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ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE

SAFETY ANALYSIS REPORT

APPENDIX J

SAFETY ANALYSIS REPORT

for

OUTDOOR WASTE MANAGEMENT

REVIEWED FOR
CLASSIFICATION/UCNI
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CHANGE SUMMARY

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EXECUTIVE SUMMARY

This safety analysis provides the final hazard classification and Authorization Basis documentation for Outdoor Waste Management at the Rocky Flats Environmental Technology Site (Site). Justification is provided for categorizing areas of the Site as Hazard Category 3 "facilities" called Waste Management Cells (WMCs). These WMCs are specific areas in which Outdoor Waste Management activities may be performed. The WMCs are identified and described in Section 2.2, *WMC Descriptions* and are evaluated in this safety analysis.

Department of Energy (DOE) documents (Refs. 1, 2, and 3) mandate that safety evaluations be performed for nuclear facilities within the DOE nuclear complex that have the potential to adversely affect the health and safety of the workers, the public, or the environment. The controls listed in Section 5, *Technical Safety Requirements* are placed on WMCs to maintain a Hazard Category 3 designation and prevent the introduction of materials that would invalidate the safety analysis basis documented herein.

A readiness determination will be performed prior to start-up of waste management activities at a WMC, and will include verification of compliance with the controls listed in Section 5, *Technical Safety Requirements*. Department of Energy - Rocky Flats Field Office (DOE-RFFO) approval of a page change to this Appendix J is required to add a new WMC.

The accident scenario results for each of the bounding cases are summarized in Table 1, *Bounding Accident Scenario Results*.

Table 1 Bounding Accident Scenario Results

Accident Scenario	Frequency	Radiological Dose (rem)		Risk Class	
		CW	MOI	CW	MOI
1. Major Waste Container Fire 8,500 Gallons of Diesel Fuel, 1 WMC	Extremely Unlikely	1.0E+1 Moderate	9.7E-1 Moderate	III	III
2. Major Waste Container Fire Non-Aqueous Liquid Waste Fire	Anticipated	3.6E-0 Low	3.5E-1 Low	III	III
3. Spill Crane Load Drop	Anticipated	3.1E-1 Low	1.1E-2 Low	III	III
4. NPH Seismic-Induced Structural Failure	Unlikely	3.1E+0 Low	1.1E-1 Low	III	III
5. NPH Lightning Breach	Anticipated	7.3E-01 Low	2.6E-02 Low	III	III
6. External Event Aircraft Crash	Extremely Unlikely	4.8E+0 Low	4.1E-1 Low	IV	IV
7. External Event Ground Vehicle Impact	Anticipated	3.1E-01 Low	1.1E-02 Low	III	III

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1 INTRODUCTION

This safety analysis is part of the Rocky Flats Environmental Technology Site Safety Analysis Report (Site SAR), Volume 1, Site Description and Characterization (Ref. 4). Upon approval, this safety analysis will become the Authorization Basis for Outdoor Waste Management activities.

The low plutonium (Pu) waste types evaluated include low-level waste (LLW), low specific activity (LSA) materials, and surface-contaminated objects (SCO). Also included are hazardous waste (HAZ) and low-level mixed waste (LLMW) as regulated by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) in compliance with standards from a variety of federal and state environmental laws and guidance through the Applicable or Relevant and Appropriate Requirements (ARARs) process.

Transportation vehicles loaded with Type B shipping container(s) (*i.e.*, TRUPACT II) that are "incident-to-shipping" may be staged on WMCs. "Incident-to-shipping" within Appendix J means that the transportation vehicle is loaded with packaged waste that is assayed and appropriately packaged for transport to an offsite receiver. For the purpose of this safety analysis, packaged waste refers to either an un-containerized waste item [*e.g.*, Surface Contaminated Object (SCO) or Low Specific Activity (LSA)] or a containerized waste item (*e.g.*, in a drum, box, *etc.*). Also, staging is considered to be the same as storage.

This safety analysis identifies spills and fires associated with Outdoor Waste Management activities. The activities evaluated in this safety analysis include the following:

- receipt of radioactive packaged waste from Site transportation vehicles, including the unloading of the vehicles by forklifts and cranes or detaching trailers from tractors;
- packaging/repackaging of waste not involving externally contaminated packaged waste;
- outdoor storage of radioactive packaged waste;
- staging of radioactive waste in truck trailers, on flatbeds, or other transportation vehicles;
- bulk storage of wastewater or organic solutions in tanker trucks;
- loading of radioactive packaged waste onto Site transportation or offsite transportation vehicles, including the loading of the vehicles by forklifts and cranes or attaching trailers to tractors;
- cleanup of spills; and
- maintenance/repair of trailers, cargo containers, *etc.*

The closure mission of the Site requires the decontamination, decommissioning, and demolition of the Site buildings and infrastructure. Environmental Restoration (ER) activities are also required to support the closure mission. The waste generated from these activities is packaged or containerized and eventually shipped to offsite disposal/treatment facilities. Outdoor storage of radioactive packaged waste is necessary to support Site closure activities. Radioactive packaged waste may be stored in a variety of configurations, including inside tractor/trailers and cargo

containers, as well as on asphalt pads, gravel, soil, *etc.* The methodologies for the hazard identification/evaluation and accident analysis are consistent with NSTR-010-01, *Safety Analysis for Waste Management Activities* (Ref. 5). The storage/handling (SH), generation of waste (GN), and routine activity (RA) modules as defined in NSTR-010-01 are the applicable activity modules for the scope of this safety analysis.

The MAR assumptions used for this safety analysis are consistent with the nature and objectives of the Outdoor Waste Management mission. The activities will be conducted through Site closure, and waste will be generated from D&D facilities and ER projects. The waste stored outdoors is waste intended to be shipped offsite. There may be occasions when packaged waste items are found to be overloaded (*i.e.*, greater than the limits imposed in Section 5, *Technical Safety Requirements*). This safety analysis evaluates higher gram amounts to account for these potential situations, but does not permit the configuration as part of normal routine operations. A required action to remove overloaded packaged waste items from the waste storage area to an authorized area, or to restore compliance within a specified time frame is defined in these cases. The per-container inventory limits are based on the standard Site LLW/LLMW package values and transportation values for SCO and bulk LLW items.

This safety analysis considers accident initiators unique to Outdoor Waste Management activities. For example, accidents involving large quantities of flammable liquids associated with tractor/trailers and fuel delivery vehicles must be considered in the midst of outdoor waste storage arrays. Liquid waste forms (including non-aqueous liquids such as solvents, oils, *etc.*) are also unique in terms of the quantities involved. Lightning as an accident initiator is also unique in that waste containers may be stored away from building structures such that they are not "shielded" by the structure from direct lightning strikes. This AB document provides a bounding set of representative accident scenarios with a set of controls to safely manage waste outdoors.

This safety analysis provides authorization, from a nuclear safety standpoint, for the outdoor management of radioactive waste (including LLW/LLMW, SCO, and LSA materials), and for the outdoor storage of contaminated wastewater or organic solutions. The transfer and shipment of waste materials is addressed separately in Chapter 8, *Transportation Safety Analysis*, of the Site SAR (Ref. 4). Activities involving packaged waste on a facility loading dock is evaluated in the facility-specific Authorization Basis (AB) document(s). Activities involving packaged waste at a facility loading dock (*i.e.*, loaded on a transfer vehicle) is evaluated in the Site SAR Transportation Safety Analysis.

This safety analysis also provides authorization for the packaging and repackaging of waste not involving externally contaminated packages. Large containers such as cargo containers or truck trailers may require repackaging in response to an out-of-compliance condition with the AB or Waste Acceptance Criteria (WAC). Such containers are typically too large to move into a facility and are packaged/repackaged outdoors. The packaged waste destined for these large containers are typically packaged to support radiological release criteria and are not externally contaminated. This type of waste can be packaged/repackaged outdoors in accordance the Radiological Protection Program. Smaller containers (*e.g.*, drums, wooden waste boxes, *etc.*) may require that all barriers to the contaminated waste (*i.e.*, packaging materials) be breached in order to repackage the waste. These containers are typically packaged/repackaged inside facilities as additional confinement may

be necessary in order to minimize the spread of contamination. While the accidents associated with the unconfined packaging and repackaging of externally contaminated waste are equivalent to those analyzed in this safety analysis, the corresponding normal operational releases associated with that activity are not analyzed.

If a waste container exceeds the applicable bounding safety analysis values defined in this document, repackaging and/or storage of the containers must be evaluated on a case-by-case basis. The containers may also be subject to requirements under the Criticality Safety Program if the bounding safety analysis values are exceeded.

Outdoor Waste Management is intended to cover radioactive material packages with low Pu content but can also include packages with uranium. Low Pu content waste is intended to cover waste that is generally designated as LLW/LLMW, SCO, or LSA material. Due to the significant differences between radiological dose consequences for Pu and uranium, packaged waste can contain significantly larger amounts of uranium and remain bounded by the Pu package nuclear safety analyses. However, storage of uranium waste is subject to the requirements of the Criticality Safety Program.

Designated areas in which radioactive packaged waste is stored are referred to as Waste Management Cells (WMCs). The WMCs are identified and described in Section 2.2, *WMC Descriptions* and are evaluated in this safety analysis. Controls are placed on WMCs to maintain a Hazard Category 3 designation and prevent the introduction of materials that would invalidate the safety analysis basis documented herein. A readiness determination will be performed prior to start-up of waste management activities at a WMC, and will include verification of compliance with the controls listed in Section 5, *Technical Safety Requirements*. DOE-RFFO approval of a page change to this Appendix J is required to add a new WMC.

The safety analysis uses a hazard identification checklist and description table to provide the framework for the hazard evaluation. Standard industrial hazards are not analyzed further unless they initiate a release of hazardous materials or worsen the consequences of a hazardous material release. This safety analysis is intended to provide the bounding analyses for Outdoor Waste Management at the Site.

Potential accidents associated with Outdoor Waste Management activities (*e.g.*, fuel pool fires, ground vehicle impacts) that could negatively impact an adjacent Hazard Category 2 or 3 Nuclear Facility are either (1) analyzed in facility-specific AB document(s) or (2) must be screened against both the facility AB document(s) and this Site SAR Appendix J using the Unreviewed Safety Question Determination process. This Site SAR safety analysis evaluates potential impacts that a structure (including a Hazard Category 2 or 3 Nuclear Facility) near a WMC has on the WMC. For instance, a seismic event could cause a nearby structure to fall onto packaged waste items stored on a WMC.

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2 OUTDOOR WASTE MANAGEMENT ACTIVITIES

2.1 ACTIVITY DESCRIPTIONS

Six generic activity modules are defined in the Safety Analysis for Waste Management Activities (Ref. 5). Outdoor Waste Management includes activities from three of these activity modules. Sections 2.1.1 through 2.1.3 identify and discuss the Outdoor Waste Management activities in the context of the appropriate modules. Section 4, *Hazards and Accident Analyses*, of this safety analysis contains the hazard and accident analysis for the proposed Outdoor Waste Management activities at the Site.

2.1.1 Waste Storage and Handling (SH)

The Waste Storage and Handling (SH) module involves all activities associated with receipt, handling, storage and packaging/repackaging of waste not involving externally contaminated packages. The waste types evaluated are low Pu content wastes such as LLW/LLMW, SCO, and LSA materials. Low Pu content, contaminated wastewater and organic solutions (including non-aqueous liquids) may be stored outdoors and are evaluated in this safety analysis. The hazards and accident analyses specific to the activities and waste types discussed above are presented and evaluated as part of this safety analysis. Unconfined packaging and repackaging of externally contaminated waste is not evaluated in this safety analysis and is therefore not authorized.

All physical waste container handling, storage activities in support of the related Waste Generation module (see Section 2.1.2) are enveloped by this module.

Waste containers are received from onsite waste generators and waste management facilities. The containers are moved within a WMC via manual conveyance, forklift, crane, or drum huggers. Waste containers also are loaded onto and unloaded from tractor/trailers and cargo containers. Large, low Pu content items that are packaged per Site and regulatory requirements (*e.g.*, shrink-wrapped, fixed contamination) may be placed in a WMC pending offsite shipment or transfer to another facility.

Waste containers may be prepared for transport at WMCs. Preparation includes inspection and certification to maintain/verify compliance with waste packaging requirements, waste form requirements, waste limits, and documentation requirements. Radiological monitoring and radioactive contamination surveys are also performed.

Large waste containers at the Site as defined in this safety analysis are containers with net weight capacities > 5,520 lbs. This specific net weight capacity was chosen from the Safety Analysis and Risk Assessment Handbook (Ref. 6) for the net weight capacity of the largest waste box or crate (full metal crate) addressed in the determination of the standard 3 gram limit for LLW/LLMW boxes.

The larger waste containers (*e.g.*, cargo containers, Industrial Package (IP)-2s, *etc.*) would generally have larger net weight capacities and would therefore have a larger allowable Pu content than the 3 grams associated with standard boxes and crates and the safety analysis sets their limit to 6 grams which is consistent with Department of Transportation (DOT) limits for specific types of shipments. The Site generally associates the 6 gram limit with SCO waste material limits.

Bulk storage of aqueous waste in tanker trucks supports collection of wastewater from onsite waste transfer stations and the pumping/collection of aqueous waste from valve vaults, excavations, and manholes or other locations. In addition, the bulk storage of organic waste in tanker trucks supports collection of the solutions from onsite containers or tanks in preparation for removal of the waste solutions from the Site. The contaminated low Pu content wastewater or organic solutions will be stored in tanker trucks that could have a capacity of 8,500 gallons, and also will be stored in waste drums.

2.1.2 Waste Generation (GN)

The Waste Generation module involves the generation of radioactive waste (including LLW/LLMW, SCO, and LSA materials) or HAZ during incidental spill cleanup, construction, and decontamination and decommissioning (D&D) activities. Waste containers are packaged and filled as a normal activity within the Waste Generation module.

The hazards and accident analyses specific to Waste Generation are bounded by the SH activity analyses. Waste container receiving, handling and storage activities in support of this module are addressed in the SH module discussion above. Routine activities responsible for the generation of waste (*e.g.*, construction, maintenance, repair *etc.*) are addressed in the Routine Activities module below.

2.1.3 Routine Activities (RA)

The Routine Activities module involves only those activities generally necessary to support day-to-day conduct of outdoor waste storage activities (e.g., maintenance, construction, surveillance, and general housekeeping required for control of combustible and hazardous materials). Primary waste container packaging is not breached under normal operating conditions in the Routine Activities module. The hazards and accident analyses specific to Routine Activities are evaluated as part of the safety analysis.

Maintenance activities may include use of heavy equipment for grading, paving or other surface preparations, and repair work on transport vehicles or cargo containers, *etc.* Construction includes Integrated Work Control Program (IWCP) activities including modifications to or expansion of waste storage surfaces (*i.e.*, asphalt or gravel pads, *etc.*). These activities include grading, paving, or other surface preparations.

Surveillance activities predominately consist of routine WMC operator rounds, including maintenance of logs and records; security force tours and response actions; and programmatic inspections and audits (*e.g.*, environmental compliance assessments, fire protection and radiological protection surveys, and audits from federal, state and local authorities).

2.2 WASTE MANAGEMENT CELL (WMC) DESCRIPTIONS

CHG-14

The locations and descriptions of designated WMCs are provided in Table 2. Each of the WMCs will meet the siting criteria identified in Section 3, *Safety Management Programs,* as derived in Section 4, *Hazards and Accident Analysis.* These descriptions do not supercede WMC siting criteria from Section 3.1.2.9.

Table 2 WMC Descriptions

Designation	Description
WMC-371-1	Area located west of Building 371 in a north-south orientation between two roads, beginning at the intersection of roads near the southwest corner of the building and extending to the north and northeast between the two roads to the point where the interior road (main building-access road) turns due east.
WMC-371-2	Area located north of the northeast corner of Building 371 and north of Building 374 in the location previously occupied by the Building 374 potassium hydroxide tanks, nitric acid tanks, process wastewater tanks, cement silo, and associated ancillary equipment and buildings. This WMC extends from west to east, 30 feet north of Buildings 371 and 374 and south of the main building-access road on the north side of the Protected Area (PA), beginning at the dock 18T access road and ending at the north-south road on the east side of Building 374.
WMC-371-3	Area located north of Building 371 extending from west to east, 30 feet north of Building 371 and south of the main building-access road on the north side of the PA, beginning to the north of Door 20 and extending eastward to the dock 18T access road.
WMC-371-4	Area located north of Buildings 371 and 374 extending west to east between the main building-access road and the minor road located at the slope break of the hill extending down to the north access road. This WMC extends from the north-to-east turn in the main building-access road to the eastern side of the north-south road on the east side of 374.
WMC-707-1	This WMC consists of two areas located on the west side of Building 707 (each area is about 40 feet wide by 110 feet long). These areas are located west of the paved road on the west side of Building 707, east of Building 564, along roadway beside utility pole D5-364, and along roadway beside utility pole C5-362.
WMC-707-2	Area 50' x 60' east of and immediately adjacent to the foundation of the 709 cooling tower location.
WMC-707-3	Area located within a 30-ft wide perimeter of the outside walls of Building 707 and 778 and ending at the interface between B778 and 776/777.

Table 2 WMC Descriptions

Designation	Description
WMC-771-1	This WMC is located north of the Building 771 and north of the old PA security fence that is about 100 feet wide and 150 feet long, between the new access road into the old PA and the new personnel walkway into the Building 771/774 Project fenced area.
WMC-771-2	This WMC is located north of the Building 771 and north of where the old PA security fence used to be that is about 100 feet wide and 150 feet long, directly east of the new personnel walkway.
WMC-776-1	This WMC is the Building 779 Pad and an expanded area around the Building 779 pad. It is bordered on the west by the east side of Building 777, on the east by a line running along the fence west of 207A, on the north by a line running along the fence south of 207C, and on the south by a line running along the north walls of Buildings 705 and 706.
WMC-776-2	Area located near Dock 3 that encompasses the area extending 30 feet east from the east edge of the dock platform and extending north from the building as far as the north edge of the dock platform.
WMC-776-3	Area located near Dock 4 that encompasses the area extending approximately 45 feet east of the east edge of the dock platform (up to temporary chiller #1) and extending the length of the dock in a north/south direction.
WMC-776-4	Area located near Dock 5 that encompasses the area extending 50 feet north of the dock platform and extending west from the building as far west as the dock platform.
WMC-776-5	Area located near Dock 2 that encompasses the dock ramp, extending east of the east edge of the dock platform for approximately 70 feet.
WMC-776-6	Area located near Dock 6 that encompasses the dock ramp, extending south of the south edge of the dock platform for approximately 50 feet. It additionally includes the outdoor dock platform area (approximately 25 feet north/south and 20 feet east/west).
WMC-776-7	Area located east of the 207 ponds, south of Building 964, and north of Spruce Avenue.
WMC-569-1	Area located across the road north of Building 569, immediately east of the old fence and security zone, west of Building 564, west of WMC-559-5, and south of RCRA Unit 10.
WMC-569-2	Area located along the east side of Building 569 extending out to just west and north of Building 711 cooling towers.
WMC-884-1	Area located just east of Building 884.
WMC-884-2	Area located just south of Building 884.
WMC-559-1	Area located north of Building 559 and west of Building 563, separated from Building 563 and Building 559 by the roads, an area approximately 140 ft by 70 ft.

Table 2 WMC Descriptions

Designation	Description
WMC-559-2	Area located immediately west of Building 561, between the building and the road, an area approximately 100 ft by 35 ft.
WMC-559-3	Area located south of Building 559, north of Building 528, and northeast of Building 561, separated from Building 559 by the road, a pie-shaped area approximately 30 ft by 50 ft.
WMC-559-4	Area located immediately east of Building 559, north of Building 528, separated from Building 528 by the road, an area approximately 40 ft by 25 ft.
WMC-559-5	Area located west of Building 564, an area approximately 60 ft by 50 ft.
WMC-559-6	Area located east of Building 564, an area approximately 35 ft by 50 ft.
WMC-559-7	Area located west of Building 559, in the old security zone, an area approximately 90 ft by 250 ft.
WMC-559-8	Area located southwest of Building 561, in the old security zone, an area approximately 90 ft by 130 ft.
WMC-MS-1	Loaded truck staging area that includes the paved areas located north of Cedar Avenue, west of Eighth Street, south of the 690 north parking lot on Central Avenue, and on the eastern half of the block between Seventh and Eighth Streets.
WMC-MS-2	Loaded truck staging area in the Building 850 parking lot. This area is located east of Seventh Street, south of Cedar Avenue, north of Cactus Avenue, and west of Building 850 in the paved parking lot.
WMC-MS-3	Loaded truck staging area in the 690 area north paved parking lot. This area is located near the southwest corner of Eighth Street and Central Avenue.
WMC-MS-4	Loaded truck staging area located west of Seventh Street, south of the driveway halfway between Sage and Central, north of Central Avenue, and east of Building 551 in the paved parking lot.
WMC-MS-5	Loaded truck staging area located east of Second Street, south of Cedar Avenue, north of Cactus Avenue, and west of Third Street in the west half of the Building 460 paved parking lot.
WMC-MS-6	Loaded truck staging area located east of the northwest perimeter road and East of T130H trailer, in the Building 130 paved parking lot north and west of Building 130 (the parking lot south of Building 130 is not included).

2.3 WASTE MANAGEMENT CELL (WMC) SYSTEMS

There are no SSCs that support the WMCs. Temporary electrical lighting may be used to allow the safe performance of nighttime operations as needed. Gasoline powered portable generators may be used to support some activities.

2.4 WASTE MANAGEMENT CELL (WMC) INTERFACES

The WMCs do not have system or utility interfaces with other WMCs or Site facilities. The WMCs can receive waste from or transfer waste to any Site facility as long as the packaged waste is compliant with this AB document. The seismic-induced structural failure of an adjacent building falling onto a WMC was evaluated; however, impacts to nearby facilities (when applicable) from Outdoor Waste Management activities are not evaluated in this AB document. These impacts are more appropriately evaluated in facility-specific AB documents.

