportation applications.

The transport locomotive is supplied with electrical power through an overhead catenary (trolley wire)/pantograph system. The catenary system is a series of wires mounted to the crown of the access mains that carry a nominal 600 volts of direct current. The pantograph is positioned atop a tower, which is mounted above the rear truck of the transport locomotive.

Although the transport locomotive will primarily draw power from the pantograph system, the use of an overhead power system in certain areas of the subsurface repository and surface facilities is not a preferred design solution due to the difficulty of passing an overhead power line through door openings. These areas include the turnout drifts in the subsurface and within the exit vestibules and load-out cells of the surface facilities. For operations in these areas, the transport locomotive will be designed with a secondary power system, a self-contained battery. Therefore, while the transport locomotive is entering and exiting either the surface facilities or the emplacement drift turnouts, it will operate on battery power. For the remainder of transportation operations, the transport locomotive will operate on the primary power system, the overhead pantograph system (BSC 2004aa [DIRS 171251], Section 4).

The primary function of the WP transporter is to transport WPs between the surface facilities and the emplacement transfer docks for both emplacement and retrieval operations. Major components of the WP transporter include: the radiological shielded enclosure, undercarriage (frame) including the transfer deck, brake systems, doors and door operators, bedplate and guides, and rigid chain mechanisms and guides for moving the bedplate. The WPs are loaded onto emplacement pallets within the surface facilities. A single WP on its associated emplacement pallet is placed onto the WP transporter extended bedplate. The bedplate is a steel plate that transfers the load of the WP to the deck of the transporter. Attached to the underside of the bedplate are rollers that allow smooth movement of the WP and the bedplate across the transfer deck, allowing the WP to move into and out of the shielded enclosure of the transporter. The bedplate is then retracted by a rigid chain mechanism into the shielded portion of the transporter (BSC 2004aa [DIRS 171251], Section 4).

The WP emplacement gantry is a specialized component that receives an individual WP and its associated emplacement pallet from the WP transporter at the emplacement transfer dock, transports the WP into the emplacement drift, places the WP at its final emplacement position, and returns to the emplacement transfer dock. The WP emplacement gantry is a rail-based carriage assembly that runs on standard crane rails and is self-propelled. The same WP emplacement gantry can be used for waste retrieval, where the gantry reverses the process of emplacement. The WP emplacement gantry lends itself to such remote operation due to its simplicity. Only two major movements need to be controlled: (1) the backward and forward movement of the gantry on the emplacement drifts rails, and (2) the up and down motion of its lift hooks. Furthermore, the vertical motions do not require precise control in order to successfully engage and lift or set and disengage the emplacement pallet, on which rests the WP. The lift hooks never touch the WP itself but rather engage the emplacement pallet, which minimizes the risk of damage to the WP during handling. The primary source of electrical power for the WP emplacement gantry is an electrified third rail (conductor bar) system. The vehicle has redundant power pickup mechanisms to ensure a reliable and continuous connection

to the source of power. The gantry has a reliable backup power system (onboard rechargeable storage batteries) with enough power to lower and release the load and return to the drift entrance. The WP emplacement gantry conceptual design allows the lift hooks to be lowered so that they pass under the overhanging lift-points of the emplacement pallet structure and engage the WP via the emplacement pallet for lifting and carrying. This pass-under capability allows for the re-spacing of WPs after emplacement (BSC 2004aa [DIRS 171251], Section 4).

The purpose of the gantry carrier is to transfer the WP emplacement gantry between the surface facilities and the subsurface emplacement drifts. In addition, the carrier will also transfer the gantry from drift to drift during normal WP emplacement operations. The carrier is similar to a standard railroad flat car (BSC 2004aa [DIRS 171251], Section 4).

The operations for waste emplacement start with the loading of a single emplacement pallet onto the movable bedplate of the WP transporter at the Heavy Equipment Maintenance Facility. The bedplate with the pallet is then pulled into the shielded enclosure of the transporter. The transport locomotive moves the transporter through the vestibule airlocks and shield doors into the loadout area of the surface facility holding the WP to be emplaced. The transport locomotive is disconnected and moved into the surface facility vestibule and the surface facility shield doors are closed. Once in the loadout area, the WP transporter shield doors are opened and the emplacement pallet is pushed out of the shielded portion onto the transfer-deck portion of the transporter. The emplacement pallet is lifted off the WP transporter for the loading of a WP onto the pallet. A single WP is placed on the emplacement pallet and then placed back onto the transfer deck of the WP transporter. The emplacement pallet and WP is pulled into the shielded enclosure of the transporter and the WP transporter shield doors are closed. The surface facility shield doors are opened and the transport locomotive is reconnected to the WP transporter. The loaded transporter is moved away from the surface facility docking area and through the vestibule shield doors and airlocks (BSC 2004aa [DIRS 171251], Section 4).

The train is then moved through surface area track switches to sidings and turnouts to ensure that the WP transporter is correctly oriented for entry into the subsurface facility and subsequently into the turnout drift. The transport locomotive stops at the North Portal entrance to perform safety inspections and diagnostic checks prior to descending the north ramp. Once systems have been checked, the train descends the north ramp and proceeds to the predetermined emplacement drift (BSC 2004aa [DIRS 171251]), Section 4).

A transition from the main drifts into each emplacement drift is required to support emplacement operations and to accommodate the waste emplacement equipment. This transition is known as the emplacement drift turnout. To provide ventilation flow-control through the turnout and into the emplacement drift, the entrance to each turnout has been configured for the installation of turnout bulkheads. The turnout bulkheads, located at the entrance to each turnout, contain emplacement access doors and an adjustable regulator. The doors control equipment and personnel access into the emplacement drift. The adjustable regulator controls airflow in the emplacement drift (BSC 2004aa [DIRS 171251]), Section 4).

The train stops near the predetermined emplacement turnout drift. The transport locomotive controls are turned over to remote-control operations in the Central Control Center at the surface. The on-board transport locomotive operators then disembark and move to a designated

subsurface location near the emplacement drift. The emplacement doors at the entrance to the emplacement drift turnout are opened, and the rail switch is thrown to the turnout side. The transport locomotive remotely moves the transporter into the turnout and stops before reaching the emplacement drift docking area. The emplacement doors are closed after the transport locomotive and WP transporter pass. The transport locomotive docks the transporter, pushing the transfer deck portion of the transporter completely inside the emplacement transfer dock. The shielded transporter enclosure doors are remotely opened from the Central Control Center (BSC 2004aa [DIRS 171251]), Section 4).

The emplacement transfer dock provides an interface between the emplacement drift and the emplacement drift turnout. The primary function of the emplacement transfer dock is to allow the transfer of a WP from the WP transporter to the WP emplacement gantry. The shape of the emplacement transfer dock is unique in that it has a cutout to allow the WP transporter to enter the dock. The emplacement drift rails are mounted on either side of the cutout portion of the dock. This design allows the WP emplacement gantry to straddle the WP transporter transfer deck. When the WP is moved out of the shielded portion and onto the transfer deck portion of the transporter, the WP emplacement gantry is able to engage and lift the WP via the emplacement pallet off the WP transporter. Because the gantry rolls on the emplacement transfer dock and not on the WP transporter, the springs within the WP transporter suspension are allowed to decompress as the gantry lifts the WP (BSC 2004aa [DIRS 171251]), Section 4).

The rigid chain mechanism pushes the WP from inside of the shielded transporter enclosure to the transfer deck portion of the transporter. The WP emplacement gantry lifts the WP and pallet off the transporter for emplacement. Once the WP is removed and the gantry exits the emplacement transfer dock for emplacement. The remote mechanism on the WP transporter retracts the bedplate back into the transporter shielded enclosure. The shielded transporter enclosure doors are closed and the transport locomotive moves the transporter away from the emplacement drift docking area and stops. The emplacement drift doors are opened to allow the WP transporter to pass, and then closed after the WP transporter passes. Under remote control by the operators located in the Central Control Center, the transport locomotive and the WP transporter are directed from the drift entrance to the access main. The transport locomotive operators re-enter the cab, local controls are restored to them by the Central Control Center, and the train proceeds to the surface facilities for another emplacement operation. If necessary, the emplacement and retrieval equipment is surveyed for radiological contamination prior to exiting the North Portal (BSC 2004aa [DIRS 171251]), Section 4).

Waste package retrieval operations may utilize the same site-specific transportation/handling equipment used for waste emplacement. These retrieval operations would proceed in the reverse order. Retrieval under off-normal conditions may require the use of specially designed vehicles and support equipment (BSC 2004aa [DIRS 171251], Section 4).