2.5 INVENTORY AND SOURCE TERM DEVELOPMENT

By nature of the Outdoor Waste Management operations, the inventory at any WMC changes as wastes are transferred to the area from other storage areas and generating facilities, and as wastes are shipped to offsite treatment or disposal facilities. An inventory control limits the maximum Weapons Grade (WG) Pu gram loading per WMC to 900 grams to preserve the hazard classification of Nuclear Facility Hazard Category 3, and to ensure that WMCs are operated within the bounds of the safety analysis (see Section 5.6, *Inventory Control and Material Management*).

2.6 HAZARD CATEGORIZATION

The DOE has provided guidance on the determination of a nuclear facility Hazard Category in DOE-STD-1027-92 (Ref. 2). The DOE Standard allows for the use of a facility inventory comparison to isotopic radiological thresholds, which are provided in the attachment to the Standard, to determine an initial nuclear facility Hazard Category. The determination of a facility Hazard Category primarily focuses on the radiological material inventories of a facility but consideration must be given to other hazardous materials or hazardous operations.

The Hazard Category of a nuclear facility is used, in part, to determine if the facility is exempt from the requirements of 10 Code of Federal Regulations (CFR) Part 830, *Nuclear Safety Management* (Ref. 1) to develop a facility Safety Analysis Report (SAR). In addition, the nuclear facility Hazard Category can be used as one consideration in the Safety Analysis graded approach concept. A 900-gram WG Pu maximum inventory limit at any WMC is established to maintain a Hazard Category 3 Nuclear Facility categorization for WMCs. The inventory associated with waste contained in Type B shipping containers is exempt from the Hazard Category determination (Ref. 2).

The gram inventory threshold between a Hazard Category 3 Nuclear Facility and a Hazard Category 2 Nuclear Facility for depleted and enriched uranium is 710 metric tons and 110 metric tons, respectively. This quantity of uranium far exceeds any expected inventories associated with Outdoor

Waste Management Activities. Therefore, depleted and enriched uranium are not isotopes of concern for this Hazard Category determination.

The gram inventory threshold between a Hazard Category 3 Nuclear Facility and a Hazard Category 2 Nuclear Facility for americium-241 is 16 grams. At Rocky Flats, high americium wastes do not fall in the category of LLW (Ref. 7). Therefore, americium-241 is not an isotope of concern for this Hazard Category determination.

The final Hazard Category determination is provided in Section 4.8, *Final Hazard Classification.*

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3 SAFETY MANAGEMENT PROGRAMS

The safety analysis for Outdoor Waste Management relies on implementation of Site Safety Management Programs (SMPs) as defined in the Rocky Flats Environmental Technology Site Safety Analysis Report (Site SAR), Chapter 6 (Ref. 4). These SMPs provide specific safety functions assumed in the safety analysis that are either specifically credited or recognized to be important for providing defense-in-depth. All of the identified SMPs and their important nuclear safety attributes are implemented at a Site level.

The WMCs each implement the Site-level SMPs based upon the specific hazards identified in Section 4, *Hazards and Accident Analyses*. The implementation is focused on those specific attributes of the SMPs associated with identified hazards, hazard assumptions, and initial conditions presented in the safety analysis.

3.1 SMP RELATIONSHIP TO HAZARDS AND ACCIDENT ANALYSIS

The following sections delineate the relationship between the various Site-level SMPs and the WMC operation and the operation's related hazards.

3.1.1 WMC Activity Participation in Site SMPs

Based on the Outdoor Waste Management mission and the associate identified hazards, the WMCs implement the following SMPs at a Site level:

- Conduct of Operations (COOP)
- Configuration Management (CM)
- Criticality Safety (CRIT)
- Document Management (DOC)
- Emergency Preparedness (EP)
- Engineering (ENG)
- Environmental Management (EM)
- Fire Protection (FIRE)
- Integrated Work Control (IWCP)
- Nuclear Safety (NS)
- Occupational Safety and Industrial Hygiene (OS&IH)
- Quality Assurance (QA)
- Radiological Protection (RAD)
- Testing, Surveillance, and Maintenance (TSM)
- Training (TRAIN)
- Transportation Safety (TRAN)
- Waste Management (WM)

3.1.2 SMPs Important To Hazard and Accident Analysis

The following SMPs support the hazard evaluation in Section 4, *Hazards and Accident Analyses*, to maintain specific hazards as Standard Industrial Hazards. SMPs identified in Section 3.1.1 that are not listed below are only relied upon to provide worker protection against the hazards identified in Section 4. Additional SMP requirements are identified if they are relied upon in the safety analysis for providing prevention or mitigation of the postulated accident scenarios.

3.1.2.1 Configuration Management

The AB inherently assumes that configuration management is being adhered to with respect to the documented conditions, assumptions, and controls. Adherence to configuration management principles ensures conditions are accurately reflected in analysis. The hazards evaluation relies upon configuration management to maintain certain physical configurations such that specific hazards remain Standard Industrial Hazards and do not impact the WMCs.

3.1.2.2 Criticality Safety

Packaged waste received at, stored in, and/or processed in WMC shall be in accordance with nuclear material mass limits defined by the Site Criticality Safety Program. Movement of packaged waste that is non-compliant with Criticality Safety requirements is subject to the requirements of the Criticality Safety Program. Restart of suspended movements of packaged waste in the vicinity of the non-compliant packaged waste is also subject to the requirements of the Criticality Safety Program.

3.1.2.3 Environmental Management

The hazard evaluation relies upon the Chemical Life Cycle Management element of the EM Program to maintain chemical inventories and define appropriate chemical packaging. These actions ensure that the chemical hazards remain Standard Industrial Hazards and do not impact the WMCs, or present an unanalyzed risk to the onsite worker or the public.

3.1.2.4 Fire Protection

The hazard evaluation relies upon the Fire Protection Program to maintain combustible loading around specific ignition sources such that the hazards remain Standard Industrial Hazards and do not impact the WMCs. The accident analysis relies on the Fire Protection Program to prevent gross accumulation of combustible materials in and around WMCs.

3.1.2.5 Nuclear Safety

The NS Program contributes to Site configuration control using the Unreviewed Safety Question Determination Process. The safety analysis relies upon the NS Program to ensure that changes to existing or proposed WMCs, or changes to areas, equipment, or structures adjacent to WMCs are within the safety envelope evaluated in this document.

3.1.2.6 Occupational Safety and Industrial Hygiene

The OS&IH Program ensures that hazard analyses and routine surveys are performed to anticipate, identify, evaluate, and control activity-specific health and safety hazards. The hazard evaluation relies upon the OS&IH Program to evaluate chemical inventories and specify appropriate controls such that the chemical hazards remain Standard Industrial Hazards and do not impact the WMCs or present an unanalyzed risk to the onsite worker or the public.

3.1.2.7 Radiological Protection

The Radiological Protection Program interfaces with Site Projects to protect personnel from radioactive materials through surveillance, contamination control, and minimization of personnel exposure to penetrating radiation. The hazard evaluation relies upon the Radiological Protection Program to assess various radiological hazards and specify appropriate controls such that specific radiological hazards (e.g., sealed sources, radiation from containers) remain Standard Industrial Hazards and do not present an unanalyzed risk to the onsite worker. This program is also relied upon to manage the packaging/repackaging of waste items that are externally contaminated.

3.1.2.8 Transportation Safety

The Transportation Safety Program establishes the programmatic responsibilities and requirements to safely conduct transportation activities within the Site boundary. These requirements are consistent and compliant with DOE Transportation Safety Policies, transportation orders, applicable Federal regulations, and other Site programmatic requirements. These requirements apply to Site personnel performing transportation-related activities, which include on-Site transfer or off-Site shipment of radioactive and other hazardous materials, including preparations for transfer/shipment (e.g., packaging, marking, and labeling), vehicle readiness and operation, and operator qualification and training. The safety analysis for WMCs during "incident-to-shipping" activities relies upon compliant packaging, DOT compliant transportation vehicles, and qualified vehicle operators to maintain the analysis assumptions and not adversely impact the onsite worker. These attributes have already been implemented at the Site-level through the implementing procedures and controls for the Site Transportation Safety Manual and the Site SAR, Volume I, Chapter 7. No new or additional attributes of the Transportation Safety Program are required.

3.1.2.9 Waste Management

The hazard evaluation relies upon the WM Program to ensure packaged waste is configured such that the hazards remain Standard Industrial Hazards and do not impact the WMCs. The hazard evaluation also relies upon the WM program to ensure that radiation associated with packaged waste does not adversely impact the onsite worker due to WMC siting, and to ensure that hazardous waste packaging properly confines the materials.

The safety analysis assumes that the following WMC siting criteria are met:

- WMCs will be located no less than 850 meters from the nearest Site boundary (minimum distance used for evaluating the dose consequences to the public),
- WMCs will be located no less than the following distances from propane storage tanks: 126 feet from 1,000-gallon tanks, 100 feet from 500-gallon tanks, and 90 feet from 250-gallon tanks (larger overpressures from a boiling liquid expanding vapor explosion – BLEVE and close-in turbulent gas jet explosion are not analyzed),
- WMCs will be located no less than 15 feet from natural gas distribution lines (minimizes the amount of vehicle and material handling equipment interaction that could cause a rupture of a distribution line),
- WMCs will not be located in a flood plain (flooding scenarios are not evaluated),
- WMCs will be located no less than 30 feet from active railroad tracks (impacts from a train accident are not evaluated),
- WMCs will not be located adjacent to a road that is used by fuel delivery vehicles with a capacity greater than 400 gallons (reduces frequency of major fire), and
- WMCs will be located such that spacing or other barriers are in place between WMC-managed waste containers and other staged/stored waste containers to preclude accidents impacting both WMC-managed waste containers and other staged/stored waste containers.

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The safety analysis also assumes that packaged waste in WMCs is Site-approved (*i.e,* in compliance with applicable procedures and Quality Assurance specifications). This is an inherent assumption that preserves the damage ratios applied in the safety analysis.

4 HAZARDS AND ACCIDENT ANALYSIS

4.1 ANALYSIS METHODOLOGY

The hazards and accident analysis for Outdoor Waste Management is documented in Nuclear Safety Technical Report NSTR-001-02 (Ref. 8) and is summarized in this Outdoor Waste Management Safety Analysis Report. The hazards and accident analyses were performed to support the activities described in Section 2, *Outdoor Waste Management Activities*, for areas designated as Waste Management Cells (WMCs) and supports the final facility hazard categorization discussed in Section 4.8, *Final Hazard Categorization.*

Hazards Identification and Description

Table B-2 of the *Site Preliminary Hazards Analysis* (Ref. 9) was reviewed to assure that all potential hazards were considered during the development of NSTR-001-02 and this safety analysis document. NSTR-001-02 includes a Hazard Description Summary Table that identifies and documents potential hazards in terms of quantity, form, packaging, affected or affecting activities, and recognized preventive and/or mitigative features associated with the hazards. The Hazard Description Summary includes additional hazards unique to Outdoor Waste Management activities and is provided as Table 3 in Section 4.2, *Hazard Identification and Description.*

Based on information contained in the Site PHA and the Hazard Description Summary Table, determinations were made in NSTR-001-02 on whether further evaluation of specific hazards was necessary. In general, no further evaluation was performed on hazards that (1) were characterized as Standard Industrial Hazards and (2) have limited impact on postulated accident initiation frequency, accident mitigation, and accident consequences (in other words, hazards that do not contribute to accident source terms and are not accident precursors, initiators, or propagators). Standard industrial hazards are considered controlled by implementation of Site Safety Management Programs (SMPs), including DOE-prescribed occupational safety and health standards, and are not evaluated further unless they could initiate a release of hazardous materials or worsen the consequences of a hazardous material release.

Hazards Evaluation

For hazards that were determined to require further evaluation, NSTR-001-02 considered (1) scenario progression and related activities, (2) determination of accident types, and (3) a qualitative assessment of scenario frequency. Based on these considerations, a set of general accident scenarios was identified that is considered important to the development of WMC controls. This set of accident scenarios is summarized in Section 4.3, *Hazards Evaluation.* At this point in the hazards/accident analysis process, the descriptions and frequency assignments are general and have not been adjusted to reflect activity-specific conditions and operations associated with Outdoor Waste Management. There are three general types of accident scenarios that could yield a radiological release: fires, spills and explosions. Operational, natural phenomena, and external events may initiate these general types of scenarios. Explosions were dismissed from further analysis in NSTR-001-02.

Nuclear criticality accident scenarios are not evaluated further as discussed in Section 4.3, *Hazards Evaluation.*

Selection of Accident Scenarios Requiring Further Evaluation

NSTR-001-02 further evaluated the general set of accident scenarios considering activity-specific conditions and operations. For each general type of accident scenario multiple specific accident scenarios were identified/postulated based on the operational activity being performed, storage and/or handling configuration, container type, waste type, *etc.*

NSTR-001-02 identified a representative set of accident scenarios based on a comparison of the initial respirable source term (IRST) for each of the specific unmitigated accident scenarios. The IRST was calculated by multiplying together the material-at-risk (MAR), the damage ratio (DR), and the airborne respirable release fraction (ARRF). Eighteen (18) accident scenarios (see Table 9) were identified as representative for Outdoor Waste Management activities and include fires, spills, natural phenomena hazard events, and external event scenarios. These scenarios, summarized in Section 4.4, *Selection of Representative Accident Scenarios*, are carried forward in this safety analysis report in order to determine the bounding accident scenarios to be analyzed. Selection of the bounding accident scenarios is discussed in Section 4.5, *Bounding Accident Scenarios.*

4.2 HAZARD IDENTIFICATION AND DESCRIPTION

This section identifies the radioactive materials and other hazardous materials present during Outdoor Waste Management activities as well as identifying hazards and energy sources that may contribute to a radiological and/or toxicological release. Table 3 is the Hazard Description Summary Table from NSTR-001-02 and lists potential hazards in terms of quantity, form, packaging, affected or affecting activities, and recognized preventive and/or mitigative features associated with the hazards. Table 3 identifies those hazards that were further evaluated in NSTR-010-01 (Ref. 5) with a "Further Evaluated" notation in the Credited Protective Features column. Under the Remarks column, the first set of applicable SMPs address how the identified hazard/energy source is controlled and the second set addresses worker protection.

Table 3 Hazard Description Summary

Hazard/Energy Source	Form/ Description	Packaging	Interact Activities	Credited Protective Features	Remarks
1. ELECTRICAL ENERGY					
A. 13.8 kV Transformers [high voltage]	Std. transformers for converting Site power (13.8 kV) to facility power (480V).	Impact barriers (cement poles), fenced enclosures, equipment design.	SH, RA	HAZARD CONTROL • Combustible control [FIRE] • Configuration control [CM, NS, WM] WORKER PROTECTION • Impact barriers, insulated enclosure [CM, OS&IH] • Standard PPE, insulated clothing, insulated tools [OS&IH, TSM] • Equipment inspection, postings, LO/TO, training, work planning, work instructions, work control [COOP, DOC, IWCP, OS&IH, TRAIN, TSM]	Used as source of Site electric power. Not an Accident Source Term/Precursor/Initiator/Propagator • Lower voltage electric power is considered in Safety Analysis as fire initiator (see THERMAL ENERGY/Electric Power System). • No direct hazard to the onsite worker or the public due to separation distance from receptors. • Negligible indirect hazard to the onsite worker or the public due tono identified mechanism for impact to waste containers **Applicable SMPs:** CM; FIRE; NS; and WM. **Standard Industrial Hazard** • Worker electrocution or burn risk. **Applicable SMPs:** CM, COOP; DOC; IWCP; OS&IH; TRAIN; and TSM.
3. DIRECT RADIATION SOURCES:					
A. Sealed Sources	Site standard instrument calibration sources, radiological monitoring sources.	Site standard sealed source packaging, equipment design.	SH, GN, RA	HAZARD CONTROL • Package/container [RAD] • Configuration control [RAD] WORKER PROTECTION • Locked cabinet, shielding, enclosures, package/container, equipment design [RAD] • Protective clothing, dosimeters [RAD] • Monitoring, package inspection, labeling, RWP/ALARA, inventory track/control, training, work planning, work instructions, work control, QA [COOP, DOC, IWCP, QA, RAD, TRAIN]	Used for instrument calibration, including portable equipment, and radiological monitoring. Not an Accident Source Term/Precursor/Initiator/Propagator • No direct hazard to the onsite worker or the public due to low energies and separation distance from receptors. • Negligible indirect hazard to the onsite worker or the public due to low energies and no identified mechanism for impact to waste containers. **Applicable SMPs:** RAD. **Standard Industrial Hazard** • Worker radiation exposure risk. **Applicable SMPs:** COOP; DOC; IWCP; QA; RAD; and TRAIN

Table 3 Hazard Description Summary

Hazard/Energy Source	Form/ Description	Packaging	Interact Activities	Credited Protective Features	Remarks
3. DIRECT RADIATION SOURCES: (continued)					
B. Radiation From Stored Waste	Radioactive material radiation through waste packaging in waste management cells (WMCs).	Approved on-site shipping containers; drums, metal waste boxes, wood crates; cargo containers, transport trailers, tanker trucks, DOT Type B shipping containers, *etc.* ; Approved packaged waste configurations; Shrink-wrap; fixatives.	SH, GN, RA	HAZARD CONTROL • Container [RAD, WM] • Configuration control [CM, NS, WM] WORKER PROTECTION • Shielding, container [RAD, WM] • Protective clothing, dosimeters [RAD] • Monitoring, area surveys, postings, RWP/ALARA, inventory track/control, work control [COOP, IWCP, RAD, WM]	Hazard associated with the storage of radioactive waste. Not an Accident Source Term/Precursor/Initiator/Propagator • No direct hazard to the onsite worker or the public due to low energies and separation distance from receptors. • Negligible indirect hazard to the onsite worker or the public due to limited energies and no identified mechanism for impact to waste containers. **Applicable SMPs:** CM; NS; RAD and WM. **Standard Industrial Hazard** • Worker radiation exposure risk. **Applicable SMPs:** COOP; IWCP; RAD; and WM.

Table 3 Hazard Description Summary

Hazard/Energy Source	Form/ Description	Packaging	Interact Activities	Credited Protective Features	Remarks
C. Radiation exposure from a Nuclear Criticality	Radioactive packaged waste in WMCs.	Approved on-site shipping containers; drums, SWBs, metal waste boxes, wood crates; cargo containers, transport trailers, tanker trucks, DOT Type B shipping containers, *etc.*	SH, GN	**Further Evaluated** WORKER PROTECTION • Waste Packaging [WM] • Package limits, inventory tracking/control, training, work planning, work instructions, work control [COOP, CS, TRAIN, WM]	Hazard associated with the storage of radioactive waste. An Accident Source Term/Precursor/Initiator/Propagator • No direct hazard to the onsite worker or the public due to Site configuration. • Indirect hazard to the onsite worker and the public as a source of intense radiation and as an energy source for the release of radioactive materials. **Safety Analysis:** Criticality events. **Standard Industrial Hazard** • Worker radiation exposure risk. **Applicable SMPs:** COOP, CS, TRAIN, and WM.
4. RADIOACTIVE MATERIALS:					
A. Radioactive Waste - Solid [includes LLW/LLMW, SCO, and LSA material]	Plutonium, americium, or uranium contaminated waste in WMCs.	Approved on-site shipping containers; drums, SWBs, metal waste boxes, wood crates; cargo containers, transport trailers, tanker trucks, *etc.*; Approved packaged waste configurations; Shrink-wrap; fixatives.	SH, GN	**Further Evaluated** WORKER PROTECTION • Container, shrink warp, fixatives [RAD, WM] • Standard PPE, dosimeters [OS&IH, RAD] • Monitoring, container inspection, postings, area restrictions, labeling, RWP/ALARA, inventory track/control, training, work planning, work instructions, work control, QA [COOP, DOC, IWCP, QA, RAD, TRAIN, WM]	Hazard associated with the storage or packaging/repackaging of solid radioactive waste including LLW/LLMW, SCO, and LSA. • 0.5 gram drums, 3 gram metal/wood boxes, 6 gram cargo containers. **Accident Source Term/Precursor/Initiator/Propagator** • No direct hazard to the onsite worker or the public due to confinement. • Indirect hazard to the onsite worker and the public as the source of radioactive materials available for release. **Safety Analysis:** Radioactive material hazard in container fires and spills, truck trailer fires and spills, WMC fires, NPH events, and external events. **Standard Industrial Hazard** • Worker radioactive material inhalation risk. **Applicable SMPs:** COOP; DOC; IWCP; OS&IH; QA; RAD; TRAIN; and WM.

Table 3 Hazard Description Summary

Hazard/Energy Source	Form/ Description	Packaging	Interact Activities	Credited Protective Features	Remarks
B. Radioactive Waste – liquid waste (aqueous and non-aqueous solutions).	Plutonium, americium, or uranium contaminated waste in WMCs.	Approved on-site shipping containers; Drums, tanker trucks.	SH, GN	**Further Evaluated** WORKER PROTECTION • Container [WM] • Standard PPE, dosimeters [OS&IH, RAD] • Monitoring, container inspection, postings, area restrictions, labeling, RWP/ALARA, inventory track/control, training, work planning, work instructions, work control, QA [COOP, DOC, IWCP, QA, RAD, TRAIN, WM]	Hazard associated with the storage of liquid radioactive waste including aqueous and non-aqueous solutions. • 0.5 gram drums, 6 gram tanker trucks. **Accident Source Term/Precursor/Initiator/Propagator** • No direct hazard to the onsite worker or the public due to confinement. • Indirect hazard to the onsite worker and the public as the source of radioactive materials available for release. **Safety Analysis:** Radioactive material hazard in container fires and spills, tanker truck/truck trailer fires and spills, WMC fires, NPH events, and external events. **Standard Industrial Hazard** • Worker radioactive material inhalation risk. **Applicable SMPs:** COOP; DOC; IWCP; OS&IH; QA; RAD; TRAIN; and WM.