Table 32a lists the applicability of generic events to the WP subsurface transport and emplacement; Table 32b lists the potential events for each applicable category.

Table 32a. Generic Events Applicability to Waste Package Subsurface Transport and Emplacement

Generic Event Category	Is Generic Event Applicable?
Collision/Crushing	Yes
Chemical Contamination/Flooding	Yes
Explosion/Implosion	Yes
Fire	Yes
Radiation/Magnetic/Electrical/Fissile	Yes, Radiation/Fissile
Thermal	Yes (see Fire)

Source: BSC 2004aa [DIRS 171251], Section 4

Table 32b. Potential Events for Waste Package Subsurface Transport and Emplacement

Generic Event Category	Potential Event
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. 2. Derailment of a WP transporter outdoors, prior to entering the north ramp, followed by a load tipover or fall. 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. 4. Runaway of a loaded WP transporter while proceeding down the north ramp. 5. Collision involving a WP transporter (holding a sealed WP on a pallet) and other stationary or moving equipment. 6. Derailment of a WP transporter at the turnout drift switch, followed by a load tipover or fall. 7. Collision involving a WP transporter (holding the sealed WP on a pallet) and the emplacement access doors. 8. Emplacement access doors close on the WP transporter (holding the sealed WP on a pallet). 9. Rockfall onto a WP transporter while in the subsurface. 10. Collision involving a WP transporter (holding the sealed WP on a pallet) and the emplacement transfer dock (while entering the dock). 11. WP transporter doors close on the WP on a pallet. 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.

Generic Event Category	Potential Event
	13. WP and pallet drop from a WP emplacement gantry. 14. Derailment of a WP emplacement gantry holding a WP on a pallet, followed by a load drop (drop of the WP and pallet). 15. WP emplacement gantry carrying a WP collides with another WP in the drift. 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. 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). 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. 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). 20. Rockfall onto a WP. 21. Rockfall onto a WP emplacement gantry holding a WP on a pallet. 22. Ground support drop onto a WP. 23. Ground support drop onto a WP emplacement gantry holding a WP on a pallet. 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.
Chemical Contamination/Flooding	1. Flooding from a water pipe break originating on the development side of the repository (there are no sources of water present in the emplacement side of the repository; Assumption 5.2.5). 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).
Explosion/Implosion	1. Hydrogen explosion involving batteries on the transport locomotive. 2. Hydrogen explosion involving batteries on the WP emplacement gantry.

Generic Event Category	Potential Event
Fire, Thermal	1. Electrical fire associated with the transport locomotive. 2. Fire/explosion (battery/electrical fire) associated with the transport locomotive. 3. Fire/explosion (battery/electrical fire) associated with the WP emplacement gantry. 4. Electrical fire associated with equipment on the WP transporter, including motors to extend the WP transporter bedplate. 5. Electrical fire associated with the WP emplacement gantry or other subsurface equipment. 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. 7. Extended loss of the subsurface ventilation system.
Radiation	1. Radiation exposure of a facility worker and/or the offsite public. 2. Early WP failure while in the subsurface during the preclosure period and a resultant release of radioactive material. 3. Release of activated air and dust to the environment. 4. Inadvertent opening of the WP transporter shielded enclosure doors, leading to a worker exposure. 5. Radiation-induced damage to a facility SSC. 6. Inadvertent opening of the emplacement access doors, leading to a worker exposure.
Fissile	Criticality associated with a drop or collision of a WP and a rearrangement of the container internals.

6.6.6 Surface Facilities: SNF Aging System

The internal hazards associated with the SNF Aging System are presented in *SNF Aging System Safety Study* (Cogema 2004c [DIRS 171793]).

6.6.7 Subsurface Facility: Construction Hazards

Area Description/Process Description: The subsurface components of the repository are built in phases to support waste emplacement (DOE 2004b [DIRS 168857], Section 2.23). The WPs are

emplaced over a period of approximately 24 years, which allows for a phased approach to completion of the emplacement drifts. The construction phases for the subsurface facilities include the initial construction phase, followed by emplacement and development phases. Initial construction includes excavation of an entrance ramp north of the existing North Portal; this entrance is designated as the Construction Portal. The development phases include excavation of emplacement drifts and ventilation shafts. The operations of subsurface systems (such as ventilation and controls) vary during the development phases as emplacement activities begin and continue over a period of approximately 24 years.

A variety of methods will be implemented to eliminate interfacing between subsurface construction and nuclear operations, including the assignment of different work areas. Surface nuclear operations are located at the North Portal and construction is located at both the South Portal and the new Construction Portal. Subsurface work areas are separated with isolation barriers. In addition, it is assumed that separate utility systems are provided, such that there are no penetrations through the isolation barriers (Assumption 5.2.7). These utility systems include power, ventilation, communication, emergency notification, and data acquisition. However, systems such as communications and emergency management are to be integrated. Therefore, there may be a penetration through the isolation barrier for communication lines. The responsibility for system modification and maintenance is changed at the defined surface interface point (DOE 2004b [DIRS 168857], Section 2.23).

The subsurface ventilation system consists of two separate and independent airflow networks and fan systems partitioned by isolation barriers. The system serves to accommodate the concurrent development and construction of the subsurface repository and the subsurface WP handling operations. The emplacement ventilation subsystem provides airflow to the emplacement operations. The development ventilation subsystem provides airflow to the development operations. Air pressure in the repository development side (provided by a forcing fan system) is maintained at a higher pressure than the repository emplacement side (exhausting fan system). The air pressure differential prevents infiltration of air from the emplacement side of the repository into the development side of the repository (BSC 2004bb [DIRS 172345], Section 4).

The subsurface ventilation system consists of the development ventilation subsystem and the emplacement ventilation subsystem. The development ventilation subsystem serves to provide fresh air and remove exhaust air and the emplacement ventilation subsystem is used primarily to remove heat generated by the emplaced WPs. The independent subsystems provide for concurrent development/construction of the repository and waste emplacement. The two subsystems have independent airflow networks and fan systems that operate simultaneously. To prevent the spread of any unlikely radioactive releases from the emplacement subsystem, the development subsystem is physically separated by isolation barriers (bulkheads). The development ventilation subsystem is operated as a positive pressure system and the emplacement ventilation subsystem is operated as a negative pressure system. This combination will ensure that even in the event that one subsystem shuts down, a pressure differential between the subsystems will be maintained. This design will ensure that any potential radioactive releases are contained to the emplacement side of the subsurface facility (BSC 2004bb [DIRS 172345], Section 4).

The subsurface isolation barriers (bulkheads) are designed to accommodate the maximum credible pressure differential from events such as ventilation failure or a concussion from blasting operations. In addition, doors located in the intake main isolation barrier are used during emergency conditions. A control system addresses how this potential interface is managed. During construction, isolation barrier locations change as construction is completed and the emplacement area is expanded. The interface point for the turnover of a new emplacement area is assumed to occur when isolation barrier doors are considered operational (Assumption 5.2.8) (DOE 2004b [DIRS 168857], Section 2.23).

The excavation of alcoves, emplacement drift turnouts, and intake drifts will be accomplished with common drill and blast techniques or by mechanical excavation (DOE 2004b [DIRS 168857], Section 2.3.2.2). Because movable isolation barriers, such as isolation barriers, in the mains isolate the development activities from the emplacement activities, off-normal events that could occur during drift development activities are unlikely to affect the integrity of the WPs. However, smoke and heat from a fire on the development side of the repository could be transferred to the emplacement side of the repository by the subsurface ventilation system. The goal of the subsurface fire protection system is to prevent the spread of smoke and heat.

Table 33a lists the applicability of generic events to the subsurface construction hazards; Table 33b lists the potential events for each applicable category.

Table 33a. Generic Events Applicability to the Subsurface Construction Hazards

Generic Event Category	Is Generic Event Applicable?
Collision/Crushing	None identified that affect/interact with a waste form
Chemical Contamination/Flooding	Yes, Flooding
Explosion/Implosion	None identified that affect/interact with a waste form
Fire	Yes
Radiation/Magnetic/Electrical/Fissile	None identified that affect/interact with a waste form
Thermal	Yes (see Fire)

Sources: DOE 2004b [DIRS 168857], Sections 2.3.2.2 and 2.23; BSC 2004bb [DIRS 172345], Section 4

Table 33b. Potential Events for the Subsurface Construction Hazards

Generic Event Category	Potential Event
Fire, Thermal	1. Diesel fuel fire/explosion associated with subsurface development equipment resulting in damage to the subsurface isolation barriers. 2. Electrical fire associated with subsurface development equipment or other equipment resulting in damage to the subsurface isolation barriers. 3. Transient combustible fire in the development side of the subsurface facilities resulting in damage to the subsurface isolation barriers.
Flooding	Flooding from a pipe break originating on the development side of the repository (there are no sources of process water present in the emplacement side of the repository; Assumption 5.2.5).