Table 3 Hazard Description Summary

Hazard/Energy Source	Form/ Description	Packaging	Interact Activities	Credited Protective Features	Remarks
4. RADIOACTIVE MATERIALS: (continued)					
C. Contamination [Including newly generated radioactive waste from LL smears and swipes]	Limited radioactive material on containers, equipment.	Not applicable	GN, RA	HAZARD CONTROL • No exposure of contaminated waste at WMCs [RAD] • Configuration control [CM, RAD] WORKER PROTECTION • Confinement areas [RAD] • Standard PPE, dosimeters [RAD] • Package inspection, postings, area restrictions, labeling, RWP/ALARA, inventory track/control, training, work planning, work instructions, work control, QA [COOP, DOC, IWCP, QA, RAD, TRAIN]	Packaged waste, equipment, and structures. Not an Accident Source Term/Precursor/Initiator/Propagator • Levels of contamination have been negligible on drums and building equipment/structure. • Negligible indirect hazard to the onsite worker or the public due to separation from waste storage areas and no identified mechanism for impact to waste containers. **Applicable SMPs:** CM and RAD. **Standard Industrial Hazard** • Worker radiation exposure risk. **Applicable SMPs:** COOP; DOC; IWCP; QA; RAD; and TRAIN.
5. THERMAL ENERGY:					
A. Steam Lines	125 psig steam.	Insulated steel piping	SH, RA	HAZARD CONTROL • Configuration control [CM, WM] WORKER PROTECTION • Current location, insulation, equipment [CM, OS&IH, TSM] • Standard PPE, non-absorbent thermal protection clothing [OS&IH] • Equipment inspection/monitoring/ maintenance, labeling, LO/TO, training, work planning, work control [COOP, IWCP, OS&IH, TRAIN, TSM]	Used for heating site facilities. Not an Accident Source Term/Precursor/Initiator/Propagator • No direct hazard to the onsite worker or the public due to low temperatures and separation distance from receptors. • Negligible indirect hazard to the onsite worker and the public due to limited energies and no identified mechanism for impact to waste containers. **Credited SMP:** CM and WM. **Standard Industrial Hazard** • Worker burn risk. **Applicable SMPs:** COOP; IWCP; OS&IH; TRAIN; and TSM.

Table 3 Hazard Description Summary

Hazard/Energy Source	Form/ Description	Packaging	Interact Activities	Credited Protective Features	Remarks
5. THERMAL ENERGY: (continued)					
B. Flammable Gases	Flammable gas is used for some maintenance activities, steel tanks used for Site storage (*e.g.*, 750 and 904 tank farms); propane gas used for vehicle fuel; natural gas lines	Limited capacity gas cylinders; vehicle tanks Large capacity steel tanks, steel piping	SH, RA	HAZARD CONTROL Configuration control [CM, WM] WORKER PROTECTION • Container [FIRE] • Standard PPE, hot work clothing/eye protection, special tools [OS&IH] • Container inspection, labeling, HWP, operation requirements, inventory track/control, training, work planning, work control, QA [COOP, FIRE, IWCP, OS&IH, QA, TRAIN]	Used in maintenance and heating Not an Accident Source Term/Precursor/Initiator/Propagator (dismissed in NSTR-001-02) • No direct hazard to the onsite worker or the public due to low temperatures and separation distance from receptors. • Negligible indirect hazard to the onsite worker and the public due to limited energies and no identified mechanism for impact to waste containers. **Credited SMP:** CM and WM. **Standard Industrial Hazard** • Worker burn and explosion risk. **Applicable SMPs:** COOP; FIRE; IWCP; OS&IH; QA; and TRAIN.
C. Hot Work (not involving flammable gases)	Welding, grinding, cutting	Standard welding equipment, standard power tools	RA	**Further Evaluated** WORKER PROTECTION • Equipment [FIRE] • Standard PPE, hot work clothing/eye protection, special tools [OS&IH] • Monitoring, equipment inspection, area restrictions, HWP, operation requirements, inventory track/control, training, work planning, work control [COOP, FIRE, IWCP, OS&IH, TRAIN, TSM]	Used in maintenance. • Equipment creating high temperatures results in a potential, significant ignition source. **Accident Source Term/Precursor/Initiator/Propagator** • No direct hazard to the onsite worker or the public due to separation distance from receptors. • Indirect hazard to the onsite worker or the public as an energy source to cause radioactive material releases. **Safety Analysis:** WMC fire event initiator. **Standard Industrial Hazard** • Worker burn risk. **Applicable SMPs:** COOP; FIRE; IWCP; OS&IH; TRAIN; and TSM.

Table 3 Hazard Description Summary

Hazard/Energy Source	Form/ Description	Packaging	Interact Activities	Credited Protective Features	Remarks
5. **THERMAL ENERGY:** (continued)					
D. Electric Power System [including electromagnetic sources]	From 110 V to 480 V wiring, service outlets/ fittings, temporary diesel generators, *etc.* Electromagnetic sources include electromagnetic field, radio frequency, and microwave sources.	Not applicable	SH, GN, RA	**Further Evaluated** WORKER PROTECTION • Current location, insulation, enclosures [CM, OS&IH, TSM] • Standard PPE, insulated clothing, insulated tools [OS&IH, TSM] • Equipment inspection/maintenance, labeling, LO/TO, training, work planning, work control [COOP, IWCP, OS&IH, TRAIN, TSM]	Used to support all electric powered equipment. • Failed insulation or power surges result in potential ignition source. **Accident Source Term/Precursor/Initiator/Propagator** • No direct hazard to the onsite worker or the public due to separation distance from receptors. • Indirect hazard to the onsite worker or the public as an energy source to cause radioactive material releases. **Safety Analysis:** WMC fire event precursor and/or initiator. **Standard Industrial Hazard** • Worker electrocution, burn and explosion risk. **Applicable SMPs:** CM; COOP; IWCP; OS&IH; TRAIN; and TSM.
E. Liquid, Fossil-Fueled Transport Vehicles	Standard gasoline and diesel-fueled trucks and cargo trailers	Vehicle design, forklift fuel tank has protective plate and surrounded by counter weights	SH, RA	**Further Evaluated** WORKER PROTECTION • Equipment inspection [TSM] • Postings, area restrictions, operations requirements, training [COOP, OS&IH, TRAIN] Also see Site SAR Chapter 8, *Transportation Safety Analysis* (Ref. 4).	Used for intra-WMC movement and onsite transfer of waste containers. **Accident Source Term/Precursor/Initiator/Propagator** • No direct hazard to onsite worker or the public • Indirect hazard to the onsite worker or the public as an energy source to cause radioactive material releases. **Safety Analysis:** WMC pool fire precursor and/or initiator. Also, considered in Site SAR Chapter 8 *Transportation Safety Analysis* as a facility fire initiator/precursor. **Standard Industrial Hazard** • Worker burn risk. **Applicable SMPs:** COOP; OS&IH; TRAIN; and TSM.

Table 3 Hazard Description Summary

Hazard/Energy Source	Form/ Description	Packaging	Interact Activities	Credited Protective Features	Remarks
5. THERMAL ENERGY: (continued)					
F. Bulk Fuel Delivery Vehicles	>400 gallon tanker trucks	Tanker truck design	SH	**Further Evaluated** WORKER PROTECTION • Equipment inspection [TSM] • Postings, area restrictions, operations requirements, training [COOP, OS&IH, TRAIN] Also see Site SAR Chapter 8, *Transportation Safety Analysis* (Ref. 4).	Used for bulk fuel delivery. **Accident Source Term/Precursor/Initiator/Propagator** • No direct hazard to onsite worker or the public • Indirect hazard to the onsite worker or the public as an energy source to cause radioactive material releases. **Safety Analysis:** WMC pool fire precursor and/or initiator. Also, considered in Site SAR Chapter 8 *Transportation Safety Analysis* as a facility fire initiator/precursor. **Standard Industrial Hazard** • Worker burn risk. **Applicable SMPs:** COOP; OS&IH; TRAIN; and TSM.
G. Contaminated Organic Solutions	Drums, Tanker trucks	Drum and tanker truck design	SH	**Further Evaluated** WORKER PROTECTION • Container [WM] • Standard PPE, dosimeters [OS&IH, RAD] • Monitoring, container inspection, postings, area restrictions, labeling, RWP/ALARA, inventory track/control, training, work planning, work instructions, work control, QA [COOP, DOC, IWCP, QA, RAD, TRAIN, WM]	Hazard associated with storage of organic solutions. **Accident Source Term/Precursor/Initiator/Propagator** • No direct hazard to the onsite worker or the public due to separation distance from receptors. **Safety Analysis:** WMC fire event precursor. **Standard Industrial Hazard** • Worker burn risk. **Applicable SMPs:** COOP; DOC; FIRE; IWCP; and TRAIN.

Table 3 Hazard Description Summary

Hazard/Energy Source	Form/ Description	Packaging	Interact Activities	Credited Protective Features	Remarks
6. PRESSURE SOURCES:					
A. Compressed Air, Compressors	Compressors up to 130 psi, Air systems up to 90 psi normal operating pressure	Piping and compressors	RA	HAZARD CONTROL • Configuration control [CM, NS, WM] WORKER PROTECTION • Equipment [TSM] • Standard PPE [OS&IH] • Equipment inspection/maintenance, labeling, LO/TO, training, work planning, work control [COOP, IWCP, OS&IH, TRAIN, TSM]	Used for maintenance activities. Not an Accident Source Term/Precursor/Initiator/Propagator • No direct hazard to the onsite worker or the public due to low energies and separation distance from receptors. • Negligible indirect hazard to the onsite worker and the public due to limited energies and no identified mechanism for impact to waste containers. **Applicable SMPs:** CM; NS; and WM. **Standard Industrial Hazard** • Worker physical injury risk (*e.g.*, flying debris in eyes, cuts, *etc.*). **Applicable SMPs:** COOP; IWCP; OS&IH; TRAIN; and TSM.
B. Hydraulic Equipment	Forklifts, drum lifting devices, construction equipment, *etc.*	Piping and hoses	SH, RA	HAZARD CONTROL • Configuration control [CM, WM] WORKER PROTECTION • Equipment [TSM] • Standard PPE [OS&IH] • Equipment inspection/maintenance, operations requirements, work control [COOP, IWCP, OS&IH, TSM]	Used in waste container transport and handling equipment and construction equipment. Not an Accident Source Term/Precursor/Initiator/Propagator • No direct hazard to the onsite worker or the public due to limited energies and separation distance from receptors. • Negligible indirect hazard to the onsite worker and the public due to limited energies and no identified mechanism for impact to waste containers. **Applicable SMPs:** CM; and WM. **Standard Industrial Hazard** • Worker physical injury risk (*e.g.*, flying debris/hydraulic fluid in eyes, cuts, *etc.*). **Applicable SMPs:** COOP; IWCP; OS&IH; and TSM.

Table 3 Hazard Description Summary

Hazard/Energy Source	Form/ Description	Packaging	Interact Activities	Credited Protective Features	Remarks
6. PRESSURE SOURCES: (continued)					
C. Compressed Gas Cylinders	Various, used in support of maintenance work	Standard compressed gas bottles	RA	**Further Evaluated** WORKER PROTECTION • Container [OS&IH] • Standard PPE [OS&IH] • Equipment inspection, labeling, inventory track/control, work planning, work instructions, work control [COOP, DOC, IWCP, OS&IH, TRAIN]	Used for maintenance activities. • Breach of cylinder results in potential missile source. **Accident Source Term/Precursor/Initiator/Propagator** • No direct hazard to the onsite worker or the public due to limited energies and separation distance from receptors. • Indirect hazard to the onsite worker or the public as an energy source to cause radioactive material releases. **Safety Analysis:** Spill event initiator. **Standard Industrial Hazard** • Worker missile risk. **Applicable SMPs:** COOP; DOC; IWCP; OS&IH; and TRAIN.
D. Water Lines	Up to 80 psi normal operating pressure	Steel piping	SH, RA	HAZARD CONTROL • Configuration control [CM, WM] WORKER PROTECTION • Equipment [TSM] • Standard PPE [OS&IH] • Work control [COOP, IWCP]	Used for domestic water and fire suppression. Not an Accident Source Term/Precursor/Initiator/Propagator • No direct hazard to the onsite worker or the public due to low energies and separation distance from receptors. • Negligible indirect hazard to the onsite worker and the public due to limited energies and no identified mechanism for impact to waste containers. **Credited SMP:** CM and WM. **Standard Industrial Hazard** • Worker physical injury risk (*e.g.*, flying debris in eyes, cuts, *etc.*). **Applicable SMPs:** COOP; IWCP; OS&IH; and TSM.

Table 3 Hazard Description Summary

Hazard/Energy Source	Form/ Description	Packaging	Interact Activities	Credited Protective Features	Remarks
7. KINETIC ENERGY:					
A. Vehicles, Material Handling Equipment	Electric forklifts, diesel forklifts, mobile cranes, construction equipment, tractor/ trailers, automobiles, emergency response vehicles, hand-controlled lifts, carts/dollies, pallet jacks, *etc.*	Not applicable	SH, RA	**Further Evaluated** WORKER PROTECTION • Standard PPE [OS&IH] • Monitoring, equipment inspection/maintenance, area restrictions, operations requirements, training, work planning, work instructions, work control [COOP, DOC, IWCP, OS&IH, TRAIN, TSM]	Electric forklifts, diesel forklifts, mobile cranes, tractor/ trailers, hand-controlled lifts, carts/dollies, pallet jacks, *etc.* used for receipt, transport, handling, and shipment of waste containers. Construction equipment used for routine activities, emergency response vehicles used for Site support services, personal automobiles used for Site access. • Out of control vehicle results in impact/puncture source. **Accident Source Term/Precursor/Initiator/Propagator** • No direct hazard to the onsite worker or the public due to separation distance from receptors. • Indirect hazard to the onsite worker or the public as an energy source to cause radioactive material releases. **Safety Analysis:** Spill (and puncture) event initiator. **Standard Industrial Hazard** • Worker impact or crush risk. **Applicable SMPs:** COOP; DOC; IWCP; OS&IH; TRAIN; and TSM.
B. Rotating Machinery & Tools	Fans, pumps, compressors, electric motors, rotating cutting tools, drills, grinders, *etc.*	Not applicable	RA	HAZARD CONTROL • Configuration control [CM, NS, WM] WORKER PROTECTION • Enclosure/equipment [OS&IH, TSM] • Standard PPE, no loose clothing, eye protection [OS&IH] • Monitoring, equipment inspection/maintenance, LO/TO, training, work planning, work control [COOP, IWCP, OS&IH, TRAIN, TSM]	Used in fans, compressors, general maintenance tools, and various equipment. Not an Accident Source Term/Precursor/Initiator/Propagator • No direct hazard to the onsite worker or the public due to low energies and separation distance from receptors. • Negligible indirect hazard to the onsite worker and the public due to limited energies and no identified mechanism for impact to waste containers. **Applicable SMPs:** CM; NS; and WM. **Standard Industrial Hazard** • Worker flying debris, puncture (drills), and cutting/ crushing (rotating fans) risk. **Applicable SMPs:** COOP; IWCP; OS&IH; TRAIN; and TSM.

Table 3 Hazard Description Summary

Hazard/Energy Source	Form/ Description	Packaging	Interact Activities	Credited Protective Features	Remarks
7. KINETIC ENERGY: (continued)					
C. Suspended Loads/Material	Overhead cranes and hoists, hoisting and rigging equipment and accessories (slings, lifting devices, shackles, eyebolts, turnbuckles, *etc.*)	Varies	SH, RA	**Further Evaluated** WORKER PROTECTION • Current location, equipment [CM, TSM] • Standard PPE [OS&IH] • Equipment inspection, LO/TO, work control [COOP, IWCP, OS&IH, TSM]	Used in receipt, transport, handling, and shipment of waste containers. • Inappropriate movement results in container impact. **Accident Source Term/Precursor/Initiator/Propagator** • No direct hazard to the onsite worker or the public due to separation distance from receptors. • Indirect hazard to the onsite worker or the public as an energy source to cause radioactive material releases. **Safety Analysis:** Spill (drop, impact) event precursor. **Standard Industrial Hazard** • Worker crushing risks. **Applicable SMPs:** CM; COOP; IWCP; OS&IH; and TSM.
8. POTENTIAL ENERGY:					
A. Overhead Cranes and Equipment	Overhead cranes and hoists, hoisting and rigging equipment and accessories (slings, lifting devices, shackles, eyebolts, turnbuckles, *etc.*).	Not applicable	SH, RA	**Further Evaluated** WORKER PROTECTION • Current location, equipment [CM, TSM] • Standard PPE [OS&IH] • Equipment inspection, LO/TO, work control [COOP, IWCP, OS&IH, TSM]	Used in receipt, transport, handling, and shipment of waste containers. • Equipment failure or inappropriate movement results in container drop/impact. **Accident Source Term/Precursor/Initiator/Propagator** • No direct hazard to the onsite worker or the public due to separation distance from receptors. • Indirect hazard to the onsite worker or the public as an energy source to cause radioactive material releases. **Safety Analysis:** Spill (drop, impact) event precursor. **Standard Industrial Hazard** • Worker falling or crushing risks. **Applicable SMPs:** CM; COOP; IWCP; OS&IH; and TSM.

Table 3 Hazard Description Summary

Hazard/Energy Source	Form/ Description	Packaging	Interact Activities	Credited Protective Features	Remarks
8. POTENTIAL ENERGY: (continued)					
B. Raised Loads on Cranes, Forklifts, or on Truck Beds	When handling and stacking waste containers or when containers on truck beds, containers may be raised above four feet.	Approved on-site shipping containers; drums, SWBs, metal waste boxes, wood crates; *etc.* ; Approved packaged waste configurations; Shrink-wrap; fixatives.	SH	**Further Evaluated** WORKER PROTECTION • Standard PPE [OS&IH] • Monitoring, area restrictions, RWP/ALARA, operations requirements, training, work planning, work instructions, work control [COOP, DOC, IWCP, OS&IH, RAD, TRAIN]	Used in receipt, transport, handling, and shipment of waste containers. • Vehicle failure or inappropriate movement results in container drop. **Accident Source Term/Precursor/Initiator/Propagator** • No direct hazard to the onsite worker or the public due to separation distance from receptors. • Indirect hazard to the onsite worker or the public as an energy source to cause radioactive material releases. **Safety Analysis:** Spill (drop, impact) event precursor. **Standard Industrial Hazard** • Worker impact or crush risk. **Applicable SMPs:** COOP; DOC; IWCP; OS&IH; RAD; and TRAIN.
C. Stacked Waste Containers	Stacked waste drums or waste boxes.	Approved on-site shipping containers; drums, SWBs, metal waste boxes, wood crates; *etc.*	SH	**Further Evaluated** WORKER PROTECTION • Container [WM] • Standard PPE [OS&IH] • Monitoring, postings, RWP/ALARA, work control [COOP, IWCP, OS&IH, RAD]	Used as storage configuration of waste containers. • Stack toppling results in container drop. **Accident Source Term/Precursor/Initiator/Propagator** • No direct hazard to the onsite worker or the public due to separation distance from receptors. • Indirect hazard to the onsite worker or the public as an energy source to cause radioactive material releases. **Safety Analysis:** Spill (drop, impact) event precursor. **Standard Industrial Hazard** • Worker impact or crush risk. **Applicable SMPs:** COOP; IWCP; OS&IH; RAD; and WM.

Table 3 Hazard Description Summary

Hazard/Energy Source	Form/ Description	Packaging	Interact Activities	Credited Protective Features	Remarks
9. TOXIC, HAZARDOUS, OR NOXIOUS CHEMICALS:					
A. General Industrial Chemicals; Bulk or Process Chemicals below Thresholds of Concern (*i.e.*, TPQs listed in 40 CFR 355 or TQs listed in 40 CFR 68 and 29 CFR 1910.119 (Refs. 12, 13, & 14)	Paints, developer fluid, sealers, maintenance supplies, *etc.*	Standard containers: drums, vials, bottles, bags, cans, *etc.*	RA	HAZARD CONTROL • Container [EM, OS&IH] • Configuration control [CM, EM, OS&IH] WORKER PROTECTION • Locked cabinet, enclosures, container [EM, OS&IH] • Chemical resistant clothing, eye protection, safety showers, respirators [EM, OS&IH, TSM] • Monitoring, container inspection, labeling, operations requirements, inventory track/control, training, work planning, work instructions, work control [COOP, DOC, EM, IWCP, OS&IH, TRAIN]	Hazard associated with the use of standard chemicals as part of routine activities. Not an Accident Source Term/Precursor/Initiator/Propagator • No direct hazard to the onsite worker or the public due to limited amounts and separation distance from receptors. • Negligible indirect hazard to the onsite worker or the public due to no identified mechanism for impact to waste containers. **Credited SMP:** CM; EM; and OS&IH. **Standard Industrial Hazard** • Worker chemical exposure or burn risk. **Applicable SMPs:** COOP; DOC; EM; IWCP; OS&IH; TRAIN; and TSM.
B. Beryllium	Waste	Approved on-site shipping containers; drums, metal waste boxes, wood crates, cargo containers, transport trailers, *etc.* Use of fixatives and shrink-wrap.	SH	HAZARD CONTROL • Container [OS&IH, WM] • Configuration control [CM, OS&IH, WM] WORKER PROTECTION • Container [OS&IH, WM] • Standard PPE [OS&IH] • Labeling, inventory track/control, training, work planning, work instructions, work control [COOP, DOC, IWCP, OS&IH, TRAIN]	Hazard associated with the storage of Beryllium waste containers. Not an Accident Source Term/Precursor/Initiator/Propagator • No direct hazard to the onsite worker or the public due to limited amounts and separation distance from receptors. • Negligible indirect hazard to the onsite worker or the public due to no identified mechanism for impact to waste containers. **Applicable SMPs:** CM; OS&IH; and WM. **Standard Industrial Hazard** • Worker Beryllium inhalation risk. **Applicable SMPs:** COOP; DOC; IWCP; OS&IH; TRAIN; and WM.