6.6.8 Surface Facilities: Construction Hazards

Area Description/Process Description: The repository construction schedule requires the performance of construction activities and repository nuclear operations concurrently. Construction is to be performed in phases; therefore, it is necessary to separate these activities to ensure the safety and security of project personnel. During detailed design, considerations are given to achieving this separation by designing independent support systems for repository operations and construction. This work includes designing sufficient space separations for activities that may impact operations. Areas of concern include crane locations and movements and the routing of utility sources. Boundaries are designed to isolate personnel movement between nuclear operations and construction areas.

In addition, a repository design requirement involves the minimization of the interfaces between subsurface construction and nuclear operations. The subsurface construction and nuclear operations each have unique requirements. Therefore, any interface between construction and operations increases the complexity of these requirements (DOE 2004b [DIRS 168857], Section 2.23).

Because the various waste canisters, casks, and containers contain SNF and HLW, the onsite movement of the containers must be free of interference from suspended loads, excavation equipment, construction equipment, and other potential sources of container damage. Although the waste container structures are robust, radiological safety considerations demand that they not be subjected to unplanned loads or impacts. The erection of temporary physical barriers to separate the construction activities from the rest of the site activities is an effective and common method of reducing, if not eliminating, interference. Barriers may be substantial and may surround the construction area and provide for separate personnel and equipment access. In addition to barriers, administrative controls are used to keep construction activities away from the operating surface facilities and WPs, transportation casks, and various containers.

Table 34a lists the applicability of generic events to the surface construction hazards; Table 34b lists the potential events for each applicable category.

Table 34a. Generic Events Applicability to the Surface Construction Hazards

Generic Event Category	Is Generic Event Applicable?
Collision/Crushing	Yes
Chemical Contamination/Flooding	None identified that affect/interact with a waste form
Explosion/Implosion	Yes – see Fire
Fire	Yes
Radiation/Magnetic/Electrical/Fissile	Yes, Radiation/Fissile
Thermal	Yes (see Fire)

Sources: DOE 2004b [DIRS 168857], Section 2.23

Table 34b. Potential Events for the Surface Construction Hazards

Generic Event Category	Potential Event
Collision/Crushing	Impacts on a loaded transportation cask, a loaded MSC, or a loaded WP as a result of construction operations.
Fire, Thermal	1. Diesel fuel fire/explosion associated with construction equipment. 2. Electrical fire associated with construction equipment or other equipment. 3. Transient combustible fire.
Radiation	Radiation exposure of a facility worker and/or the offsite public.
Fissile	Criticality associated with an impact on a loaded transportation cask, a loaded MSC, or a loaded WP and a rearrangement of the container internals.

6.6.9 Subsurface Facility: Drip Shield Installation

Area Description/Process Description: Drip shields are to be installed over the WPs before permanent closure of the repository. The function of the drip shield is to divert the liquid moisture that drips from the drift walls, as well as the water vapor that condenses on the drip shield surface, around the WPs and to the drift floor, prolonging the longevity and structural integrity of the WPs. The drip shields are designed to link together, forming a single, continuous barrier for the entire length of the emplacement drift. The design requirements for the drip shield include corrosion resistance as well as structural strength. Corrosion resistance is required so the drip shields can reliably perform their moisture diversion function for 10,000 years. Structural strength is required so the drip shield can protect the WPs against damage by rock falls resulting from degradation of the drift walls, thereby withstanding damage from rocks weighing several tons.

A drip shield emplacement gantry emplaces the drip shields. The drip shield emplacement gantry is designed specifically to emplace drip shields over the emplaced WPs in the emplacement drifts. The drip shield emplacement gantry design is based on the WP emplacement gantry design with similar structural and mechanical components. The drip shield emplacement operation is similar to the WP emplacement operation. The transport locomotive and gantry carrier transport the drip shield emplacement gantry to the emplacement drift turnout. The remote control operators then drive the drip shield emplacement gantry into the drift and put the gantry on standby inside the drift until a drip shield is delivered to the emplacement drift entrance. After a drip shield carrier car docks at the emplacement drift, the drip shield emplacement gantry moves over a drip shield by straddling the railcar. The gantry lifts the drip shield off the railcar then carries the shield through the emplacement drift and over the WPs to emplace the shield (BSC 2004cc [DIRS 172344], Section 4).