Table 3 Hazard Description Summary

Hazard/Energy Source	Form/ Description	Packaging	Interact Activities	Credited Protective Features	Remarks
9. TOXIC, HAZARDOUS, OR NOXIOUS CHEMICALS: (continued)					
C. Batteries	Lead acid batteries for forklifts; other vehicles	Contained within equipment.	SH, RA	HAZARD CONTROL • Configuration control [CM, OS&IH] WORKER PROTECTION • Container [OS&IH, TSM] • Standard PPE, eye protection, safety showers [OS&IH, TSM] • Container inspection, labeling, LO/TO, training, work planning, work instructions, work control [COOP, DOC, IWCP, OS&IH, TRAIN, TSM]	Used in fork trucks and other vehicles. Not an Accident Source Term/Precursor/Initiator/Propagator • No direct hazard to the onsite worker or the public due to separation distance from receptors. • Negligible indirect hazard to the onsite worker or the public due to no identified mechanism for impact to waste containers. **Applicable SMPs:** CM and OS&IH. **Standard Industrial Hazard** • Worker chemical burn risk. **Applicable SMPs:** COOP; DOC; IWCP; OS&IH; TRAIN; and TSM.
D. Diesel Fuel (Gasoline)	Gasoline or diesel fuel tank on the forklift, mobile crane, tractor, fuel delivery vehicle, construction equipment, automobiles, emergency response vehicles, *etc.*	Tanks	SH, RA	HAZARD CONTROL • Configuration control [CM, OS&IH] WORKER PROTECTION • Enclosure/equipment [OS&IH, TSM] • Equipment inspection, labeling, inventory control, work control [COOP, IWCP, OS&IH]	Used as vehicle fuel. Not an Accident Source Term/Precursor/Initiator/Propagator • No direct hazard to the onsite worker or the public due to separation distance from receptors. • Negligible indirect hazard to the onsite worker or the public due to no identified mechanism for impact to waste containers. **Applicable SMPs:** CM and OS&IH. **Standard Industrial Hazard** • Worker chemical exposure risk. **Applicable SMPs:** COOP; IWCP; OS&IH; and TSM.

Table 3 Hazard Description Summary

Hazard/Energy Source	Form/ Description	Packaging	Interact Activities	Credited Protective Features	Remarks
9. TOXIC, HAZARDOUS, OR NOXIOUS CHEMICALS: (continued)					
E. Mixed Waste (RCRA, TSCA, CERCLA)	Solid and liquid containerized wastes	Approved on-site shipping containers; drums, metal waste boxes, wood crates, cargo containers, transport trailers, *etc.*	SH, RA	**Further Evaluated** WORKER PROTECTION • Container [WM] • Standard PPE, dosimeters [OS&IH, RAD] • Monitoring, container inspection, postings, area restrictions, labeling, RWP/ALARA, inventory track/control, training, work planning, work instructions, work control, QA [COOP, DOC, IWCP, QA, RAD, TRAIN, WM] • Standard RCRA, TSCA, CERCLA Programs fully implemented [EM]	Hazard associated with the storage of mixed waste. • RCRA, TSCA and CERCLA program requirements. **Accident Source Term/Precursor/Initiator/Propagator** • No direct hazard to the onsite worker or the public due to limited amounts and separation distance from receptors. • Negligible indirect hazard to the onsite worker or the public due to no identified mechanism for impact to waste containers. **Safety Analysis:** Chemical hazard in container fires and spills, tanker truck/truck trailer fires and spills, WMC fires, NPH events, and external events. **Standard Industrial Hazard** • Worker chemical exposure or burn risk. **Applicable SMPs:** COOP; DOC; EM; IWCP; OS&IH; QA; TRAIN; WM; and TSM.
11. MATERIAL HANDLING:					
A. Handling, Transfer, and Shipment of Waste Containers	Removing/loading waste containers from/on transport vehicles; moving waste containers between transport vehicles and storage location. Packaging and repackaging waste	Approved on-site shipping containers; drums, SWBs, metal waste boxes, wood crates; cargo containers, *etc.* ; Approved packaged waste configurations; shrink-wrap; fixatives.	SH, GN	**Further Evaluated** WORKER PROTECTION • Standard PPE, dosimeters [OS&IH, RAD] • Monitoring, area restrictions, RWP/ALARA, operations requirements, inventory track/control, training, work planning, work instructions, work control [COOP, DOC, IWCP, OS&IH, RAD, TRAIN, TSM, WM]	Hazard associated with receipt, transport, and shipping and handling of waste containers. • Handling error results in impact/drop source. • Evaluated under Hazard/Energy Source 7A, *Vehicles, Material Handling Equipment*; Hazard/Energy Source 7C, *Suspended Loads/Material*; Hazard/Energy Source 8A, *Overhead Cranes and Equipment*; and Hazard/Energy Source 8B, *Raised Loads on Forklifts.* **Accident Source Term/Precursor/Initiator/Propagator** • No direct hazard to the onsite worker or the public due to separation distance from receptors. • Indirect hazard to the onsite worker or the public as an energy source to cause radioactive material releases. **Safety Analysis:** Spill (drop, puncture, impact) event initiator. **Standard Industrial Hazard** • Worker impact or crush risk. **Applicable SMPs:** COOP; DOC; IWCP; OS&IH; RAD, TRAIN; TSM; and WM.

Table 3 Hazard Description Summary

Hazard/Energy Source	Form/ Description	Packaging	Interact Activities	Credited Protective Features	Remarks
13. OTHER HAZARDS:					
A. Combustibles	Wooden pallets, plywood sheets, hydraulic fluid, plastics, trash, miscellaneous flammable chemicals, misc. process supplies.	Flammable chemicals in flammable liquid storage cabinets, not applicable for other combustibles	SH, GN, RA	**Further Evaluated** WORKER PROTECTION • Monitoring, postings, training, work planning, work instructions, work control [COOP, DOC, FIRE, IWCP, TRAIN]	Hazard associated with normal operations involving transient combustibles. • Buildup of combustible materials in waste storage areas or placement of combustible materials near waste containers impacts the type and size of fires involving waste containers. **Accident Source Term/Precursor/Initiator/Propagator** • No direct hazard to the onsite worker or the public due to separation distance from receptors. • Indirect hazard to the onsite worker or the public as a configuration that is more susceptible to radioactive material releases. **Safety Analysis:** WMC fire event precursor. **Standard Industrial Hazard** • Worker burn risk. **Applicable SMPs:** COOP; DOC; FIRE; IWCP; and TRAIN.
B. Natural Phenomena or External Event	Seismic events, high winds, tornadoes, heavy snow, lightning, aircraft crash, range fires	Approved on-site shipping containers; drums, SWBs, metal waste boxes, wood crates; cargo containers, transport trailers, *etc.* ; Approved packaged waste configurations; Shrink-wrap; fixatives.	SH	**Further Evaluated** WORKER PROTECTION • Structure [ENG, EP] • Monitoring, postings, training, work planning, work instructions, work control [COOP, DOC; ENG, EP, IWCP, TRAIN]	Hazard primarily associated with seismic, high wind, snow loading, and aircraft crash events. • Natural phenomena and external events may result in container toppling/impact. **Accident Source Term/Precursor/Initiator/Propagator** • Direct hazard to the onsite worker or the public from the event. • Indirect hazard to the onsite worker or the public as an energy source to cause radioactive material releases. **Safety Analysis:** Fire and spill event initiator. **Standard Industrial Hazard** • Worker crush or impact risk. **Applicable SMPs:** COOP; DOC; ENG; EP; IWCP; and TRAIN.

4.3 HAZARDS EVALUATION

Table 4 lists the general accident scenarios applicable to Outdoor Waste Management activities by scenario type. The table provides a description of the scenario progression and related activities as well as a qualitative assessment of scenario frequency. These general descriptions and frequency assignments do not reflect activity-specific conditions and operations associated with Outdoor Waste Management. For example in the description of the small fire scenario the waste type, container type, container storage configuration, MAR loading, associated activity, available mitigative features, *etc.* are not yet considered. Such activity-specific conditions were considered in NSTR-001-02 in order to identify a set of representative accident scenarios. Representative accident scenarios are discussed in Section 4.4, *Selection of Representative Accident Scenarios.*

Table 4 General Accident Scenarios

Scenario Type	Description
Storage and Handling (SH) Scenarios	
FIRE	SMALL. Transient combustible materials (*e.g.*, plywood, wooden pallets, flammable/combustible liquids, *etc.*) may be present in and around WMCs. If combustible materials are inadvertently stacked against or are in close proximity to waste containers and are ignited, several waste containers can be exposed to enough thermal energy to cause lid or lid seal failure and venting of radioactive materials. SMALL fire scenarios can be initiated by electric power or hot work and are judged to be *anticipated* events without prevention.
FIRE	MEDIUM. In the event that the combustible loading increases above that involved in a SMALL fire scenario, a MEDIUM fire can result that impacts additional waste containers beyond those involved in a SMALL fire scenario. Additional combustible loading may include leaking fuel from a fork-truck or tractor, or an excess amount of transient combustibles. MEDIUM fire scenarios can be initiated by electric power or hot work and are judged to be *anticipated* events without prevention.
FIRE	LARGE OR MAJOR (up to 400 gallons of liquid fuel). A larger fire can result that impacts additional waste containers beyond those involved in a MEDIUM fire scenario due to leaking fuel from a gasoline or diesel fuel-powered tractor or fuel delivery vehicle. These LARGE or MAJOR fire scenarios can be initiated by electric power, hot work, or range fires and are judged to be *anticipated* events without prevention.
FIRE	MAJOR (up to 8,500 gallons of liquid fuel). A larger fire can result that impacts additional waste containers beyond those involved in a LARGE fire scenario due to an accident involving a large-capacity fuel delivery vehicle. These MAJOR fire scenarios can be initiated by electric power, hot work, or range fires and are judged to be *unlikely* events without prevention.
FIRE	UNCONTAINERIZED ITEMS. A fire can result that impacts packaged waste items during loading, unloading, storage, and repackaging activities. This fire scenario can be initiated by electric power or hot work and is judged to be an *anticipated* event without prevention.
FIRE	TANKER TRUCK. A fire can result that impacts tanker trucks filled with wastewater. This fire scenario can be initiated by electric power, hot work, or range fires and is judged to be an *anticipated* event without prevention.

Table 4 General Accident Scenarios

Scenario Type	Description
Storage and Handling (SH) Scenarios (continued)	
FIRE	TRUCK TRAILER. A fire can result that impacts truck trailers filled with waste containers. This fire scenario can be initiated by electric power, hot work, or range fires and is judged to be an *anticipated* event without prevention.
FIRE	NON-AQUEOUS LIQUID WASTE: A fire can result that impacts waste containers or tankers containing contaminated, non-aqueous liquids (*e.g.*, oils, solvents, *etc.*). This fire scenario can be initiated by electric power, hot work, or range fires and is judged to be an *anticipated* event without prevention.
SPILL	CONTAINER: DROP/FALL. Waste containers are routinely raised above ground level (*e.g.*, during stacking, loading on transport vehicle, *etc.*) using handling equipment including mobile cranes, hoists, forklifts, and drum lifters. During container handling activities, various equipment failure mechanisms or improper rigging can result in waste container drops and falls. Upon impact with a hard surface (*e.g.*, ground, equipment, other waste containers, *etc.*) waste containers can fail resulting in a container breach and subsequent release of a portion of the container contents. Container drop/fall scenarios are judged to be *anticipated* events without prevention.
SPILL	CONTAINER: PUNCTURE. Waste containers are routinely moved using forklifts. A forklift operator error when attempting to position the tines can result in the forklift tines puncturing one or more waste containers. Upon container puncture, a portion of the container contents can be released. Container puncture scenarios during material handling are judged to be *anticipated* events without prevention. Compressed gases are used during maintenance activities. If a cylinder valve was accidentally sheared off during cylinder handling, the cylinder could become an airborne missile that impacts and punctures nearby waste container(s) resulting in a release of a portion of the container contents. Container puncture scenarios due to cylinder impacts are judged to be *unlikely* events without prevention.
SPILL	CONTAINER: IMPACT. Waste containers may be physically impacted several ways during storage and handling. Material handling equipment (*e.g.*, forklifts) or other vehicles can inadvertently impact waste containers resulting in crushing or toppling; raised or suspended loads can drop onto waste containers as a result of lifting equipment failure or improper rigging. Natural phenomena events such as high winds or tornadoes can cause wind-generated missiles that can impact waste containers. Container impact scenario events can be initiated by seismic events or snow loading on a facility adjacent to a WMC and are judged to be *anticipated* events without prevention.
SPILL	TANKER TRUCK: IMPACT. Material handling equipment (*e.g.*, forklifts) or other vehicles can inadvertently impact a tanker truck filled with wastewater resulting in a spill. This spill scenario is judged to be an *anticipated* event without prevention.
SPILL	CONTAINER: LIGHTNING. A waste container may be directly struck by lightning. The effect of the lightning strike could be nothing more than a surface burn with no impact to the contents of the package. A potential worst case effect of the strike is unpredictable. It is postulated that the lightning strike could rapidly heat any residual liquids inside of the container leading to a rapid pressurization of the container or an "internal steam explosion" of sorts. This spill scenario is judged to be an *anticipated* event without prevention.

Table 4 General Accident Scenarios

Scenario Type	Description
Storage and Handling (SH) Scenarios (continued)	
SPILL & FIRE	CONTAINER: EXTERNAL EVENT. In the event of an aircraft crash, two release mechanisms are considered; spill and fire. Such spill and fire scenarios are a combination of two separate failure paths: (1) container failure/external/ mechanical/impact/natural phenomena hazard/ external event (NPH/EE) and (2) container failure/external/thermal/fire/NPH/EE. During an aircraft impact into a WMC, the kinetic energy dissipated into waste containers can breach several containers resulting in a spill of all or a portion of the container contents. Subsequent to impact, an ensuing pool fire can involve a number of waste containers. The pool fire can involve the waste containers spilled due to aircraft impact (unconfined material fire) as well as additional waste containers that may not have been breached due to aircraft impact (confined material fire). Aircraft crash induced spill and fire scenarios are judged to be *extremely unlikely* events without prevention.
Routine Activities (RA) Scenarios	
FIRE	CONTAINER: DIRECT FLAME IMPINGEMENT. Flammable gas torches are routinely used during maintenance and construction activities. In the event that a flammable gas device flame comes into direct contact with a stored waste container, a breach of the container is possible resulting in a radiological release. Direct flame impingement scenarios are judged to be *unlikely* events without prevention and are bounded by the SH fire scenarios. Therefore, direct flame impingement fires are not evaluated further.

A fire or spill scenario involving DOT Type B shipping containers [e.g., Transuranic Package Transport (TRUPACT) II] is not included in Table 4 because there are no identified release mechanisms for these containers due to the rigor of their construction.

An explosion scenario is not included in Table 4 because explosions (vapor cloud explosion, turbulent gas jet explosion and boiling liquid expanding vapor explosion [BLEVE]) were dismissed from further analysis in NSTR-001-02. The vapor cloud explosion scenario was shown to be bounded by the *unlikely* NPH Scenario 1: *Seismic-Induced Structural Failure* that involved the entire contents of a WMC. The turbulent gas jet explosions and BLEVE event were shown to be bounded by the *unlikely* (unprevented) Fire Scenario 1: *Major Waste Container Fire (8,500 Gal. Diesel)* that involved the entire contents of a WMC. The frequency of occurrence of the turbulent gas jet explosion (involving acetylene and propane cylinders) and vapor cloud explosion was determined to be *unlikely* without controls. The frequency of occurrence of the turbulent gas jet explosion (involving natural gas distribution lines) was determined to be *extremely unlikely* without controls. The frequency of occurrence of the BLEVE was determined to be *extremely unlikely* without controls. WMC siting controls are imposed to ensure that WMCs are sited with a minimum separation distance from propane storage tanks and natural gas distribution lines. Therefore, explosion scenarios are not evaluated further.

A criticality scenario is not included in Table 4 due to the limited radioactive material associated with LLW/LLMW, SCO, and LSA materials and the configuration of waste in Type B containers that are "incident-to-shipping." For these types of waste, criticalities are considered to

be incredible; therefore, the criticality hazard is not carried forward in the safety analysis (Ref. 15 and Ref. 16, respectively).

The purpose of the accident analysis portion of the safety analysis was to refine the assessment of the risk associated with facility operation and to determine the appropriate set of protective features or controls to ensure safe operation. Risk assessment refinement can be accomplished by improving the understanding of accident scenario progression, by improving the quality of the estimate of the scenario frequency, and by improving the assessment of accident scenario dose consequences. Appropriate control set determination can be accomplished by initially crediting a set of protective features/controls that are expected to be in place during operation, by assessing the acceptability of the scenario risk under the expected set of controls, and by identifying appropriate controls for scenario risk reduction in cases where the scenario risk could exceed Risk Class III. Control appropriateness may be determined using multiple factors including: (1) risk reduction benefit; (2) control cost; (3) scenario risk class; and (4) control impact on operations.

4.3.1 Chemical Hazards

The accident consequence levels for accidents involving chemicals and hazardous materials are summarized in Table 5, *Chemical Evaluation Summary*. Concerns associated with the non-radiological hazardous constituents of waste include exceeding adverse health affect thresholds, unplanned chemical reactions, challenging waste container integrity, and environmental impact.

A qualitative determination was made of the consequence levels for accidents involving WMC inventories. This was necessary because complete and accurate characterization data are not available for all of the waste types potentially present in the WMCs and the fact that the waste inventory will continuously change. Existing engineered and administrative controls mandated by RCRA, TSCA, and CERCLA regulations are credited as preventive and mitigative measures for controlling chemical hazards associated with these wastes.

Containerized wastes include those packaged in standard containers such as drums, metal boxes, and wooden crates. Containerized wastes that can be characterized as "RCRA non-hazardous" have been eliminated from further evaluation based on their non-hazardous designation. The presence of Toxic Substances Control Act (TSCA) wastes that may or may not be designated as RCRA hazardous waste are discussed separately below. Accident consequence levels for accidents involving RCRA non-hazardous wastes (excluding TSCA wastes) have been judged to be *insignificant*. The presence of these non-hazardous wastes do not present any potential safety or health hazards such as fire or chemical exposure above the normal conditions in the WMCs. For the purpose of this evaluation, the hazardous constituents of CERCLA and RCRA wastes are considered to be the same, and the CERCLA Program requirements provide a comparable level of control to manage mixed waste safely in WMCs.

For containerized mixed wastes, the Site relies on the characterization data required by the RCRA and/or CERCLA programs. A *low* accident consequence has been qualitatively assigned to *anticipated* accident scenarios involving containerized mixed waste that result in the release of the contents of a single container. This determination is based on approximately 20% of the various types of waste containers present at the Site, no ERPG fraction for an individual container has

exceeded 1.0. Typical ERPG fractions (at a distance of 1,900 meters), for fire and spill scenarios, involving specific Item description Codes (IDCs) range from 10^{-13} to 10^{-4} per Nuclear Safety Calculation 96-SAE-006 (Ref. 17).

A *low* accident consequence has also been assigned to *unlikely* and *extremely unlikely* accident scenarios involving containerized mixed waste which result in the release of the contents of multiple containers. This *low* accident consequence has been qualitatively assigned based on multiple containers of multiple IDCs being breached and the low possibility of exceeding unity when summing the individual fractions for ERPG-2 at 1,900 meters or ERPG-3 at 100 meters. This low possibility is assumed based on the relatively small number of waste containers that will be present in WMCs, the number of waste containers involved in the bounding accident scenarios, and the very small ERPG fractions determined in Nuclear Safety Calculation 96-SAE-006 (Ref. 17) for analyzed waste IDCs typically stored at the Site. WMCs are located no closer than 850 meters to the nearest Site boundary. This distance is 2.2 times less than the 1,900 meters evaluated; however, the ERPG fractions are sufficiently small (orders of magnitude difference) that the conclusions do not change for WMCs evaluated at 850 meters.

Containerized wastes with Toxic Substances Control Act (TSCA) regulated Polychlorinated Biphenyls (PCBs) could also be present in the WMCs. Site PCB wastes include liquid PCB waste forms (oil with PCBs and fluorescent light ballasts) and solid PCB waste forms (drained PCB equipment, rags, debris, or soils). Liquid PCB waste forms include IDC 533 (PCB liquids with hazardous constituents), IDC 970 (PCB liquids without hazardous constituents), IDC 971 (PCB fluorescent light ballasts), and IDC 973 (PCB transformers/ capacitors). Solid PCB waste forms include IDC 972 (miscellaneous PCB debris). A *low* accident consequence has been assigned to accident scenarios involving containerized wastes with PCB liquids based on the small number of containers of these IDCs present at the Site. The ERPG-2 and ERPG-3 fractions for IDC 970 range from 10^{-8} to 10^{-5} for various accidents (e.g., fire or spill) and container types per Nuclear Safety Calculation 96-SAE-006. With ERPG fractions in this range, it would require a release from many containers to exceed the *low* accident consequence level. The storage of TSCA regulated waste meets all applicable requirements of the *TSCA Management Plan* (Ref. 18).

Table 5 Chemical Evaluation Summary

CHEMICAL OR CHEMICAL SOURCE	ACCIDENT CONSEQUENCE LEVEL[a]		
	MOI	Collocated Worker	Immediate Worker
Containerized Mixed Waste (release of a single container)	Moderate - Low	Moderate - Low	High - Low
Containerized Mixed Waste (release of multiple containers)	Moderate - Low	Moderate - Low	High - Low
TSCA Polychlorinated Biphenyl (PCB) Containerized Waste (potentially present)	Low	Low	Low

For WMCs that have both radiological and chemical hazards in solid, non-liquid, waste forms (*i.e.*, IDCs that contain free liquids in quantities less than approximately 4 liters), the radiological consequences dominate any significant hazardous chemical release. This has been shown in the analysis for other Site waste storage facilities (Refs. 19 and 20), which have documented that even with conservative analysis, adverse health affect thresholds for the public and collocated worker are not exceeded for facilities containing waste representative of the current backlog.

For WMCs that store liquid waste forms (containers with chemical quantities greater than 4 liters), it is judged that a chemical release could result in adverse consequences to the MOI, collocated worker, or immediate worker due to inhalation, or absorption in the case of the immediate worker, depending on the quantity and toxicity of the chemical(s) released. Release mechanisms include those accident scenarios addressed earlier for radiological releases. A liquid chemical release at a WMC is estimated to involve multiple drums based on (1) the amount of liquid chemical waste stored within a WMC, and (2) the likelihood of such an inventory being involved in a postulated accident scenario previously discussed.

A *moderate* to *low* accident consequence level has been qualitatively assigned to the MOI based on the quantities of chemicals, that if spilled, could result in an airborne release that migrates to the MOI. RCRA and CERCLA require additional provisions such as secondary containment and/or spill response procedures to effectively mitigate releases. Secondary containment, such as a berm or a catch pan, reduces the surface area of the chemical spill/puddle, which in turn reduces the evaporation rate, and subsequently reduces the amount of chemical that becomes airborne. Similarly, the use of absorbent packaging materials reduce the quantity of material that becomes airborne. Timely spill response reduces the release duration, which also reduces the amount of chemical that becomes airborne.