The drip shield emplacement gantry frame is designed to support its own weight, the weight of the drip shield, and appropriate seismic loads. The gantry is self-propelled. The primary source of electrical power to the gantry is an electrified third rail (conductor bar) system. This is the same electrical supply system that is used by the WP emplacement gantry (BSC 2004cc [DIRS 172344], Section 4).

Table 35a lists the applicability of generic events to the subsurface installation of drip shields; Table 35b lists the potential events for each applicable category.

Table 35a. Generic Events Applicability to the Subsurface Installation of Drip Shields

Generic Event Category	Is Generic Event Applicable?
Collision/Crushing	Yes
Chemical Contamination/Flooding	Yes
Explosion/Implosion	None identified that affect/interact with a waste form
Fire	Yes
Radiation/Magnetic/Electrical/Fissile	Yes, Radiation
Thermal	Yes (see Fire)

Source: BSC 2004cc [DIRS 172344], Section 4

Table 35b. Potential Events for the Subsurface Installation of Drip Shields

Generic Event Category	Potential Event
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. 2. Drip shield emplacement gantry carrying a drip shield collides with a WP or WPs due to gantry failure. 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. 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. 5. Rockfall onto a WP. 6. Ground support drop onto a WP. 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.
Chemical Contamination/Flooding	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

Generic Event Category	Potential Event
	ventilation subsystem).
Fire, Thermal	1. Electrical fire associated with the drip shield emplacement gantry or other subsurface equipment. 2. Loss of the subsurface ventilation system.
Radiation	1. Early WP failure while in the subsurface during the preclosure period and a resultant release of radioactive material. 2. Release of activated air and dust to the environment.
Fissile	Criticality associated with an impact or collision with a WP and a rearrangement of the container internals.

6.6.10 Subsurface Facility: Retrieval

Area Description/Process Description: If it is determined that any or all WPs are to be retrieved from the repository, the process of retrieval will commence. Normal retrieval operations will be executed using the same WP transportation and emplacement equipment as that used for initial emplacement, but generally in a reverse sequence. Use of the same equipment provides a built-in capability for retrieval that can be readily implemented (BSC 2004aa [DIRS 171251], Section 2).

Waste retrieval operations begin by ventilation blast cooling of the emplacement drift, if required. If the decision for retrieval occurs after drip shield installation, then drip shield removal is also required. The WP emplacement gantry is moved from the surface to the subsurface. A gantry carrier transports the WP emplacement gantry to the selected emplacement drift. Once unloaded from the gantry carrier, operators in the Central Control Center will ready the WP emplacement gantry for waste retrieval operations. The gantry carrier will be returned to the surface and the WP transporter will be prepared for waste retrieval operations (BSC 2004aa [DIRS 171251], Section 4).

Waste package retrieval is initiated with the removal of the first WP emplaced nearest the emplacement drift entrance. Since the WP emplacement gantry design does not allow the lifting of one WP over another, the WPs are removed in sequence. The retrieval process continues with delivery of the WPs to the emplacement transfer dock for loading onto the WP transporter and movement to the surface facilities. At the surface facilities, the retrieved WPs are processed and moved to an alternate storage facility (BSC 2004aa [DIRS 171251], Section 4).

Upon retrieval of the WPs from an emplacement drift, the gantry is moved to the next available drift to repeat the retrieval cycle until the WPs have been removed (BSC 2004aa [DIRS 171251], Section 4).

While retrieved WPs that are in good condition will be taken to the surface and staged in a dedicated area within the surface facilities complex, if a damaged WP or a drift condition preventing normal retrieval or recovery is encountered, the sequence is interrupted and a contingency plan is initiated to mitigate the problem. Damaged WPs, or WPs suspected of being damaged, will first be taken to the load-out area in the DTF and will then be directed to the remediation area for detailed inspection, repairs, or repackaging, as required. Individual WP recovery for inspection, testing, and emplacement drift maintenance is not considered retrieval; however, WP recovery for these purposes, if needed, will involve the same equipment and operational steps. If a specific WP to be recovered is not readily available from the drift entrance, the WPs in front of it will have to be temporarily relocated to another emplacement drift following a sequence of events similar to the retrieval and emplacement operations described above. The transport locomotive, WP emplacement gantry, gantry carrier, and WP transporter used for normal retrieval are the same as those used for WP emplacement (BSC 2004aa [DIRS 171251], Section 4).