A *moderate* to *low* accident consequence level has also been assigned to the collocated worker as a result of a chemical release at a WMC. Secondary containment and/or spill response procedures effectively mitigate releases that could affect the collocated worker.

A *high* to *low* accident consequence level has been qualitatively assigned to the immediate worker in close proximity to a chemical release at a WMC. An immediate worker exposed to a spill of hazardous chemicals could be exposed to airborne concentrations, at or near the point of release, that exceed short-term exposure guidelines such as Permissible Exposure Limit-Ceiling (PEL-C), Immediately Dangerous to Life or Health (IDLH), or Threshold Limit Value-Ceiling (TLV-C). Exceedance of any of these thresholds can result in adverse health effects to the immediate worker. For this reason a *high* consequence level is assigned to the immediate worker. For a smaller spill or a spill of a less toxic chemical, the accident consequences would be less severe.

Chemical hazards associated with wastes stored in crates would be bounded by the liquid chemical wastes in drums.

4.3.2 Radiological Hazards

A Surface Contaminated Object (SCO), as defined in 49 CFR 173 (Ref. 21), is a solid object which is not itself classed as radioactive material, but which has radioactive material distributed on any of its surfaces.

Low Specific Activity (LSA) material, as defined in 49 CFR 173, is a special classification given to any radioactive material which is dispersed throughout a substance to such an extent and in such a form that it poses little hazard even if released in an accident. The consequences associated with accidents involving this type of material are bounded by the safety analysis of LLW/LLMW materials.

Facility-specific criticality safety requirements are detailed for facilities that handle, process, store, stage, transfer, transport fissionable material (greater than 15 grams per container) in accordance with the Nuclear Criticality Safety Manual (Ref. 15). Facilities or operational activities that contain more than a significant quantity of fissionable material, but only contain either waste material containing less than 100 nanocuries per gram of transuranic nuclides and no enriched uranium or packaged waste material containing less than or equal to 15 grams fissionable material in each 55-gallon or larger waste drum/package, are exempt from the facility-specific criticality safety requirements. As such, limitations are imposed on individual container inventory (see Section 5, *Technical Safety Requirements*) to ensure that Outdoor Waste Management activities remain exempt from criticality safety requirements.

The gram inventory threshold between a Hazard Category 3 Nuclear Facility and a Hazard Category 2 Nuclear Facility for depleted and enriched uranium is 710 metric tons and 110 metric tons, respectively. The total Site inventory of depleted and enriched uranium does not exceed Hazard Category 3 quantities. From a radiological dose consequence standpoint, it would take an amount of uranium that is several orders of magnitude greater than Aged WG Pu to produce the same dose consequence to a receptor. Therefore, depleted and enriched uranium are not evaluated further.

High americium wastes do not fall in the category of LLW (Ref. 7) and are not evaluated in this safety analysis. In-growth amounts of americium are accounted for in the accident analysis by evaluating the MAR as a Site Weapons Grade Plutonium (WG Pu) isotopic mix per the Safety Analysis and Risk Assessment Handbook (Ref. 6).

In the packaging of LLW/LLMW or SCO materials into waste containers, it is often the case that the analyzed Pu content of the container is not finalized until after the container is placed in a WMC. Based on the characterization of the waste prior to packaging, a conservative determination is made about the type of waste involved. If the waste is determined to be non-compliant with the per-container inventory limits in the Technical Safety Requirements, the container will not be placed in a WMC. If the waste is determined to be compliant, the container may be placed in the WMC prior to finalization of its Pu content based on the determination that the waste conforms to LLW/LLMW, SCO, or LSA requirements. The container may be placed in a WMC awaiting laboratory analysis of its contents, a final weighing of the container, or an assay of the container. Based on the results of the final characterization, the container may exceed the container limits associated with LLW/LLMW, SCO, or LSA materials.

Table 6 shows the amount of Aged WG Pu per container evaluated for accident scenarios involving metal drums, metal boxes, wood crates, and cargo containers. Wood crates are intended to cover any soft-sided waste containers such as super-sacks, soft boxes, *etc.* These values do not represent container limits in the "Evaluated Maximum Inventory Per Container" cases, but rather an upper threshold for the safety analysis.

Table 6 Waste Container Type MAR Comparison

Container Type	Evaluated Maximum Inventory Per Container (grams WG Pu)		AB Maximum Allowed Inventory Per Container (grams WG Pu)
	Accident Involving ≤ 3 Containers	Accident Involving > 3 Containers	
Drums	3	1	0.5
Low Capacity Containers (Net Weight Capacity ≤ 5,520 lbs.) [crates or boxes]	15*	6	3
High Capacity Containers (Net Weight Capacity > 5,520 lbs.) [cargo containers]	15*	15*	6+

* This limit set as a boundary based on Criticality Safety Program concerns.

\+ The Aged WG Pu inventory is controlled by being in compliance with DOT regulations that effectively limit the amount of Pu-239 to 6 grams per SCO shipment.

4.3.3 Evaluated Container Types

For the purpose of this safety analyses, the waste container/waste item types evaluated in the safety analysis are defined in Table 7, *Evaluated Container Types.*

Table 7 Evaluated Container Types

Container Type	Description
Drums	A metal drum. Includes but is not limited to 55-gallon waste drums and various sized overpack containers.
Boxes	A low-capacity metal container with a net weight capacity of no more than 5,520 lbs. Includes but is not limited to Standard Waste Boxes (SWBs), Sandia Metal Waste Boxes (SAN Boxes), High Efficiency Particulate Air (HEPA) Filter Coffins, HEPA Filter Standard Boxes.
Wood Crates	A low-capacity wooden container with a net weight capacity of no more than 5,520 lbs. Generally includes wooden containers of the same size or smaller than a Full Size Wooden Waste Box which is approximately 4 ft. × 4 ft.× 7 ft. Also intended to cover soft-sided containers like super-sacks.
Large Crates	A high-capacity wooden container with a net weight capacity in excess of 5,520 lbs. Generally includes wooden containers larger than Full-Size Wooden Waste Boxes.
Cargoes	A high-capacity metal container with a net weight capacity in excess of 5,520 lbs. Generally includes containers larger than SWBs and SAN Boxes including Cargo Containers and IP-1/2 Containers.
Large Packages	An un-containerized item (MAR values equivalent to high-capacity containers) that is usually too large to place into a container and that is packaged compliant with onsite transportation and/or Department of Transportation (DOT) requirements. Generally includes large metal items that are shrink-wrapped or have had contamination fixatives applied.
Tankers	Transport equipment for moving liquids with a capacity of about 8,500 gallons.
Trailers	Transport equipment for moving containers and packages. Includes flatbeds and enclosed trailers.

4.4 SELECTION OF THE REPRESENTATIVE ACCIDENT SCENARIOS

The scenario selection process focuses on those aspects of the radiological dose consequence calculation model that vary between scenarios. Radiological dose consequence evaluations are performed using the following equation:

$$\text{Dose} = \text{MAR} * \text{DR} * \text{ARRF} * \text{LPF} * \chi/\text{Q} * \text{BR} * \text{DCF} / \text{PDC}$$

where
- MAR is the radioactive material-at-risk (in grams, varies with scenario);
- DR is the MAR damage ratio (varies with scenario);
- ARRF is the airborne respirable release fraction (varies with form of radioactive material and scenario);
- LPF is the facility leakpath factor (set to 1.0, outdoors);
- χ/Q is the atmospheric dispersion factor (in s/m^3, varies with receptor and scenario);
- BR is the receptor breathing rate (in m^3/s, set for heavy activity);
- DCF is the radiological material dose conversion factor (in rem/gram, varies with material type); and
- PDC is the plume duration correction factor (varies with scenario).

The PDC value is used for accident scenarios with a duration longer than 10 minutes (*e.g.*, some large fires). The PDC value is used to modify the atmospheric dispersion value to correct for plume meander during the scenario. The formula used for determining plume meander for longer duration releases is as follows:

$$PDC = (\textit{plume duration in minutes / time base})^n$$

where the time base is 10 minutes; "n" has a value of 0.2 if the plume duration is less than or equal to 60 minutes; otherwise, "n" has a value of 0.25.

The radiological dose calculation parameters applicable for distinguishing between scenarios are MAR, DR, ARRF, χ/Q, and 1/PDC; the others remain constant within each accident scenario. MAR and DR vary with the scenarios based on package type and event size, ARRF varies with the scenario type (*e.g.*, fire, spill, *etc.*) and with the form of radioactive material (*e.g.*, confined or unconfined), χ/Q is affected by wind speed and amount of plume lofting in a fire event, and PDC is time dependent (the release duration for the scenarios are assumed to be 10 minutes unless otherwise stated).

The scenarios are compared against each of the applicable parameters of the dose calculation equation and a determination is made as to which scenarios are bounding based on their scores. The Atmospheric Dispersion Factors (χ/Q and PDC) are extracted from RADIDOSE (V1-4) and the RADIDOSE spreadsheet values yielding the presented results are listed. Table 8 presents this information. All of the parameters trend similarly for both the CW and MOI receptors, with the

results for the CW being more prominent. Therefore, the CW receptor values for atmospheric dispersion factors are used to determine the relative ranking presented later in this section.

Table 8 Atmospheric Dispersion Factors

Atmospheric Dispersion Factors	χ/Q (CW @ 100 m)	Plume/Release Duration (min)	PDC	1/PDC
Non-Lofted	9.94E-3	10	1	1
Small Fire	1.51E-3	10	1	1
Medium Fire	6.98E-4	10	1	1
Large Fire	3.59E-4	10	1	1
Major Fire	9.89E-5	10	1	1
Small Fire: 60 min	1.06E-3	60	1.431	0.699
Medium Fire: 30 min	5.60E-4	30	1.246	0.803
Major Fire: 60 min	6.91E-5	60	1.431	0.699
Non-Lofted 8 hr (480 min)	3.78E-3	480	2.632	0.380
High Wind	1.26E-4	10	1	1

In those cases where the scenario consequences are composed of multiple components, the largest contributor is used and multiplied by the number of components to determine a scenario relative ranking value rather than evaluating each of the components and summing them together.

Individual waste container/item MAR values are generally assumed to vary from 0.5 grams for LLW/LLMW drums up to 6 grams for SCO/LSA items and large containers. However, packaged waste in a WMC may only have preliminary MAR estimates that may underestimate the amount of radioactive material present. This safety analysis evaluates overloaded LLW/LLMW, SCO waste, and LSA waste items at a higher amount than the standard Site limits imposed on LLW/LLMW, SCO waste, and LSA waste items. For larger PACKAGED WASTE items, the MAR is evaluated up to an amount that is generally associated with a Criticality Safety Program limit of concern (*i.e.*, 15 grams). That is, PACKAGED WASTE items containing less than 15 grams of WG Pu are exempt from any Criticality Safety Program requirements. The intent of evaluating the PACKAGED WASTE items at a higher MAR value is to assess overloaded container configurations but not to permit the configuration as part of normal routine operations. The standard Site limits imposed on LLW/LLMW, SCO waste, and LSA waste items remain in effect and waste items that exceed those limits are considered to be out-of-compliance with the inventory limits is Section 5, *Technical Safety Requirements*. However, Unreviewed Safety Question Determinations (USQDs) do not have to be performed for situations where the PACKAGED WASTE item MAR values are below the analyzed values. For scenarios that involve waste containers that are "incident-to-shipping," individual waste container MAR values are set to the controlled amount (*e.g.*, 0.5 grams per Drum, 3 grams per Box, *etc.*); otherwise the MAR values are analyzed at the higher values specified in Table 6, *Waste Container Type MAR Comparison*. Note that in some of the scenario evaluations specifically involving drums, individual drum MAR values are set to 1 gram.

For scenarios that involve waste containers that are "incident-to-shipping," individual waste container MAR values are set to the controlled amount (e.g., 0.5 grams per Drum, 3 grams per Box,

etc.) because the waste is fully characterized; otherwise the waste item MAR values are analyzed at the higher values specified in Table 6, *Waste Container Type MAR Comparison.* For the large-scale accident scenarios (*i.e.*, 8,500 gallon fuel pool fires, seismic, and aircraft crash), the maximum MAR for a WMC (900 g WG Pu) is postulated to be involved in the events.

Because criticalities are considered to be incredible, WMC MAR values are set at the nuclear facility Hazard Category 3 upper limit for plutonium for situations where criticalities are not possible (*i.e.*, 900 grams versus 450 grams for situations where criticalities are possible).

A Fire Hazards Analysis (FHA) evaluates and assesses the fire hazards associated with WMCs (Ref. 22).

Table 9 Representative Accident Scenario Summary

Scenario Number in NSTR-001-02	MAR / Waste Container Type	Representative Bounding Scenario Summary
Fire Scenario 1: Waste Container Fire (Small Fire Intensity)	Entire WMC composed of wooden waste crates	Intent: This scenario postulates involvement of the largest MAR possible in a fire with limited lofting. By postulating a WMC composed entirely of wooden crates, it is possible to involve the entire WMC inventory (900 grams WG Pu). The limited lofting can occur by assuming that the fire propagates slowly from crate to crate which is assumed to result in the equivalent of a small fire (1 MW) lofting effect. However, this slow propagation does extend the duration of the release which is evaluated as being 60 minutes. Note: It is assumed that this fire bounds any situation where more than one WMC is impacted by the fire. The conservative assumption of involving the entire WMC inventory in the slowly propagating fire ensures that multiple WMC-impacting fires that involve only a portion of their inventory (or burn faster/hotter) are bounded by this scenario. Summary: MAR = 900 grams, DR = 1.0, ARRF = 5.0E-4, χ/Q = small fire lofting, PDC based on a duration of 60 minutes.

Table 9 Representative Accident Scenario Summary

Scenario Number in NSTR-001-02	MAR / Waste Container Type	Representative Bounding Scenario Summary
Fire Scenario 2: Waste Container Fire (Medium Fire Intensity)	Entire WMC composed of wooden waste crates	Intent: This scenario postulates involvement of the largest MAR possible in a fire with moderate lofting and shorter duration. By postulating a WMC composed entirely of wooden crates, it is possible to involve the entire WMC inventory (900 grams WG Pu). The moderate lofting can occur by assuming that the fire propagates moderately from crate to crate which is assumed to result in the equivalent of a medium fire (5 MW) lofting effect. However, this propagation does extend the duration of the release, which is evaluated as being 30 minutes. Note: It is assumed that this fire bounds any situation where more than one WMC is impacted by the fire. The conservative assumption of involving the entire WMC inventory in the moderately propagating fire ensures that multiple WMC-impacting fires that involve only a portion of their inventory (or burn faster/hotter) are bounded by this scenario. Summary: MAR = 900 grams, DR = 1.0, ARRF = 5.0E-4, χ/Q = medium fire lofting, PDC based on a duration of 30 minutes.

Table 9 Representative Accident Scenario Summary

Scenario Number in NSTR-001-02	MAR / Waste Container Type	Representative Bounding Scenario Summary
Fire 3: Major Waste Container Fire (400 gal diesel)	Entire WMC composed of waste drums	Intent: This scenario postulates involvement of the largest MAR possible in a short duration fire, which results in major lofting. By postulating a fuel pool type of fire impacting drums, higher MAR involvement can occur due to the potential for drum lid loss and some unconfined material releases versus a confined material release found in wooden crate fires under similar conditions. The postulated scenario involves the currently permitted maximum amount of diesel fuel in a "unrestricted route, non-bulk fuel delivery" situation (400 gallons) in combination with a stacked arrangement of drums with the postulated fuel spill footprint (410 drums) involving an entire WMC inventory of 900 grams. The shortest duration fire lasts only 10 minutes. This fire must be highly intense to cause drum lid loss which yields major lofting. Note: It is assumed that this fire bounds any situation where more than one WMC is impacted by the fuel spill fire. The conservative assumption of involving the entire WMC inventory in the pool fire ensures that multiple WMC-impacting fires that involve only a portion of their inventory are bounded by this scenario. Components: There are three components to the fire: 1) MAR from ejected material associated with drum lid loss (25% of top tier); 2) MAR from non-ejected material associated with drum lid loss; and 3) MAR from drums with seal failure rather than lid loss (75% of top tier and 100% of lower tiers). Summary: Part 1: MAR = 103 grams, DR = 0.33, ARRF = 1.0E-2, χ/Q = major fire lofting. [largest contributor] Part 2: MAR = 103 grams, DR = 0.67, ARRF = 5.0E-4, χ/Q = major fire lofting. Part 3: MAR = 797 grams, DR = 0.50, ARRF = 5.0E-4, χ/Q = major fire lofting.

Table 9 Representative Accident Scenario Summary

Scenario Number in NSTR-001-02	MAR / Waste Container Type	Representative Bounding Scenario Summary
Fire 4: Major Waste Container Fire (8,500 gal diesel)	Entire WMC composed of waste drums	Intent: This scenario postulates involvement of the largest MAR possible in a long duration intense fire, which results in major lofting. By postulating a fuel pool type of fire impacting drums, high initial MAR involvement can occur due to the potential for drum lid loss and some short duration unconfined material releases. The lighter material that is ejected is assumed to have an ARF of 1E-2. The heavier material that is not ejected is assumed to have an ARF of 5E-2). By exposing the containers to a very long duration and intense fire, releases in excess of the standard 5E-4 confined material ARF are expected. While this release may not be as large as the bounding unconfined material ARF (*i.e.*, 5E-2), the release is conservatively evaluated using this ARF in lieu of determining the actual ARF. The material release from the remaining drums is assumed to occur over the period of an hour as the normally confined material pyrolyzes beyond the point that is normally analyzed. Therefore, the ARF for these drums is assumed to be 5E-2. The postulated fire involves a bulk fuel delivery vehicle in combination with a non-stacked arrangement of drums involving an entire WMC inventory of 900 grams. The initial unconfined material release lasts 10 minutes and the remaining unconfined material release lasts 60 minutes. This fire must be highly intense to cause drum lid loss and subsequent extensive pyrolyzation which yields major lofting. Note: It is assumed that this fire bounds any situation where more than one WMC is impacted by the fuel spill fire. As the spilled fuel pool size gets larger such that multiple WMCs are involved, the pool depth decreases making the duration of the fire go down, reducing the subsequent "extensive pyrolyzation". Therefore, the conservative assumption associated with analyzing the fire as an unconfined release of an entire WMC ensures that multiple WMC-impacting fires are bounded by this scenario. Components: There are three components to the fire: 1) MAR from ejected material associated with drum lid loss (25% of drums since spill footprint can cover entire WMC); 2) MAR from non-ejected material associated with drum lid loss; and 3) MAR from drums with seal failure rather than lid loss (75% of drums). Summary: Part 1: MAR = 225 grams, DR = 0.33, ARRF = 1.0E-2, χ/Q = major fire lofting. Part 2: MAR = 225 grams, DR = 0.67, ARRF = 5.0E-2, χ/Q = major fire lofting, PDC based on duration of 60 minutes. Part 3: MAR = 675 grams, DR = 1.00, ARRF = 5.0E-2, χ/Q = major fire lofting, PDC based on duration of 60 minutes [largest contributor].

Table 9 Representative Accident Scenario Summary

Scenario Number in NSTR-001-02	MAR / Waste Container Type	Representative Bounding Scenario Summary
Fire 5: Un-containerized Item Fire	Single "open" waste item	Intent: This scenario postulates involvement of an initially unconfined MAR in a fire with limited lofting. "Un-containerized" waste is postulated to occur during the packaging of cargo containers, for example. This waste is normally confined in plastic bags since the safety analysis does not authorize the packaging/repackaging of externally contaminated items, but no credit is taken for the plastic bags to serve to confine the material in the fire. The MAR value is evaluated at 15 grams. The limited lofting can occur by assuming a small fire (1 MW) lofting effect. Summary: MAR = 15 grams, DR = 1.0, ARRF = 5.0E-2, χ/Q = small fire lofting.
Fire 6: Tanker Truck Fire	Single tanker truck with aqueous liquid waste	Intent: This scenario postulates involvement of an aqueous radioactive solution in a fire with limited lofting. The release mechanism is associated with boiling rather than burning. A fire sufficient to boil the contents of a tanker truck is postulated. The boiling liquid pressurizes the tanker causing relief valves to actuate and vent the tanker leading to the release. The venting is assumed to occur in a manner that is not directly impacted by the fire; that is, the vented material is only lofted like a small fire (1 MW) even though the fire leading to the event may be a major fire. The MAR value is evaluated at 15 grams. Summary: MAR = 15 grams, DR = 1.0, ARRF = 2.0E-3, χ/Q = small fire lofting.
Fire 7: Truck Trailer Fire	Incident-to-shipping trailer with waste crates	Intent: This scenario postulates involvement of radioactive material that is incident-to-shipping. A fire sufficient to impact the entire contents of a truck trailer loaded with waste crates is postulated. Because the waste is "incident-to-shipping," it is characterized and is limited to 3 grams per crate and the trailer load is set at 36 crates. A *medium* fire (5 MW) is not large enough to impact the entire trailer contents but a *large* fire (10 MW) is assumed to be large enough to impact the load. Summary: MAR = 108 grams, DR = 1.0, ARRF = 5.0E-4, χ/Q = large fire lofting.