The generic events applicability and potential events associated with retrieval operations 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 6.6.5.

If additional surface facilities (such as an Alternate Storage Facility) are required for retrieval activities, the hazards associated with these facilities will be examined in a future hazards analysis. Alternately, the hazards analysis may be performed during the design stage should a decision to retrieve be made.

6.6.11 Surface Facilities: Site-Generated Radiological Waste Disposal

Area Description/Process Description: Waste handling facilities containing equipment and components producing LLW streams include: DTF 1, DTF 2, the DTF remediation area, CHF, and FHF. The other area under LLW management control is that area designated for staging of LLW disposal containers prior to their shipment to the approved offsite disposal facility.

The LLW management system is comprised of the following subsystems (BSC 2004dd [DIRS 172098], Section 4):

- Solid LLW subsystem
  - Dry Solid LLW
  - Wet Solid LLW
  - Spent DPCs.
- Liquid LLW subsystem
- Gaseous LLW subsystem
- Mixed Waste subsystem.

The LLW management system is responsible for the handling of the LLW streams from the point of generation, when it is produced in the waste handling facilities during the processing of HLW and SNF, through final disposal of LLW at an offsite location. This system responsibilities include the collection of LLW at the point of generation, characterization of the contents, volume reduction where appropriate, solidification of liquid LLW, packaging in approved containers, preparation for shipping and disposal, and shipment to an approved offsite disposal facility (BSC 2004dd [DIRS 172098], Section 4).

6.6.11.1 Description of the Solid LLW Subsystem

The solid LLW subsystem includes the collection, processing, and packaging in LLW disposal containers of solid LLW streams generated during the handling of HLW and SNF at the repository. The subsystem also includes areas for the staging and shipment of LLW disposal containers to an approved offsite disposal facility.

The solid LLW subsystem consists of three separate categories of solid LLW streams; dry solid LLW, wet solid LLW, and spent DPCs, which are described in the following sections. The solid LLW subsystem also manages solid LLW streams generated by the liquid and gaseous LLW subsystems (BSC 2004dd [DIRS 172098], Section 4).

6.6.11.2 Dry Solid LLW

Dry solid LLW streams include personal protective equipment, wipes from sampling and external decontamination of transportation casks, MSCs, and WPs; and contaminated tools or equipment. Dry solid LLW is collected at the points of generation. Prior to designating tools and/or equipment as LLW, decontamination and recycling are considered and evaluated as a means of reducing the volume of LLW. Volume reduction is carried out by mechanical means such as mechanical disassembly, shredding, and compacting. Processed dry solids are then packaged in drums or other LLW disposal containers for shipment to an offsite disposal facility.

Air filters such as high-efficiency filters and HEPA filters used in the surface nuclear heating, ventilation, and air-conditioning (HVAC) system remove airborne contaminates from the air. These filters are removed according to procedures that will be developed in the future, moved to the LLW staging area, and handled as dry solid LLW.

Compactable solids (e.g., paper or cloth) are shredded and/or compacted directly into the shipping and disposal containers. Non-compactable solid such as tools and equipment are placed either directly in LLW disposal containers, cut into smaller pieces, or mechanically disassembled to fit in LLW disposal containers. Liquid LLW that has been solidified and sealed in disposal containers becomes part of the solid LLW system. When full, LLW disposal containers are transported to the staging area and shipped to an offsite disposal facility (BSC 2004dd [DIRS 172098], Section 4).

6.6.11.3 Wet Solid LLW

Wet solid LLW generated by water treatment systems includes spent ion-exchange media in self-shielding vessels, mechanical filters in self-shielding vessels, filters from the underwater vacuum system from the waste transfer pool in the remediation area, decontamination water, and

consumable materials from the treatment of HVAC equipment drain water from the nuclear HVAC system. Wet solids are collected at the points of generation and processed by solidification or immobilization to ensure that the final solid LLW form meets acceptance criteria of the offsite disposal facility. Repository Operations personnel remove the contaminated equipment or material from service, drain, stabilize, and place the LLW in staging areas for LLW management collection. The processing and packaging activities include characterization and analysis, decontamination and recycling, volume reduction, consolidation, and segregation of LLW solids (BSC 2004dd [DIRS 172098], Section 4).