Table 9 Representative Accident Scenario Summary

Scenario Number in NSTR-001-02	MAR / Waste Container Type	Representative Bounding Scenario Summary
Fire 8: Non-Aqueous Liquid Waste Fire	Entire WMC composed of non-aqueous liquid waste containers	Intent: This scenario postulates involvement of a combustible radioactive solution in a fire with limited lofting. By postulating a WMC composed entirely of non-aqueous liquid containers which will tend to propagate the fire from container to container in a rapid fashion, it is possible to involve the entire WMC inventory (900 grams WG Pu). However, by its nature a combustible liquid fire involving drums or tankers of the liquid will tend to be a major fire and limited lofting is not possible. The release mechanism is associated with burning rather than boiling. Notes: It is assumed that this fire bounds the situation where the non-aqueous liquid waste forms a pool fire that involves other waste containers on a WMC. Therefore, the conservative assumption associated with analyzing the entire WMC inventory as non-aqueous liquid waste (with an ARRF of 7.0E-2) ensures that the release from waste containers in a pool fire is bounded by this scenario. It is also assumed that this fire bounds any situation where more than one WMC is impacted by the non-aqueous liquid waste fire. If a non-aqueous liquid pool forms such that multiple WMCs are involved, the pool depth decreases as the area increases making the duration of the fire go down, reducing the subsequent "extensive pyrolyzation" as described in Fire 1 earlier in this table. Therefore, the conservative assumption associated with analyzing the fire as an unconfined release of an entire WMC ensures that multiple WMC-impacting fires are bounded by this scenario. Summary: MAR = 900 grams, DR = 1.0, ARRF = 7.0E-2, χ/Q = major fire lofting.
Spill 1: Waste Container Drop/Fall	Single waste container/item (relatively container type independent)	Intent: This scenario postulates involvement of the largest confined MAR possible in a material handling accident that involves only the material being handled. It is postulated that a large waste container is dropped during handling. The MAR value is evaluated at 15 grams. The release is non-lofted. Summary: MAR = 15 grams, DR = 1.0, ARRF = 1.0E-4, χ/Q = non- lofted.
Spill 2: Waste Container Puncture by Forklift Tine	Single waste container/item (relatively container type independent)	Intent: This scenario postulates involvement of the largest unconfined MAR possible in a material handling accident. It is postulated that a large waste container is punctured by forklift tines during handling. A fraction (10%) of the waste material in the container exits the breach and falls to the ground as an unconfined release. The MAR value is evaluated at 15 grams. The release is non-lofted. Summary: MAR = 15 grams, DR = 0.1, ARRF = 1.0E-3, χ/Q = non- lofted.

Table 9 Representative Accident Scenario Summary

Scenario Number in NSTR-001-02	MAR / Waste Container Type	Representative Bounding Scenario Summary
Spill 3: Compressed Gas Cylinder Missile	Two wooden waste crates	Intent: This scenario postulates involvement of the largest confined MAR possible in an accident associated with equipment missiles. It is postulated that a WMC composed of wooden crates (assumed to be the most vulnerable to missiles versus metal containers) is impacted by a compressed gas cylinder missile (e.g., oxygen). SARAH does not specifically address the number of wooden crates damaged by a missile. It is assumed that 2 crates are breached based on the values for other containers presented in SARAH and based on engineering judgement. The MAR value for each crate is evaluated at 15 grams. The release is non-lofted. Summary: MAR = 30 grams, DR = 1.0, ARRF = 1.0E-4, χ/Q = non- lofted.
Spill 4: Crane Load Drop	Waste cargo container and five large waste crates	Intent: This scenario postulates involvement of the largest confined MAR possible in a material handling accident involving more than just the material being handled. It is postulated that a large waste container (*e.g.*, cargo container) is dropped during handling by a crane and falls upon other packaged waste. It is assumed that up to five large crates could be impacted by the dropped container. The MAR value for the dropped container and the impacted packaged waste is evaluated at 15 grams each. The release is non-lofted. Summary: MAR = 90 grams, DR = 1.0, ARRF = 1.0E-4, χ/Q = non- lofted.

Table 9 Representative Accident Scenario Summary

Scenario Number in NSTR-001-02	MAR / Waste Container Type	Representative Bounding Scenario Summary
Spill 5: Wastewater Tanker Spill	Single tanker truck with aqueous liquid waste	Intent: This scenario postulates involvement of the largest radioactive solution MAR in a spill. It is postulated that the tanker leakage goes unnoticed and the spilled liquid is not cleaned up. The initial release mechanism is the spill of the liquid. A secondary release mechanism is the evaporation of the liquid in the spill which is assumed to occur over the period of 1 hour. A third release mechanism is the resuspension of the residual radioactive material following evaporation of the liquid. The worst-case duration/ARRF of the resuspension release (for bounding scenario determination) coincides with the CW exposure duration/ARRF of 8 hours/3.2E-4. The MAR value is evaluated at 15 grams. Components: There are three components to the spill: 1) MAR from the spilled liquid; 2) MAR from evaporation of the spill liquid over a 1-hour period; and 3) MAR from resuspension of the material following evaporation over an 8-hour period. Summary: Part 1: MAR = 15 grams, DR = 1.0, ARRF = 4.0E-5, χ/Q = non-lofted. Part 2: MAR = 15 grams, DR = 1.0, ARRF = 4.0E-8, χ/Q = non-lofted, PDC based on a duration of 60 minutes. Part 3: MAR = 15 grams, DR = 1.0, ARRF = 3.2E-4, χ/Q = non-lofted, PDC based on a duration of 480 minutes [largest contributor].
NPH 1/Seismic-Induced Structural Failure	Entire WMC (relatively container type independent)	Intent: This scenario postulates involvement of the largest confined MAR possible in an adjacent structure collapse induced by an earthquake. By postulating a WMC is contiguous to a structure, it is possible to involve the entire WMC inventory (900 grams WG Pu). It is postulated that a seismic event causes the collapse of the structure onto the WMC, breaching the waste containers. The release is non-lofted. Note: The potential for the collapse of a facility wall to impact multiple WMCs is considered to be bounded by the assumption that all the containers in a single WMC are breached by the collapse. Summary: MAR = 900 grams, DR = 1.0, ARRF = 1.0E-4, χ/Q = non- lofted.

Table 9 Representative Accident Scenario Summary

Scenario Number in NSTR-001-02	MAR / Waste Container Type	Representative Bounding Scenario Summary
NPH 2/Lightning Breach	Single waste container/item (relatively container type independent)	Intent: This scenario postulates involvement of the largest confined MAR possible in an accident associated with a lightning strike. It is postulated that a large waste container in a WMC that is separated from nearby facilities is directly struck by lightning. WMC containers that are located in close proximity to buildings or other high profile equipment are expected to be significantly less vulnerable to direct lighting strikes due to the tendency for the lightning to strike high profile objects rather than low profile objects. The effect of the lightning strike is most likely to be nothing more than a metal container surface burn with no impact to the contents of the package or serve as another initiator of a fire if the WMC contains wooden crates (see Fire Scenario 1 above). The potential worst case effect of the strike is unpredictable. It is postulated that the lightning strike could travel through the container (*e.g.*, if the package contained metal pieces that would serve as a conductor pathway) and could rapidly heat any residual liquids inside of the container leading to a rapid pressurization of the container or an "internal steam explosion" of sorts. The current Site methodology associated with container internal hydrogen explosions is used to bound any effects of this type caused by a lightning strike. No assumption is made relatively to the vulnerability of one type of container relative to other containers so a large box or cargo container is used to set a bounding MAR, which is evaluated at 15 grams. The release is non-lofted. Summary: MAR = 15 grams, DR = 0.1, ARRF = 1.4E-2, χ/Q = non-lofted.

Table 9 Representative Accident Scenario Summary

Scenario Number in NSTR-001-02	MAR / Waste Container Type	Representative Bounding Scenario Summary
NPH 3/High Winds and Tornadoes	Entire WMC (relatively container type independent)	Intent: This scenario postulates involvement of the largest confined MAR possible in an accident associated with natural phenomena missiles. By postulating a WMC is impacted by multiple missiles generated during a high wind or tornado, it is possible to involve the entire WMC inventory (900 grams WG Pu). It is assumed that only a fraction (10%) of the containers are actually breached by the missiles. The release is a high-wind release. Note: Natural phenomena events of this type can impact multiple WMCs as well as multiple nuclear facilities. The current Site approach does not look at the cumulative effects of an event in the assessment of a single nuclear facility authorization basis. Similarly, the impact of high-winds on multiple WMCs is not addressed. However, the potential for a high-wind event or tornado to impact multiple WMCs is considered to be bounded by the assumption that 10% of the containers in a single WMC are breached by the missiles. In a high-wind situation, only the containers directly exposed to the wind would be impacted by the missiles since most of the containers are shielded from the effects by other containers or by other structures at the Site. Of the containers exposed, only a small fraction will actually be breached. Summary: MAR = 900 grams, DR = 0.1, ARRF = 1.0E-4, χ/Q = high-wind.

Table 9 Representative Accident Scenario Summary

Scenario Number in NSTR-001-02	MAR / Waste Container Type	Representative Bounding Scenario Summary
EE 1: Aircraft Crash	Entire WMC composed of wooden waste crates	Intent: This scenario postulates involvement of the largest MAR possible in an aircraft crash that impacts a storage array. By postulating a WMC composed entirely of wooden crates, it is possible to involve the entire WMC inventory (900 grams WG Pu). The aircraft crash will directly impact a fraction of the crates (25%) which will be breached and spill their contents. The fuel from the aircraft will result in a fire and burn both the spilled crate contents and the remaining intact crates. The spilled crate contents are assumed to be exposed sufficiently to burn as unconfined materials. The spill release is a non-lofted release but the fire release has a major fire lofting effect. Note: It is assumed that aircraft crash events that impact multiple WMCs will result in less breach of containers and will be bounded by this scenario even though multiple WMCs with wooden crates could burn. The burning of less unconfined material from a breach as a result of the aircraft crash hitting between two WMCs, for example, easily compensates for the increased release from the WMC crates in both WMCs being burned. Components: There are three components to the fire: 1) MAR from spill of breached containers evaluated as a confined spill (25%); 2) MAR from burning of breached container material evaluated as an unconfined release; and 3) MAR from burning of intact containers (75%). Summary: Part 1: MAR = 900 grams, DR = 0.25, ARRF = 1.0E-4, χ/Q = non-lofted Part 2: MAR = 900 grams, DR = 0.25, ARRF = 5.0E-2, χ/Q = major fire lofting.[largest contributor] Part 3: MAR = 900 grams, DR = 0.75, ARRF = 5.0E-4, χ/Q = major fire lofting.
EE 2: Ground Vehicle Impact	Entire WMC (relatively container type independent)	Intent: This scenario postulates involvement of the largest confined MAR possible in a vehicle crash accident impacting a storage array. By postulating a WMC is relatively near to a roadway and that a large vehicle leaves the roadway and crashes into the WMC, it is possible to involve the entire WMC inventory (900 grams WG Pu). It is postulated that the vehicle will breach no more than 10% of the containers in the entire WMC. The release is non-lofted. Note: The potential for the vehicle crash to impact multiple WMCs is considered to be bounded by the assumption that 10% of the containers in a single WMC are breached by the impact. Summary: MAR = 900 grams, DR = 0.1, ARRF = 1.0E-4, χ/Q = non- lofted.

Table 10 Bounding Scenario Determination

	Fire: Waste Container Fire (Small Fire Intensity)	Fire: Waste Container Fire (Medium Fire Intensity)	Fire: Major Waste Container Fire (400 gal diesel)*	Fire: Major Waste Container Fire (5,000 gal diesel)*	Fire: Un-containerized Item Fire	Fire: Tanker Truck Fire	Fire: Truck Trailer Fire	Fire: Non-Aqueous Liquid Waste Fire	Spill: Waste Container Drop/Fall	Spill: Waste Container Puncture by Forklift Tine	Spill: Compressed Gas Cylinder Missile	Spill: Crane Load Drop	Spill: Wastewater Tanker Spill*	NPH: Seismic-Induced Structural Failure	NPH: Lightning Breach	NPH: High Winds and Tornadoes	EE: Aircraft Crash*	EE: Ground Vehicle Impact
MAR	900	900	103	675	15	15	108	900	15	15	30	90	15	900	15	900	900	90
DR	1	1	0.33	1	1	1	1	1	1	0.1	1	1	1	1	0.1	0.1	0.25	0.1
ARRF	5.0E-04	5.0E-04	1.0E-02	1.0E-02	5.0E-02	2.0E-03	5.0E-04	7.0E-02	1.0E-04	1.0E-03	1.0E-04	1.0E-04	3.2E-04	1.0E-04	1.4E-02	1.0E-04	5.0E-02	1.0E-04
X/Q	1.5E-03	5.6E-04	9.9E-05	9.9E-05	1.5E-03	1.5E-03	3.6E-04	9.9E-05	9.9E-03	9.9E-03	9.9E-03	9.9E-03	9.9E-03	9.9E-03	9.9E-03	1.3E-04	9.9E-05	9.9E-03
1/PDC	0.699	0.803	1	0.699	1	1	1	1	1	1	1	1	0.38	1	1	1	1	1
# of Comp	1	1	3	3	1	1	1	1	1	1	1	1	3	1	1	1	3	1
Score	4.7E-04	2.0E-04	1.0E-04	1.4E-03	1.1E-03	4.5E-05	1.9E-05	6.2E-03	1.5E-05	1.5E-05	3.0E-05	8.9E-05	5.4E-05	8.9E-04	2.1E-04	1.1E-06	3.3E-03	8.9E-06
Frequency	A	A	A	U	A	A	A	A	A	A	U	A	A	U	A	A	EU	A
Bounding				X				X				X		X	X		X	X

* Highest contributing components used for scenarios with multiple components and then multiplied by number of components
MAR does not include mitigative controls
Frequency does not include preventive controls

4.5 BOUNDING ACCIDENT SCENARIOS

An assessment of the 18 representative accident scenarios summarized in Section 4.4, *Selection of the Representative Accident Scenarios*, compared the radiological dose calculation parameters for the various scenarios. A determination of the bounding accident scenarios is made based on their scores. Of these scenarios derived from NSTR-001-02, seven are carried forward for further analysis. These are the scenarios with the highest "scores" for each scenario category, and more than one is chosen (as applicable) when there is more than one representative bounding scenario in different frequency bins.

The bounding accident scenarios from Table 10, *Bounding Scenario Determination* are identified below. The scenarios are summarized and further evaluated if needed. Preventive or mitigative controls are applied when appropriate in accordance with the Authorization Basis development guidance from DOE, RFFO (Ref 23).

1. Unlikely Fire – Major Waste Container Fire (8,500 Gallons of Diesel)
2. Anticipated Fire – Non-Aqueous Liquid Waste Fire
3. Anticipated Spill – Crane Load Drop (bounds unlikely spill)
4. Unlikely NPH – Seismic-Induced Structural Failure
5. Anticipated NPH - Lightning Breach
6. Extremely Unlikely EE - Aircraft Crash
7. Anticipated EE - Ground Vehicle Impact

4.5.1 Major Waste Container Fire (8,500 Gal. Diesel)

Accident Scenario

It is postulated that a diesel fuel delivery truck spills its 8,500-gallon payload of diesel fuel and involves waste containers located at a WMC. It is assumed that a collision breaches the tanker and ignites the resulting fuel pool. At a depth of 1 cm, the pool fire area is 3217 m^2 (34,620 ft^2). Portions of the pool would likely be deeper due to the large volume of fuel spilled and irregularities of outdoor surfaces with natural and man-made barriers. This pool fire would be large enough to potentially involve the entire inventory of a WMC.

Accident Frequency

The frequency of this fire is *unlikely* without preventive controls due to the low speeds along Site roadways adjacent to WMCs and the low number of deliveries at the Site (Ref. 4). The scenario becomes *extremely unlikely* when crediting ***Route Control*** for large fuel delivery tanker trucks (*i.e.*, > 400 gallon fuel capacity) to prohibit access to WMCs or roadways adjacent to WMCs.

Material-At-Risk

By postulating a fuel pool type of fire impacting drums, high initial MAR involvement can occur due to the potential for drum lid loss and some short duration unconfined material releases. The lighter material that is ejected is assumed to have an ARF of 1E-2. The heavier material that is not ejected is assumed to have an ARF of 5E-2.

By exposing the containers to a very long duration and intense fire, releases in excess of the standard 5E-4 confined material ARF are expected. While this release may not be as large as the bounding unconfined material ARF (*i.e.*, 5E-2), the release is conservatively evaluated using this ARF in lieu of determining the actual ARF. The material release from the remaining drums is assumed to occur over the period of an hour as the normally confined material pyrolyzes beyond the point that is normally analyzed. Therefore, the ARF for these drums is assumed to be 5E-2.

The postulated fire involves a bulk fuel delivery vehicle in combination with a non-stacked arrangement of drums involving an entire WMC inventory of 900 grams. The initial unconfined material release lasts 10 minutes and the remaining unconfined material release lasts 60 minutes. This fire must be highly intense to cause drum lid loss and subsequent extensive pyrolyzation which yields major lofting.

It is assumed that this fire bounds any situation where more than one WMC is impacted by the fuel spill fire. As the spilled fuel pool size gets larger such that multiple WMCs are involved, the pool depth decreases making the duration of the fire go down, reducing the subsequent "extensive pyrolyzation." Therefore, the conservative assumption associated with analyzing the fire as an unconfined release of an entire WMC ensures that multiple WMC-impacting fires are bounded by this scenario.

There are three components to the *major* fire: 1) MAR from ejected material associated with drum lid loss (25% of drums since spill footprint can cover entire WMC); 2) MAR from non-ejected material associated with drum lid loss; and 3) MAR from drums with seal failure rather than lid loss (75% of drums). A DCF based on ICRP-68 Moderate Solubility Class is used.

Part 1: MAR = 225 grams, DR = 0.33, ARRF = 1.0E-2, duration of 10 minutes.
Part 2: MAR = 225 grams, DR = 0.67, ARRF = 5.0E-2, duration of 60 minutes.
Part 3: MAR = 675 grams, DR = 1.0, ARRF = 5.0E-2, duration of 60 minutes.

Accident Consequences

Dose Consequences (rem)		**Risk Class** Without Prevention *(unlikely)*		**Risk Class** With Prevention *(extremely unlikely)*	
CW	**MOI**	**CW**	**MOI**	**CW**	**MOI**
1.0E+1 (moderate)	9.7E-1 (moderate)	II	II	III	III

Controls

Route Control – Fuel delivery tanker trucks or other fossil fuel powered vehicles having a total fuel capacity of greater than 400 gallons shall not be driven on a WMC or on a roadway adjacent to a WMC. This control reduces the scenario frequency from *unlikely* to *extremely unlikely*. ***Route Control*** is a Site SAR control (STC 4).

A ***WMC Inventory Control*** imposes a 900 g maximum inventory per WMC to set the maximum MAR for the scenario. No other specific controls or restrictions are credited for this scenario beyond what the Site SMPs provide.

4.5.2 Fire – Non-Aqueous Liquid Waste

Accident Scenario

It is postulated that a fire involves non-aqueous liquid waste (e.g., solvents, oils, *etc.*) stored either in drums or tanker trucks at a WMC. By postulating a WMC composed entirely of non-aqueous liquid waste containers which will tend to propagate the fire from container to container in a rapid fashion, it is possible to involve the entire WMC inventory, which is 900 grams. For the unmitigated case, the bounding scenario is a fire involving the entire inventory of a WMC comprised of all non-aqueous liquid waste. For the mitigated case, a ***WMC inventory control*** is applied to limit the amount of non-aqueous liquid waste available to be involved in the scenario.

Accident Frequency

The frequency of this fire is *anticipated* without preventive controls.

Material-At-Risk

For the unmitigated case, the bounding scenario involves 900 grams Aged WG Pu.

For the mitigated case, a ***WMC inventory control*** is applied to limit the total inventory of non-aqueous liquids at a WMC to no more than 150 grams WG Pu. Therefore, the bounding scenario involves 150 grams Aged WG Pu.

The release mechanism for this scenario is associated with burning rather than boiling. Therefore, the cases are evaluated as a *major* fire because the non-aqueous liquids are burned and contribute to the overall heat of the fire. The material is evaluated as a volatile liquid (consistent with RADIDOSE – Ref. 25) with a DR of 1. The duration is assumed to be 10 minutes and a DCF based on ICRP-68 Moderate Solubility Class is used.

It is assumed that this fire bounds the situation where the non-aqueous liquid waste forms a pool fire that involves other waste containers on a WMC. Therefore, the conservative assumption associated with analyzing the entire WMC inventory as non-aqueous liquid waste (with an ARRF of 7.0E-2) ensures that the release from waste containers in a pool fire is bounded by this scenario.

It is also assumed that this fire bounds any situation where more than one WMC is impacted by the non-aqueous liquid waste fire. If a non-aqueous liquid pool forms such that multiple WMCs are involved, the pool depth decreases as the area increases making the duration of the fire go down, reducing the subsequent "extensive pyrolyzation" as described in Fire 1. Therefore, the conservative assumption associated with analyzing the fire as an unconfined release of an entire WMC ensures that multiple WMC-impacting fires are bounded by this scenario.

Accident Consequences

	Dose Consequences (rem)		Risk Class Without Prevention (*anticipated*)	
	CW	**MOI**	**CW**	**MOI**
Unmitigated	22 (moderate)	2.1 (moderate)	I	I
Mitigated	3.6 (low)	3.5E-1 (low)	III	III

Controls

A ***WMC Inventory Control*** imposes a 900 g maximum inventory per WMC to set the maximum MAR for the scenario. A ***WMC Inventory Control*** imposes a maximum of 150 grams WG Pu in non-aqueous liquid waste per WMC to set the MAR for the mitigated case. No other specific controls or restrictions are credited for this scenario beyond what the Site SMPs provide.

4.5.3 Spill – Crane Load Drop

Accident Scenario

It is postulated that a large waste container (e.g., cargo container) is dropped during handling by a crane and falls upon other packaged waste. Both the dropped package and the packaged waste underneath are assumed to be breached by the impact.

Accident Frequency

The frequency of this spill scenario is *anticipated* without preventive controls.

Material-At-Risk

It is assumed that up to five Large Crates could be impacted by the dropped container. The MAR value for the dropped package and the impacted packages is evaluated at 15 grams each. Therefore, the scenario MAR is 90 g Aged WG Pu for the 6 packages breached in the scenario. This is a non-lofted event and a DCF based on ICRP-68 Moderate Solubility Class is used.

Accident Consequences - Unmitigated

Dose Consequences (rem)		**Risk Class** Without Prevention (*anticipated*)	
CW	MOI	CW	MOI
3.1E-1 (low)	1.1E-2 (low)	III	III

Controls

No specific controls or restrictions are credited for this scenario beyond what the Site SMPs provide.

4.5.4 NPH: Seismic-Induced Structural Failure

Accident Scenario

It is postulated that a seismic event causes the collapse of the structure onto the WMC, breaching all of the stored waste containers.

Accident Frequency

The frequency of this seismic-induced spill scenario is *unlikely* based on the seismic history of the region (Ref. 4).