6.6.11.4 Description of Spent DPC Subsystem

DPCs may be used by the electrical utility companies for shipment of commercial SNF to the repository. Once the SNF is removed, the empty DPCs are not reusable and must be managed as LLW. Disposition of spent DPCs will be addressed in the future (BSC 2004dd [DIRS 172098], Section 4).

6.6.11.5 Description of the Liquid LLW Subsystem

Liquid LLW is generated by the repository in routine operations including decontamination of equipment and tools and general housekeeping, such as floor mopping and chemical cleaning at various locations throughout the repository operations area. Liquid LLW collected throughout a building is delivered to a central drum filling station located in the building where it is generated. Collected liquid LLW is solidified in drums suitable for transfer to the LLW Handling Facility for staging and eventual transportation to an offsite disposal facility.

Personnel safety showers and eyewash stations are self-contained, with liquid LLW contained by the unit. Safety showers and eyewash stations will be plumbed and drained to meet the current-day standard for temperature control and their contents will be transferred for processing on an as-needed basis to the liquid LLW collection and processing area. Firewater that is discharged in potentially contaminated areas of a waste handling facility may become contaminated with radioactive material. Contaminated liquid will be contained and collected by the facility and managed as liquid LLW by the LLW management system (BSC 2004dd [DIRS 172098], Section 4).

6.6.11.6 Description of the Gaseous LLW Subsystem

Processing of gaseous LLW streams includes filtration to remove particulates and radioactive isotopes. Spent filters are managed by the solid LLW system. Processed gases are discharged to the repository HVAC system, which ensures that releases to the atmosphere satisfy the requirements of 10 CFR 63.111(a)(2) [DIRS 156605].

Gaseous LLW streams are generated during transportation cask cavity gas sampling, WP evacuating and inerting, cask evacuating and inerting, cooling of casks prior to transition to the pool in the DTF remediation area, and SNF assembly drying and inerting in the DTF remediation area (BSC 2004dd [DIRS 172098], Section 4).

6.6.11.7 Description of the Mixed Waste Subsystem

Mixed waste is not generated in routine operations. However, repository facilities have the capability to manage mixed waste that operations might generate in off-normal circumstances. Mixed waste will be managed in accordance with applicable federal and state requirements and shipped offsite for treatment and disposition at an approved treatment, storage, and disposal facility (BSC 2004dd [DIRS 172098], Section 4).

Table 36a lists the applicability of generic events to the disposal of LLW; Table 36b lists the potential events for each applicable category.

Table 36a. Generic Events Applicability to the Disposal of LLW

Generic Event Category	Is Generic Event Applicable?
Collision/Crushing	Yes
Chemical Contamination/Flooding	Yes
Explosion/Implosion	None identified that affect/interact with a waste form
Fire	Yes
Radiation/Magnetic/Electrical/Fissile	Yes, Radiation
Thermal	Yes (see Fire)

Sources: BSC 2004dd [DIRS 172098], Section 4; BSC 2004aa [DIRS 171251], Section 4

Table 36b. Potential Events for the Disposal of LLW

Generic Event Category	Potential Event
Collision/Crushing	1. Drop of a heavy load onto a tank, piping, or a container containing liquid or solid radioactive waste. 2. Drop of a container or drum containing solid LLW.
Chemical Contamination/Flooding	1. Drop of a container or drum containing liquid LLW. 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.
Fire	Transient combustible fire in areas where dry, flammable LLW is stored.
Radiation	Radiation exposure of a facility worker.

7. CONCLUSIONS

This analysis identifies internal hazards and potential initiating events that may result in a radiological release or a radiological hazard, based on available repository design information. These hazards and potential initiating events are listed in Section 6.6. The results/output of this analysis are reasonable compared to the inputs and are suitable for their intended use.

As the repository design progresses, this analysis will be reviewed to ensure that no new hazards are introduced and to determine if previously evaluated hazards have been eliminated or otherwise affected by a design change. The results of this analysis will be used as input to the event sequence selection and event sequence categorization process for the repository.

8. REFERENCES

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