Material-At-Risk

The MAR associated with this event is 900 grams Aged WG Pu, the maximum inventory of a WMC. The release is non-lofted. The potential for the collapse of a facility wall to impact multiple WMCs is considered to be bounded by the assumption that all the containers in a single WMC are breached by the collapse.

This is a confined spill with an ARRF of 1E-4. It is a non-lofted event and a DCF based on ICRP-68 Moderate Solubility Class is used.

Accident Consequences - Unmitigated

Dose Consequences (rem)		**Risk Class** Without Prevention (*unlikely*)	
CW	MOI	CW	MOI
3.1 (low)	1.1E-1 (low)	III	III

Damage to packaged waste resulting in a radiological material release could also occur due to a less severe seismic event. The damage and subsequent consequences of such an event would be low and the Risk Class determination would be the same.

Controls

A ***WMC Inventory Control*** imposes a 900 g maximum inventory per WMC to set the maximum MAR for the scenario. No other specific controls or restrictions are credited for this scenario beyond what the Site SMPs provide.

4.5.5 NPH: Lightning Breach

Accident Scenario

It is postulated that a large waste container in a WMC that is separated from nearby facilities is directly struck by lightning. WMC containers that are located in close proximity to buildings or other high profile equipment are expected to be significantly less vulnerable to **direct** lighting strikes due to the tendency for the lightning to strike high profile objects rather than low profile objects. The effect of the lightning strike is most likely to be nothing more than a metal container surface burn with no impact to the contents of the package or serve as another initiator of a fire if the WMC contains wooden crates. The potential worst-case effect of the strike is unpredictable. The outer surface of a metal container is most likely to direct the lightning away from any internal contents of the container. However, if the waste container has within it pieces of metal equipment, these items could serve to create a pathway for the lightning to travel through the container, particularly given the significant energy involved in a lightning strike. It is postulated that the lightning strike could travel through the container and could rapidly heat any residual liquids inside of the container leading to a rapid pressurization of the container (*i.e.*, steam explosion), causing a release similar to an "internal explosion." The current Site methodology associated with container internal hydrogen explosions is used to bound any effects of this type caused by a lightning strike.

Accident Frequency

The likelihood of a lightning strike at the Site is *anticipated* (Ref. 4). The frequency of lightning striking a waste container stored outdoors in WMCs located away from facilities or other high profile objects is conservatively judged to be *anticipated*, even though the phenomena of an internal steam explosion resulting from a lightning strike is expected to be a remote possibility given the very specific container content configurations necessary to support the phenomena. The frequency of lightning striking a waste container stored outdoors in WMCs located in close proximity to facilities or other high profile objects is judged to be *beyond extremely unlikely* given the tendency of lightning to strike the high profile objects and the need for the strike to be a direct strike on the container to result in the release scenario being evaluated.

Material-At-Risk

No assumption is made relatively to the vulnerability of one type of container relative to other containers so a large box or cargo container is used to set a bounding MAR, which is evaluated at 15 grams. This is an unconfined material release. The DR = 0.1, ARRF = 1.42E-2 (ARF = 0.02 and the RF = 0.7). Releases from a lightning strike are short-duration events and a minimum release (10 minutes) is analyzed.

Accident Consequences - Unmitigated

Dose Consequences (rem)		Risk Class Without Prevention (*anticipated*)	
CW	MOI	CW	MOI
7.3E-1 (low)	2.6E-2 (low)	III	III

Controls

No specific controls or restrictions are credited for this scenario beyond what the Site SMPs provide.

4.5.6 External Event - Aircraft Crash

Accident Scenario

A 6,000-pound aircraft is postulated to crash into a WMC at 90 knots causing physical damage to stored waste containers and also results in a 800 ft^2 fuel pool fire (Ref. 24). By postulating a WMC composed entirely of wooden crates, it is possible to involve the entire WMC inventory.

Accident Frequency

The frequency of an aircraft crashing into a WMC is considered to be *extremely unlikely*.

Material-At-Risk

The MAR for this scenario is the entire WMC inventory, which is 900 grams Aged WG Pu. The aircraft crash will directly impact a fraction of the crates (25%) which will be breached and spill their contents. The fuel from the aircraft will result in a fire and burn both the spilled crate contents and the remaining intact crates. The spilled crate contents are assumed to be exposed sufficiently to burn as unconfined materials. The spill release is a non-lofted release but the fire release has a major fire lofting effect.

It is also assumed that aircraft crash events that impact multiple WMCs will result in less breach of containers and will be bounded by this scenario even though multiple WMCs with wooden crates could burn. The burning of less unconfined material from a breach as a result of the aircraft crash hitting between two WMCs, for example, easily compensates for the increased release from the WMC crates in both WMCs being burned.

There are three components to the fire: 1) MAR from spill of breached containers evaluated as a confined spill (25%); 2) MAR from burning of breached container material evaluated as an

unconfined release; and 3) MAR from burning of intact containers (75%). This is assumed to be a short-duration event and a minimum release (10 minutes) is analyzed.

Part 1: MAR = 900 grams, DR = 0.25, ARRF = 1.0E-4, spill, non-lofted.
Part 2: MAR = 900 grams, DR = 0.25, ARRF = 5.0E-2, major fire lofting.
Part 3: MAR = 900 grams, DR = 0.75, ARRF = 5.0E-4, major fire lofting.

Accident Consequences - Unmitigated

Dose Consequences (rem)		**Risk Class** Without Prevention (*extremely unlikely*)	
CW	**MOI**	**CW**	**MOI**
4.8 (low)	4.1E-1 (low)	IV	IV

Controls

A ***WMC Inventory Control*** imposes a 900 g maximum inventory per WMC to set the maximum MAR for the scenario. No other specific controls or restrictions are credited for this scenario beyond what the Site SMPs provide.

4.5.7 EE Scenario 2 – Ground Vehicle Impact

Accident Scenario

Roadways near WMCs are used by a variety of vehicles including emergency response vehicles, construction vehicles, personal automobiles, *etc.* By postulating a WMC is relatively near to a roadway and that a large vehicle leaves the roadway and crashes into the WMC, it is possible to involve the entire WMC inventory.

Accident Frequency

The scenario frequency is considered to be *anticipated* without preventive controls.

Material-At-Risk

The MAR for this scenario is the entire WMC inventory, which is 900 grams Aged WG Pu. It is judged that the vehicle will breach no more than 10% of the containers in the entire WMC. The potential for the vehicle crash to impact multiple WMCs is considered to be bounded by the assumption that 10% of the containers in a single WMC are breached by the impact. The spill is a confined release that is non-lofted. A release of 10 minutes is analyzed.

Accident Consequences - Unmitigated

Dose Consequences (rem)		**Risk Class** Without Prevention *(anticipated)*	
CW	MOI	CW	MOI
3.1E-1 (low)	1.1E-2 (low)	III	III

Controls

No specific controls or restrictions are credited for this scenario beyond what the Site SMPs provide.

4.6 RADIOLOGICAL DOSE CONSEQUENCE CALCULATIONS

Table 11, *Radiological Dose Consequence and Risk Class Determination* supports the bounding accident scenarios evaluated in Section 4.5, *Bounding Accident Scenarios*. The radiological dose consequences calculated in this spreadsheet is consistent with the RADIDOSE template (Ref. 25).

Table 11 Radiological Dose Consequence and Risk Class Determination

Scenario	MAR	DR	ARF	RF	LPF	χ/Q (CW)	χ/Q (MOI)	BR	DCF	Consequences				Freq*	Risk Class	
										CW Dose (rem)	MOI Dose (rem)	CW	MOI		CW	MOI
1. Major Waste Container Fire, 8,500 Gallons of Diesel Fuel, Lid Loss, Material Ejection	2.25E+02	0.33	1.00E-02	1.0	1.0	9.89E-05	9.43E-06	3.60E-04	9.70E+06	2.6E-01	2.4E-02	-	-	-	-	-
1. Major Waste Container Fire, 8,500 Gallons of Diesel Fuel, Lid Loss, No Material Ejection	2.25E+02	0.66	5.00E-02	1.0	1.0	6.91E-05	6.59E-06	3.60E-04	9.70E+06	1.8E+00	1.7E-01	-	-	-	-	-
1. Major Waste Container Fire, 8,500 Gallons of Diesel Fuel, Seal Failure	6.75E+02	1.00	5.00E-02	1.0	1.0	6.91E-05	6.59E-06	3.60E-04	9.70E+06	8.1E+00	7.8E-01	-	-	-	-	-
1. Total :Major Waste Container Fire	9.00E+02	-	-	-	-	-	-	-	-	1.0E+01	9.7E-01	Moderate	Moderate	EU	III	III
2. Non-Aqueous Liquid Waste Fire, Unmitigated:** 900 Grams	9.00E+02	1.00	7.00E-02	1.0	1.0	9.89E-05	9.43E-06	3.60E-04	9.70E+06	2.2E+01	2.1E+00	Moderate	Moderate	A	I	I
2. Non-Aqueous Liquid Waste Fire, Mitigated:** 150 Grams	1.50E+02	1.00	7.00E-02	1.0	1.0	9.89E-05	9.43E-06	3.60E-04	9.70E+06	3.6E+00	3.5E-01	Low	Low	A	III	III
3. Spill: Crane Load Drop	9.00E+01	1.00	1.00E-03	0.1	1.0	9.94E-03	3.48E-04	3.60E-04	9.70E+06	3.1E-01	1.1E-02	Low	Low	A	III	III
4. NPH, Seismic-Induced Structural Failure	9.00E+02	1.00	1.00E-03	0.1	1.0	9.94E-03	3.48E-04	3.60E-04	9.70E+06	3.1E+00	1.1E-01	Low	Low	A	III	III
5. NPH: Lightning Breach	1.50E+01	0.10	2.00E-02	0.7	1.0	9.94E-03	3.48E-04	3.60E-04	9.70E+06	7.3E-01	2.6E-02	Low	Low	A	III	III
6. External Event: Aircraft Crash [Spill]	9.00E+02	0.25	1.00E-03	0.1	1.0	9.94E-03	3.48E-04	3.60E-04	9.70E+06	7.8E-01	2.7E-02	-	-	-	-	-
6. External Event: Aircraft Crash [Fire, Unconfined Material]	9.00E+02	0.25	5.00E-02	1.0	1.0	9.89E-05	9.43E-06	3.60E-04	9.70E+06	3.9E+00	3.7E-01	-	-	-	-	-
6. External Event: Aircraft Crash [Fire, Confined Material]	9.00E+02	0.75	5.00E-04	1.0	1.0	9.89E-05	9.43E-06	3.60E-04	9.70E+06	1.2E-01	1.1E-02					
6. Total: External Event/Aircraft Crash	-	-	-	-	-	-	-	-	-	4.6E+00	4.1E-01	Low	Low	EU	IV	IV
7. External Event: Ground Vehicle Impact	9.00E+02	0.10	1.00E-03	0.1	1.0	9.94E-03	3.48E-04	3.60E-04	9.70E+06	3.1E-01	1.1E-02	Low	Low	A	III	III

* The accident frequency for the Major Waste Container Fire is shown with prevention, the frequency without prevention is *unlikely*.

4.7 WORKER SAFETY EVALUATION

Administration of the derived or institutionalized controls affords an adequate level of protection to the Immediate Worker commensurate with the hazards. It was expected that any further detailed analyses of the identified hazards would not result in any additional controls other than those already contained in the SMP infrastructure to protect the Immediate Worker. Table B-2 of the Site PHA, NSTR-007-01 (Ref. 9) was reviewed to assure that all potentially available preventive and mitigative controls were considered during the development of this Authorization Basis document. In the event the detailed analysis presented in NSTR-007-01 indicates that the hazards and consequences are significant, those SMP controls needed to protect the Immediate Worker will be identified for TSR coverage as Safety SSCs or Administrative Controls. Therefore, it is assumed that if no additional controls are identified, the SMP infrastructure is adequate for protecting the Immediate Worker, and no additional risk determinations will be presented unless the scenario involves serious injury or prompt death.

4.8 FINAL HAZARD CATEGORIZATION

The radiological inventory, which constitutes the material at risk (MAR) for any individual WMC, will not exceed 900 grams WG Pu as controlled administratively. Based on the maximum possible radioactive material inventory and results of the accident analysis in Section 4.5, the WMCs within the scope of this safety analysis are categorized as Hazard Category 3 Nuclear Facilities per DOE-STD-1027-92 (Ref. 2).

4.9 DERIVATION OF TECHNICAL SAFETY REQUIREMENTS

Based on the hazards and low risk associated with WMCs, no safety structures, systems, and components (SSCs) are relied upon to protect the collocated worker and/or the public. Therefore, no Limiting Conditions for Operation (LCOs) have been written for the Outdoor Waste Management activities. The Technical Safety Requirements derived for the Outdoor Waste Management activities consist only of Administrative Controls (ACs).

5 TECHNICAL SAFETY REQUIREMENTS

The following ADMINISTRATIVE CONTROLS (ACs) maintain the validity of this safety analysis and assure the continued safe operations of Outdoor Waste Management in WASTE MANAGEMENT CELLS (WMCs).

5.1 DEFINITIONS

NOTE
The defined terms of this section appear in capitalized type throughout the ACs.

TERM	DEFINITION
ADMINISTRATIVE CONTROLS (ACs)	Provisions relating to SMPs necessary to ensure safe operations. Specific attributes may be AOLs or ACs.
AC NONCOMPLIANCE	A failure to meet an AC resulting in an unplanned entry into AC CONDITION(s) and associated REQUIRED ACTIONS.
ADMINISTRATIVE OPERATING LIMITS (AOLs)	Specific ACs/limits that have been credited in the Safety Analysis. AOLs are credited as providing a reduction in postulated accident scenario initiation frequency and/or a reduction in postulated accident scenario consequences. Such controls are more precise and discrete than those defined by a SMP. The AOLs are an administrative equivalent to hardware requirements specified in LCOs and, as such, have requirements for verification of the AOL and requirements for actions following DISCOVERY of a noncompliance with the AOL.
BASIS/BASES	Summary statement(s) of the rationale for the ACs. The BASES explain how the numeric value, the specified function, or the SURVEILLANCE fulfills the credited safety function assumed in the Safety Analysis.
COMPLETION TIME	The amount of time allowed to complete a REQUIRED ACTION. The COMPLETION TIME starts whenever a situation (e.g., variable not within limits) is DISCOVERED that requires entering a REQUIRED ACTION for a given CONDITION. REQUIRED ACTIONS shall be performed before the specified COMPLETION TIME expires.
CONDITION	Configuration and status of the facility or activity related to compliance with the TSRs for which REQUIRED ACTIONS must be performed within a specified COMPLETION TIME.

TERM	DEFINITION
DISCOVERY/ DISCOVERED	For SRs, the point in time when WASTE MANAGEMENT CELL management is notified of, or reviews, information showing that a SR was not met. For AC compliance, the point in time when WASTE MANAGEMENT CELL management makes the determination that an AC is not being met or that an unplanned CONDITION has been entered and REQUIRED ACTIONS must be implemented. Note: The definitions listed above apply to TSR compliance and should not be confused with AB inadequacy discovery issues.
LIMITING CONDITION FOR OPERATION (LCO)	The lowest functional capability or performance level of SAFETY SSCs and their support systems required for safe operations of the facility.
PACKAGED WASTE	PACKAGED WASTE refers to either an un-containerized waste item [e.g., Surface Contaminated Object (SCO) or Low Specific Activity (LSA)] or a containerized waste item (*e.g.,* in a drum, box, *etc.*).
REQUIRED ACTIONS	The mandatory response when an AC CONDITION is entered.
SURVEILLANCE	Process or activity documenting that ACs and AOLs are met.
SURVEILLANCE REQUIREMENTS (SRs)	Testing, calibration, or inspection requirements to ensure that the AC required safety function is maintained and/or that operations are within the specified criteria of the ACs.
SUSPEND OPERATIONS	A formal suspension of those activities capable of initiating an analyzed operational accident (e.g., movement or handling of PACKAGED WASTE, hot work, flammable gas use) except for those directly involved in: 1. Placing and maintaining the WASTE MANAGEMENT CELL in a safe configuration; 2. Restoring the safety function associated with the suspension; or 3. Remediating AC NONCOMPLIANCES; This means that activities such as tours, inspections, and maintenance not requiring PACKAGED WASTE or material handling equipment movement, hot work, or flammable gas use may be authorized.
TECHNICAL SAFETY REQUIREMENTS (TSRs)	Those requirements that define the conditions, safe boundaries, and the management or administrative controls necessary to ensure the safe conduct of WASTE MANAGEMENT CELL activities and to reduce the potential risk to the public and site workers from uncontrolled releases of radioactive materials. A TSR consists of ACs, use and application instructions, and the BASES thereof.

TERM	DEFINITION
VIOLATION	A TSR VIOLATION occurs when the WASTE MANAGEMENT CELL Management: a. fails to take REQUIRED ACTIONS within the specified COMPLETION TIME after failing to meet an AC or AC SR; b. fails to perform an AC SR within the specified frequency including the "grace period" (violates SR 5.5.2); c. fails to SUSPEND OPERATIONS when REQUIRED ACTIONS cannot be met or are not provided (violates AC 5.5.3); or d. determines that continued recurrence of an AC NONCOMPLIANCE represents a safety-significant trend (violates AC 5.5.4). A VIOLATION is considered historical if the CONDITION was corrected prior to DISCOVERY.
WASTE MANAGEMENT CELL	Areas used for outdoor management of nuclear material as operated in accordance with the criteria in AOL 1.1 through AOL 1.3.

5.2 FREQUENCY NOTATIONS

The frequency notations, followed by a nominal 25% grace period, as used in SURVEILLANCES and elsewhere, are defined as follows when included in the TSR:

Notation	Minimum Frequency (Periodicity Notation)
Once per Working Shift	Once per 9 hours not to exceed 12 hours.
Once per Day (Daily)	Once per 24 hours not to exceed 30 hours.
Once per Week (Weekly)	Once per 7 days not to exceed 9 days.
Once per Month (Monthly)	Once per 30 days not to exceed 37 days.
Once per Quarter (Quarterly)	Once per 13 weeks not to exceed 16 weeks.
Once per 6 Months (Semi-annually)	Once per 6 months not to exceed 32 weeks.
Once per Year (Yearly, Annually)	Once per 12 months not to exceed 15 months.
Once per 18 Months	Once per 18 months not to exceed 22 months.

Use of the grace period does not extend the due date for the next SURVEILLANCE period.

A SURVEILLANCE is considered complete when it has been signed by the WASTE MANAGEMENT CELL Manager or designee.

5.3 TSR BASES CONTROL

The contractor may make changes to the TSR BASES without prior Department of Energy-Rocky Flats Field Office (DOE-RFFO) approval provided:

(1) The changes are editorial in nature; and

(2) The changes do not significantly alter the intent, scope, or application of the TSRs.

Proposed changes that do not meet the criteria of (1) and (2) above shall be reviewed and approved by the DOE prior to implementation. Changes to the BASES that may be implemented without prior DOE approval will be provided to the DOE at least annually.

5.4 LOGICAL CONNECTORS

Logic terms (**AND**, **OR**) may be used in the CONDITION, REQUIRED ACTION, or the COMPLETION TIME section of an AC REQUIRED ACTION statement or in the SR or frequency sections of the AC SURVEILLANCE statement. The following definitions and format are applicable to the use of logic terms throughout the TSRs.

NOTE: The defined terms of this section appear in CAPITALIZED, bolded, and underlined type throughout the TSRs.

Definitions of Logic Terms

Term	Definition
AND	Used to connect two or more sets of criteria that must both (all) be satisfied for a given logical decision.
OR	Used to denote alternate combinations or criteria, meaning either one or the other criterion will satisfy a given logical decision.

The formats for the level of logic are illustrated in the following examples:

ACTIONS:

CONDITION	REQUIRED ACTION	COMPLETION TIME
1. The CONDITION	For **statements containing a single level** – The connector is *left justified to the column* and the criteria are *single* numbered, *i.e.*, "1." single versus "1.1". 1. The REQUIRED ACTION **OR** 2. The REQUIRED ACTION	

This example demonstrates that for CONDITION 1, either REQUIRED ACTION 1 or REQUIRED ACTION 2.1 must be completed. This is because the logical connector **OR** is used.

5.4 LOGICAL CONNECTORS (continued)

ACTIONS:

CONDITION	REQUIRED ACTION	COMPLETION TIME
1. The CONDITION	**For statements containing two levels:** For the 1st level – The connector is *left justified to the column* and the criteria are *single* numbered. For the 2nd level – The connector is *indented once to the right* and the criteria are *double numbered.* 1. The REQUIRED ACTION **OR** 2.1 The REQUIRED ACTION **AND** 2.2 The REQUIRED ACTION	

This example demonstrates that for CONDITION 1, either REQUIRED ACTION 1 or REQUIRED ACTION 2 must be completed. If REQUIRED ACTION 2.1 is chosen, an additional requirement, indicated by the indented logical connector **AND**, is imposed. This additional requirement is met by performing REQUIRED ACTION 2.2.

5.4 LOGICAL CONNECTORS (continued)

ACTIONS:

CONDITION	REQUIRED ACTION	COMPLETION TIME
1. The CONDITION	**For statements containing three levels:** For the 1st level – The connector is *left justified to the column* and the criteria are *single* numbered. For the 2nd level – The connector is *indented once to the right* and the criteria are *double numbered.* For the 3rd level – The connector is *indented twice to the right* and the criteria are *triple numbered.* 1. The REQUIRED ACTION **OR** 2.1 The REQUIRED ACTION **AND** 2.2.1 The REQUIRED ACTION **OR** 2.2.2 The REQUIRED ACTION	

This example demonstrates that for CONDITION 1, either REQUIRED ACTION 1, or REQUIRED ACTION 2.1 must be completed. If REQUIRED ACTION 2.1 is chosen, an additional requirement, indicated by the indented logical connector **AND**, is imposed. This additional requirement is met by choosing REQUIRED ACTION 2.2.1 or REQUIRED ACTION 2.2.2. The indented position of the logical connector **OR** indicates that REQUIRED ACTION 2.2.1 and REQUIRED ACTION 2.2.2 are alternate and equal choices, one of which shall be performed.

5.5 GENERAL APPLICATION of ADMINISTRATIVE CONTROLS (ACs) and AC SURVEILLANCE REQUIREMENTS (SRs)

AC 5.5.1 ACs Shall Be Met

ACs shall be met at all times except as provided in 5.5.2.

AC 5.5.2 AC REQUIRED ACTION Shall Be Met

Upon DISCOVERY that an AC is not being met or that an unplanned CONDITION has been entered, the associated REQUIRED ACTION(S) shall be implemented. If compliance with the AC is restored before expiration of the specified COMPLETION TIME(S), completion of the REQUIRED ACTION(S) is not required.

AC 5.5.3 AC REQUIRED ACTION Cannot be Met or Is Not Provided

When an AC is not met, and the associated REQUIRED ACTION(S) cannot be met, the WASTE MANAGEMENT CELL shall SUSPEND OPERATIONS in AFFECTED AREA(S) within the time prescribed by the REQUIRED ACTION. When REQUIRED ACTIONS are not provided, the facility shall SUSPEND OPERATIONS in the AFFECTED AREA(S) within four hours. Actions taken to SUSPEND OPERATIONS shall be initiated upon the determination that the specified REQUIRED ACTION(S) cannot be met.

Completion of SUSPEND OPERATIONS within the AFFECTED AREA(S) within the specified COMPLETION TIME constitutes taking the REQUIRED ACTION for the actual CONDITION and no VIOLATION is declared.

When the AC or REQUIRED ACTION can be met, completion of the AC 5.5.3 REQUIRED ACTION is not required.

AC 5.5.4 Continued Recurrence of an AC NONCOMPLIANCE

AC NONCOMPLIANCES shall be tracked and trended. If an AC NONCOMPLIANCE continues to occur, indicating that corrective actions have not been effective, the following ACTIONS shall be taken:

1. Ensure that the facility is in a safe configuration;
2. Notify DOE-RFFO of the potential trend within 1 week of identification;
3. Senior WASTE MANAGEMENT CELL management shall meet with DOE-RFFO senior management to determine if there is a trend, determine its safety significance, and determine if a VIOLATION exists; and
4. Implement corrective actions.

AC 5.5.5 Response to an AC VIOLATION

Upon DISCOVERY of an existing VIOLATION, the following ACTIONS shall be taken:

1. Complete the appropriate REQUIRED ACTIONS when possible and SUSPEND OPERATIONS at the WASTE MANAGEMENT CELL within four hours;
2. Notify DOE-RFFO of the AC VIOLATION in accordance with approved procedures; and
3. Identify and implement corrective actions and resume operations in accordance with Conduct of Operations (COOP).

Upon DISCOVERY of a historical VIOLATION, the following ACTIONS shall be taken:

1. REQUIRED ACTIONS do not need to be entered;
2. Notify DOE-RFFO of the AC VIOLATION in accordance with approved procedures; and
3. Identify and implement long-term corrective actions to prevent recurrence in accordance with COOP.

AC 5.5.6 Initiation of REQUIRED ACTIONS

REQUIRED ACTION(S) shall be initiated when a CONDITION is DISCOVERED and completed as soon as practicable within the allowed COMPLETION TIME. COMPLETION TIMES shall not be used for operational convenience.

SR 5.5.1 SRs Shall Be Met

SRs shall be met during the conditions specified.

Failing an AC SR requires the associated AC to be deemed not in compliance and the appropriate REQUIRED ACTIONS be taken.

SR 5.5.2 Frequencies

Each SR shall be performed within the specified interval as defined in Section 5.2, *Frequency Notations*.

5.6 INVENTORY CONTROL AND MATERIAL MANAGEMENT

5.6.1 Requirements for Inventory Control and Material Management

A program shall be established, implemented and maintained to protect nuclear material and to control storage configurations, locations and quantities in accordance with the safety analysis assumptions. This element protects the assumptions of the accident analysis that limit the amount of MAR available for release.

5.6.2 Specific Controls or Restrictions

The program shall have the inventory control and material management control limits noted in the following AOLs.

APPLICABILITY:

This control applies to PACKAGED WASTE that is stored in WASTE MANAGEMENT CELLS.

Exceptions:

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1) The nuclear material that is packaged in DOT Type B shipping containers [e.g., Transuranic Package Transport (TRUPACT) II] is not subject to AC 5.6 controls.

2) Metal containers that are used as secondary confinement (*i.e.*, Drums in Cargo Containers) are not subject to the inventory limits of AOL 1.3 as long as the interior PACKAGED WASTE meets the appropriate limits of AOL 1.3.

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CONTROLS/RESTRICTIONS:

AOL 1	NUCLEAR MATERIAL LOADING
AOL 1.1	The total quantity of nuclear material present at a WASTE MANAGEMENT CELL **SHALL NOT** exceed 900 grams WG Pu.
AOL 1.2	The total quantity of nuclear material present in non-aqueous liquid waste at a WASTE MANAGEMENT CELL that contains non-aqueous liquid waste **SHALL NOT** exceed 150 grams WG Pu.
AOL 1.3	The quantity of nuclear material in a PACKAGED WASTE item received, staged, or stored at a WASTE MANAGEMENT CELL **SHALL NOT** exceed the following gram limits (WG Pu): • ≥ 55-gallon Drums: 0.5 grams • < 55-gallon and > 10-gallon Drums: 0.4 grams • ≤ 10-gallon Drums: 0.2 grams • Container (Box or Crate) ≤ 5,520 lbs (net weight capacity): 3 grams • Container (Box, Crate, or Cargo Container) > 5,520 lbs (net weight capacity): 6 grams • Un-containerized SCO or LSA Item: 6 grams • Tanker Truck Containing Liquid: 6 grams

ACTIONS:

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. WASTE MANAGEMENT CELL not compliant with AOL 1.1 or AOL 1.2.	A.1 Suspend acceptance of PACKAGED WASTE receipts at the WASTE MANAGEMENT CELL. **AND** A.2 Bring the non-compliant WASTE MANAGEMENT CELL into compliance with the AOLs.	1 hour. 3 weeks.
B. PACKAGED WASTE item not compliant with AOL 1.3.	B.1 Suspend all PACKAGED WASTE movements within 10 feet of the non-compliant PACKAGED WASTE item. **AND** B.2.1 Bring the non-compliant PACKAGED WASTE item into compliance. **OR** B.2.2 Remove the non-compliant PACKAGED WASTE item from the WASTE MANAGEMENT CELL	1 hour. 3 weeks. 3 weeks.

SURVEILLANCE REQUIREMENTS:

	SURVEILLANCE REQUIREMENT	FREQUENCY
SR 5.6.1	Verify that the WASTE MANAGEMENT CELL does not exceed the criteria in AOL 1.1.	Monthly.
SR 5.6.2	Verify that the WASTE MANAGEMENT CELL does not exceed the criteria in AOL 1.2.	Monthly.
SR 5.6.3 EXCEPTION:	Verify that the PACKAGED WASTE item (with a final radiological characterization) that is to be transferred to the WASTE MANAGEMENT CELL does not exceed the criteria of AOL 1.3. SR 5.6.3 does not apply to PACKAGED WASTE that has been packaged for off-Site shipment and is to be transferred to a WMC used exclusively for staging loaded transportation vehicles.	Prior to transfer of the PACKAGED WASTE item.
SR 5.6.4	Verify that a PACKAGED WASTE item (with preliminary radiological characterization) that is to be transferred to the WASTE MANAGEMENT CELL does not exceed the criteria of AOL 1.3.	Prior to transfer of the PACKAGED WASTE item (based on the preliminary characterization) **AND** Within one week of final radiological characterization of the PACKAGED WASTE item if the final characterization exceeds the preliminary characterization.
SR 5.6.5	Verify that a PACKAGED WASTE item being generated within the WASTE MANAGEMENT CELL does not exceed the criteria of AOL 1.3.	Within one week of final radiological characterization of the PACKAGED WASTE item.

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5.7 SAFETY MANAGEMENT PROGRAMS

In addition to worker safety, the cumulative effect of the programmatic details in SMPs is important the safe operation of WASTE MANAGEMENT CELLS.

5.7.1 Requirements for Safety Management Programs

a. The SMPs, as described in Chapter 3, *Safety Management Programs*, shall be established, implemented, and maintained.

b. WASTE MANAGEMENT CELL Management shall correct a SMP noncompliance in accordance with the requirements of the specific Safety Management Program.

c. WASTE MANAGEMENT CELL Management shall provide tracking and trending data to the Site program owner in accordance with the requirements of the specific SMP.

APPLICABILITY:

These requirements are applicable at all times.

ACTIONS:

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. The overall safety function of an SMP (identified in the SMP description) is lost due to a programmatic failure [noncompliance with 5.7.1(a)].	A.1	Notify DOE RFFO of the programmatic failure.	7 days.
	AND		
	A.2	Determine the safety significance of the programmatic failure.	60 days.
	AND		
	A.3	Identify and implement corrective actions.	60 days.

SURVEILLANCE REQUIREMENTS:

None Required

5B TECHNICAL SAFETY REQUIREMENTS BASES

5B.6 INVENTORY CONTROL AND MATERIAL MANAGEMENT BASES

5B.6.1 Requirement for Inventory Control and Material Management

Inventory Control and Material Management provides control for the location, storage configuration, and handling of nuclear material within a WASTE MANAGEMENT CELL based on the quantity, type, and form. This element protects the assumptions of the accident analysis that limit the amount of MAR available for potential release in the event of an accident.

5B.6.2 Specific Controls or Restrictions

Specific controls and restrictions are placed on radiological material inventory (PACKAGED WASTE items and WASTE MANAGEMENT CELLS) to prevent the introduction of materials into any of the WASTE MANAGEMENT CELLS that would invalidate the safety analysis basis.

AOL 1.1 restricts the total amount of WG Pu to 900 grams total per WASTE MANAGEMENT CELL. This control preserves the hazard classification of Nuclear Facility Hazard Category 3 for WASTE MANAGEMENT CELLS. This control also sets the initial MAR for the scenarios that involve an entire WASTE MANAGEMENT CELL (*i.e.*, major fires, seismic, aircraft crash).

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AOL 1.2 restricts the total amount of WG Pu in a WASTE MANAGEMNET CELL that contains non-aqueous liquid wastes to 150 grams. AOL 1.2 does not preclude the co-mingling of non-aqueous liquid waste with other waste forms (i.e., sold waste forms) provided the total WMC inventory does not exceed 150 grams WG Pu. For the purpose of this safety analysis, non-aqueous liquids are considered to be liquids that burn rather than boil when exposed to fires. This control sets the maximum amount of MAR that can be involved in a non-aqueous liquid waste fire because a fire involving non-aqueous liquid waste is expected to propagate from container to container due to the high heat release associated with this waste form.

The total radiological inventory of a WASTE MANAGEMENT CELL can be tracked by maintaining records of the cumulative contents of PACKAGED WASTE at a WASTE MANAGEMENT CELL. The radiological inventory can be based on final radiological characterization, conservative default values for PACKAGED WASTE items, or a combination of both. The final radiological characterization for a PACKAGED WASTE item is a gram loading value that is not anticipated to be changed prior to offsite shipment. A conservative default value may be based on statistical data, process knowledge, maximum loading value based on the net weight capacity of PACKAGED WASTE items, or other assessment method indicating that the waste is LLW/LLMW, SCO, or LSA. Default values will be evaluated via the SES/USQD process to ensure that their use for inventory tracking will not compromise the hazard categorization of a WASTE MANAGEMENT CELL.

generally assumed to vary from 0.5 grams for LLW/LLMW drums up to 6 grams for SCO items and bulk LLW/LLMW in large containers.

When available, gram values from WEMS may be used to comply with AOL 1.3. However, PACKAGED WASTE items in a WASTE MANAGEMENT CELL may have only a preliminary designation of LLW, LLMW, SCO, or LSA without an associated WG Pu gram value. In the packaging of LLW/LLMW or SCO materials into waste containers, it is often the case that the analyzed Pu content of the container is not finalized until after the container is placed in a WASTE MANAGEMENT CELL. Based on the characterization of the waste prior to packaging, a conservative determination is made about the type of waste involved (*i.e.*, LLW/LLMW, SCO, LSA, or TRU). If the waste is determined to be non-compliant with the per-container inventory limits in the TSRs (*i.e.*, it is TRU waste), the container will not be placed in a WASTE MANAGEMENT CELL. If the waste is LLW/LLMW, SCO or LSA based on an initial characterization, the container may be placed in the WASTE MANAGEMENT CELL prior to finalization of its Pu content. The container may be placed in a WASTE MANAGEMENT CELL awaiting laboratory analysis of its contents, a final weighing of the container, or an assay of the container if needed. If the results of the final characterization shows that a PACKAGED WASTE item exceeds the container limits associated with LLW/LLMW, SCO, or LSA materials, the REQUIRED ACTIONS would apply.

A preliminary characterization may be based on process knowledge, scan data, radiological surveys, statistical data, default values, bounding values, or other assessment methods indicating that the waste is LLW/LLMW, SCO, or LSA. A situation could arise where the preliminary MAR estimate may underestimate the actual amount of radioactive material present in a PACKAGED WASTE item. This safety analysis evaluates overloaded LLW/LLMW, SCO waste, and LSA waste items at a higher amount than the standard Site limits imposed on LLW/LLMW, SCO waste, and LSA waste items. For larger PACKAGED WASTE items, the MAR is evaluated up to an amount that is generally associated with a Criticality Safety Program limit of concern (*i.e.*, 15 grams). That is, PACKAGED WASTE items containing less than 15 grams of WG Pu are exempt from any Criticality Safety Program requirements. The intent of evaluating the PACKAGED WASTE items at a higher MAR value is to assess overloaded container configurations but not to permit the configuration as part of normal routine operations. The standard Site limits imposed on LLW/LLMW, SCO waste, and LSA waste items remain in effect and waste items that exceed those limits are considered to be out-of-compliance with AOL 1.3. However, Unreviewed Safety Question Determinations (USQDs) do not have to be performed for situations where the PACKAGED WASTE item MAR values are below the analyzed values. For scenarios that involve waste containers that are "incident-to-shipping," individual waste container MAR values are set to the controlled amount (e.g., 0.5 grams per Drum, 3 grams per Box, *etc.*); otherwise the MAR values are analyzed at the higher values specified in Table 6, *Waste Container Type MAR Comparison*. The exception for AOL 1.3 allows higher MAR values for metal containers that are used as secondary confinement (*i.e.*, drums in a cargo container). High americium wastes do not fall in the category of LLW and are not evaluated in this safety analysis

The safety analysis specifies limits on PACKAGED WASTE item fissionable material content for uranium and plutonium wastes as defined by the Site Criticality Safety Program. Compliance verification occurs prior to PACKAGED WASTE transfer into a WASTE

MANAGEMENT CELL using whatever radiological inventory assessment was developed for the PACKAGED WASTE. This assessment could represent a final characterization of the PACKAGED WASTE item radiological material inventory, or it could represent a preliminary characterization.

The REQUIRED ACTIONS and COMPLETION TIMES assure that WASTE MANAGEMENT CELLS maintain compliance with the specific controls and restrictions. The COMPLETION TIMES generally allow sufficient time to re-establish compliance with the AOLs.

If a WASTE MANAGEMENT CELL exceeds the total inventory limits specified in AOLs 1.1 and 1.2, acceptance of PACKAGED WASTE item receipts in the WASTE MANAGEMENT CELL must be suspended within 1 hour. Based upon the simplicity of the PACKAGED WASTE movement activities in WASTE MANAGEMENT CELLS, one hour is judged to be adequate to notify all workers in the WASTE MANAGEMENT CELL to suspend receipt activities.

If a WASTE MANAGEMENT CELL exceeds the total inventory limits specified in AOLs 1.1 and 1.2, the WASTE MANAGEMENT CELL shall be brought into compliance with the limits in AOLs 1.1 and 1.2. Compliance may be established by removing PACKAGED WASTE item(s), re-assay to obtain a more accurate count, expert review of an existing assay, or correction of the non-compliance. Bringing the WASTE MANAGEMENT CELL within 3 weeks is required. Three weeks is considered adequate time for WASTE MANAGEMENT CELL management to identify, communicate with, and coordinate a transfer to an appropriate on-site facility.

If a PACKAGED WASTE item in a WASTE MANAGEMENT CELL contains more than the specified nuclear material limits in AOL 1.3, all PACKAGED WASTE item movement within 10 feet of the non-compliant PACKAGED WASTE item must be suspended within 1 hour. Based upon the simplicity of the PACKAGED WASTE movement activities in WASTE MANAGEMENT CELLS, one hour is judged to be adequate to notify all workers in the vicinity to suspend movement activities and to safely secure the handling equipment. It is judged that the 10-foot separation provides an adequate buffer to protect the non-compliant PACKAGED WASTE item from impacts with material handling equipment.

If a PACKAGED WASTE item in a WASTE MANAGEMENT CELL contains more than the specified nuclear material limit in AOL 1.3, it is to be removed from the WMC or brought into compliance. Compliance may be established by re-assay to obtain a more accurate count, expert review of an existing assay, or correction of the non-compliance. Bringing the WASTE MANAGEMENT CELL within 3 weeks is required. Three weeks is considered adequate time for WASTE MANAGEMENT CELL management to identify, communicate with, and coordinate a transfer to an appropriate on-site facility.

An increase in a specific PACKAGED WASTE item MAR does not have any impact on contiguous PACKAGED WASTE items, other than for issues dealing with criticality. Therefore, for all accidents not involving a criticality, high MAR PACKAGED WASTE items do not require segregation. The Criticality Safety Program is credited for handling any criticality issues related to high MAR PACKAGED WASTE items and their movement.

An increase in a specific PACKAGED WASTE item MAR does not have any impact on contiguous PACKAGED WASTE items, other than for issues dealing with criticality. Therefore, for all accidents not involving a criticality, high MAR PACKAGED WASTE items do not require segregation. The Criticality Safety Program is credited for handling any criticality issues related to high MAR PACKAGED WASTE items and their movement.

The likelihood of an occurrence of an accident involving identified high MAR PACKAGED WASTE item(s) is small during the maximum three-week interval for removal or achieving compliance.

SRs 5.6.1 through SR 5.6.5 are intended to assure that the WASTE MANAGEMENT CELLS are operated within the bounds of the safety analysis. Verification prior to transfer that the PACKAGED WASTE items are LLW, LLMW, SCO or LSA provides a reasonable assurance that the hazards associated with WASTE MANAGEMENT CELLS remain low.

SR 5.6.3 through SR 5.6.5 cover three situations: (1) receipt of a PACKAGED WASTE item with final characterization, (2) receipt of a PACKAGED WASTE item with preliminary characterization, and (3) generation of a PACKAGED WASTE item in a WASTE MANAGEMENT CELL, respectively. For SR 5.6.3 the surveillance is only performed prior to transfer. The exception statement to SR 5.6.3 applies to PACKAGED WASTE that has been packaged for off-Site shipment and is to be transferred to a WMC used exclusively for staging loaded transportation vehicles. WMCs used exclusively for staging loaded transportation vehicles are not used for waste packages, trailers, cargo containers, etc. The Waste Management SMP ensures that each individually packaged waste item to be transferred to a WMC used for staging loaded transportation vehicles (1) has been packaged for off-Site shipment, (2) meets the Waste Acceptance Criteria (WAC) for the Treatment, Storage, and Disposal (TSD) site, and (3) meets the nuclear material loading limits in AOL 1.3. Therefore, SR 5.6.3 is not required to be performed at the receiving WMC. For SR 5.6.4, a "prior to transfer" surveillance always must be performed, but the "after final characterization" surveillance only needs to be performed if the final characterization gram value is greater than the preliminary characterization gram value. For SR 5.6.5, only the "after final characterization" surveillance is required because waste generated from an existing PACKAGED WASTE item on a WMC will not exceed the AOL 1.3 thresholds (TRU waste cannot be generated from LLW).

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In the event that the radiological inventory assessment of a PACKAGED WASTE item was preliminary or the PACKAGED WASTE item was generated in the WASTE MANAGEMENT CELL, a final radiological inventory characterization would be pending. A gram loading value that is not anticipated to be changed prior to offsite shipment is considered to be a final radiological characterization. Once the final radiological characterization is received by the manager of a WASTE MANAGEMENT CELL, a final radiological inventory compliance verification of the PACKAGED WASTE item must be conducted within one week only if: (1) the final characterization gram content exceeds the preliminary characterization gram content of the PACKAGED WASTE item, or (2) the preliminary characterization was qualitatively determined to be LLW, LLMW, SCO, or LSA materials based on process knowledge. Typically, any noncompliance would be readily

WASTE MANAGEMENT CELL inventory verification on a monthly basis, and PACKAGED WASTE item inventory compliance verification within a week of final radiological characterization are appropriate to maintain an acceptable level of risk due to the limited hazards associated with the waste types evaluated in this safety analysis.

5B.7 SAFETY MANAGEMENT PROGRAMS BASES

5B.7.1 Requirements for Safety Management Programs

This AC makes a commitment to Safety Management Programs (SMPs). The commitment to each program encompasses a large number of details that are more appropriately covered in program documents. These SMPs provide specific safety functions assumed in the safety analysis that are either specifically credited or recognized to be important for providing defense-in-depth. The cumulative effect of these details are recognized as being important to WASTE MANAGEMENT CELL safety, which is the rationale for a top-level commitment becoming part of the safety basis. In addition to worker safety, the cumulative affect of the programmatic details is important to Site safety and is an integral part of the Site safety envelope.

The SMP AOL 5.7.1a is established to ensure that there is a commitment to SMPs at the Site. The commitment to each program encompasses a large number of details that are more appropriately covered in program documents. The cumulative affect of these details is recognized as being important to Site safety, which is the rationale for a top-level programmatic commitment becoming part of the safety basis. The discipline imposed by SMPs goes beyond supporting assumptions in the hazard analysis and is an integral part of defense-in-depth.

The SMP AOL 5.7.1b is established to ensure that SMP compliance is maintained by the correction of any identified noncompliance in accordance with the requirements of the specific SMP. A noncompliance in a program do not constitute a programmatic failure or violate the Site SAR safety basis.

The SMP AOL 5.7.1c is established to ensure that chronic noncompliance events are identified in accordance with the specific SMP so that appropriate actions can be taken to prevent repeated non-compliant situations.

6 REFERENCES

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